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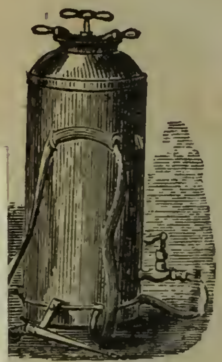

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TO THE HONOURABLE

THE MINISTER OF AGRICULTURE FOR CANADA,

WHO IS

WORKING FOR THE ADVANCEMENT OF AGRICULTURE IN OUR YOUNG

DOMINION, AND WHO IS EARNESTLY ENGAGED

IN THE CARRYING OUT OF

AN ENLIGHTENED IMMIGRATIONAL POLICY,

THIS WORK

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BY

THE AUTHOR.

Bordeaux Spray Cure for Trees
4 lbs sulphate of copper
4 lbs Lime
40 gall water

INTRODUCTION.

In all countries, and under all circumstances, the principles that underlie the art of husbandry are identical, but the practice through which they are brought to bear upon the cultivation of the soil must necessarily vary, owing to the modifications that are indispensable to bring that practice into harmony with surrounding circumstances.

Hence, while the scientific or theoretical literature of agriculture is of universal application, and may with success be imported, that relating to the practice of the farm should, to be of substantial use, be a home, and not a foreign production.

The present condition of Canadian agriculture demands the increase, if not indeed the introduction, of such a literature, and it is gratifying to find that this want has a fair prospect of being supplied by the publication of such works as that which follows this introductory notice. In it the author has kept steadily in view the fundamental principles of true husbandry, and has, in harmony with them, endeavoured to sketch an agricultural practice in no way antagonistic to the modifying influences peculiar to the country.

This harmony is indispensable to successful farming, and unless it be established, no matter how suitable to a country a system of husbandry may otherwise be, it must inevitably fail to be successful. It may, under exceptional circumstances, appear for a time to be successful, but permanent it cannot be.

The system of cropping introduced by the early settlers of Canada affords a striking illustration of this fact; for a time it appeared to be everything that could be desired, but, owing to the fact that it was opposed to the fundamental principles of true husbandry, in depending upon the unaided resources of the soil, it was not, and could not be, permanent. Its success, even for a time, was due to the exceptional fertility of a rich virgin soil. Now, however, particularly in the older settlements, that exceptional fertility has been exhausted, and the skill of the true farmer becomes indispensable to successful cultivation.

Canadian agriculture is now in a trasition state ; it is gradually, but steadily, assuming the character of real husbandry, and to aid it in this transition is the mission that its agricultural literature has to perform.

Under such circumstances, no elaborate treatises on scientific or theoretical agriculture are demanded. What is wanted is a literature that will aid the farmers of the country in applying to the work of the field and farm-yard the principles upon which husbandry is based, and this has evidently been the aim of the author of the *Manual of Agriculture.*

In it the farmer will find no elaborate theories or intricate problems discussed, but a reliable book of reference that may be promptly consulted on almost any subject connected with his daily avocations.

To be of practical utility for this purpose, that reference must be easily made, and the convenient arrangement of the work makes it so.

Does the farmer require information on the building of a house or barn, on the treatment of his cattle in sickness, on the special cultivation of any particular crop, or, in short, upon any matter connected with the daily routine of farm management, he has but to open the index, and, without loss of time, refer to the page on which information upon that subject is given, and he will seldom refer to it and be disappointed.

Such a work must be of much value to the practical farmer, and it is to be hoped that thousands will avail themselves of the information it contains.

H. McCANDLESS,
Principal of the Ontario School of Agriculture.

GUELPH, 28th May, 1874.

PREFACE.

TO MY BROTHER FARMERS OF CANADA.

The want of a standard work on Canadian agriculture has long been felt by our class. I have endeavoured to step in and fill the breach by laying before you the accompanying work, entitled "The Canadian Farmer's Manual of Agriculture."

We are all well aware that farming is no sinecure in the way of work in Canada. Stout hearts and willing hands must be employed to win a way to fortune on our farms. But these are not the only necessary qualifications—wages are high and hands are scarce; to pay the one and create a substitute for the other, increased knowledge and intelligence must be the instruments. To make farming profitable we do not require larger holdings; but the one thing needful is larger yields per acre. To attain such a desirable increase of production, a more thorough knowledge of the laws of growth, and the requirements of plant-life becomes necessary. This knowledge, which is in itself indefinite, I have endeavoured partially to provide in the following pages. It cannot be that any single work, especially of the proportions of the present, can cover *all* the ground necessary to be touched upon in a treatise on the Principles and Practice of Agriculture. This work is not and could not be exhaustive, but where it fails to give full information, I trust it may at least set the reader "upon the right track." The farmer in Canada must be essentially a practical man. The reader will find advanced no theories that have not stood the test of practice. It has been my constant aim to adapt every chapter to the present state of agriculture in Canada. Topics on which the opinion of eminent farmers are divided, are treated from every stand-point: where I have given a personal opinion upon these subjects of debate, it has been based upon no hobby of my own, but upon a mature consideration of the several arguments advanced by eminent authorities, and governed by my own and my neighbours' practical experience.

opinion upon these subjects of debate, it has been based upon no hobby of my own, but upon a mature consideration of the several arguments advanced by eminent authorities, and governed by my own and my neighbours' practical experience. For instance, in the chapter devoted to Barnyard Manure, I have set down the arguments of the advocates of Raw or Rotten, Long or Short; and the subject being one on which I do not feel decided, I have refrained from the expression of any dogmatical opinion. Whilst this is not a work of compilation, the reader. will find scattered through its pages many quotations, in the citation of which I have endeavoured to give due credit. These selections, appropriate to the several subjects, I have been careful to obtain in the majority of cases, from such authorities as I am aware are or have been engaged in actual farming in Canada, or in those States of the Union in which the soils, climate, and systems of husbandry are generally of a nature similar to those of our Dominion. The central object which this work is intended to keep in view, is the demonstration of how farming may be made to pay —by the general improvement of the soil, of seeds, and of methods of cultivation. With these few prefatory remarks, I leave "THE CANADIAN FARMER'S MANUAL" in the hands of my brethren of the plough. That it may prove useful to them, and a welcome addition to the agriculturist's library, is the sincere wish of the author.

C. E. W.

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Grafting wax

Rezin - 4 pts

Beeswax - 1 do

Beef tallow - 1 - do.

From 3 lb Rochester Rose potatoes planted May 24 - 137 lbs

1904

THE

CANADIAN FARMER'S

MANUAL OF AGRICULTURE.

CAPITAL.

WHEN the day arrives at which farming shall be recognized as in every way a profession, requiring as thorough knowledge and as regular business habits as any other calling or trade, we may look for an advance in the agricultural progress of the country, commensurate to raise her to the highest position in the scale of nations.

The man who, relying from the first upon credit, enters into the business of manufacturing or of storekeeping, cannot succeed. As well purchase a large factory or commodious store, and then, deficient of means to stock the same, sit down and think of the ways and means of establishing a trade, as to buy a farm and hope to work it profitably without a sufficient stock of horses, cattle, implements and seed.

The man who enters upon a farm relying upon his credit for the purchase of the necessary stock, seldom, if ever, succeeds in his business. To-day an immense number of farms in Canada are mortgaged; the first incumbrance upon the property was in many cases the means by which necessary capital was secured, and only in the case of a few men of indomitable energy and untiring perseverance has the farm been ever cleared from its first imposed debt, but rather that debt has accumulated until the day of forced sale has arrived.

The man who has not sufficient capital to thoroughly stock one hundred acres should be content with a farm of half that size, for experience has shown that whilst, on the one hand, a large farm is more economically worked than a smaller, yet on the other a farm of say fifty acres, properly stocked and started, will yield one hundred per cent. more profit than a larger holding insufficiently stocked or hampered with incumbrances.

2

It has been too much the fashion in Canada for the farmer, when surplus produce has been sold, to rush to the purchase of more land, without staying to place all the capital upon the old land which was absolutely required, and, as a consequence, we can point to many of our "large" farmers who do not sell as much off their immense area, insufficiently stocked and imperfectly worked, as do "smaller" neighbours upon lands which carry a full complement of necessary stock.

HOW CAPITAL MAY BE INVESTED ON THE FARM TO BEAR GOOD INTEREST.

By removing stones from the fields, *by stumping and cleaning, by squaring the fields* so that all operations are performed in a rectangular manner, and great saving of time effected. The chief loss of time in the daily work of a team at ploughing, harrowing, or in any field operation, is in *turning;* make the fields right-angled, and the turning will be reduced to a minimum.

By good fencing.—It is as poor economy to have bad fences as to leave the till unlocked and invite the burglar to remove its contents. Good fences once put up are an economy in many ways. Not only is the cost of repairing and patching reduced, but cattle do not learn to breach. The animal that has once broken bounds into the rich clover field, or filled his belly in the ripe grain, will in future assuredly seek for and find out every weak spot in the protecting fence. We have seen as much damage done to a wheat crop in one season, in this manner, as would pay for a *board* fence round the whole field.

By buying the best of tools.—The carpenter cannot make a good job with blunt chisel or ill-set saw, neither can the farmer with inferior implement or poor seed.

We have seen a heavy team struggling along before a short cast-iron plough with iron mould-board, sole and land plate; while upon the opposite side of the road, in exactly similar soil, a light, active team would be drawing with perfect ease the light-made plough, in which all friction acts upon steel that shines like polished silver.

By good accommodation for live stock and implements.—It is useless to attempt to keep animals in winter with insufficient accommodation. Unless we provide shelter and warmth to every head of stock, we shall require to feed so much more to keep up the necessary animal heat.

Each year, then, the extra amount of feed required to keep in the cow or pig, &c., the requisite amount of animal heat, might be to far greater advantage expended on warm accommodation. The former plan, of supplying the heat requisite, must be repeated each year, while suitable buildings will last for very many seasons.

Avoiding the first accumulation of mechanics' and tradesmen's bills.—The first year upon a farm is invariably one of loss. An accumulation of extraneous accounts often throws a man so far back that it becomes a chance whether he ever recover his lost ground. In entering on a farm, sufficient available capital should be kept over to pay all possible expenses for the first year. Never, if it be possible to avoid it, trust to a future return to pay current accounts. The perspective of the return generally recedes towards a point, while the bulk of accounts usually exceeds all anticipation. Interest increases on the bills, while it is a constant drain upon the value of crops in prospective.

Underdraining.—It has been demonstrated by the most experienced and practical farmers, both in England and in America, that the surplus produce upon well-drained land will pay for the expense of underdraining in *three* years; or, in other words, that capital invested in this form will yield interest at the rate of *thirty-three and one-third* per cent. per annum in actual returns, while the market value of the land is improved to the full amount of expenditure.

On the purchase of improved stock.—While we do not advocate the raising of thorough-bred stock by the generality of farmers, it must be a self-evident fact, that the animal which produces the largest amount of meat, wool or milk for a given quantity of food must be the most valuable.

It is demonstrated yearly at our Exhibitions, and by the written and spoken experience of practical men, that good grade cattle, sheep and hogs produce a greater amount of meat, wool or milk than the coarse, bony, ill-bred animal.

The more capital, then, that can be retained for the purchase of stock, the greater the interest that will accrue.

Safe speculation in live stock.—The sound principle of safety known as *small profits and quick returns* applies with as great force to the business of the farmer as to that of the merchant or tradesman. The value of live stock is constantly fluctuating.

With a cash capital attainable at any day, the farmer may take advantage of the fluctuation of the market by buying cheaply and selling at a profit.

It is not an uncommon thing for the price of pork, beef or mutton to rise one hundred per cent. in a very short time. The man who has always cash available is at any time prepared to buy cheaply, and can sell as soon as the advance will yield him a profit.

It is this very want of ready cash amongst the farmers generally that tends to bring about these sudden and rapid fluctuations. Produce being down in value is often the result of a necessity that drives the many producers to sell even at a sacrifice; whilst in a short space of time the reaction in the market must set in, and yield a profit to him who can keep over or who has bought in the decline of the market.

An attempt to dictate the amount of capital requisite upon a given acreage would be futile in such a work as the present. There are so many circumstances—the condition of the land, the state of improvements, or the style of husbandry required—that it would be impossible to lay down any arbitrary rules based upon the size or locality of various farms.

Most farmers are anxious for large occupations, and a great number thus fall into the error of attempting to work more land than they possess capital to manage properly; some are seduced by delusive hopes of making up all present deficiencies by future savings; while others are led forward by the vanity of being greater landholders than their neighbours.

From these causes arise a meagre stock, imperfect cultivation, and consequent scanty returns, and in their train follow debt, distress and final ruin. On the other hand, the man who is content to commence with as many acres as he has capital to properly work and cultivate, may look forward with certainty to a full return from his land, will not be ever running into debt, and will obtain in his daily occupations contentment of mind, while laying the sure foundations of a future fortune.

ON FARM BUILDINGS.

Convenience and simplicity should never, in the arrangement of farm buildings, be sacrificed to symmetry. Neatness, compactness and warmth are the great points always to be carefully studied by the farmer in laying out or adding to his cattle-houses or barns.

"Time is money," and any arrangement which will render the work of feeding and attending on cattle easier, and to be performed in less time, should be carefully carried out, especially in Canada, where seasons are short and wages are high. Besides, if hired men perceive a neatness and compactness in the internal fittings of a building, evincing a desire to make their work less onerous, they will generally take a pride in the superiority of their employer's arrangements over those of the neighbours, and will attend more carefully to, and carry out more thoroughly, the operations of winter feeding, &c. Such buildings as are erected should be on the north, east and west sides of the yard, leaving the south open to the full benefit of the mid-day sun.

In Canada, where warmth is so great a requisite, the bank barn is, undoubtedly, the most convenient, giving a great capacity in room on a comparatively small scale.

Homesteads, however, must vary with farms, and it would be as inconsistent to dictate the plan of farm buildings as of the farms themselves.

We will merely point out those general rules which should be carefully weighed ere the farmer engage in either new building accommodation, or additions to former barns and out-houses.

Convenience and economy of space are here almost synonymous terms, and are points to be carefully kept in view.

Good ventilation is as essential to the well-being of stock as of man. Cattle and pigs require plenty of warmth, while horses and sheep should be kept in cool, well-sheltered steadings, where thorough ventilation has been carefully secured.

Ammonia and other noxious odours that emanate from animal manure are very injurious to health, and means should be employed to carry off all such poisonous gases.

Grain, hay and roots also require good ventilation, and for this reason there is great objection to the not uncommon system of close-battening barns.

Ventilators should be provided for all barns and cellars, to carry the heated air caused by fermentation out at the roof of the building.

Granaries should not be built in under the swing-beam of a barn, surrounded by solid masses of grain, hay or straw. We should advise, if possible, the building of a granary in the shape of a lean-to, or, better, as a detached building from the main barn, allowing the free play of air upon every side. We shall at a future page speak more particularly on the subject of granaries.

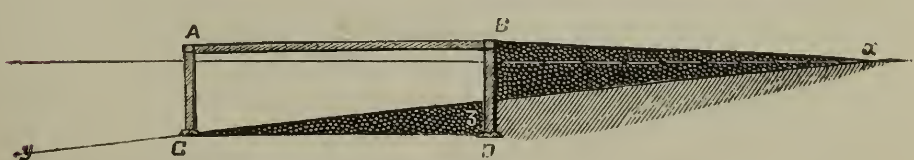
Basement Barns.—Every barn should have a basement, wherever stone to build one is accessible.

The sills are thoroughly protected from rot by being placed high and dry above the ground.

The basement is well adapted to fatting cattle, hogs and milch cows, while a cellar for the storage of roots may be built at the back end. It is a great advantage to have roots stored upon the same level as the feeding stalls, as there is a great loss of time in carrying large quantities of roots up stairs or ladders. Where a site upon a hill side can be obtained, there is nothing but a simple excavation to be made, the labour becoming greater as the slope of the land approaches a dead level.

The accompanying diagram shows the form of excavation where

DIAGRAM 1.

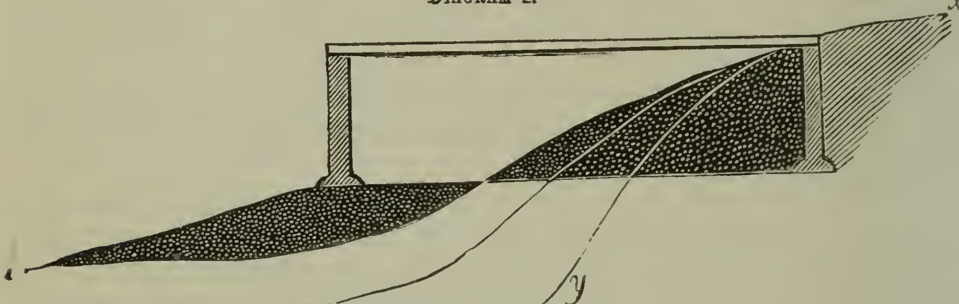


the slope is slight, the earth taken from the basement being thrown out on the upper side to form the road-way to the barn.

Here *x y* shows natural slope of ground, making an angle of 5° with the horizon. By excavating three feet at the inside, and supposing the barn to be forty feet wide, sufficient earth is obtained to make a raised road to the top of a basement wall, D B, nine feet high. Raised road running out twenty feet from the barn floor to the natural ground, and making an incline of three feet in twenty, up which to take waggons into the barn.

If the site should be a dead level, earth must be obtained elsewhere to make a protection to those walls of the basement forming the outside of the cellar.

Diagram 2.



x y shows the natural slope of the ground, being say three feet in forty. By excavating three feet at the inside, and supposing the barn to be forty feet wide, earth sufficient is obtained from the excavation to make a raised road to the top of a nine-foot basement wall; such raised road running forty feet out to meet the ground, has only an incline of three in forty, up which to draw on to the barn floor.

If the site should be a dead level, the cost becomes far greater, as the earth required to protect the outer walls of the cellar would have to be drawn to the spot, whilst if the basement be commenced on the crest of the elevation, as in Diagram 2, the labour of excavation is reduced to a minimum.

A basement wall resting against a bank should be built of stone and first-class mortar, and should be at least 1½ feet thick. Masons generally slope such a wall upwards and outwards to the bank, giving as their reason that the slope overcomes the pressure of the contiguous earth.

To keep the walls free from dampness, and to still further lessen any danger from the crowding of the bank, small stone or coarse gravel should be filled in for about twelve inches in width between the wall and the bank, and this gravel rest over a drain below.

In this manner all wet, especially in spring, escaping from the ground, will filter through the gravel, and, before reaching the cellar wall, will escape by the drain beneath.

Accommodation in a Basement.—For the purpose of approximation, it will be near enough to calculate that ten bushels of roots require *fifteen* cubic feet of space.

On this basis the following Table will serve to measure the necessary size of a cellar to contain various quantities of roots :—

1,000	Bushels of roots	will require	1,500	cubic feet, or	20 × 8·4 × 9	high.
					or, 20 × 9·4 × 8	"
1,500	"	"	2,250	"	20 × 12·6 × 9	"
					or, 20 × 14·0 × 8	"
2,000	"	"	3,000	"	20 × 16·8 × 9	"
					or, 20 × 18·9 × 8	"
3,000	"	"	4,500	"	20 × 25·0 × 9	"
					or, 20 × 28·0 × 8	"
4,000	"	"	6,000	"	20 × 33·4 × 9	"
					or, 20 × 37·6 × 8	"
7,000	"	"	10,500	"	20 × 58·4 × 9	"
					or, 20 × 65·7 × 8	"
10,000	"	"	15,000	"	20 × 83·4 × 9	"
					or, 20 × 93·9 × 8	"

And so on.

TO SELECT BUILDING STONE.

The following instructions for the selection of building stone are taken from the London *Builder*, and are of great interest to all who may have anything to do with such work :—"In selecting a quarry from which to get the stone best suited for the purpose, great care is required. Having first satisfied yourself that stone of the size required can be obtained, and at a reasonable price, the next and most important step of all is to find out if it be durable stone. Too much weight must not be placed on the assurance of quarrymen that the bed which is the cheapest for them to get at is the best and most durable, nor the best looking and easiest to work. It does not follow that because certain old buildings in the neighbourhood have lasted well, therefore all the quarries in the neighbourhood produce the same stone.

"It often occurs that a quarry on one side of a hill produces much better stone than that on the other. Specimens, dressed up square and sent out by the quarryman or agent, are very dangerous things to form an opinion on ; because what looks very well in small pieces, is really often of an inferior quality, and a stone that would appear coarse and rough in the specimen would not do so when in the mass. Stones that rub up to a smooth face are often not so durable as those of a rougher texture.

"To give an example, 'best bed' Portland is much superior in colour and texture to 'brown bed' Portland, but far inferior to it in durability. Examine all the different beds in the quarry, noting the particular grain, texture and colour of each bed ; compare them with the buildings around ; and if there be any old quarries near with the face exposed, see which of the beds stand out the most and show the old tool marks, and consequently have yielded to the action of the weather least. It frequently happens that the best stone is neglected, or only in part worked, from the cost of removing the rubbish with which it may be associated.

"As an economical supply of stone in particular localities would sometimes appear to depend on accidental circumstances, such as the cost of quarrying, the degree of facility in transport, and the prejudice that generally exists in favour of a material which has been long in use ; and as the means of transportation have of late years been greatly increased, it becomes essential to ascertain whether better materials than those which have been employed in any given place may not be obtained from other, although more distant, localities, offering equally advantageous terms. The relative facility with which good materials may be obtained in a district is to a certain extent marked by the appearance of the towns and villages, the comparative cost in obtaining them being in general better shown by the character of the ordinary buildings than by that of the public buildings and large mansions, the stone for which may sometimes have been brought from comparatively considerable distances.

"From the frequent practice, however, of selecting those stones which yield readily to the tool, and are hence commonly called freestone, whatever may be their mineralogical characteristics, the most durable and therefore the cheapest are far from being always employed ; and it sometimes happens that we find the common cottages built of durable materials, while large mansions and public buildings are not, the materials for the latter having been selected only because they were so readily worked up for ornamental parts, while those for the former may have been thrown aside in the same quarries because they yielded less freely to the tool."

For the reverse process, or *to find how many bushels can be stored in a given cellar :*

RULE.

Multiply the length, breadth and height of the cellar together, to obtain the number of cubic feet in space—divide by 15, and multiply result by 10.

Example.—Wanted to find the number of bushels of roots that a cellar measuring 37 feet in length, 33 feet 6 inches in width, and 8 feet in height will contain :

37 ft. × 33 ft. 6 in.=1239·50 square feet
1239·50 sq. feet × 8 feet = 9916 cubic feet
9916 cubic feet ÷ 15 = 661·06 "

and 661·06 × 10 = 6610, or the number of bushels that the cellar will contain.

Price of building such basements.—Excavation of, varying according to the nature of the soil, from clay through gravel to clear sand—10 to 12 cents per cubic yard.

Stone.—There are 99 cubic feet of stone to the cord. There are $16\frac{1}{2}$ square feet in a perch—a wall 12 inches thick would then run 6 perches to a cord of stone, whilst if 18 inches thick it would only run 4 perches to a cord of stone.

The following prices apply more particularly to the classes of limestone commonly used in Canada by farmers when building :

Cost of quarrying a cord of stone...........................	from $2 00 to $3 00
" " hauling (regulated by distance)..................	" 2 00 to 5 00
" " Lime required for a cord of stone—6 bush...	" 90 to 1 20
" " Sand " " " 1 load. ...	" 25 to 50
" " hauling lime and sand......................	
" " building (at 50 to 60 cts. per perch) per cord	" 3 00 to 3 60
Total cost per cord....................	from $8 15 to $13 30
" " " perch of 12 in. wall	1 35 to 2 20
" " " " 18 in. "	2 20 to 3 30

TO KEEP CELLAR WALLS DRY.

It has been recommended to put a coat of tar on the inside, and this custom is much practised in England.

The coal tar is boiled in an iron boiler until all the watery portion has been driven out in steam. The tar should then be laid on hot with a common whitewash brush, care being taken not to use the tar hot enough to destroy the hairs of the brush. One or more coats may thus be evenly painted on a rough stone wall, and will render it quite impervious to that damp which is occasioned by a difference in temperature between the outside and inside of a wall.

We have already alluded to an effectual means for securing dryness, by filling up for about a foot between the wall and the adjacent soil with coarse gravel, small stones or brick rubble over a drain. The most effective drain is one made of tiles, and laid at least a foot deeper than the foundation ; this is best done before the walls are commenced.

Another very dry form of cellar is that built with a double brick wall, leaving a vacancy of about six inches, and tied at the corners and at several places in the sides—this, however, is too expensive, unless in a neighbourhood where it is impossible to obtain the requisite building stone.

Cellar floors should be made smooth and hard, so as to offer every facility for shovelling upon and cleaning.

CONCRETE FOR WALLS.

"The gravel should be coarse and not screened—the coarsest kind of building sand or gravel right from the bed is best, as the coarse gravels ballast and support irregular stone best, and make a porous mortar unfavourable to capillary attraction, rendering the walls drier. The mortar or concrete should be made and piled up in a heap, lightly covered with the gravel, and lay a week or two before using, and thoroughly tempered or washed over before using."—*John Strathmore, in " Country Gentleman."*

ASPHALT OR CONCRETE FOR FLOORS.

The *Gardener's Magazine* has the following:—" Three parts coal ashes (those from the blacksmith's forge to be preferred) and two parts gas-lime from the gas-works, to be thoroughly mixed, and then made into a mortar with gas-tar. If the gas-tar comes from the gas-works, where the ammoniacal liquor is not separated, it will be sufficiently mixed for the purpose; but if the latter be separated and the tar be thick, it will set quicker if about one-fourth part of water be mixed thoroughly with the tar when used. For the floors of cow sheds, this should be laid about three inches thick in one layer, on an even surface of gravel, or stone broken very small with a sprinkling of gravel over, and rolled down. The mortar may be laid on with a common shovel, and merely patted down flat. In dry, warm weather, if the mortar has been carefully made, the floor will set firm in a few days. For any ordinary outhouse, half the thickness will make a permanent floor."

TO MAKE CELLARS FROST-PROOF.

Before leaving the subject of cellars, we will point out an excellent plan for making cellars temporarily frost-proof. Take paper (coarse brown paper is the best, but, in lieu of such, newspapers will do), mix a strong size, and paste the papers—if common papers, two or three thicknesses will be necessary—firmly upon the walls. There is no need to press the paper into the interstices, as each air spot between the paper and the wall forms an additional non-conducting medium of heat. This remedy has been often adopted with great success--paper being one of the best non-conductors known.

Ventilation is very necessary in a cellar, and the higher the ventilator is carried the more thorough will be the action of its draught in drawing away the noxious gases evolved by fermentation or decay.

In the case of cellars under a house, very fatal injuries may arise by a want of due cleanliness and imperfect ventilation.

DANGER TO HEALTH OF BAD VENTILATION.

" Few people are fully aware," says the *Pennsylvanian*, " of the danger to health and life of living in damp houses. It is now unquestioned by intelligently inclined men that damp houses are a prolific cause of consumption. This influence is more marked in individuals who are predisposed to the disease of hereditary taint, but unmistakable instances are on record where whole families have died of this disease, in which no trace of hereditary taint was discoverable by the most careful investigation, from the noxious influence of living in a damp house.

"What is remarkable about this phase of dampness, like that of malaria, is that its effects may not be immediate, but show themselves years afterward. It seems somehow to produce such latent depravation of the vital powers that at some future time, when certain occult vital conditions are supplied, tubercular generation inevitably takes place. A family reared in a damp house may for years be apparently healthy, but the chances are decidedly that they will die of consumption before forty-five. These conclusions are borne out by carefully analyzed statistics by competent medical men. Any person who is any way predisposed to lung troubles is in imminent danger, if living in a damp house.

"Not only does dampness produce and awake the germs of consumption, it manifests itself in numerous ways in producing disease and breaking down the powers of the system. To intelligent medical eyes, those who have long lived in damp houses are known by their devitalized look. Children manifest effects of the poison in bilious troubles, sallow complexions, scrofulous affections, debility and marasmus; while grown people suffer from rheumatism, catarrh, frequent colds and general loss of vitality.

"So manifestly dangerous are damp houses to life and health, that boards of health and civil authorities should proscribe their use and condemn them as effectually as though they were centres of contagion. We have no doubt but a civil action for damages, and under certain circumstances even a criminal action, would be sustained before an enlightened court, if brought by a person who had been in any way compelled to live in a habitually damp house.

"A house with water continually in its cellar is as unfit and dangerous to live in as a malarious swamp. This is strong language, but facts will prove the statement. The fearful mortality among the poor of large towns and cities is largely owing to so many living in damp cellars. Let no family live in damp houses who value their health or lives."

We have ourselves observed a very strong proof of this fact. Canadian farmers' families have been born and have grown up in robust health in wooden houses, which cannot but be dry. The farmer has made money and has built himself a fine stone house; however, he utterly neglected the first laws of ventilation by building high rooms, and plastering well away from contact with the outside walls. The consequence has in several instances been that the family, who were robust in person and constitution, have become consumptive, and one by one have sunk into an early grave. This fatal effect has been owing entirely to the change from a dry residence to one in which continuous dampness existed.

COW STABLES AND STALLS FOR FATTENING BEASTS.

It will be found very advantageous to have these in the basement, as they will be warm—upon the same level as the root-cellar, and *underneath* all other feed.

A milch cow requires from 3½ to 4 feet of room in which to stand at the byre, although less may do in the case of Ayrshires or other small breeds. In arranging a milking stable, it is very necessary that each cow be completely isolated by a partition, so that the milker may not be troubled by the restlessness of the neighbouring beast; whilst fatting or stalled dry stock should be tied side by side without partitions, as by this means economy of space is secured, whilst in our cold climate a number of bodies close to one another afford mutual warmth.

FLOORING.

In milking stables, great care should be exercised that the cattle cannot lie down in their own dung, and that all manure be regularly removed; for milk is exceedingly susceptible of taint by dirt upon the udder, or by contact with impure air.

Behind every cow there should be a gutter, the length of the stall being so regulated that, whilst standing, her dung shall fall into the gutter, but long enough to enable her to lie down upon the stall floor.

There are various methods of constructing floors, amongst which the three most practicable are with wood, cement or brick.

FLOORING WITH WOOD.

Lay a double floor of 2-inch plank. Let the upper floor be just long enough from manger to heel to admit of a cow comfortably lying down; this is usually about 5½ feet. The lower floor should be about 12 inches longer, and be gently declined from the inside of the stable to the door through which manure is thrown or wheeled out. This will secure a run down the gutter. Let the upper and shorter floor, also of 2-inch pine or hemlock, be graded with a slight fall from the feeding-box towards the back, so that no urine or other wet may stagnate, but be carried back to the gutter. Cross pieces should always be laid between these floors, as a slight circulation of air will save the contiguous parts from rotting. In laying any double floor, except where great strength is required, they should, in order to preserve well, be invariably kept apart from one another.

The manure drop or gutter should be 12 inches wide, 7 inches deep, and water-tight. If the floor be planked, the best form of gutter is one sided with plank or two square timbers, and the bottom composed of pounded stone grouted in cement. A plank drop is highly objectionable, as it absorbs the urine, rots quickly, and is a constant source of taint to the stable; whilst it is always slippery.

CEMENT FLOORS.

To make these, take three parts of clear gravel and one part of water-lime cement; add water until a thin grout is formed; mix it *thoroughly*, and lay it on evenly with a trowel.

BRICK FLOORS.

Take what are technically called harp bricks, and set them on their edges; when the brick has been evenly laid, make a concrete by mixing two parts of sharp sand with one of cement; add water until the mixture will run readily, and then pour it on the bricks, and even it over with an old broom; the cement will run between the bricks and firmly unite them, while a surface will be formed quite impervious to water, and not liable to become slippery.

Or hard-burned bricks may be simply laid edgeways in mortar; the addition of the cement, however, makes a more even job.

In the planning or building of cattle stalls this question of flooring is one of great importance, as, unless a proper material and sufficient drainage are secured, the noxious gases emanating from animal dung, which has fermented in the stall, are not only certain to taint milk, but are very injurious to the general health of beasts.

The *Scottish Farmer*, in an article on "Cows and Dairying," says:—"Perfect cleanliness in every part of the cow-house is of essential importance. To judge from the filthy condition in which many—too many—are kept, we would think that this was not essential. The stalls should be kept clean, and not only so, but the walls free from cobwebs and dust; and not less essential is it, that the mangers should be kept clean also. If we would only pay a little attention to the habits of our farm animals, it would be seen that they are scrupulously clean, almost fastidiously so. Much of the benefit of good food is lost by giving it badly prepared, and in dirty mangers or boxes. We have alluded to the importance of ventilation, but the benefit of this will be to a large extent lost if the interior of the house is not kept clean. It is of little use to admit fresh air into the interior, if it is only there to be mixed with nóxious emanations arising from the presence of dirt. Another point to be attended to is the bedding or littering for the cows; in many cases this is grossly neglected—the animals being kept in a very uncomfortable condition. As a rule, the long straw which is generally used, is used in a way anything but economical; by far the most efficient and most economical way to use straw is to cut it with the straw-cutter. This may appear to be a costly mode of using it, but it is quite the reverse. Less straw is required in this form than if used long, and it not only admits of the 'droppings' of the cow being lifted easily away without disturbing the rest of the bedding, but it is, when done well, in the best condition for the manure or dung heap. Sawdust also forms an excellent bedding, as do leaves and fine tanners' bark. The ammonia which, in even ordinary circumstances, rises from the droppings and bedding saturated with urine, and is lost, may be fixed by sprinkling the bedding and the gutters with sulphuric acid—the oil of vitriol of commerce—1 lb. weight of this will fix the ammonia of 60 or 70 gallons of urine. The liquid should be led at once from the house to the liquid manure tank, which will soon pay for itself, the using of sulphuric acid will raise the value of the liquid manure, that being estimated at a couple of pounds a year per cow. The cost of the acid thus used will be very trifling—an authority puts it at one halfpenny per cow per week.

"The best material for making floors of cowhouses, is 'Portland Cement Concrete.' It is easily made, easily laid, economical, and gives a surface as fine and as hard as stone. Grooves for giving a foothold, if thought necessary, and gutters can be formed in it with the greatest ease."

STALLS.

The width of stalls should vary from 3 to 4 feet. Whilst, on the one hand, economy of space is secured by narrow stalls, on the other, animals seem to do better when allowed sufficient room to lie down and stretch themselves, without interfering with the neighbour on either side.

When separate stalls are built, remember that the partitions should be built very strong. At all times when confined, cattle get a certain itchiness, which they will relieve by rubbing against the dividing compartment.

FEEDING-TROUGHS.

The most convenient material for the construction of troughs or feeding boxes in Canada is of wood—the cheapness of wood makes the use of cast-iron a needless extravagance.

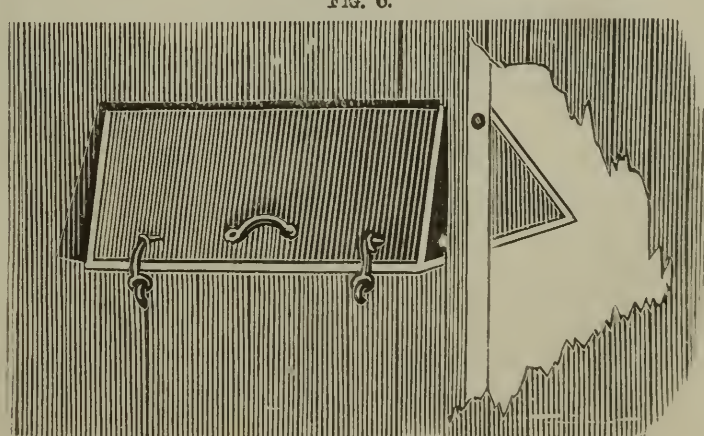
Always raise a box from the floor, so as to secure dryness. To make a handy set of feeding-troughs in cattle stalls, take two—one 1 inch and one ½ inch—pine planks; construct the bottom of the former and the sides of the latter; let the front be 8 inches deep, while the back is about 30 inches; let the back incline outwards at least 7 inches—this is a most important feature, as the beast is prevented from throwing out his food; the divisions between the boxes should be 5 feet high. The common form of feeding-box is, however, inconvenient, as the cow being usually difficult to make "stand over," and being, unless a muley or Galloway, possessed of horns, it is a dangerous course to go up alongside with feed, while if thrown over from the front, a portion is apt to fall on the beast's head, and be thereby dislodged to the floor beneath her feet.

It is a great convenience to build feeding-troughs on a framework similar to that on which the drawer of a table slides, so that the box may be drawn away from the cow when it is necessary to fill.

Cows are also very apt to breathe upon and roll up into a solid ball any portion of their food which is distasteful to them, and this portion, adhering to the sides and bottom of the feed-box, soon ferments, and besides rotting the woodwork, becomes a source of noxious inhalations to the animal.

The following plan of a movable manger for stalls appeared in the *American Agriculturist,* in the November number of 1872, and seems to us to be well worthy of the consideration of all cattle-feeders. The feed-box is simply swung upon two pins or pivots, and kept in its place by a pair of bolts. When ready to be filled, the box is swung out clear of the animal, and thoroughly cleaned, after which the food is placed in the box, pushed in again, and fastened in its place. By this plan, the necessity of going up alongside, or throwing over food to the animal, is obviated, while the quantity of food may be readily regulated by the cleanliness with which a former meal has been consumed.

FIG. 6.



The hole is made, in the engraving, in the partition, simply to give a fuller view of the feeding-box.

It is very necessary that the mangers be divided, so that the turnips or other roots, when not pulped with chaff, may be kept separated from other dry food; as cattle will often throw out all their dry food in order to get at the succulents more freely.

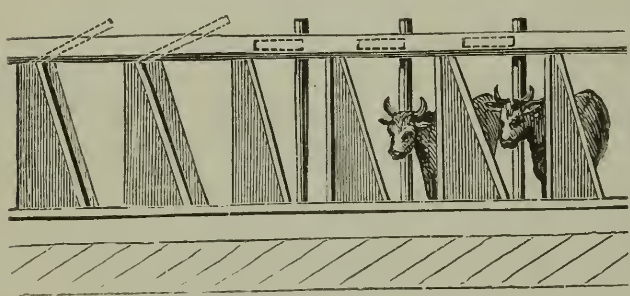
CATTLE FASTENINGS.

To secure cattle, so that they may have ease, and be at the same time unable to break away, is a most important consideration, while opinions on the best method amongst those now in practice are very varied.

MOVABLE STANCHIONS.

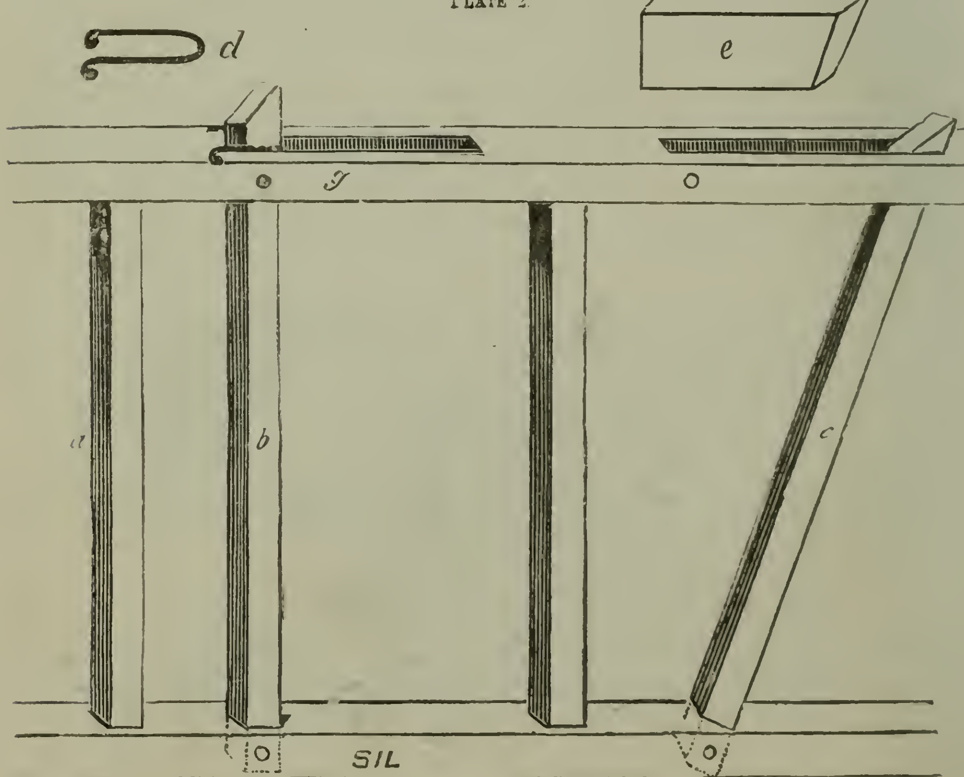
Plates 1 and 2 illustrate the stanchion principle

PLATE 1.



Each cow is fastened between two oak stanchions, $2\frac{1}{2} \times 3$; one, *a*, is fixed, being morticed into the sill and the upper beam; whilst *b* is movable, and works upon a pin in a loose mortice hole in the sill, and in a slot cut in the upper

PLATE 2.



beam. When thrown open, the movable stanchion has a slope, as shown by the dotted lines; when closed upon the neck of the beast, it is secured, at a distance of 6½ to 7 inches, by means of an iron, *d*, of a wedge, *e*, or a pin as at *g*. Of these three fastenings, the wedge is undoubtedly the safest, unless the pin be secured in its place by a key through the smaller end.

The upper beam, which should be about 4 feet 6 inches from the floor, is also of great use in preventing animals raising their heads when they are about to swallow an awkward sized piece of turnip; if the animal be unable to raise his head he will very seldom choke.

PLATE 3.

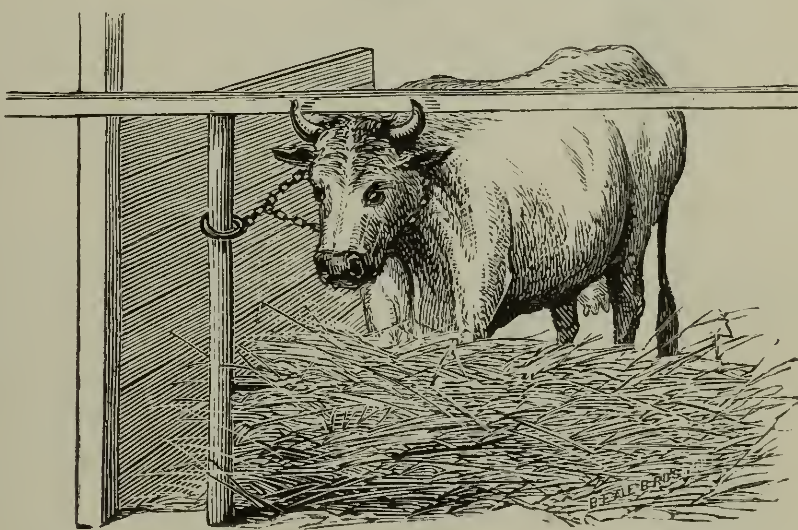


Plate 3 shows a chain which passes round the neck, and is attached to an iron ring which slides upon a post.

This fastening secures to the animal more freedom of head, but is not so secure as the former, whilst it has the disadvantage of allowing a milch cow to move further back, and perhaps soil the udder by lying in manure.

Plate 4 shows a modification of the former, and will readily explain itself; the bar being of good iron and secured to the post by being passed through at the ends, and nutted upon the back side.

Plate 5 represents a more secure plan of fastening by chain. This plan gives the advantage of the stanchion in keeping the beast forward, whilst allowing rather more freedom to the head.

In all cases a beam or pole over the cow's neck, at a height of about four feet and a half from the floor, is a very useful adjunct to secure against choking by pieces of turnip or other roots.

Plate 6 gives a side view of such a stable and stall as has been recommended.

3

PLATE 4.

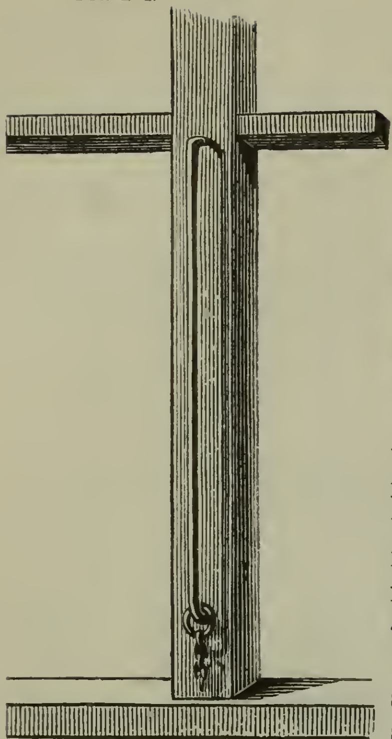
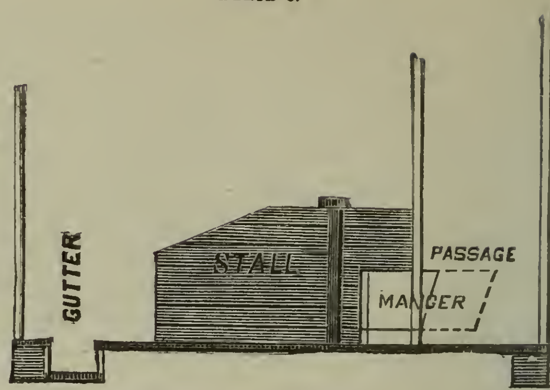


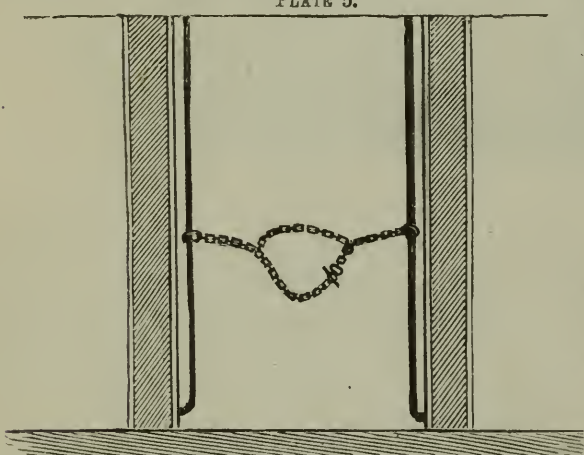
PLATE 6.



Passage, four feet wide; manger, 2 feet wide at the bottom; stall, 6 feet from front to rear; floor, 5 feet from manger to gutter; gutter, 1½ feet wide and 7 inches deep, with the stalls from 3 to 4 feet wide, and a beam over cows' necks 4½ feet from the floor.

Light must be carefully secured in all stables for milch cattle or for young stock; though it is usually considered that a dark place is better for fatting animals, as inducing a desire to lie down more frequently.

PLATE 5.



GENERAL CLEANLINESS.

It is imperative that at all times, and, as far as possible, under all circumstances, general cleanliness be carefully secured and rigidly enforced.

A COMMON FORM OF DISEASE ARISING FROM UNCLEANLINESS.

The most prevalent form of disease among cattle, arising from want of proper and sufficient cleanliness, is that of *lice*. When these appear upon any individual in a lot, the affection almost invariably spreads throughout the whole herd. It is impossible to keep up the condition of an animal, when once troubled with such parasites; and as there is often much trouble in destroying the evil when it has once put in an appearance, and as all applications of tobacco water, carbolic acid, coal oil, sulphur or mercurial ointment are attended with more or less risk to the beast, we would impress upon the farmer the importance of striking at the root of such diseases by taking preventive measures. The best preventive to the spread of this evil is a thorough whitewashing of the stalls, ceilings and manger. Take your pail of whitewash, and drop into it about 3 tablespoonfuls of the commercial carbolic acid; as the lime and water is renewed in the whitewash, also renew the carbolic; take an old broom and thoroughly wash everything round and about the animal, not forgetting the floor overhead. Not only is the stable thus purified and these insects driven off, but a coat of whitewash with carbolic acid is a perfect disinfectant, is at all times conducive of health to animals, and makes every thing lighter, assimilating the light in the stables to that of the dazzling snow without. Whilst upon the subject of these parasites, we will give a few of the methods of cure most efficiently recommended for their removal from the affected animal.

TO CURE LICE AND MANGE IN CATTLE.

As far as the cure is concerned, these two diseases may be classed under the same head. The cause of mange is the presence of a minute insect (or *acarus*) which burrows its way from the surface underneath the cuticle or outer skin.

Though the *acarus*, in each case, may vary in size and form, yet mange in the horse and ox and scab in the sheep are one and the same affection.

Of the primary cause of the appearance of this insect we have no certain knowledge. Poverty of the animal and uncleanliness of stables are, however, most certainly causes, while a plethoric state of the system caused by blood-heating food is undoubtedly a predisposing agent. It is, however, more common in poverty-stricken and debilitated animals than in those that are kept sleek and fat; though the latter are not free from the disease, as may be seen by the very common appearance of a mange on animals to whom is fed a quantity of meal.

The disease spreads rapidly by contagion. When an animal affected with mange or lice is introduced into a herd, the disease is sure to spread throughout, and it is, therefore, very important that affected animals be isolated without delay.

The symptoms of mange are a constant rubbing and itchiness of the animal, and are usually first observed about the root of the tail and along the crest of the neck. On examination it will be found that the location of this irritation is bare, and covered with a dry scurf. If this scurf be removed by the nail, small raw-looking pimples will be found beneath, discharging a yellow serous fluid. The *acari* beneath this scab may be plainly seen through a microscope. In chronic cases, or in those of long continuance, the skin thickens and falls into wrinkles and folds.

To treat mange effectually, two things must be accomplished —primarily to remove the insect and all ova, and then to renew the healthy action of the skin.

Nearly every poisonous compound known in the *Pharmacopœia* has been used for this purpose, and all are more or less dangerous to the animal.

Compounds containing a proportion of arsenic will assuredly kill the insect, but are very apt to be fatal also to the patient. These compounds should never be used by men unskilled in medicine.

Mercurial Ointments are very effectual, but must be used with extreme caution, as mercury has a tendency to produce salivation or ptyalism; if mercury be used in any form, the animal must be kept carefully from cold, and especially from getting wet

If the case is bad enough to warrant the use of mercury, take: Soft-soap one pound, and mercurial ointment (blue ointment) four ounces. Let these two be thoroughly mixed; rub small quantities well into the parts affected; let it remain for a few days, and then wash off with warm water and a brush.

When the disease is not too strongly developed, oils of all kinds, especially animal oils, will destroy the insect, and are perfectly innocuous to the beast.

Sulphur is an effectual remedy, but should also be used with the precaution of keeping the animal dry after application. The best form of employing sulphur is to take sulphuret of potassium (liver of sulphur) one ounce, water eight ounces; and apply the lotion twice a day

In very bad and long-standing cases take equal portions of oil of tar, oil of turpentine, and linseed oil, and rub it well into the skin about every other day with a hard stiff brush. In using any of these remedies, it must be borne in mind that no one agent can be considered as a certain specific After a number of applications, any one remedy, even the most potent, is apt to lose its effect. In this case a change of remedy even from severe to mild will often ensure success.

In cases that will yield to no milder application, a solution of bichloride of mercury may be made, two drachms of the bichloride to a quart of soft water; but this should not be used without the superintendence of or advice from a qualified veterinary surgeon.

Amongst other remedies are:—An infusion of quassia (one pound to the gallon of boiling water) is very safe and often effectual.

Miller's Tick Destroyer, carefully used in accordance with the patentee's printed directions, is in ordinary cases effectual.

The following are peculiarly effective in the case of the large lice:—The *Hœmatopinus Eurysternus*, or *Hœmatopinus ani et vulgœ* (respectively those that appear on the neck and such as appear about the anus and thighs).

A decoction of tobacco—two drachms of tobacco to about a pint of water.

A safe and effectual dressing is: Stavesacre seeds four ounces, white hellebore one ounce; boil in a gallon of water down to two quarts, and apply with a brush to the affected parts. Again, when other methods fail, take red precipitate a teaspoonful (this is mercurial, and the cautions given above with regard to the use of mercurial compounds must here be adopted), and mix in a pound of hog's lard; apply it with the finger to the parts most seriously affected, but not all over at once—say to five or six different spots at a time—and be sure and keep the animal warm and dry under this treatment.

The following plan has been recommended by a practical farmer who is extensively engaged in cattle-raising, and, if effectual, is certainly perfectly safe:

Dissolve about a pint of strong soft-soap in a pail of warm soft water; saturate the whole surface of a lousy cow's body with it; after about thirty minutes repeat the operation, and in another half hour take a pail of clean warm water, and quickly and thoroughly wash out all the soap water and dead lice, put her in a warm stable, and cover her with a dry blanket.

Again, take flowers of sulphur a pound, common turpentine four ounces, mercurial ointment two ounces, and linseed oil a pint; warm the oil, and melt the turpentine in it; when the mixture begins to cool, add the sulphur, and stir the ingredients well together, and afterwards incorporate the blue ointment with the mass by rubbing them together on a marble slab, and apply to the infected spots.

It is well, however, not to confine the treatment to local applications. Give warm mashes, and if the animal be poor and weak endeavour to raise the system.

It should be borne in mind that when mixtures are applied locally, *a small quantity well rubbed in* is more effectual than a greater mass smeared on.

Horse Stables.—The most essential points to be considered in the fitting up of horse stables are, in addition to those appertaining to convenience of feeding, freedom from dust, cleanliness and abundance of light.

The stable which has a loft over it should be at least twelve feet high, and perfect ventilation should be secured either by tubes carrying the foul air away at the roof or by gratings close to the ceiling.

These gratings should be so arranged that, whilst effecting perfect ventilation, they may also be made the means of securing cool currents of air in spring and summer.

It has too long been considered by the groom that a glossy coat can only be associated with a hot stable. To this we would reply that a thin glossy coat is not at all times desirable, for when cold weather approaches nature provides the animal with thick and warm clothing. Man in winter puts on additional clothing, and the horse in like manner requires additional covering, and to the farm horse no blanketing can properly take the place of his natural winter coat.

The coat, however, need not be so long as to be unsightly; warm clothing in a cool stable, with plenty of honest grooming, will keep the hair sufficiently glossy to please any but the most over-fastidious.

The over-heated air in a close stable saves much of this grooming, and for this reason the unscrupulous attendant will sacrifice his horse's health.

The air of the improperly close and heated stable becomes contaminated by the urine and dung, which, rapidly fermenting, give out stimulating and unwholesome vapours. When a person first enters such an ill-managed stable, and especially in the early morning, he is annoyed not only by the muggy heat of the confined air, but by a pungent smell resembling that of hartshorn. Can he then be surprised at the inflammation of the eyes, the chronic cough, and the disease of the lungs, by which the animal, who has been all night shut up in this vitiated atmosphere, is often attacked, or when farcy and even glanders should break out in such a stable ? Chemistry shows us that urine contains a large amount of ammonia, and moreover that, influenced by the heat of a crowded stable, the ammoniacal vapour begins to be given off rapidly almost immediately after the urine has been voided.

THE CEILING OVER HORSES SHOULD BE TIGHT.

For this there are two especially important reasons: first, as a preventive against the ascension of the carbonized and foul air exhaled by the horse; and secondly, as against its circulation through the feed above ; thus injuring both its taste and wholesomeness, and rendering it distasteful to the horse. The fact of the breath of one horse rendering food unpalatable to another is daily illustrated in our public stables in town. By close observation, the reader may notice that his horse will often refuse the hay in the racks from which another horse has previously been eating, while if fresh hay of just the same quality be provided he will no longer leave it untouched.

There should never be trap-doors directly over hay racks—for immediately the attendant commences to pass down hay, the horse will look upwards ; and, by this means, particles of dust or hay seeds are often dropped in his eyes, and may cause severe inflammation, and in many instances lasting injury.

STABLES SHOULD BE ALWAYS KEPT WELL PURIFIED.

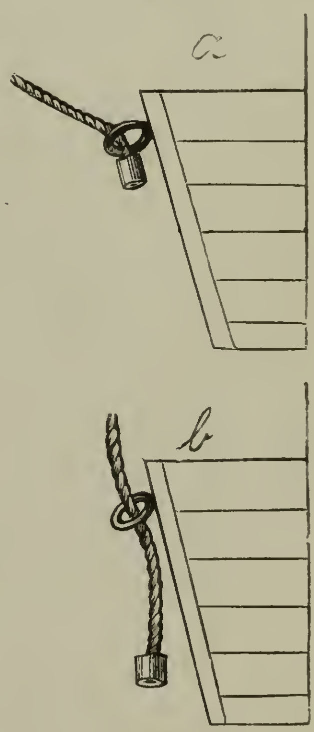
This is best effected by liberal whitewashing and the occasional addition of disinfectants, chief among which ranks carbolic acid; moreover, the whitewash keeps a stable light.

Mangers should be made so that they may be cleaned from the front and filled by the attendant without interference by the horse.

Oat-boxes should be built deep, to prevent the horse casting out with his nose any feed.

There is only one proper way by which to attach a horse's halter to manger or stall, and that is by a rope or strap *running through* a ring and fastened to a block just large enough to prevent it coming through the ring. More horses have been injured by getting their fore leg over the halter-shank, and in consequence being *cast*, than in any other manner in the stable.

FIG. 7.



In accompanying diagram, *a* shows the position of the tie-rope when the horse is standing back, holding his head up high, or lying down; when the horse stands up, instead of the rope forming a loop over which he can get his foot, the weight at the end causes it to run through the ring, and keeps it straight, and at all times tightened.

The feeding and management of horses, mares and colts will be treated of in a subsequent chapter.

THE BARN.

Building Timber.—Much more economy might by a little foresight be practised in the use of building timber than has been formerly. For instance, in many cases the logs used for the sills, plates or beams of a barn are large enough to make two or even four pieces, had they been only *sawn through the middle.* Where a saw mill is not too far distant it will pay, at the present value of timber, to convey such large logs to the mill to be sawn in two. To carry a long stick, take an ordinary strong lumber waggon, attach a reach to both fore and hind parts, and lash the free ends of these reaches to the stick, while the same is securely chained and boomed to both axles. Neither is there any unconquerable difficulty in sawing a stick through, even should it be twice as long as the saw mill carriage. Sticks sawn in this manner, from a large log, are even better than ordinary squared timber for building purposes. Where the heart is near the centre of a beam, the timber will often crack badly while drying, from the centre towards the outer surface. If a tree be, however, sawn through the centre, the heart being outside, these cracks will not appear.

Economy.—In many buildings, where the framework rests upon solid masonry, sills one foot square are rested on the wall, and gains are cut in for each joist. In this case, the large stick of timber is reduced to the thickness of a plank beneath the joists, and the large amount of timber between these joists is useless for any practical purpose. Much saving may be effected by replacing the large sill with a heavy plank, from two to four inches in thickness, and allowing the joists to extend clear across the top of the wall, and flush with its outer face.

Buildings sometimes spread under the old system from the ends of the joists starting out of the gains. By the plan advocated above, where the joists are laid right across the wall and secured by spikes, there is no possibility of any lateral pressure causing a spread, while the expense of material is reduced to one-half of the cost under the old-fashioned system.

As a partial estimate of the solidity of various woods, we here quote the weight per cubic foot of various kinds of wood :

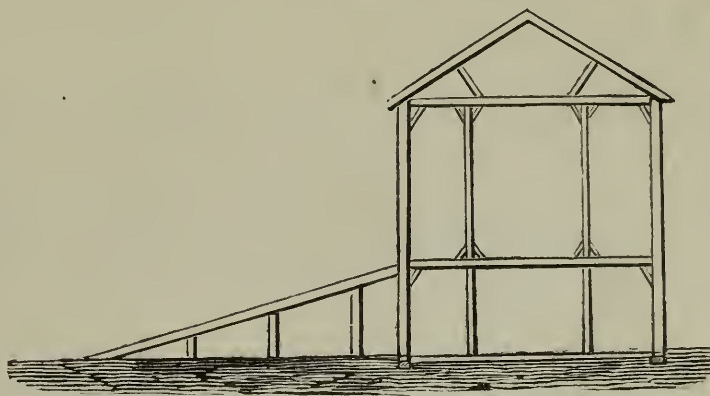
Hickory,	52 lbs per cubic foot.	Pine, Yellow,	38 lbs. per cubic foot.
Beech,	40 " " " "	Cedar,	28 " " " "
Birch,	45 " " " "	Pine, White,	25 " " " "

The Depth of Joists is dependent more upon the length over which they, unsupported, spread, than upon the superincumbent pressure. The rule in this case is,—*The depth must increase as the square of the distance from the point of support on a wall.*

Height of a Barn.—In building a barn for the storage of hay or grain, height should be considered as a general principle in economy of space. While adding a few feet in height to the frame of a barn is not a great extra expense, the additional room attained by extending the barn horizontally would cost very much more in material and work, for in the one case there is no extra roofing or flooring.

Where it can be attained, it is a good plan to build a high barn, the inner frame being so constructed as to admit of two floors, one above the other, in such a manner that the loaded team can drive on to the upper floor and throw its load *down* for perhaps nine feet. Even where this costs the erection of a long bridge, it will be found economical in saving much work at busy times, while we question if the material requisite for an increased area for the storing of hay and grain crops will not more than pay for any bridge required. The accompanying diagram illustrates the principle by showing the gable view of a barn so constructed.

Fig. 8.



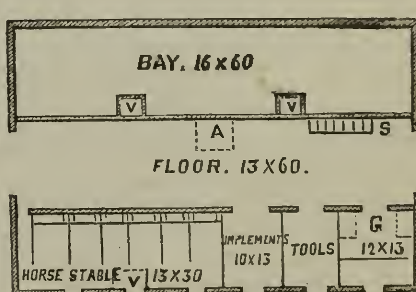
Now that the use of the horse-fork is becoming very general, in the plan of a barn, the upper old-fashioned cross beams should be avoided. We shall presently, by plan, show a barn constructed on this principle.

Among the many plans for barns that we have in view, we select one which appeared not a long time ago in the columns of the *Country Gentleman* as one that admirably suits the system of farming in, and the climate of Canada, and as one from which many valuable ideas may be gained by the intending builder, and which is susceptible of modification to suit almost any locality and site.

The accompanying plan is for a barn of a size suitable for about 75 acres of land under cultivation on the system of mixed husbandry.

The barn is 42 × 60 ft. Figure 1 shows the common or principal floor, and is so constructed that a loaded waggon is driven in at one end and when emptied is driven out at the other. The arrangement for this purpose, so as not to interfere with the cellar or basement, is shown in the perspective view, figure 2, an embankment being made at each end, which would be facilitated if the building were placed between two slight knolls or in a moderate hol-

Fig. 9.



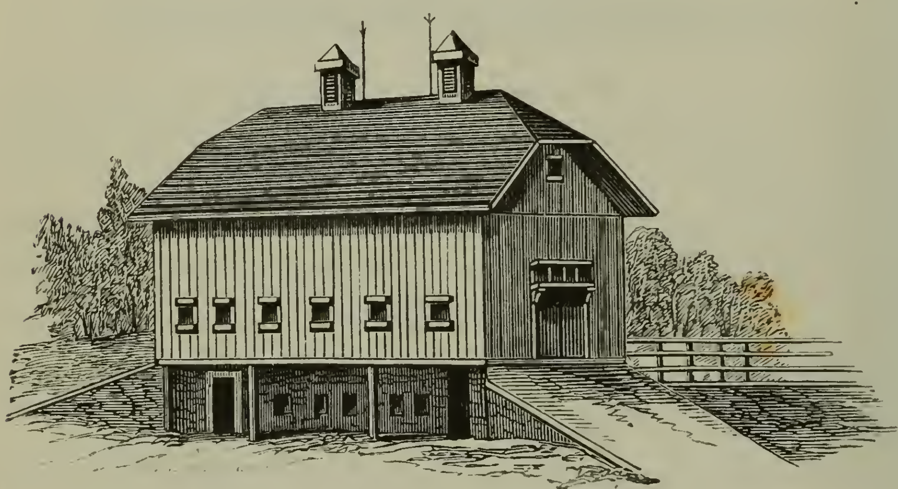
1. Principal Floor.

low, in which case ample drains should be provided round the whole. The plan fig. 1, mostly explains itself; V V being ventilators or hay shutes; A, trap door for throwing down chaff or straw; G, granary; and S, stairs. The bay contains 950 square feet, and will hold nearly 40 tons of compact hay of about 500 cubic feet to the ton when well settled.

The space over the horse stables and platforms over the floor will hold at least 20 tons more, making a complete available space for 60 tons of hay.

By marking or graduating one of the ventilators in the large bay into feet, the owner can see about how many tons of hay he has on hand at any time.

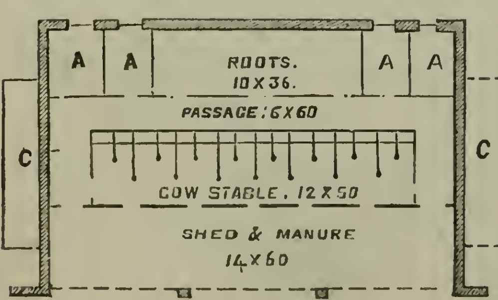
FIG. 10.



2. Perspective View.

Figure 3 represents the basements. The roots are drawn in on the barn floor and dumped down the trap A; fig. 1, A A A A, are calf pens or boxes for cows in calf.

FIG. 11.



3. Basement.

The 3000 square feet of roof will supply an annual average of about 2000 barrels of water—and cisterns may be made, say at C C, to contain from 400 to 500 barrels—*i. e.*, if they are to be depended on mainly for watering the stock.

The accompanying plan and view and explanation are from a frequent correspondent of the *Canada Farmer*, who writes over the initial "C.," and are well worthy of consideration on the part of any farmer about to build.

He says: "Among the advantages which this design embraces, may be reckoned the excellent ventilation provided. By the arrangement indicated, the trap-doors (1, 1,) on the main floor answer the double purposes of filling the root-house below and of affording the means of perfect ventilation to the heaps of roots when required by the removal of the obstructing shutters at (4, 4,) under the root-house floor, and admitting a draught of cold air to ascend through the roots and to escape by the traps in the floor. The grave objection to the usual plan of allowing the breath and exhalations of animals to pass into the grain or hay above is also entirely avoided by providing the spaces marked (2, 2). This construction secures an opening over each row of cattle. The arrangements also provide for an exceedingly convenient space through which to feed the cattle with hay or straw from the barn floor. The barn has three floors: one of twelve feet in width at each end, and one of twenty feet in the centre. There are doors on these floors opposite each other, to admit of the free passage of air in the summer.

"On the lower side, which is not designed for the egress of waggons, the doors open outwards, and over the waggon shed below. This shed will be found useful to drive under, and also admits of loading from the barn floor through a small trap into the waggon whilst standing under the shed. This is not shown in the drawing, as it would only require a board on which the bags should be caused to slide down.

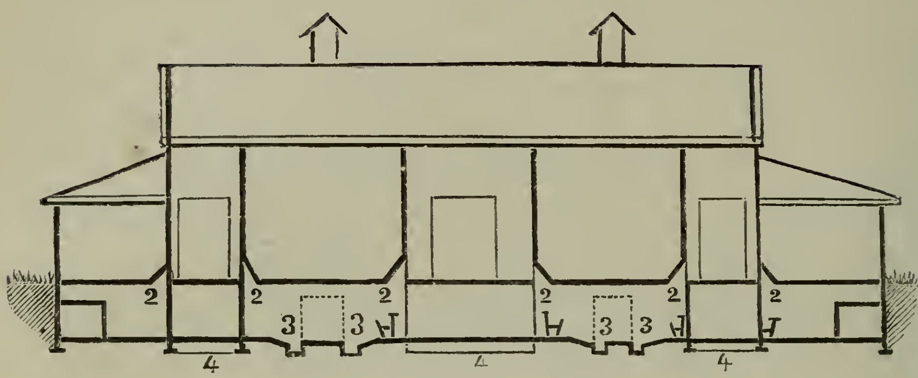
"The two end floors are no loss of space, as they can be filled with grain at harvest to be thrashed out first in time for storing roots, and as they are only eight feet high the portion overhead may be occupied, as the other parts of the barn, with grain. When thrashing is done, they form a most convenient granary, storehouse for tools, &c. A hill-side is undoubtedly the best site on which to build such a barn, but it is by no means an absolute necessity. An ascent may be formed as a substitute.

"When we consider that all the product of the farm, after being once hauled in by horses, has again to be passed in detail to its destination, it will be at once manifest that there is great advantage in causing it to work down hill into racks and cribs, instead of all being carried out on a level by hand.

"Again, the horse-power works to great advantage in such a barn as this, as all cut hay or straw made on the upper floor will readily be fed to cattle below, through the ventilators over their heads, and the pulped turnips below are readily mixed therewith."

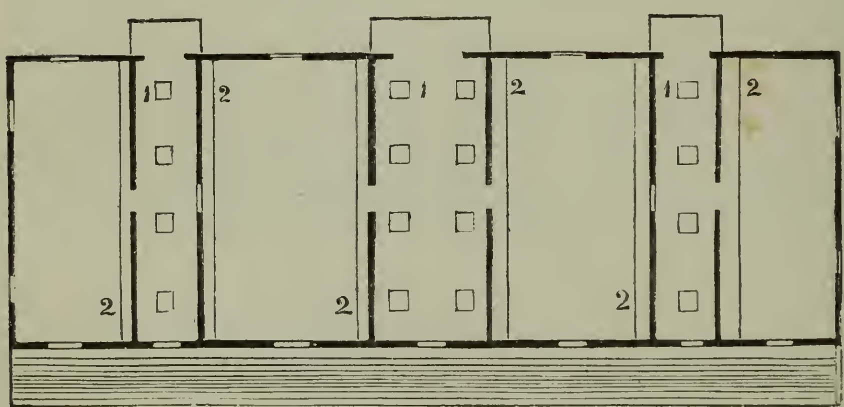
No provision for water is shown, as it is the writer's opinion that the exercise for the cattle of walking to water once a day is beneficial.

Fig. 12.



Longitudinal Section.

Fig. 13.



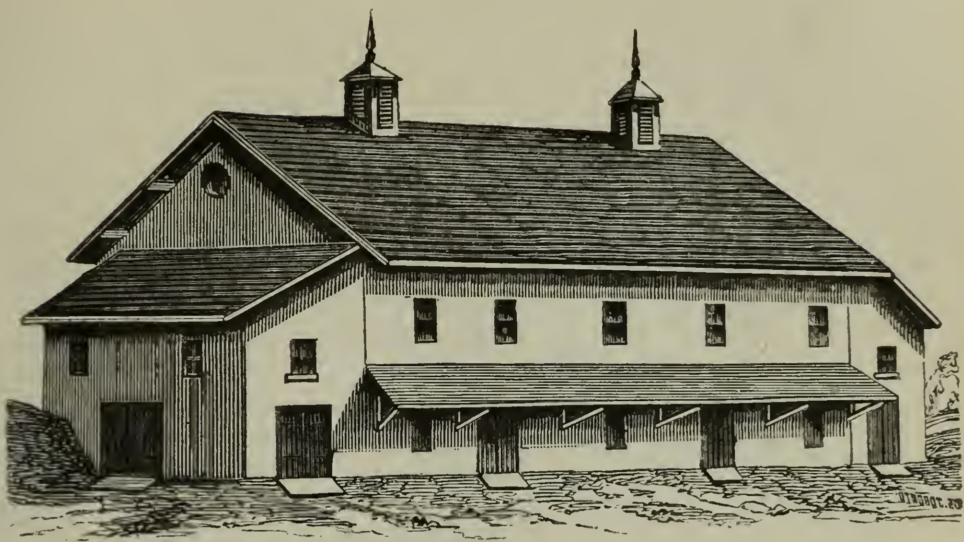
Second Floor Plan.

Still, a cistern would be handy, for water is often required to mix ground grain with chaff, for watering fatting cattle, sick beasts, and for many other purposes, immediately within the building. Neither are racks shown, as the writer prefers feeding cut fodder.

The large doors in the sheds at the end are designed, among other purposes, to allow of a team being driven in through the sheds to carry away the manure.

We have not space, in a work of the proposed dimensions, to enter more fully into the various forms of barn buildings. We believe there are works to be obtained, specially devoted to this subject, and these may be, with advantage, perused by the farmer proposing to build or increase.

FIG. 14.



We should like to have given more plans, for we consider that the saving of trouble and labour is, in a carefully schemed steading, of no small magnitude.

We now proceed to some practical remarks on the various materials brought into requisition in the construction of farm buildings.

ROOFING MATERIALS.

Our pine woods have so far provided us with an abundance of material for the covering of our buildings, but the time cannot be far distant when this source will not be so readily at hand, and when we must look to some other and more lasting material for the purpose.

Tiles, being made of burnt earth, are fireproof, and as such are valuable, but from their weight it is necessary that the woodwork be of sufficient strength. Moreover, to prevent the snow and rain beating under, it becomes necessary to lay them in mortar, and this again forms an additional weight upon the framework of the buildings. Tiles must be laid on a steep roof, at least a quarter pitch; *i.e.*, the rafters being at right angles with one another at the peak. The tiles are hung by means of one or more wooden pegs driven through the tile and hung upon the roof boards, which are composed of strong slats laid lengthways upon the rafters. The pegs through the tiles catch on the upper side of these slats. The pegs must be driven home on each tile, so as not to incommode the lay of the tile next above.

The tiles are laid in mortar; *i.e.* the mortar is laid on that part of each tile that is covered by the next above.

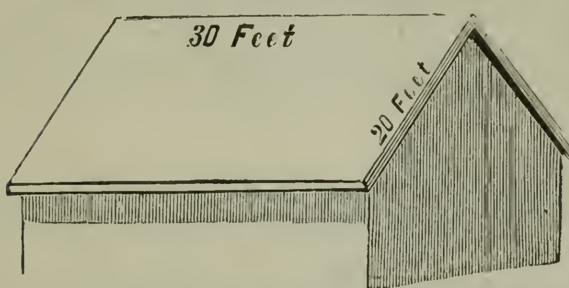
It must, however, be borne in mind, that this roof is very expensive, and that the tiles have to be burned from clay entirely free from limestone. For, unless the pottery be of the best, it is subject to be severely injured by Canadian frosts. There are various shapes of tiles, from the plain flat to the fluted tile.

Slates also form an excellent roof, but are very expensive.

Shingles.—Extra shaved shingles made from large sound pine timber are the most durable. Spruce, if large, and the sap all taken off, will make shingles to last for fifteen or twenty years. Some ash shingles last well, but they are very apt to warp and crack.

TO FIND THE NUMBER OF SHINGLES ON A GIVEN SIZED ROOF.

DIAGRAM 3.



Rule.—Multiply the breadth of one side of the roof in feet by its full length in feet; reduce to inches; and divide by 10, the result will be the number of shingles required for one side of the roof.

Examples.

The roof in the diagram measures in length 30 feet.
" " " in breadth 20 "

The breadth of one side	20
" length "	30
	600 feet.
To reduce to inches by 144	144
	86400
Divide by ten..	8640

—the number of shingles required for one side.

Therefore it would take 17,280, or seventeen thousand shingles to cover this roof.

Paint for Shingles.—Slake stone lime by putting into a tub and keeping in the steam. When slaked, pass through a fine sieve, and to each six quarts add one quart of salt and one gallon of water; boil and skim off what rises to the surface. To each five gallons of this result add *pulverized alum*, one pound; *copperas*, one half-pound; *potash*, one half-pound; *hardwood ashes*, sifted, four pounds; apply with a whitewash brush. This is a very cheap paint, and will last for many years.

To prevent decay in Shingles, the following has been well recommended:—Take a potash kettle or large tub, and put into it one barrel of lye of wood ashes, five pounds of white vitriol, five pounds of alum, and as much salt as will dissolve in the liquor. Make the mixture, when all dissolved, warm; soak in it the shingles. Then lay the shingles on the roof in the usual manner. After the roof is laid, take what liquor is left, put lime enough in it to make a whitewash, and if you desire colour, add some colouring matter, as ochre, Spanish brown, lampblack, &c., and wash on the roof with an old broom or whitewash brush.

Paint for Buildings.—A cheap wash may be made as follows:— Take a clean water-tight barrel, and put into it half a bushel of good lime; slake it with boiling water; cover it six or seven inches deep, and see that it be thoroughly slackened. Then dissolve the slackened lime in water, and add two pounds of sulphate of zinc and one pound common salt. This will harden the wash, and prevent its cracking after application. Colour it with: For a cream colour add, in proportion to the above mixture, three pounds yellow ochre; for lead colour, add a lump of iron black; for fawn colour, add four pounds umber, one pound of Indian red, and one pound lampblack; for stone colour, add two pounds of raw umber and two pounds lampblack. To render it still more durable, and to give a glossiness to the work, before application to woodwork add a pint of sweet milk to a gallon of the wash.

Crude petroleum, or coal tar, as an application to woodwork, is of some value, although dangerous on account of fire. The proper method of applying coal or gas tar to woodwork is by heating it to the boiling point. Of course, this, when subject to light, heat and rain, will come off in a year or two; but when applied hot, it will soak into the pores of wood and render it impervious to damp.

Petroleum is not affected as coal tar, and outside influences will not wash it off.

In using paint, it must be borne in mind that the advantages of rendering damp proof arise chiefly from the use of oil. The natural pigments are not only the most durable, but the most economical to use in painting.

For painting brick, about the best mixture is finely-ground French yellow ochre and American white zinc, equal quantities by weight. The resulting colour is a soft buff, pleasing and permanent.

The ordinary colours used are Venetian red, artificial ochres and red oxide of iron; but these do not hold oil as well as the French yellow ochre.

Brick should never be painted except in dry, warm seasons, after the moisture which brick absorbs in spring and winter has dried out. If painted too early, the paint is apt to scale off.

Painting is too often executed rapidly, to the injury of its permanent results.

Oil without any paint at all would be the best method of renderring wood waterproof, but for the combined effects of economy and appearance it is desirable to mix with the oil various paints.

The extra ingredients for drying, such as benzine, turpentine, Japan varnish, litharge, &c., should be used sparingly, for their effect is to prevent the oil in paint mixtures from saturating the wood; and it is in this saturation of wood by the oil that the best results are attained.

Where much of these drying materials are used, the oil contained in the paint is formed into a gloss, which is rapidly washed off by rain and peeled off by the sun.

Of course this does not apply to inside painting, but only to that which is meant to render exposed wood impervious to damp.

Oil must be boiled, to free it from impurities, before using in paint.

Never use any but the purest oil. Moderately cold weather is the best time in which to paint buildings, fences, &c., and great haste in the application and drying is inadmissible.

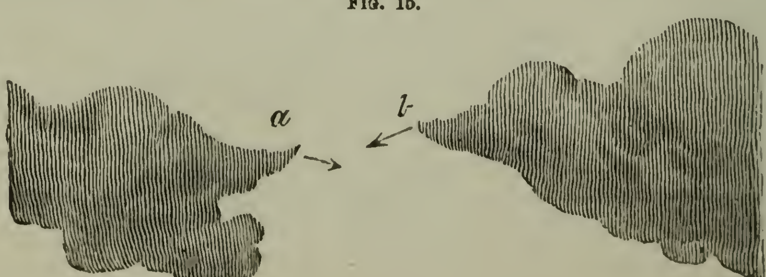
The very best plan to be adopted is, paint with pure boiled linseed oil and pigment, no drying material, and let it have sufficient time to dry and soak into the pores of the wood; long intervals between the several coats of paint.

Lightning Rods.—It has been asked by some, what benefit can be derived from the use of Lightning Rods? We will explain in a very short manner the principle upon which these rods operate. *Lightning*, or *electricity*, is supposed by science, in lieu of a more definite theory, to be composed of two fluids, to which have been given the names Positive Electricity and Negative Electricity. It is also an accepted fact, that the natures of these two are such that like repels like and attracts unlike.

In other words, a body surcharged with *positive* electricity, over which positive electricity preponderates, will attract to itself the electricity of a body surcharged with *negative*, and *vice versa*.

As an instance, we shall take the two clouds. We shall say

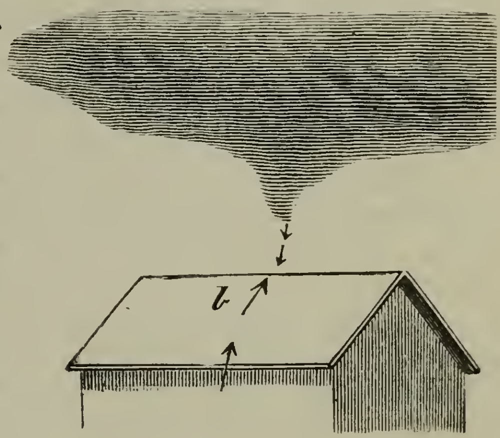
FIG. 15.



that the negative electricity of the one cloud *a* is gathered towards the point *a*, and the positive electricity of the cloud *b* is gathered towards the point *b*. Then when *a* and *b* come within a certain distance of one another, the attraction of the opposite poles of electricity, mutually the one to the other, becomes so great, that they rush to unitewith great rapidity through the intervening space. The union is attended with combustion, which is the *flash of lightning*, while the sound of such combustion is the thunder.

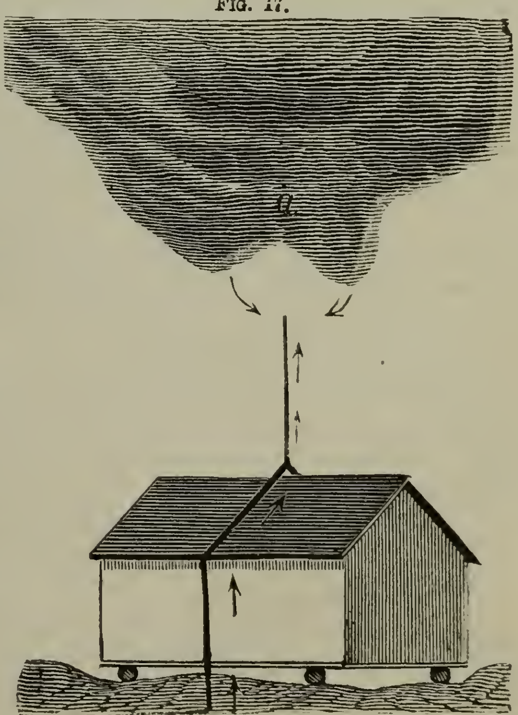
We will now take as one illustration the cloud and the barn, and before doing so, point out another very important fact with regard to the escape of electricity from bodies: *i.e.*, that *electricity in any body will invariably gather to a point, and will escape first from that point.* This is very important, as upon it rests the entire principle of the use of the lightning rod.

Fig. 16.



Supposing, as in the annexed diagram, there is a point *a* in the cloud, to which is gathered the positive electricity of the cloud: the barn *b* charged with an opposite or negative electricity: the affinity of the electricity respectively contained in the barn and in the cloud is so great that, should the cloud be driven within a certain distance of the barn, their severally contained electricities will burst all bonds asunder, and, rushing with prodigious force to meet one another, will evolve such heat as will, in all probability, set the barn on fire.

Fig. 17.



We now consider the exact use and advantage of the lightning rod. A thunder cloud charged with, say positive electricity, appears and is driven by the upper currents of air into the neighbourhood of our barn. The barn and the earth contiguous are surcharged with an electricity of an opposite nature (or pole), say negative. There is then an attraction between the electricities contained in the cloud and in the earth.

If a solid rod of iron be carried up from the earth towards the cloud, electricity will gather in force at its point, and rush from that point to meet the opposite electricity from the cloud.

The currents, evolving immense heat, will combine in and above the rod, and if the rod be properly isolated (by glass) from the building, the shock will take place directly between the earth and the cloud, and will not affect the building.

Brief as is this explanation, it is all for which we can afford space in this work; at least, from it may be deduced the safety to a building of a contiguous but yet isolated lightning rod.

Professor Henry, of the Smithsonian Institute, gives the following instructions for the erection of lightning rods :—

1. The rod should consist of round iron of about one inch in diameter; its parts, throughout the whole length, should be in perfect metallic continuity, by being secured together with coupling ferrules.

2. To secure it from rust, the rod should be coated with black paint, itself a good conductor.

3. It should terminate in a single platinum point.

4. The shorter and more direct the course of the rod to the earth, the better; bending should be rounded, and not formed in acute angles.

5. It should be fastened to the building by iron eyes, and may be insulated from these by cylinders ot glass.

6. The rod should be connected with the earth in the most perfect manner possible. Where practicable, let the rod be conveyed horizontally to the nearest well, and then turned vertically downwards until the end enters the water as deep as its lowest level. The horizontal part of the rod may be buried in a stratum of pounded charcoal and ashes. The rod should be placed, in preference, on the west side of a building. A rod of this kind may be put up by any ordinary blacksmith.

The rod in question is in accordance with our latest knowledge of all the facts of electricity.

Attempted improvements on it are worthless, and, as a general thing, are proposed by those who are but slightly acquainted with the subject (and we may add, who are interested in the sale and erection of rods).

ON CULTIVATION.

Thorough cultivation and liberal manuring are the two keystones upon which are built the success of agriculture. It is perfectly useless to half-work our lands. If we would raise a fine horse, he must be generously fed, and moderately exercised from a colt: should we starve him and put him to heavy work when young, he will assuredly turn out a stunted beast. And so it is in regard to our land; we must feed generously and work moderately if we would have profitable returns.

The land is the store-room to which the plant—be it grain, grass or root—must go to obtain the greater part of its daily sustenance. It is for us to see that the store-room is well provided, and is at all times and in due seasons accessible to the tender rootlet.

As man's life and growth is dependent upon a regular supply of food, which, entering into the body and being subjected to certain chemical processes within, is divided into various portions, which portions are severally appropriated to the different wants of the body, some to blood, some to bone, some to tissue, &c., so the life and growth of the plant is equally dependent upon a constant and regular supply of food, which, entering into its body by a thousand tiny mouths, is appropriated to the different wants of the living plant, some to the formation of straw, some to grain, some to sugar, some to starch, &c.

The operations of nature, on the control and subordination of which man's life is dependent, are almost analogous to those by which are regulated the life and growth of plants; and the same urgency which calls for a generous supply of food to man is necessary if we would have our plants to grow and thrive.

The knowledge, to the perfection of which we as farmers should strive, is that of the best plan by which to supply food, and then to render such supply available to our crops. The former of these is performed by gift of manure, the latter by cultivation of the soil. As a practical illustration of the effects of thorough culture, let us only point to the gardener's crops. In the garden, thorough cultivation and generous manuring are faithfully performed, and the results are such that if the acre should yield in proportion to the yard, the crops upon a hundred-acre farm would be wondrous to behold.

Now, whilst we cannot expect to cultivate our farm as thoroughly as does the gardener his plot, yet it should be the constant aim of the farmer to bring his land to a state of garden fertility. The nearer to that end that he attains, the greater his profit proportionately to the expense of cultivation. If land is rich, and is kept rich, there is no more cost in the raising of forty bushels than in that of ten bushels of wheat to the acre.

The foundation of farm cultivation must ever be good ploughing. The reader may say, "Why! almost any boy can plough." We respectfully answer, a very great number of farm men cannot plough.

To plough well, a good implement is necessary. The style, shape and work of the plough vary according to the various natures of soil, and are greatly governed by taste.

In a later portion of this work will be found a chapter devoted to ploughs and implements.

Ploughing.—No amount of after-cultivation can retrieve bad ploughing; if the field be once turned over badly, it will be the cause of extra trouble to the cultivator and injury to the crop throughout the whole season.

We need not here dilate upon the necessity of economizing the work of horses; suffice it to say, that it is a matter of vital importance to use the plough which, with the minimum draught, will thoroughly perform the required work.

There are various styles of ploughing, upon which we now propose to dwell shortly.

Permanent meadows or pastures.—Where it is intended that certain fields be used for a length of time in grass, they should be laid flat and well surface-drained by narrow grips in any direction necessary to carry away stagnant water. It must be remembered that whilst water lying upon and freezing in young clover meadows is almost always fatal to the plant, yet, that the old and permanent meadows will stand a great deal of stagnant surface water, and require to hold all the water that falls throughout the spring, summer and fall seasons.

Width of lands.—In ploughing for a seed bed there is a great variation, according to soil, in regard to the requisite width. *Upon the heavy clays* a narrow land is required, so that there are plenty of furrows to act as surface drains, while the land is so rounded up that surface water cannot rest upon it.

On the lighter lands, especially where the subsoil is of a gravelly nature, it were better if no furrow were made in the whole field; but, at any rate, where the land system as now generally adopted prevails, they may be at least twenty-four paces wide from crown to crown.

To do without lands there are two methods—one, the use of the *turnwrest* or *swivel* plough, and the other by ploughing round the field. To the latter there may be taken great objection on account of the one fact that the horses trample down the new turned seed bed at each corner.

The *turnwrest* or *swivel* plough has of late years become more popular. The peculiar principle of this plough is, that by reversing the mould board at each end of the field the furrow slice can be thrown up first on the *gee* side, and then, on returning, on the *haw* side; so that all loss of time in taking the plough empty across the breadth of the land at the headlands is done away with, and instead the plough returns each time in the same furrow in which it previously came down.

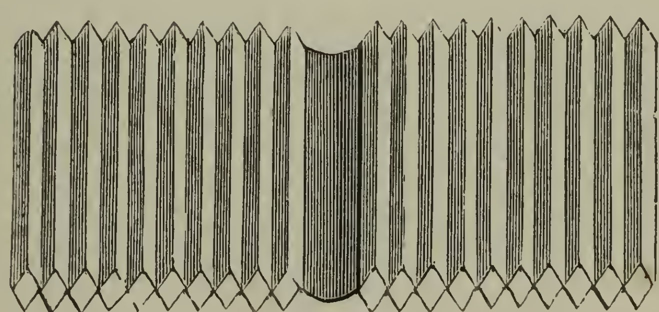
The adoption of this plan will yet be general on our light lands. On sandy soils the furrow is utterly useless; in its finishing, in the setting out of stakes for and the first slices of the land crown,.

there is an amount of time taken up which might just as well be saved to the regular ploughing; whilst the furrows are a constant source of annoyance in after cultivation, taking extra strokes from the drag harrows to fill them, compelling the roller to travel across them, jolting the mower and reaper, and also the loaded waggon, whilst, as a matter of fact, the grain in the furrow seldom does as well as that on the main land. On sandy land we should have our fields perfectly even on the surface; if we adopt the no-land system we may cross-plough with impunity—we shall have no dead furrows to cause hollows and rises all over the surface of our fields.

On lands of a clayey nature, and in which, owing to their tenacity, there is little chance for the escape of surface water by percolation, it is expedient to plough in narrow lands and to round them well off, and it is here that the knowledge of a good ploughman is shown. The object must be to preserve a gradual descent from the crown to the furrow.

Whilst sandy land may and indeed should be turned over flat, the clay furrow-slices require to be set up well on end, so that whilst each slice rests firmly against its neighbour, a provision is made between them for drainage. The accompanying diagram will show more plainly than language the shape in which clay lands and furrows should be ploughed.

Fig. 18.



Cross ploughing is of great benefit on tenacious and dirty lands, but may be advantageously dispensed with upon our sandy and lighter soils. The advantage sought in cross-ploughing is to cut across, and break into squares the old ploughing. Now upon the lighter soils this object may be better obtained by a free use of the cultivator.

The quantity of land ploughed in a day depends upon the nature of the soil, the weather, and the lay of the land. It is generally considered that two acres of stubble or one and a half acres of sod is a good average day's work for an ordinary team.

How shall we plough our hills?—There is a great difference of practice on this point. Some plough round the hill, others plough across, and others up and down hills. The last plan is radically wrong. By ploughing up and down a hill we form in each furrow a shallow underdrain with a very steep grade. Every storm of rain that falls upon a hill so ploughed rushes down these innumerable drains, carrying with it manure, mould, and even the plants themselves; in fine, not only washing away the hill and its plants, but smothering with these very washings a large portion of the crop below; whilst, on the other hand, by ploughing round and round the hill, or even straight across it, the land is laid solidly together, and through such the rains of spring and summer can only soak instead of rushing away in streams, and thus the soil on the hill-top receives a maximum amount of benefit from every rainfall.

The turnwrest plough, of which we have before spoken, and which will be found described in a future chapter devoted to implements, will be found very useful on a hilly farm, as by its use the team may be started at the bottom of the hill, and every consecutive furrow thrown down hill, leaving a perfectly even surface, without ridge or furrow.

On heavy land, where it may be thought advisable to let the rain from off the hill, it is better to plough diagonally up and down the hill, as by that means the velocity of the rushing water after a storm will not be so apt to wash away the surface soil.

From what has been stated, the reader must perceive that ploughing cannot be regulated by any given and invariable rule, but that the individual must use his own discretion, and, governed by the general knowledge that we have of the special characteristics of various soils, must adopt his own plans to the peculiar land upon which his lot has been cast.

On strong lands, clays and loams, the plough should be set in deeply, whilst on the gravelly and sandy lands, the advantages to be obtained by deep ploughing are not by any means apparent; while great harm may be done should we incautiously turn up a sterile, cold and poisonous subsoil. Of this we shall now treat more fully under the head of

DEEP AND SHALLOW PLOUGHING.

The depth of ploughing must always be regulated by the nature of the soil and subsoil. While the efficacy of renewing the surface by new soil brought up gradually from below has been practically and fully established, no one would wish to plough down into a subsoil of very inferior quality. As an instance of the injurious effects that might result from an injudicious reversal of such soil, it has been found that in cases, the subsoil is highly impregnated with oxide of iron, a substance exactly similar to ordinary iron rust. This substance is fatal to plant life, and it is found extremely difficult to neutralize it when once mixed with a seed bed.

Still, as a very general rule, shallow ploughing is one of the most crying evils in agriculture all over the world, and from the evil Canada is far from free. It is computed that the average depth to which the farming soil in Canada is now worked cannot be more than five or six inches.

Now, when we consider that the tap root of wheat, our staple crop, has been found to reach down to a depth of 12 inches, and that, under any circumstances, it will, if the soil be loose enough to permit it, sink eight and nine inches, it is apparent that, where the plan is practicable, a sufficient depth should be made loose.

If the tap root of wheat comes, in its search for deep hidden food, in contact with a pan so hard as to prevent its further progress, it will again throw out its rootlets upwards, and there becoming entangled, and struggling for food and life with a thousand other roots, its energy is wasted, its growth impeded, and the plant above must suffer.

There are two modes of deep ploughing, which may be called *deep ploughing proper* and *subsoiling.* Under the former plan, the subsoil is actually reversed and mixed with the surface mould; while, under the latter plan, the subsoil is simply stirred up and loosened. Of the latter this work will presently treat, under the caption Subsoiling.

When we propose to turn up soil from below and to incorporate it with our already cultivated land, we must be sure that we are not about to do it at the risk of poisoning the surface. As we have already stated, there are some subsoils that must *never be* turned up. These may be discovered by submission to a competent analytical chemist, but as farmers have not usually such men handy to them, the simplest plan is for the individual to institute a practical experiment for himself by taking a few spadefuls of surface and an inch or so of subsoil, mixing them together, under the same circumstances of season and management as he proposes to adopt in the field, and then try what effect these mixed soils will have upon some seed. If the seed, be it wheat or of any other kind, grows healthily, he may be assured that he is safe in carrying his experiment to the field; for, if the subsoil be not visibly injurious, he may be assured that the other benefits are so great, that the surface soil will be greatly advantaged by a renewal from below.

Even in the best of subsoils, caution must be used before an attempt is made to utilize it by deep ploughing. Having been always in a state of darkness, and removed from immediate contact with the atmosphere, it is, when first brought to the surface, in a state technically known as cold. Now to explain this term *cold*, or *sour.* A soil may be full of the necessary elements of plant life, yet those elements are so held together that the tender rootlet is unable to extract any for its use; such land, then, whilst rich in food, is yet useless to the plant, and is called cold, or sour. To release these constituent elements and render them available to the plant, a chemical process is necessary, and that is performed without the help of man, by aeration, or exposure to the air, and especially to the alternate actions of freezing and thawing.

For this reason, such deep ploughing as will rip up and bring the subsoil to the surface must always be done in the fall, when, by lying exposed, it will receive the full effects of frost, snow, rain and thaw, while after, or in spring, cultivation will distribute it evenly through the old soil. Farmers have heard of the benefits of deep ploughing, have tried it and immediately sowed grain; the crop was a failure, because the soil was sour, having had no chance of aeration; and they, disgusted, have set down deep ploughing as one of the humbugs of the book farmer.

It is not then advisable to bring up more than two or three inches of subsoil at any one time. Neither is it necessary or advisable, after once ploughing deeply, to repeat the operation in each year—for if we should, we only again fall into the error of creating another hard pan by the constant passage of horses, men and ploughs over the subsoil in the furrow. When once a field has been broken up to a greater depth than usual, it may again be ploughed for several years only sufficiently deep to give a good seed bed. This is one of the chief advantages in favour of mixed husbandry, that various crops require various depths of soil, from the short-rooted barley to the tap roots such as carrots or mangolds.

If hill sides be deeply ploughed, the soil will not as readily wash off them as when in a shallow condition; the rain falls in torrents, and rushes down, carrying soil and roots and manure along with it.

Another very good opportunity occurs in rotation for the purpose of renewing land by bringing up a fresh supply of subsoil. When land is to be fall ploughed for roots, and it is proposed to apply farm-yard manure, there is an excellent time to turn up two inches of sour subsoil, and thoroughly incorporating with it barn-yard manure, leave them together exposed to the frosts and snows of winter.

When the land is of a sandy nature, with perhaps a gravelly subsoil, and by the constant passage of the plough a hard pan has been formed at a reasonable depth, the efficacy of deepening such may be in many cases very doubtful.

The second kind of deep ploughing is that of SUBSOILING, and we consider this plan practical, and certain to be of advantage in land of almost any nature. The action of the subsoil plough is not to bring subsoil to the top, but to stir it below. The advantages obtained by its use are:

Drainage.—The average depth to which our fields have been heretofore ploughed is probably about five inches Year after year and season after season, our ploughs, horses and men have tramped upon every inch of our field in furrows, just the same depth from the surface each time. Such constant trampling has left a solid sub-surface, baked down and compressed, until it has assumed more the nature of stone than that of soil. Through this surface, or *pan,* no water can saturate, nor can any plant thrust in its tender fibrous rootlets. Every plant whose roots partake of the nature of tap root—and in this category may be found our most valuable cereal, wheat—requires a good anchorage; such tap roots strike straight down in a vertical direction, and directly on meeting this hard pan are turned back again, and, extending in an unnatural way along the surface of the ground, become entangled in a labyrinth with hundreds of other roots, and in the struggle for food that commences between them all the weaker ones must perish.

This is the only reasonable way of accounting for the rapid decline in the health of a crop that we so often see, when almost at its prime.

We want all spring and summer rains to soak through our lands, and not to rush off them.

By breaking up this hard pan, we provide for the perfect soakage or percolation of all water into our soils, and for its access to the very tiniest rootlet.

To guard against drought, deep cultivation is effectual. This is apparent to the most casual observer, for the garden, under deep spade culture, never dries out as rapidly as the open field.

The principle is what is known scientifically as *capillary attraction.*

Deep in all soils, except those of a gravelly nature (and on such subsoiling is a waste of time and labour), is contained a large amount of moisture. When the earth upon the surface becomes dried out, it has a strong tendency to draw up moisture, by the process known as capillary attraction, from the soil beneath, and it would in all dry seasons do so to advantage, were it not for the intervening barrier or hard pan caused by the passage of horses and implements so often over the one level.

The action of this hard pan, as an impediment to vegetable growth, is very apparent in the case of the long carrot. We know that to grow carrots to perfection, it is necessary that the ground be stirred to a depth of at least twenty inches; and the same principle applies to the necessities of other tap-rooted plants—for instance, wheat.

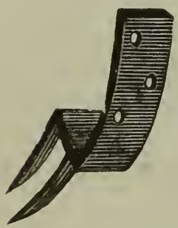
A deep loose soil can only be had by subsoiling or trench ploughing.

Trench ploughing is fitted only for very rich and deep soil, in which the subsoil is equally fertile with the surface. Where there is but a shallow depth of fertile soil, the work of subsoiling must be performed before such can be improved in depth.

This is generally done by means of a subsoil plough following in the furrow, and necessitates the use of another team.

" This is an obstacle which is insurmountable on the great majority of farms. To provide a means of accomplishing the important work of loosening the soil below the bottom of the furrow, we have hit upon the expedient here described :

Fig. 19.



"The attachment here figured may be affixed to almost any plough. Three bolts fasten it to the land side of the plough on the inside : the arrangement of the bolt holes should permit the teeth only to project beneath the soil : a small block of wood will be necessary to be laid between it and the land side, and correspond with the flange generally found at the bottom of ploughs.

" The draft is not materially increased, and the plough holds the ground more steadily. The teeth, two in number, and about four inches apart, should be of steel, and should be kept sharp in front ; the rest is of wrought iron. A blacksmith can make the affair at a cost of something over one dollar.

"The constant use of this addition to the plough will loosen the subsoil, and allow it to be turned over and intermixed at the rate of two or three inches each year. It will dry the soil by thus loosening it, in a degree gaining some of the benefits of underdraining, without any of the cost.

" But its great advantage is, that it will gradually break up the hard stratum of soil, which has been compressed at the bottom of the furrow by continued ploughing and trampling, and permit the penetration of roots into the subsoil, without necessarily bringing it up to the surface."—*American Agriculturist.*

FALL PLOUGHING.

It should be the object of every farmer in Canada to turn over as much land, intended for sowing in the spring, as possible, in the preceding fall.

The advantages of fall ploughing are very great. The earth is exposed to the action of the frosts of winter, and frost is the most perfect pulverizer that we have.

Fall ploughing exposes to the cold many of the pupæ of insects, and they are killed. It also sprouts many weeds which will be destroyed by the frosts of winter.

The object of the winter fallow is to place the soil in such a state that the frost will act most effectually upon it. To effect this, the greater amount of surface that can be exposed the better. Therefore, always lay up a winter fallow as rough and cloddy as possible; the frost penetrating thoroughly from all sides, and followed in spring by the rain, will so disintegrate the component particles, that the use of cultivator and harrows will cause them to fall apart and show a deep, mellow seed bed.

Never harrow down a winter fallow.—The great tendency of arable land in Canada is to run together and bake in the early spring. When this happens, our ploughing has been useless, and we might better have left the land in stubble throughout the winter. This is more especially the tendency of heavy lands. When the fall ploughing is made smooth, the rains of spring fall, and, saturating the surface, beat it down; the hot sun, bursting out as it often does in Canada immediately after very wet spring weather, bakes it into so hard and compact a mass, that the whole has to be again ploughed before a seed bed can be obtained. To obviate this difficulty there is no remedy so effectual as that of rough fall ploughing, exposing as great a surface as possible of earth to the action of winter's frosts.

Where the farmer feels that he cannot undertake the ploughing of his stubbles in the fall, it is an excellent plan to put heavy harrows over them; this will stir the surface, and will cause many weeds to sprout which will afterwards be destroyed by the severity of winter weather.

SUMMER FALLOW.

A great difference has and probably ever will be found on the question of the summer fallow. Many farmers consider it an actual necessity to right cultivation, while others again are of opinion that the system must be false that makes a husbandman lose a crop for a whole season.

When, however, we turn to the objects for the accomplishment of which the system of summer fallowing is adopted, we shall see that there are circumstances under which it becomes neither a matter of economy nor of fashion, but of actual necessity.

The use of the summer fallow dates from the earliest annals that we possess of agriculture. It was first introduced to Great Britain by the Romans; whilst we have in the Bible a certain knowledge that as a rest was imperative for the people every seventh day, so should the land require a like rest every seventh year—for it was laid down in the Jewish law by Moses, who ordered that the tribes of Israel, when led out of Egyptian bondage, should, every seventh year, give to the land a jubilee: "And six years shalt thou sow thy land, and gather the fruits thereof, but the seventh year thou shalt let it rest and lie still." (Exodus xxiii. 10, 11.)

The objects to be accomplished by means of the summer fallow are the destruction of weeds and the aeration of the soil. To accomplish these two objects, different soils require different treatment; and also, the destruction of weeds by some such certain process as that of summer fallow, may be of more or less frequent necessity on various kinds of lands.

On the lighter soils our weeds can nearly always be destroyed by the working of the land by hoes, incidental to the raising of root or corn crops; but upon the tenacious clays we find it very difficult to raise roots to advantage, while weeds in such soils obtain so very strong a foothold, that it is a matter oftentimes of insuperable difficulty to effect their destruction by means of hoeing.

An argument very frequently used by the opponents of the summer fallow is, that it is the work of nature to reproduce in every year; that nature knows no rest. Such an argument is correct, but not as against the system; for our object being to destroy weeds, it must be borne in mind that in that universal law of yearly reproduction, nature makes no distinction between the wild weed, and the flower and cereals raised for the use and by the hand of man.

Amongst the most eminent scientific men and chemists there is also, upon this point, no small difference of opinion.

Sir Humphrey Davy, than whom the world has known no more able and clever practical chemist, says that "it is scarcely possible to imagine a single instance of a cultivated soil, which can be supposed to remain fallow for a single year with advantage to the farmer."

> "Land unemployed no profits grateful yield;
> Man's blessings should abound in every field;
> From industry our wealth and comforts flow;
> Comforts, alas! which sloth can never know."

Another learned Professor, James Rennie, Professor at King's College, London, England, says to the very reverse: that "the whole value of the system is due to the effects of solar light upon the soil."

Let us now turn to the opinion of non-scientific but very practical men. Such authorities as we have of this nature invariably agree that, as a matter of actual observation, it is found that upon heavy lands, no matter how careful the ordinary cultivation, certain varieties of weeds obtain such a strong foothold, that they cannot be eradicated but by a steady fight, extending throughout a whole summer.

The great question at issue, and the one which every individual farmer must solve for his own guidance, is: Can clays be kept constantly clean; or, should they once become foul, can they then be cleaned by any other means than by the use of the summer fallow? For our own part, and writing under authority of very many eminent, practical and successful farmers, we answer both these questions in the negative, and feel convinced that the recurrence of the summer fallow at certain intervals is a matter of absolute necessity upon all tenacious soils.

In support of this opinion, we again quote from the words of an eminent farmer to the Board of Agriculture some years ago:—"Fallowing for wheat on cold, wet, strong lands, and on all such as are unfit for turnips, is absolutely necessary, and he who attempts to manage such land without fallowing, will have reason to repent his mistake. Mixed soils, which are too wet for turnips, have a particular propensity to the production of root grasses. Summer fallow, therefore, becomes absolutely necessary, and every attempt to crop without it, for any length of time, on such land, has terminated to its injury and to the loss of the occupier."—*Brown, of Markle,* vol. i. p. 209.

The operation of summer fallowing.—As Marshall says, in his "Rural Economy of Yorkshire," "*To begin a fallow without continuing it until its intention be fully accomplished, is throwing away labour unprofitably.*"

Now, as to the propriety of fall ploughing for the summer fallow of the succeeding year, there is some difference of opinion.

Some farmers contend that the heavier lands, when ploughed in the fall, and left exposed in an open condition to the fall and spring rains, become chilled, and do not dry off as rapidly as do those that are left in stubble, which, having a hard and more even surface, throw off the wet more readily. This is the only argument that can be given against fall ploughing for a summer fallow, although, as a matter of expediency, it is better to do such fall ploughing as is meant for a coming spring seed bed, first, because it is of more actual importance, and our short fall seldom leaves us time to plough for summer fallow.

But when, fortunately, we have the time, there are these advantages in fall ploughing: many annual weeds are turned up to the surface, sprout and grow, when they are killed by frost, whereas if they lay in the ground as seeds, the cold would have no effect upon them, and they would grow in spring. This is a slight advantage, inasmuch as it reduces the number of weeds to be destroyed in the summer.

A far greater benefit is, however, gained by the exposure of the pupæ (chrisalydæ) of our most noxious beetles and insects to the severity of winter, and the consequent destruction of them.

Another benefit is derived from the exposure of the soil to the action of the frost. Frost, or alternate frost and thaw, is the best pulverizer of soil, and the greater surface of soil we expose to its action the more thorough will be its pulverizing effect. Again, frost has an effect in heaving up the subsoil, when the surface lies loosely.

As a remarkable instance of the effect of frost in this manner, we may note a well-known fact, which has been yearly observed by the farmers of stony land, notably in the Counties of Wellington and Waterloo, in Ontario. On some fields in these counties, and doubtless elsewhere on soils of the same nature, stones are picked off, and the fields apparently cleared of the larger ones; yet, next year, when the land is ploughed *no deeper*, more large stones are again brought to the surface. Now, there is no way of accounting for the presence of these stones high enough to be turned up by the plough, except on the supposition that they have been thrown up by the frost. If the frost thus acts as a heaver up of these stones, it must also lift and disintegrate the subsoil, thus forming an excellent natural drainage and subsoiler.

The proper depth of ploughing a summer fallow.—It is urged by some that the first spring ploughing should be at the deepest intended; because they say, when the dry season sets in, if the land has been ploughed shallow, it will be found a matter of almost insuperable difficulty to plough to a lower depth; while others contend that it is better to plough shallow at first, and thoroughly kill the weeds to this depth, and then at the second ploughing fetch up more soil, and kill the weeds in that, thus, as it were, summer fallowing the soil by instalments.

However, in Canada, where the summers are so well adapted to the destruction of weeds, and where the dry season has a great power in hardening the soil, the former plan of deepest ploughing at the first will be found the most practical to the farmer.

As to the use of cultivators and harrows, the object of the summer fallow is not only to clean the land, but thoroughly to expose the soil to the air, from which it will gather much plant food, especially ammonia, and that of a nitrogenous nature. Let the first part of the summer fallowing be devoted to the destruction of the weeds; and in order to effect this, let the land be as constantly cultivated as time will allow, and the weeds thrown out be raked to the top, by the use of harrows, and there left to wilt.

If by this course all weeds can be destroyed, the last ploughing, or the one immediately before wheat, we should prefer to leave for as many days as possible in a rough and cloddy state.

It will be found that, provided the clods have been ploughed up dry, the heat of summer will have much the same effect as frost—namely, to render them susceptible to pulverization by after cultivation; while midsummer thunderstorms, succeeded by burning sun, will not bake down such land as compactly as when it has been left smooth upon the surface.

If manure is to be ploughed into a summer fallow, we would not turn it under deeply, but would rather, if it be short enough, cultivate it in just before sowing, and thus thoroughly incorporate it with the surface soil or actual seed bed. Manure will not wash upwards; every shower carries its strength into the ground. If it then be laid near the surface, its very essence will be carried to the root plant; if it be ploughed under deeply, the root must penetrate to the manure. If land is cold and sour, lime will be found an excellent addition. Applied early in summer, and thoroughly mixed up by cultivation with the land, it will also aid the extermination of all classes of weeds. For the action and benefits of lime, see chapter on Manures.

ON SOWING—BROADCAST OR DRILLING.

In ancient times the general custom of sowing was by hand, although in China the drill has been known for ages, whilst in parts of Europe its use dates back as far as 1650.

The father of drill husbandry in England was one Jethro Tell, of Berkshire, who commenced his experiments in 1731.

Broadcast Sowing.—The advocates of broadcast sowing contend, and their opinions are well worthy of consideration, especially as referring to heavy soils:

1. That the plants should not be crowded together in rows, but should spread evenly over the whole surface of the ground, and thus draw their nourishment from every portion of the soil.

2. That broadcast-sown crops are less apt to suffer from wind than such as have been drilled in; for they say, drilled crops, not giving at their roots such mutual support by interlacing on every side, have their stems broken—a process known in Scotland as *knee-shackled.*

3. That the effect of leaving rows unsown is such that they become filled with weeds, many of which would have been smothered by a broadcast crop.

On the other hand, the advocates of *Drilling* contend:

1. That the seed is deposited at a more even depth, and consequently that its growth and ripening are even throughout the season.

2. That a saving of seed to the amount of at least twenty-five per cent. is effected.

3. That the seed, being uniformly and entirely buried, is saved from the ravages of birds.

4. That the spaces between drills admit a greater amount of air and light to the growing plant than is obtained in a broadcast crop.

5. That drilled grain is less apt to lodge by storm.

6. That such weeds as pigeon weed (Red-root) and cockle are more readily observed, and therefore more easily picked, amongst drilled than in broadcast crops.

7. That by the use of the sowers, as now attached to drills, grass seed may be sown along with the grain, and at the time, the wind notwithstanding, when soil is best fitted for its reception.

The grass seed growers should be placed before the drills. Some have argued that, by so doing, the grass seed would be covered too deep; but this is not so, for the spouts of the drill do not turn over soil, but simply stir it. On the other hand, when the seed sower follows the drill, not only does the field require rolling after to press in part of the seed, but the greater portion rolls into the trench formed by the drill spout, and is either covered so deeply that it canuot sprout, or if it should grow will be found to come up in rows, and amongst the roots of the grain crops.

The qualifications of a good seed drill are :—

1. To be simple and easily operated.

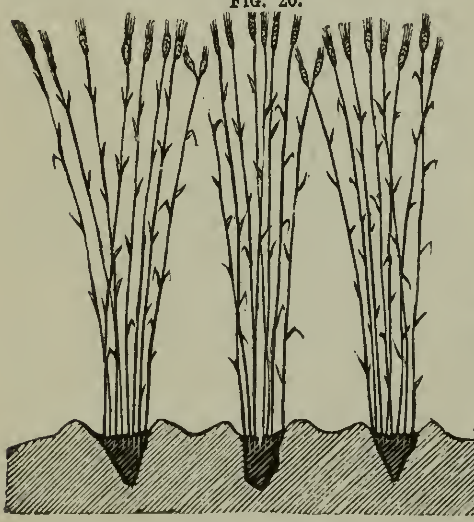
2. To be strongly built.

3. To distinguish in its sowing arrangements between wheat or small grain, and oats and coarser grain.

4. To sow immediately upon being started.

5. To sow any required quantity from a peck upwards, and drop its seeds regularly.

Fig. 20.



Drilled Wheat.

Fig. 21.

Broadcast Wheat.

ROTATION OF CROPS.

In the right and proper cultivation of a farm under the system of mixed husbandry, a recognized rotation of crops should take a very important position. Indeed, no farmer can expect to obtain the maximum yield from his farm unless he has so considered the various wants and capabilities of his various fields as to be able to adopt some systematic plan or course of cropping.

It has been well observed tnat "no branch of farming requires more sagacity and skill than a proper rotation of crops, so as to keep the ground always in good heart, and yet to draw from it the greatest possible profit."

The main object to be attained by a systematic plan of rotation of crops is, not to allow the too frequent repetition of crops of an exhaustive nature.

It is universally recognized, that in every soil there are certain particles especially adapted to the use of one kind of plant, while for others, other plants have an affinity.

For instance, the grains or cereals generally require a greater or less amount of silica, while other crops require less of silica and more of potash, or of some other mineral salt. A field which would not yield a second good crop of wheat, may, even without manuring, grow a passable crop of clover or return a large yield of roots. The important principles in the rotation of crops are, that although a given soil may contain all the mineral substances necessary for the use of every cultivable plant, yet there may be only a limited supply of that particular food essential to the well-being of some particular plant.

Plants derive their sustenance from different sources. The grains, to which few leaves are attached, depend almost entirely on the surface soil or seed bed for their sustenance; tap-rooted plants, as carrots or beets, go very deeply into subsoil for a large proportion of their food; while the cruciferæ, clover, peas, &c., depend in great measure upon the amount of food that can be inhaled from the surrounding atmosphere by the action of their leaves.

There is not space in this work, which is intended more as a book of reference than as a treatise upon scientific agriculture, to deduce from the tables of the chemical analyst the proportions of food required by the various plants.

Experience, however, shows that land requires rest.

At one time the Canadian farmer did not believe in such a requirement; but trusting to the apparently inexhaustible nature of the virgin soil, he continued to grow wheat after wheat until the diminution in its yield, began to affect his pocket, when he at last found to his cost that to receive a return from his land at all commensurate with the yearly outlay of capital, he must turn to the resting of land from the constant reproduction of any one particular crop.

The question to set before our view is then: How shall we raise the greatest amount of marketable produce in a given series of years, with the least proportionate expenditure of capital and labor?

While drawing from our lands great production in the one season, we have to beware how we accomplish such exhaustive yields at the expense of the crops of future years. We must not kill the goose for the sake of the one golden egg. Let us remember the old Scotch saying:

> "He who sows wheat after bear (barley),
> Had need of muckle gear."

We will now passingly allude to a few of the rotations that bear sway amongst the farmers of Great Britain, merely as a means from which each individual farmer in Canada may draw his own conclusions as to the probable course that will suit his own soil and circumstances.

We take first the old-fashioned three course rotation, or *Triennial,* which is ; First year, fallow ; second year, wheat ; and third year, spring crop (barley, oats and peas). This was formerly practised to a great extent over the whole of Europe, where farms contained a large proportion of pasture and meadow.

A large amount of stock being in winter yarded, sufficient manure was usually made, to go over the fallow, if not every time that it came round, at any rate in each sixth year.

The following advantages may be claimed in its favour, always allowing that the farm to which it attached was one a large proportion of which was devoted to pasture, and long laid down in low-lying meadow :

Economy of work ; less constant attention than a fuller course. For Canada, the loss of a year's crop every third year, by a fallow, seems rather a serious matter ; but the advocates of the system have claimed that, especially on heavy lands, such loss is more than compensated by increased yield of wheat.

Besides, on clay ground, the system is widely adopted on the deep sandy loams of East Kent, where, known as the *Kentish Round Tilth,* it consists of barley, beans, wheat,—although clover is sometimes substituted for beans.

We next come to more modern rotations, and such are better adapted to the general soils of this Dominion. We will take the Norfolk system, which consists of a four-year rotation :

1, turnips ; 2, barley ; 3, clover ; 4, wheat ; and this course is adopted by many of the most successful farmers in that prince of agricultural counties.

Turnips (which are usually there fed off by folded sheep) clean the ground. Barley does well after the rich manuring usually devoted to the turnips, and in the clean, well-tilled, shallow seed bed that is the result of a turnip crop properly cultivated. The ground is also clean and in good heart for a good catch of clover ; and a young clover sod ploughed down early forms an excellent bed for wheat.

This course is often extended to a five or six years' shift by leaving the clover for two or even three years, and, where there might be objection to the putting of wheat upon a two or three year old sod, it would be quite feasible to introduce some other crop, say peas, between the clover sod and wheat ; and in the interest of the advocate of summer fallow, the rest might be introduced also, supposing that a dirty crop like oats was grown in the place we have assigned to peas, when the course would stand thus :

1. Turnips.	5. Pasture.
2. Barley	6. Peas, or oats.
3. Grass,	7. Summer fallow or wheat.
4. Grass.	8. Wheat.

It is apparent, therefore, that, by taking any of these Old Country rotations as a basis, we may so change their order or make additions as to cut out for each one individually a systematic rotation, in the carrying out of which one could so adjust his work as never to lose an operation in the field by the wavering course of cropping so generally adopted.

We take another very different rotation, commonly used on cold thin clay and flinty chalk lands :—

1. Fallow.
2. Wheat.
3. Peas.
4. Turnips (fed off).
5. Oats or barley.

6 and 7. Clover, &c., left for any number of years, as individually suitable.

8. Wheat.

One of the favourite Scotch courses on a soil strong, dry, and not too tenacious, such as is found in the higher regions of the Carse of Gowrie, consists of—

1. Fallow
2. Wheat.
3. Beans.
4. Barley.
5. Clover.
6. Oats or sometimes wheat.

Among the Scotch farmers, in the neighbourhood of Edinburgh and Glasgow, where the production of potatoes is considered as remunerative as that of wheat, we find the usual course to be :—1. Potatoes. 2. Wheat. 3. Clover. 4. Oats—although we are at a loss why the oats and barley should not be at 2, and the wheat after the one year's clover.

As a conclusion to this brief reference to the principles of rotation, we would quote a letter to an American agricultural paper by John McKelan, Esq., a valued member of the agricultural press of Canada. Mr. McKelan says, in speaking of rotation in Canada :—

"It is rare to see two cereal grain crops grown (in Canada) on the same land successively. A five-course rotation has been most common, but of late years the greater profit obtained from stock raising and dairy farming has induced the adoption by many of a longer course, extending over seven years. Root crops and corn together fill one course, and, being heavily manured and well cultivated, both enrich and clean the land. Barley and spring wheat succeed, seeded down with grass ; this is followed by peas and summer fallow ; then oats and winter wheat, ending the rotation—the length of which depends upon how long the grass continues to yield profitably.

"In the five-course rotation roots and corn are not counted, as but a very few acres of either are grown, the manure not required for them being applied to the summer fallow, and these crops, when grown, forming a portion of the land which would otherwise have gone into fallow."

The following is the substance of a paper read by the author of this work before a Farmers' Club in Ontario :—

"In no art are the prejudices of habit so strongly rooted or so difficult to surmount as in that of agriculture ; and although I consider it far from expedient to oppose such too suddenly, or to eradicate them, except by the progressive and enlightening effect of practical experience, yet it behoves each one of us to discontinue customs that we have good reason to believe should be abandoned, or that are radically bad in themselves.

"In the introduction of a proper system of cropping by rotation we strike a blow at the very root of bad farming.

"It is impossible to drive in any direction in this our fair Dominion, without being struck by the appearance of an utter want of system among too many of our brother farmers.

"We see fields so run out by continuous cropping as to show plain indications of deterioration in the very colour and consistency of the soil, while others, which have been pampered, petted, and crowded with manure (because perchance they are handy to the barn-yard), are so strong and rich that no grain crop can stand upright upon them.

"The reason which renders it imperative upon our part to consider and weigh well the benefits which will most assuredly accrue from the adoption of some regular system of rotation in our crops, is that no two plants of different kinds require for their nourishment the same substances in the same proportion.

"For instance, the grains draw largely from the silica contained in a soil, and will therefore soon exhaust the supply of this ingredient in ordinary land. I say ordinary land, for in the virgin soils so great is the proportion of the humus or putrescent animal and vegetable matter—the most fertile portion of land—that wheat, or, indeed, almost any crop may be and has frequently been grown with unvarying success for many succeeding years. Under the old system of farming, this repeated cropping with wheat was adopted, and with apparent success. But it has been found that, even to the virgin soil made rich with that decaying vegetable matter, which has been deepened with each successive shedding from forest leaves, a time will come when the land, under an everlasting course of wheat, will begin to show signs of exhaustion.

"The important principles which should rule the farmer in the adoption of a regular rotation of crops are :—

"1. That though a soil may contain all the mineral substances necessary for the nourishment of every variety of cultivable plant, yet there is only a limited supply of the mineral food necessary for each particular species of plant.

"2. That some plants, as for example the grains, draw their chief nourishment from near the surface of the land, while others, like carrots or beets, seek for food at a greater depth.

"3. Clover and plants that put forth a luxuriant foliage absorb much of their food from the atmosphere, while cereals depend almost entirely upon the earth for their sustenance.

"4. Certain insects live upon certain plants, and as long as their peculiar variety of food is furnished them, so long will they grow and multiply (instance the midge in the white wheats); but if a crop should intervene which is not the natural food of these our enemies, their larvæ will perish for want of nourishment.

"Variety is then one of the first rules by which the farmer should be guided in adopting a regular rotation of cropping.

"Doubtless, by means of a copious supply of manure, sufficient to return to the soil those ingredients which the harvest has withdrawn, a succession of the same crops may be grown without the grain being either diminished or deteriorated, but the most practicable and convenient plan is to alternate the crops so that after a particular species of plant has been raised, the land may have time to recuperate ere it be again required to supply a large quantity of the same kind of food.

"The general principles upon which different farmers may work will, of course, vary with those differences, climatic and of soil, which exist in their several localities. All considerations of proper rotation should be carefully guided by the following rules:—

"To avoid the immediate succession of similar crops, especially if such be of an exhaustive nature, and to throw their return as far distant from each other as practical circumstances will admit.

"To grow intermediate crops of grass and roots, soil permitting, between cereals.

"To give the preference to such green crops as afford the best prospect of food for live stock, and particularly to those which will admit of cultivation by hoe.

"Never lay down to grass until land be free from weeds.

"The subject of this paper is, like newly cleared land, all but inexhaustible. I will therefore simply note a few of those courses which are now in vogue in Great Britain, only premising that in Canada wheat is undoubtedly the staple product, and that, owing to the length of our winters, we require much more fodder for our stock.

"First, a Quadrennial Rotation:—

"First year, summer fallow; second, wheat; third and fourth, clover.

"Now, I hardly dare here give my private views on the subject of summer fallowing, for I know that many farmers advocate, and indeed practically adopt it. The use and abuse of the summer fallow may well form a subject for future discussion.

"The advantages claimed for the above rotation are, that the system is economical, requiring nothing but the most simple operations and the most inexpensive implements; that it does not require so much attention to the management of the land as does a purely alternative system, for the repetition of the summer fallow affords plenty of time for the preparation of the land for wheat, that the labour is evenly divided throughout the seasons; that if the clover be ploughed under after the second year, the land is kept in good heart, and will be still more enriched by the application of our barn-yard manure to the fallow; that the fallow cleans the land, and is undoubtedly followed by a good crop of wheat.

"We now take a Five Years' Rotation, usually adopted upon the light lands of the east of England, a part of the kingdom famed as a great turnip-raising country:—

"First year, roots; second, barley; third and fourth, clover; fifth, wheat.

"It is not customary, nor indeed convenient, to grow such a large proportion of roots in Canada. We may therefore put part of this field in roots, peas, &c.; but should, when the rotation again comes round to this field, reverse the division, sowing grain where we before planted roots, and roots where we grew grain.

"The advantages of this system are, that it is peculiarly suitable to our lighter lands and loams; the roots get a thorough cleaning, and prepare a mellow seed-bed for the barley; and a young sod is held to be, when broken up by a single ploughing, a good preparation for a sound seed-bed for the ensuing wheat crop.

"I will close by laying down for consideration a rotation for such land as we have generally throughout this township.

"This extends over six years, and is as follows:—

"First year, wheat; second, third and fourth, grass; fifth, hoed crop; sixth, barley.

"By bringing in grass for three years—say one in pasture and one in hay—we have an excellent sod to plough down, and we also have plenty of opportunity to enrich that land which may have been put to barley, by a liberal dressing of dung before putting in fall wheat.

"The advantages that I claim for this rotation are an even distribution of crops over the land, a thorough enriching of the soil every sixth year, and a good proportion of superior hay and of wheat, the two most valuable products of a Canadian farm."

A contributor of the *Country Gentleman*, hailing from Western New York, and signing himself "Observer," in a brief communication to that paper, gives the following pertinent remarks on this subject; specially worthy of perusal by the farmer in Canada:—

"So I soon worked into a rotation of: first year, corn; second, peas, oats or barley seeded with clover; third year, clover, first crop cut for hay and the second saved for seed; fourth year, clover, cut for hay and then pastured. As the land improved and oats became more liable to rust, barley was more generally sown instead of oats.

"In this way, I not only soon got the land into condition to grow good crops, and realized more money than the previous owner had received, but the soil improved very fast.

"This improvement was due to two causes, one was, growing more corn and clover: the land was in clover half the time, and was thus greatly improved; and the other was the feeding of a good deal of clover, hay and other fodder, as well as coarse grains, which largely increased the amount and value of the manure.

"Now, I know of no way in which land can be as certainly and rapidly improved as by growing clover and making and applying a large amount of good barn-yard manure. I find an essential condition of this course is to sow clover often. Keep the land in clover half the time, if possible; to keep the clover mainly for mowing, so as to secure a large growth of clover roots, on which much of the improvement by clover depends, and to always plough up a clover sod whilst in full vigour, or at any rate before the more exhausting grasses come in and use up the fertilizers rendered available by the clover. Another important point is to feed plenty of rich feed, as clover—hay and coarse grain, in order to make rich manure, which also has no small influence upon the amount or degree of improvement that may be secured. . . . . . .

"Now, in view of these facts, I think the course proposed by *T.* (first, clover; second, wheat; third, corn [hoed crop]; fourth, wheat) may be largely improved in two particulars: first, in growing less wheat and more clover; and second, in cutting and feeding more clover-hay and making more manure. This rotation keeps the land in wheat one-half the time. In every four years there are two crops of wheat, one of corn and one of clover; but the clover is ploughed under, which only leaves three crops in four years to be gathered. This, I think, can be improved to the advantage of the land and of the owner's pocket. The first object with me would be to save ploughing under the first and best crop of clover, so as to realize something every year from the land. If the small kind is sown and a good growth secured, the first crop may be cut early for hay, and the second crop make a good start to be ploughed under in August. Then the next spring, seed again to clover with the wheat, and grow clover one year between the wheat and corn. This clover may be cut early for hay, and then saved for seed; and, if plastered and well managed, ought to turn as much money as a crop of grain. This is also a cheap crop; there is no ploughing or fitting the land for the seed; there is little to do besides gathering the two crops; and, where it is an object to save labour, it will be found one of the best crops for this purpose that is sown on the farm. The next spring the clover should not be pastured, but make as much growth as possible before it is ploughed under for corn. This allows of ploughing under a good clover sod for both the wheat and corn crops, and with the growth above ground, and the large amount of clover roots in the soil, will be better—furnish more fertilizers than any crop that can be ploughed under. Then there will be two crops of clover-hay and one crop of clover-seed; two crops of wheat, if wheat follows corn ; and one crop of corn, all grown in five years ; which, I think, will pay far better than the course proposed by *T.* Perhaps, to illustrate, the returns of each course may be calculated from one acre, as follows :—

	YIELDS.	PRICE.	COMES TO.
First year, clover	1½ tons	$10 00 per ton.	$15 00
Second year, wheat	20 bus	1 50 " bus	30 00
Third year, clover	1½ tons	10 00 " ton	15 00
Third year, clover-seed	2½ bus	6 00 " bus	15 00
Fourth year, corn	40 "	75 " "	30 00
Fifth year, wheat	20 "	1 50 " "	30 00
According to this, one acre in five years would return			$135 00

"According to the other rotation, there would be—

	YIELDS.	PRICE.	COMES TO.
First year, clover (ploughed down)	0	0	0
Second year, wheat	20 bus	$1 50 per bus	$30 00
Third year, corn	40 "	75 " "	30 00
Fourth year, wheat	20 "	1 50 " "	30 00
Which comes to			$90 00
Add one-fourth for fifth year			22 50
			$112 50

"This taken from the amount realized by the first course leaves a balance of $22 50c. in five years in favour of the first rotation. This on one hundred acres would make $2,250 in five years, or $450 per year. And even this fails to show all the advantages of the first course, as by growing clover two years, and feeding the clover-hay, and making and applying more manure, the land will improve much faster than may be expected in the last rotation. An objection to both is getting corn out of the way in time to sow wheat in the fall, which is a heavy job (and can't be done in Canada). Hence I think a still better course is to plant corn ; then sow to barley, or oats with which clover is seeded, the next year—the first crop of clover cut for hay and the second turned under for wheat; the fourth year the wheat also seeded to clover, which may be allowed to lay one or two years."

His rotation (which is excellently adapted to the average soil of Canada) then stands:

First year, corn or any hoed crop.
Second year, barley seeded down.
Third year, clover cut for hay and for seed.
Fourth year, wheat seeded down.
Fifth year, clover.
Sixth year, clover.

And he goes on to say:

"This keeps the land in clover about half the time, and only grows one crop of wheat in a rotation, which must be a decided advantage where land has been run to wheat; while the greater improvement of the soil must make the crops better, and the rotation more profitable in the long run. Indeed, with land in wheat half the time, and in clover but one year in four, I don't see much chance for improving the soil unless a good deal of manure is purchased and applied. I know from observation that good crops of clover, ploughed under every other year for wheat, will largely improve the soil, until the land gets so rich—full of vegetable matter—that the straw is weak and the crops lodge badly; but I hardly think that one crop of clover ploughed under in four years, with three exhausting grain crops in the meantime, can work any considerable improvement."

The treatment of burnt land.—A practical farmer writing to the *Canada Farmer*, in 1871, says:

"In regard to the mode of treating badly burnt land and planting root crops thereon, I have always found that turnips thrive best, after one crop of grain (followed by clover) had been taken from the land. I would recommend any one who has suffered by having the land *deeply burnt over* to sow barley, and seed down with plenty of clover, using several varieties—Alsike, Broad and Dutch. After harvesting the barley, allow the clover the following year to attain a height of eighteen inches or two feet, and let it begin to ripen its seed, and then plough all under, being careful to bury the stalks thoroughly, but not *all the heads*. As soon as these heads are thoroughly dried, but not on any account sooner, harrow the land well, and sow wheat—fall wheat if possible. There will be an abundant crop of clover amongst this crop, to be again ploughed under in early spring. As soon as this second crop of clover attains a fair growth, plough it under, and turnips on this will be a successful crop. Burnt land, if badly injured, will not do for turnips the first year; but if only partially burnt, or but little injured, the turnip crop is the best that can be grown on some descriptions of soils. If too much burnt clay results, the turnip plant does not thrive at first, and is checked too much."

We have, also, the experiments of another farmer, in the same columns, upon this subject, as follows:

"I offer what little experience I have had for the benefit of those who, like myself, have had their standing timber destroyed by those destructive fires which sometimes occur in our Canadian forests. The recommendation to sow barley for a first crop, I have no doubt, is good, when any black soil is left; but when nothing remains but the hard clay loam, I should be unwilling to try it, as such soils retain the water too long in the spring, and when the hot weather sets in the soil becomes baked hard, and cracked in every direction, and unless the barley had time to cover the ground well, the crop would hardly be worth harvesting.

"The first piece of such land I cleared was ploughed in the fall and sown the next year with spring wheat; but, although the spring was favourable, the crop was not worth much. The stubble was ploughed in the fall, and sown the next spring with peas at the rate of three bushels to the acre. The summer proved showery, and the pea stalks grew to a length of eight or nine feet, and were heavily podded; the weeds were completely smothered, and the soil mellowed, so that it was much easier to plough. The next piece I sowed with fall wheat, ploughing the ground as soon as I could get it cleared, and sowed early red clover, very early in the spring. The clover took well, and it would have been better to have ploughed it in last year, but, as is frequently the case on bush farms, I had not sufficient meadow, so I cut it for hay, and in September tried to plough in the after-grass, then over a foot high, but the ground was so hard, I had to desist and cut the after-grass for fodder. In November, when the ground was soft enough to admit of being ploughed about four inches deep, the clover was about six inches high, and I found the clover roots had penetrated the hard pan about six or eight inches. This year I sowed peas, but owing to the extraordinary drought the straw was very short but well podded, and the pods well filled. In 1869, I had a ten acre field cleared and sown with the Treadwell fall wheat, and in the following spring I sowed early red clover at the rate of twelve pounds to the acre. In some places two ploughings could not go more than two inches deep, and in those places the wheat was winter killed, but the greater part came on well, and I had a fair crop. The clover took well except on the hard places, and these I harrowed after harvest, and sowed clover again, and this year, in spite of the drought, I had a fair crop of clover hay. Last fall I cleared another field, and sowed the Treadwell wheat at the rate of two bushels to the acre. Scarcely any was killed, and though the crop is, of course, not so good as on unburnt land, yet the grain is an excellent sample, and weighs much heavier than last year; but as the clover sown last spring failed, I have ploughed in the stubble for peas next year, and in future shall sow such ground first with fall wheat and clover, then peas, followed by fall wheat, with clover again."

SOILS.

The surface of land is composed chiefly of minerals, such as clay, lime, marl, gyps, fluor, talc, sandstone, slate, quartz and barytes.

These are the scientific names given by geologists, and these substances mixed together in varying proportions, go to form the different soils.

We will shortly see what these various earths are.

Clay consists of various earths in admixture, differing only in proportion and tenacity.

Were it not for the stubborn tenacity of clay, it would be, under all circumstances, the best for the farmers, for in clay is found food in abundance for every variety of plant. Where clay can be readily brought under the disintegrating action of sun and frost, it will be found a very profitable soil; whilst, although much labour and capital is required to reduce the stiffest clay to a tillable condition, yet when once such a state is attained, it is capable of producing yearly, and of sustaining production for a long time, of immense crops.

Calx is lime in combination with acids, and to this class belong chalk and marble. These, of course, are seldom found forming the entire surface soil, but when present in moderate proportions, in other earths, are found necessary to the successful production of most crops, and more especially of cereals.

Calcareous earth.—To this belongs that peculiar earth in which we find a mixture of clay and marl. Marl is very valuable on light lands, and its presence is beneficial in all wheat lands.

Gyps is calcareous earth saturated with vitriolic acid, and in the form of gypsum is found beneficial to many soils.

Clay.—The peculiar nature of clay is its power of retaining moisture; and for this reason alone a drainage is of very great benefit to all clays. Stagnant water is poison to all plant life, and clay has peculiar power to hold water until it assumes a stagnant state.

Again, clay being saturated with water, does not dry out easily, and the effect of any sudden access of heat causes it to *run together*. In this state no crop can succeed. One of the chief objects, then, of the cultivator of clay land must ever be to counteract this natural tendency to run together or bake. Among the preventives are under drainage, subsoil and deep ploughing, and the addition and incorporation of such foreign materials as lime, chips, ashes, etc., or any substance whose mechanical action may be to render the soil more porous and to divide the particles of clay the one from the other.

The nature of clay is much benefited by deep cultivation, for then the water that falls percolates through the soil, instead of standing for a length of time at or near the surface.

Clay is a soil that no unintelligent or poor farmer can work with success. If ploughed too wet, it is ruined as a seed-bed, while if it is too dry it becomes next to impossible to rip it up.

The general characteristics of a clay farm are, that it will produce the most abundant crops, and that its strength will remain longer than any soil, but that, in its tillage, far more expenditure is absolutely necessary to secure a crop at all.

But there is a hungry clay, although happily we have but little of it in Canada, which is highly impregnated with iron ore (oxide of iron), and this substance is poison to plant life. None but a very rich man should dare to take hold of such land, for to bring it to a cultivable state requires much underdraining, liming, manure and time.

Clay is immensely improved by the application of lime, chalk or any substance, mineral or otherwise, the effect of which may be of a stimulating nature.

For instance; lime acts in three distinct and effective ways upon a tenacious clay. As a corrector of acidity it neutralizes the acids injurious to plant life, removing from a soil that sourness which is found in what is technically known as cold soil; it acts as a decomponent of vegetable matter, and by hastening decay brings the elements of plant-food into a state in which they are soluble to the growing plant. Its effect is also mechanical in keeping apart the particles of clay, and thus it becomes an instrument for the admission of air into the soil, and the consequent destruction of the natural and injurious tendency of clay soils to run together and bake.

This mechanical effect may also be attained by the incorporation of such matters as ashes, coal or wood, chips from the woodshed, etc.

It may also be borne in mind, that lime being found in the ashes of every vegetable substance, in greater or less proportion, is required as actual food to all growth

SAND.

We next come to a consideration of sand as a soil for the use of the agriculturist. As a rule, we find our best farming sections in Canada to be those where sandy or gravelly soils predominate. This is, doubtless, owing to the general want of capital as applied to our farms, for, as it has been before mentioned, the clay farm, though capable of a heavier production of almost any crop, yet requires more expensive cultivation. As an instance of this, we may point to the farming operations of Alderman Mechi, in England. When Alderman Mechi first promulgated his various peculiar theories, he was laughed at as an enthusiastic scientist; but when, by the aid of capital, he was enabled to bring his theories to actual practice, it was found that no man in Great Britain was able to approach him in the yields that he obtained from his farm of one hundred and seventy acres.

His farm was stiff, blue clay, and required a large outlay of money in drainage and mechanical efforts to render it less subject to baking. This outlay he made, and, in his report (and we have no right or reason to dispute the truth of every statement, as his books have been voluntarily thrown open at all times to inspection by proper authorities and competent critics), the alderman says:

"For the last six years my gain as landlord and tenant on my little farm of one hundred and seventy acres, has been nearly £700 ($3,500) per annum. Even this last year, with wheat at 42s. per quarter ($1\frac{27}{100}$ per bushel), I have gained £600 ($3,000) after paying every expense."

Sands are easily cleared of weeds, and do not so absolutely or often require the services of the summer fallow. Moreover, they admit of easier and certain cultivation of root crops and corn, and these being cleaning crops help to supersede the summer fallow.

They are not so subject to coldness or sourness as the clay, for less stagnant water will rest upon them, and for the same reason they are not liable to run together or bake. We may work sand at almost any time, even in a moderately wet state, without fear of the mechanical injurious effects which will assuredly accrue from meddling with heavier lands when moist. The natural drainage is better, and, consequently, under-drainage and subsoiling are not required to so great an extent as upon lands of a more compact nature.

On sands, our object will be the reverse of that upon the clay. On the latter we desire to loosen the soil, on the former our endeavour is to compact it, and lime as an instrument for the compacting of sand is as effectual as for the disintegration of clay.

Sand does not contain in its natural state as large a supply of vegetable matter as clay, nor will it retain as long the benefits of manurial applications. Whilst then we require to devote more time and capital to the actual cultivation of clay, to sand we must apply larger doses of manure of all kinds.

In Canada, one of the best plans and most practicable is the ploughing down of rank vegetable matter, rich in ammonia and nitrogenous matter.

A correspondent of the *Country Gentleman* gives to that paper his experience in the fertilization of a thin sandy soil, and we commend its principles to our readers. He says:

"About twenty-five years ago I came into possession of about nine acres of thin sandy land. There had been within, say, three or four years previous, two crops of corn taken from it that did not exceed ten bushels per acre. I had it ploughed deeply and sowed heavily to oats. As soon as they began to ripen we ploughed them in, and applied about seventy bushels of lime-kiln ashes to the acre. We then sowed it with rye, and also sowed clover and timothy. We had a splendid crop of rye, and for several years mowed a good swathe of grass; since which we have kept up a rotation of corn, then wheat or rye, followed by grass, which has been either mown or pastured; two of the years potatoes have taken the place of corn.

"The corn has averaged from fifty to sixty bushels per acre of shelled corn, and the other crops have been above the average of the balance of a good farm. We have put but little if any manure upon it, except a moderate amount with potatoes. I may add, that a large portion of this lot is so sandy that it does well for building purposes."

GRAVELS.

Physically, gravels and sands are of a similar nature, the drainage in both being good, and having no tendency to run together. But gravels are very various; while some are noted for their natural fertility, as instance in the County of Wellington and parts adjoining thereto, others are of a cold, sour and barren nature.

These barren gravels are usually known as hungry soils. They absorb all manure, and carry it beyond the reach of plant life, so that the application of manure to such soils in their natural state is like throwing gold to the bottom of the Atlantic.

The better kinds of gravel are, however, especially adapted to the growth of all kinds of plant life, both cereals and roots—whilst winter wheat and grasses flourish upon such.

Whilst the gravel is hardly capable of producing as great a yield of grain as the clay, both having an equal cultivation, yet the grain on gravelly soils is usually superior in brightness and more solid in body.

This fertility in many of our gravelly soils is due to the presence of a large proportion of phosphate of lime, potash, and silicon, all essential elements for the nourishment of grain crops.

The best of these soils, however, require a large amount of manure in order to keep them up to a high standard in their productiveness, and for this purpose we depend greatly upon the use of green manure, especially the ploughing down of green clover. By this process we not only supply a large amount of nitrogenous matter, but the decomposing vegetable matter renders the staple of the land firmer and more consistent.

Of the barren gravels, the most stubborn to improve are those in which strata of clay and gravel lie alternately, and crop out on the sides of hills.

This is one of the worst forms in which arable land is found, as it is invariably full of land springs, which render the soil cold, and it also has a tendency, from the firm binding together of stones and gravel, to become impenetrable to the plough. These land springs also render any attempt at under-draining very difficult of accomplishment.

We have yet another soil, which, though of a gravelly nature, is not purely gravel. We find land in many parts of Canada, whose staple is clay, but in which is incorporated a considerable quantity of stones, of the nature of flint. This is usually very excellent soil for wheat, fully supplied with silica, and often containing a large amount of lime We now come to the consideration of

LOAM.

This is the prince of soils, and to the nature of a loam it should be the object of every farmer, by cultivation and care, to bring his land. The loam is the farmer's paradise.

Loam is a soil composed of an admixture of different soils, in various proportions. From the preponderance of heavy or light soil, we speak of clay, sandy or gravelly loams. Loam is exceedingly friable, readily admits air and rain, and as readily discharges all superfluity of moisture, only retaining as much as is necessary to the wants of vegetation. It is deep, and is neither liable to be parched by the summer's drought nor chilled by the cold of spring and fall. The peculiar difference which exists between loam and pure clay or pure sand is caused by the presence of a large amount of vegetable humus, and for this reason it is fruitful as the virgin soil of forest lands. We have said that to the nature of a loam every farmer should assimilate his land; and as the essence of a loam is the vegetable humus contained, so almost any soil may be artificially brought to a loamy nature by the supply of decaying and decayed vegetable matter, by the ploughing down of green manures such as clover.

The loam is easily cultivated, and containing in itself all the elements of food known to the wants of vegetable life (because largely composed of putrescent vegetable matter), it is adapted to the growth of all crops, and can be brought under any system. It will grow cereals and grasses, roots and vegetables.

That the superiority of loams is due to the presence of this decayed vegetable matter may be readily proved by the observation of two very practical facts. First, that newly cleared land, made rich by the shedding of the leaves yearly from deciduous trees, through many generations, is a perfect loam; while by neglect to supply to loams long cultivated the necessary vegetable matter to decay, they lose their richness and degenerate rapidly to the nature of a loose barren sand on the one hand, or to that of a worn-out, sour and tenacious clay upon the other.

Alluvial soil is a species of rich loam, which has been formed in low lands, from the wasting of the surface of higher grounds, from the deposits of streams pouring down in flood times, or the overflowings of turbid rivers, which leave a deposit of mud richly charged with vegetable matter upon the surface. Such is the nature of the soil deposited at regular periods on the banks of the Nile, in Egypt, about whose banks are cultivated probably the heaviest crops in the world. Not only do they contain much vegetable, but they are likewise rich in animal matter, and are almost inexhaustible.

Still, as practical farmers, we should infinitely prefer, for general husbandry, the rich upland loam to the deep fertile lowland alluvial soil, for the products of the latter are very deceptive—they are usually great in quantity, but not equal in nutriment to those grown on higher lands.

This is not only observable in our own Dominion upon such land, but in Spain—in Valencia, one of the most highly cultivated districts in the world, and where the system of irrigation has been carried to an excess—its products have been found so deficient in nutriment as to have passed into a proverb, expressive of their inferiority in the power of imparting vigour :

> "*In Valencia the grass is water,*
> *The flesh is grass,*
> *The men are women,*
> *And the women—nothing.*"

So in the lowland quarter of the great sugar-producing island of Martinique, called the *Lamentin*, the richness of vegetation is extraordinary. The canes grow to a size unparalleled in any other part of the world; but the sugar, though as white and clear as possible to please the eye, is found so scantily supplied with the crystals in which lie all the saccharine strength, that it decomposes when carried across the Atlantic, and is almost useless to the refiner.

Peat is an inflammable soil, and may be said to rank with coal and bitumen.

It is formed of successive layers of heath and close herbage, which spring up, grow, and die out. There being not sufficient natural heat, they only partially decompose, and thus are truly vegetable matter in a half rotten state.

In peat, then, there is contained an immense supply of vegetable food, but it is in a state perfectly insoluble to the wants of cultivated crops.

To use it to advantage, it must be subjected to intense heat, in order that, by chemical process, its vegetable matter may be brought into a state of practical utility to the farmer.

This is best done by composting. As an addition and improvement to the manure pile, there is no substance more valuable than peat.

We conclude this section by a short allusion to the retentive power of moisture in various earths and soils, based on the Report of Professor Johnson, F.R.S., laid before the Royal Agricultural Society of England.

In the experiments brought forward, the specimens were previously dried in a temperature of 212°, and then exposed to air saturated with moisture at 60°, for three hours, under which circumstances,

1,000	parts of a	clay soil	gained	29	parts.
1,000	"	coal ashes	"	14	"
1,000	"	lime	"	11	"
1,000	"	gypsum	"	9	"
1,000	"	chalk	"	4	"

In the experiments of Professor Schubler, the amount of the moisture absorbed by the earths was ascertained at different periods, viz., 12 and 72 hours. The temperature of the atmosphere in which they were exposed was between 59 and 65, and each sample was spread over a surface of fifty square inches. The amount absorbed is stated in grains :

			12 Hours.	72 Hours.
1,000	grains of	silicious sand	0	0
"	"	calcareous sand	2	3
"	"	gypsum (powdered)	1	1
"	"	sandy clay	21	28
"	"	loamy clay	25	35
"	"	stiff clay	30	41
"	"	grey pure clay	37	49
"	"	fine lime	26	35
"	"	fine magnesia	69	82
"	"	garden mould	35	52
"	"	arable soil	16	23
"	"	slaty marl	24	33

"It is evident, then," says Professor Johnson, "that the power of absorbing moisture is in a great degree the measure of the fertility of the soil."

ON DRAINAGE.

This is a subject not only of great importance to the practical farmer, but one upon which a full work might with advantage be based. We shall, in this section, content ourselves with passing allusions to the general principles upon which the formation of lasting and useful drainage should be accomplished.

Draining is very often looked upon by the farmer as an operation entailing such a considerable outlay as to be beyond the pocket of an ordinary man

Doubtless, to undertake in a short time to effectively under-drain a farm would require a very large expenditure, but the advantages are so great to the productive power of any land, that a constant improvement in this shape, on a small scale, and the operations spread over a number of years, are hardly felt to the pocket;

while it is marvellous what an amount may be accomplished at odd times throughout the year.

There are many men who wait to hire their labour until the day for its requirement on the ordinary farm operations has arrived, and then, alas! they find it exceedingly difficult, in a country like Canada, where labour is so scarce, to find such as they require.

Rather we would advise the hiring of men for longer periods, and then, by constantly having works of improvement to turn to when other work is short, we may apply that labour at all times to some profit.

There are a great number of days when we cannot get upon our land to work profitably at field operations. If we have a certain field or spot laid out for drainage, these wasted minutes might be most profitably employed.

There are, indeed, but few farms in Canada to-day upon which there are not to be found spots, sometimes covering very many acres, which, composed of the very best kind of soil to the husbandman, are yet so apt to retain upon their surface stagnant water, as to be totally unfit for the production of marketable crops.

In many instances the drying of these spots, by means of under-drainage, is not by any means so formidable a job as may at first appear, while the profit is not only enormous, but lasting.

From the experience of all farmers who have done any underdraining, we learn that the first cost is amply repaid in three years, or, in other words, the capital so invested yields no less an interest than 33⅓ per cent. We know of no investment so profitable and safe upon the stock or money market.

The effects of drainage are very varied upon different soils. The immediate benefits derived are the removal of stagnant water, and the opening of the soil for the transmission through it of the manure laden rains and atmosphere.

The earth is full of pores. These pores must be either filled with air or with water.

If with water which stands in them for any length of time, then do they become cold and acid; if with atmospheric air, then are they warmed with every increase of the temperature of the upper air.

If these pores are filled with air, the land works up friable and mellow; if with water, then will it run together and bake like brick on the receipt of the heat from a pouring sun upon it when in such a wet state. The object of under-draining is to advance this friable state, and, on the other hand, to overcome the baking process.

By keeping the pores of the earth open, plants are enabled without resistance to strike their roots downwards and upon every side, thus securing sound anchorage, and seeking in all directions for their natural food, the earth is opened up, and worms can work down and increase in their passages the number of air channels in a soil.

Water in spring, or when falling on the growing crop, percolates or filters gently through the soil until it reaches the drain, instead of falling upon the surface and rushing off, as is its action upon a hard road. When water falls and runs off the surface of land in torrents, it is useless to the plant, for it never reaches in sufficient quantities the root, while in its superficial rush it is very apt to carry off to lower-lying spots the top soil, and leave the plant root exposed to the next burning sun.

Thus will under-drains prevent a superfluous soaking of the soil in wet cold seasons, whilst they help to retain all the water that falls at intervals through the summer months.

In other words, they are means by which to dry the land in wet weather, and also to wet the land in dry weather.

Now comes the question to the ordinary farmer: How can I afford to under-drain? Why, in the same way as you accumulate a fortune—little by little, by constant but small increase.

Begin on the worst fields or worst spots upon the farm. Put in your main-drain this year, and some of your side-drains next season.

It is extraordinary how soon this devotion of odd times constantly to the work will accumulate, and how many acres thus become drained in but a few short years.

But when once a field is begun, do not travel off all over the farm; but, if it takes ten years, stick to that field until its drainage is thorough.

Finish as you go; make good drains, if at the expense of extra time and labour, and fill them in as you go along.

A little extra care upon a drain will often add many years to the service it will render.

The outfall or main open drain, namely, that into which your main covered drains discharge, is the first to be attended to. When spring creeks of some depth of bank exist, this is often greatly expedited.

As far as possible, fields should be so arranged that open drains may run along the fences, as thus we are saved from cutting in parts our fields for cultivation, and an open ditch by the side of a fence will effectually, by draining the water from around the posts, prevent its heaving under the influence of frost and thaw.

A great mistake is made by many ditchers in not giving the sides sufficient slope; an angle of 45° is none too much at which to slope the side of a ditch from the horizontal.

Steep banks become undermined by running water, and fall in, or are poached by cattle in search of drink, and are tumbled in, and never last for any length of time without requiring to be cleaned out. The plough and scraper are very expeditious tools with which to dig an open ditch.

The bottom of an open drain is none the worse for being as wide as a scraper; whilst the horses can easily draw scrapersful of dirt up an incline of 45°.

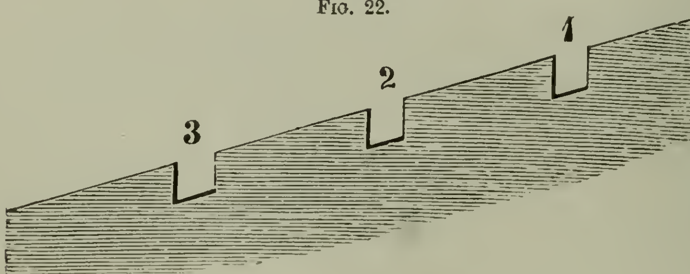
Should the subsoil become too heavy and compact to use the plough with mould boards, then take off the mould board and stick in with landside share and coulter.

The outfall ditch should be considerably deeper than the ends of main drains, so that when the former discharge they may be well above the bottom of the outfall.

The time to dig drains is when the weather is dry: the best is in September, October and November; though with some care in starting the top soil early, staking out the lines before winter, and with the blessing of deep snow, we have seen many a drain dug through mid-winter.

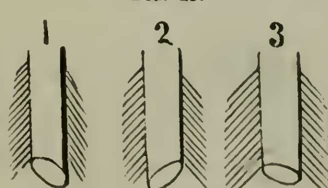
As to the direction of main under-drains, there is much variety of opinion; some are in favour of carrying main-drains across the slope of land (diagonally), thus, as they say, preventing the washing of drains by heavy storms flowing into and through them with great rapidity. For our part, we consider that if main-drains be led directly down the slope and properly joined, there will be no fear of washing. Again, that a given number of drains laid across the slope of a hill would not effectively clear as great a space of land of water, the accompanying diagram will show:—

Fig. 22.



Suppose the base upon which the drains 1, 2, 3 rest to be parallel to the surface of the slope in which they are placed, and that they are laid 30 feet apart the one from the other, then—as water cannot flow upwards, either from 3 to 2, or from 2 to 1—all the water which is below 1 in the field must flow a distance of 30 feet ere it can enter the drain 2; similarly, all the moisture below 2 must

Fig. 23.



penetrate through the soil a distance of 30 feet ere it can drain away by No. 3, and so on *ad infinitum.*

Now, if the drains be 30 feet apart, and running directly down the slope, each drain would only require to draw water from 15 feet on each side of it, and thus the water would flow away faster than in the former case. Moreover, under the former plan, the pressure would act entirely upon one side of the drain.

As the object of under-drainage is to carry away all superfluous water from the soil *quickly,* we are at a loss to understand whence such a difference of opinion amongst authorities on drainage can have arisen.

In a perfectly level field, or when the slope is not apparent to the eye, the main drain should be run down the centre of the field, and the lateral ones should empty into it at a right angle.

Side drains should be always placed equidistant in such a field, so as to obtain the minimum average of distances from which to draw water.

Depth of Drains.—This is a very particular matter in field drainage. If too deep, the action will be slow and impeded, while there is no fault so great as that of placing drains at too shallow a depth.

If too shallow, the frost may get at them, and not only is there a risk of freezing and bursting, but they will draw off, along with the water, the manurial strength of cultivated fields.

This may be readily tested by putting in a drain at, say, 15 inches, and another at 3 feet. While the latter would be running off clear water, the liquid in the former would be muddy, and, if submitted to analysis, would be found to contain much manure and valuable mineral matter; in fine, would be but partially filtered. But depth and distance apart must be regulated by variety of soil. Experience tells us that the depth of 3 feet 6 inches below the surface of the ground, in all soils, is sufficient, and that on heavy lands, be they tenacious clays or soft soils, the distance apart of side drains should be about 8 yards, while for the ordinary loamy soils, and porous sands or gravels, intervals of 10 yards will be found ample.

To mark out for drains, it will be found very handy to stake and run a plough furrow down the line.

Material.—There are, in Canada, three known materials in practical use. For neatness of work and durability upon any land but alluvial, none can compare with the burnt tile. Tiles are, however, expensive, and their use may well be governed by locality.

In some parts we have stone of a suitable kind in abundance. Stone drains carefully put down will last for years, and are very effective. To lay stone there are several methods, three of which are:—

1st.—Throw in loose stones of all shapes and of any size above a pebble, and below that of a boulder, to a depth of about 10 inches; cover with a little brush or inverted sods, and fill up with earth. Such drains in a stiffish subsoil will last for years, but their action is rather slow.

2nd.—Place two flat stones for sides on their edge, and cover them with a third; above this cover again throw in a few inches of small stone; or we have seen, where flat stones are abundant, as in many limestone ridges, the whole ditch bottom filled in, placing flat stones on their edges for sides, a flat stone on top, a few inches of loose stones above that again, and the whole then filled in with earth, ridging up a little to allow of settling.

3rd.—Place one flat stone at the bottom, and two more, one on each side, forming a triangle; cover with small stones and fill in the earth Where stones can be obtained at a reasonable distance, and laid alongside the open ditch or grip, these drains are the cheapest and most practicable, and, if care be exercised in so adjusting them that the stones cannot cave in on one another and form a dam, will last for a very long time.

It would be well, however, to bear in mind that it will not answer to make drains of stones in deep alluvial soils, such as exist in some of our swamps even, as neither stones nor tiles will do in sand that is at all of the nature of quicksand.

Wood.—In many parts of Canada, in the neighbourhood of low, wet-lying lands, there is abundance of wood suitable for drains—pines, ashes, hemlocks, &c.

In stilty land, or such as is of the nature of quicksand or muck, as cheap a drain as can be made is formed thus:—Take scantlings, boards, or even pine slabs, and lay them as with the stones in the triangular shape; fill in around them with small stones, or, if not available, with brush, to a depth of some inches. These stones or brush will catch the "silt," and prevent it choking up the drain.

This is as effectual as we can find for such land. There is always trouble in drains in such kind of soil, but probably less need be anticipated from this style of drain; moreover, they are easily raised and relaid.

In all these drains it is an excellent plan to cover over the whole with one layer of inverted turf before the earth is filled in.

Brush. — We have seen excellent drains made of simple brush.

The brush being kept from the light will not decay. The laying of a brush drain requires very great care, but if properly put down will work for a very long time.

They should never be used for main, but only for side drains. The limbs, cut a few feet in length, are placed with the butts down, commencing at the *upper end.* The ditch should be filled at least one-third full, or from twelve to fourteen inches thick of brush when well trodden down, as the weight of superincumbent earth will afterwards further compact them. The ditch must be made wider at the bottom than for tiles or stones.

Resinous and durable wood, such as pine, cedar, &c., is the best for this purpose; but if they be set deep enough, the hollow drain will remain long after the wood has decayed, while the brush itself will last for many years.

Mr. Allan Macdougall, C E., of Toronto, in his papers on Practical Drainage, to the *Canada Farmer*, says · "The outfall drain is the first thing to be looked to. If a stream or ditch, alongside of a road exists, it ought to be cleaned out to a depth of three feet nine inches or four feet. It is not necessary to have a great fall on it, as water acts more freely than solid substances. Each particle looks out for itself, and seeks the lowest place it can find; and when confined in a drain, each particle, trying to get to the lowest place, pushes on the particle next to it, until the drain is emptied. For an open outfall three or four feet to a mile is sufficient fall to allow a drain to discharge water freely, as long as the bottom and sides are kept clean and free from weeds; and for drains from a field, one foot on four chains, or half an inch on ten feet, is considered quite enough. The outfall is usually an open cut ditch, made down the side of two fields, which is used for draining the fields on both sides, as well as being an outlet for other drains coming down from other fields. It should be carried up in the lowest place, so as to drain as many fields as possible, and be made about three feet six inches to four feet deep, according to the fall it has, about eighteen inches broad at the bottom, and five feet wide at the top. Open cut outlet drains from other fields should be connected to it. They should be about one foot wide at bottom and four feet wide at top.

"The trenches or grips in which the drains are to be laid ought to be commenced at the low end and carried up the field regularly—that is, after one has been cut fifty or eighty yards, the next must be brought up that distance; then the third, then the fourth, and so on, as this enables a grip to let away some of the water from the low end of the field before the water from the top is let into it, and also lets the air get into the land. For tile drains it is not necessary to cut them more than twelve or fifteen inches wide at the top, sloping downwards to six inches at the bottom. For stone or brushwood they would need to be cut nine or twelve inches broad at the bottom. Care should be taken in making these grips that the bottom has a regular slope; for if it has not, the water will be certain to lodge in the hollow, and derange the working of the drains. This is more particularly the case where the ground is very flat. Side drains ought never to join a main drain at right angles. They ought to have a bend at the end for ten or fifteen feet, to run in the slope of the land, that the water coming from them may flow easily into the main drain. Were this not done, the two currents coming in contact would cause back-water in the weaker stream, which would be the side drain, and this would keep the drain from being properly discharged, or, as frequently happens after heavy floods, would cause the side drains to burst.

"When drains come down the whole length of a field to the outfall drain, or the principal drain that is to carry off the water, they ought to join at a little higher level, so that the two streams may unite together without any back-water.

"When the main drain happens to be an open ditch, as is usually the case, it is a good and safe plan to place a large stone below the last pipe, and another on the top of it to keep it from being washed away by floods; or in stone drains, to lay a large flat stone for the bed, and place two stones on edge, with a large one over them to cover them, which will protect the loose stones of which these drains are composed from being washed away."

Another practical writer, in giving instruction on the formation of rather more elaborate board drains than those above noted, says: "Our plan is to construct angular board drains, by putting together, in the form of an inverted Λ, two boards bevelled so as to form an angle more acute than a right angle. I have witnessed the action of great quantities of this drain, and where laid in a subsoil that does not wash, nothing can do better, especially if kept nearly level. The drain box should be formed of a ten-inch board divided obliquely through the centre. This saves lumber, and makes a perfect drain, and the angle formed by putting both bevelled parts together offers great resistance to breaking in from the weight of earth above. About four nails in each twelve-foot length will keep all steady until the earth completes the security of the drain by its weight. This plan affords the largest drain, and of the best shape for the smallest quantity of lumber used."

To render boards for draining perfectly rot-proof the following is effective, known as Robbins' process: "Strange as it may seem, after all our experimenting with wood and the tile-draining material, we are likely to come back again to wooden drains of some sort under peculiar circumstances. They are pronounced to be on good authority superior to, as they are far cheaper than, tile-drains, where the wood is subjected to the vapour of carbolic acid. But even without this preparation, wooden water pipes, made in the best manner, will last two or three generations under ground. But as it regards the so-called Robbins' process, it is not applied to logs, but *boards*, so that the logs of any perishable woods sawed into boards. and the boards subiected to carbolic acid, formed into square conductors and used as drains upon farms, will last, it is claimed, 'for ever,' at a cost of not over a fourth or a fifth of that for tile—a heavy article, and expensive to farmers living at a distance from a manufactory. Should this process turn out to be all that is claimed for it, the farmers of the country will find in it a means of rejuvenating their lands by draining, which, while it will cost but little, will nearly double their productive capacity."

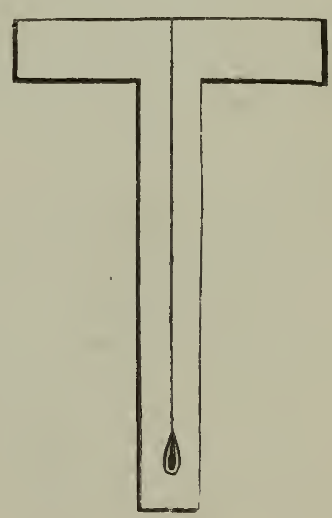
In undulating fields, the drains should not follow the exact ups and downs of the field, but should have a regular slope.

This particularity is more necessary in the laying of stone or tile drains than in those of wood, as the long length of wood will give to the drain a regular shape.

If tiles follow small undulations in the ground, the low spots will hold water, which, backing up, will form an impediment to the general flow throughout the whole length.

Where the operation of tile draining is gone into on a large scale a spirit level may be bought, but they are expensive; or where they are undertaken by professional engineers, of course the regular levelling instruments are available; but any farmer can make a small instrument, as in accompanying diagram, which will answer every practical purpose. It is simply a plumb-bob attached to a perfect T.

Fig. 23.



The operator places pegs in his hollows and on the little knobs, and by means of this T, which can be held perfectly erect by regarding the plumb-bob, drives his pegs down into the hills, so that their tops are in a regular slope with those pegs that are in the hollows, from end to end. He then measures the depth of his ditch, not from the surface of the earth, but from the tops of each of his pegs.

In all drains, difficulties will be apt to arise by the work of rats, mice, and often from roots finding their way into interstices and damming back the flow of water.

In an orchard, to avoid annoyance by roots of trees, drains should be set deep and equidistant from the rows of trees.

One great advantage possessed by wooden drains over other kinds is, that from being of larger dimensions they do not require as great a fall; but they are subject to infesting by rats. A plan is often adopted to overcome this danger, by keeping the end about half dammed up with a good heavy turf, or by some other means. This always keeps the lower end of the drain half full of water, but only for a certain distance up, so that while rats cannot easily get up the drain, neither is the flow of water impeded except for a certain distance from the mouth. Others put gratings of wire at the end; these must, however, be carefully looked after, for they are apt to become stopped with silt coming down with the water.

Wood will also last better in naturally wet soils than in those of a drier nature, for as long as the wood is kept constantly wet it will hardly rot; it is dry rot that destroys a wooden drain.

Tiles, when used, must be well burnt, and smooth within. If not well burnt, the wet is very apt to crack them.

The bottom of a drain on which tiles are laid should be very carefully made—exactly the shape of the tile—so that the tile may, when placed in position, be supported on the sides closely by the bank, and lay touching the bottom at all points.

To shape the bottom of the ditch aright, regular draining spades may be bought, and are required.

Tiles should have a flow of from three to four inches when used as main drains; when placed in lateral ditches a two-inch pipe is sufficient.

A side drain should not be longer than three hundred yards with a fair fall, or two hundred yards on a lesser grade. A sod should be carefully laid over every tile, and the earth compacted well just above the tiles.

The horseshoe-shaped drain has been almost entirely discarded in the old country, from the difficulty that was experienced in getting the flat side to burn hard. In the selection of tiles, not only must care be exercised that they be well burnt, that there be no roughnesses inside them, and that they are straight; for, if crooked, the water has to rise to get over the obstacle thus afforded.

TABLE showing the number of tiles necessary to drain one acre of land, when the drains are laid at certain regular distances from one another, supposing the pipes to be one foot long:

FEET APART.	TILES.	RODS OF DITCHING.
24	1815	108 rods.
27	1613	96 "
30	1453	88 "
36	1210	72 "
45	974	60 "

Mr. D. G. F. Macdonald, C.E., gives the following experiment in favour of the advantages of under-draining upon his own farm:

PRODUCE BEFORE DRAINING.	PRODUCE AFTER DRAINING.
Wheat 24 bushels per acre.	Wheat 38 bushels per acre.
Barley 40 " "	Barley 58 " "
Oats 48 " "	Oats 64 " "

"Ogden Farm finds encouragement in the following passage in the Hon. George Geddes' Essay on Wheat Culture: 'Undrained clay lands are never worn out, for the owner that lacks the energy to free them from stagnant water, never has force enough to exhaust their fertility by cropping. Manure on such land is nearly thrown away. Draining is the first thing to be done; next, thorough cultivation; then manure. Whoever reverses this order throws away his money and his labour.'

"This would be a good text for every farmer to keep constantly in mind. The *profit* of farming comes entirely from the *surplus* of production beyond the grand total of the cost of interest, labour, seed, manure, and wear and tear. These are nearly fixed quantities. They are at least as great, in the aggregate, with medium crops as with good ones. If thirty bushels of corn to the acre will barely return the outlay, sixty bushels may give a clear profit equal to the value of thirty bushels. There are thousands of farms in the country, whose soil contains enough of the elements of fertility to produce fair crops with the aid of ordinary manuring (if only these elements were come-atable), but which, by reason of their soggy and unpleasant condition, would do less injury to their owners if they were hopelessly barren. In the spring and early summer they are moist and cold—more like putty than like arable land; in July and August they are baked to a crust; and when the fall rains come they revert again to their weeping state. Any effort to make good land of such a farm as this without draining is simply an effort wasted. Neither labour nor manure can do much to drive away the demon of bad luck by which every path of its owner is beset. I have scores of letters from the occupants of such farms, and I have had for years. I began by advising this and that makeshift, where it was claimed that the expense of draining could not be borne; but I have finally learned to say, point-blank, to any man who is trying to make his way on this kind of a farm: 'Either drain it or give it up! You can make more money by working at days' work, on good land, than by fighting year in and year out against the established laws of nature. If you can't do better, sell off your stock, and, if necessary, work for a neighbour enough of the time to earn your bare living. Spend the rest of your time and all the money you can raise in draining the *best* field you have got. Don't imagine that your case is to be an exception, but accept the fact, now that you *can't afford* to farm wet land

—either own up that you are only fit for a day labourer, or buckle to and make your land worth cultivating.'

"There are two great obstacles to the advancement of under-draining, viz.: One is, the idea that land which suffers from *drought* does not need draining, when the fact is that land often suffers from drought just because it needs draining—take out the water and let in the air, so that the soil can be put in proper tilth, and it will be able to withstand drought. The other is, the not unnatural notion that the first land to be drained is that which is now the wettest. In my judgment the improvement should be first applied to those fields which are just dry enough to be considered arable, but which, two years out of three, disappoint the farmer's hopes, and produce barely enough to pay the cost of cultivation. If such land as this is drained, it will pay a profit. If a back lot swamp is drained, it may be years before it will do more than pay the expenses of its management. Begin with the very best land that needs draining at all, and make it produce a profit, and then take the next best and bring that to a profitable state, and so on until the back swamp comes in its turn. What we want is not so much large crops as profitable crops. A hundred dollars' worth of corn that has cost a hundred dollars had better not have been grown. It don't pay to work over large areas for meagre produce. Pile on the steam! Crowd the production to the most remunerative point; and then extend your operations to the next best field, and make that pay a round profit. This is the soundest principle of good farming, and in carrying it out we shall have no more efficient aid than is rendered by thorough draining on the best lands that need draining. When this is accepted as the correct principle, we shall see draining extending in all directions. So long as the chief object of draining is to convert innocent waste lands into fields for unprofitable work, its progress will be but halting, and farmers will continue to cry out against its great cost. Cost? Why, suppose it costs as much to drain an acre of land as to buy an adjoining acre, this is no argument against it. The one acre drained would pay a handsome profit; the two acres undrained would pay no profit at all, and had better be left to grow wood. What is wanted, as the foundation of the best improvement, is a conviction in the minds of the farming public that it is better to have good farms than to have large farms. That point being gained, all the rest will come as a matter of course. Let us confine ourselves to such areas as will give us the most money for our farming, and leave the rest of the land to take care of itself."

In the columns of the *Canada Farmer*, the author expressed himself as follows on the subject of the institution of a Private Drainage Fund by the Government, and regrets that some of the surplus money was not, in the session of '73, invested in the same way:—

"We have reason to believe that there are a great number of farmers who would gladly avail themselves of an opportunity of borrowing money at a moderate percentage upon long time, did they know of any fund from which such could be obtained.

"Some years must elapse before drainage and similar permanent farm improvements can make a return to the farmer upon his capital invested, and for this reason it is seldom within his power to borrow money at large interest for such a purpose.

"The first cost of the thorough drainage of a large area of land is very heavy, and is beyond the means of the greater number of our farmers. Of course no private individual will let out his money upon light interest for drainage purposes, when eight or ten per cent. is obtainable upon the very best of securities.

"We cannot but think that some of the surplus funds in the hands of our Government might be appropriated with great justice to the creation of a Loan Fund, from which private individuals could borrow on easy terms, giving as security mortgages upon their real estate.

"The interest of Canada as a progressive country is entirely dependent upon her agricultural prosperity, and in no way would a larger average of yield be attained than by the adoption by her farmers of a thorough system of under-drainage, and no greater incentive could possibly be conceived to an improved system of agriculture throughout the length and breadth of the Dominion than the power of borrowing public money for the specific purpose of land improvement by drainage.

"The great influence of drainage, in an increase of agricultural products, cannot be called in question by any who have seen the state to which agriculture has been brought in England within the last half century. The greater proportion of the present success of the farmer in England is due to a thorough system of drainage. Our farms in this climate stand, perhaps, more in need of under-drains than those of Great Britain, for our rain-fall is very light, and we require every drop of water to percolate our soil, and can afford to lose none of those heavy rain-falls which, few and far between, rush in torrents over the surface of our land, rather to the detriment than the benefit of the growing crop.

"We believe that, on the one hand, if a fund were appropriated from which our farmers could borrow for the especial purpose of draining their several farms, a very large amount would be sought after, and, moreover, that such expenditure would benefit the country to a far greater extent than that which is invested in Government securities and Canadian debentures, even if the latter were producing their ten per cent. The whole of the capital sum would be invested in the country and for the country's benefit, and the most ignorant of farmers knows full well that the effect of thorough drainage is to increase the crop-producing power of his land, in many cases as much as fifty per cent Thus to the country would be added, without going into minute calculations of interest accruing in collateral ways, by investment in drainage, a return commensurate with this estimate.

"It would, of course, be necessary that the Government should assure itself of the investment of such funds for *bona fide* drainage purposes and for none other.

"We are not, at this moment, in possession of a perfect knowledge of the system by which the similar fund is worked in the old country, but we do know that there the Government takes effectual means to assure itself that all such monies are well and truly applied to the purposes for which they are from time to time borrowed.

"We should like our farmers to take up this matter, and to see that their representatives are made fully aware of the importance of the subject, and we cannot but think that the county candidate for election to the House would find a broad and liberally expressed view upon this point a very safe and solid plank upon his political platform."

MANURES.

The true theory is that, to keep crops from diminution, the farmer must put as much into the soil as his crops take from it, and that if he desire to increase his returns he must put more into the land than he takes out of it.

If a man takes money out of his bank faster than he deposits, he will soon have none to his credit; and so it is to the farmer who draws more from his soil than he returns again.

The late Professor Liebig, one of the deepest philosophers, experimentalists and chemists that the world has ever produced, says :

"Perfect agriculture is the true foundation of all trade and industry ; it is the foundation of the riches of States. But a rational system of agriculture cannot be formed without the application of scientific principles ; for such a system must be based upon an exact acquaintance with the means of nutrition of vegetables, and with the influence of soils and the action of manures upon them."

An application of science to agriculture simply means a knowledge of nature's wants, demands and methods of working. Farmers are inclined to sneer at what is called book-farming, but all they know, be it handed down to them from father to son or otherwise, has been first discovered by enterprising experimenters and deep thinkers, and only ceased to be known by the name of scientific when the knowledge of it was widely spread abroad.

Every improvement in the manner of working a farm that now takes place is an effect of science; and many a system now sneered at by the illiterate will in the future be generally practised by themselves, when it has stood the test of general practical application.

Were it not for the discovery of science, and the widespread influence of books, farming would be little farther advanced in method to-day than it was when our fathers used a wooden plough and drew it through the soil by means of four or five horses, one yoked in front of the other.

Agriculture must keep pace with other arts; or rather, the other professions of the world cannot exist without a progressive advancement in the knowledge of the agriculturist.

> "The plough and the sickle shall shine bright in glory
> When the sword and the sceptre shall crumble and rust,
> And the farmer shall live both in song and in story
> When warriors and kings are forgotten in dust."

It has been well said: "It is an excellent lesson for sticklers for good old routine to cast their eyes over the surface of the land, and to note in how many cases districts the most unpromising, and with the least tractable soils, have been made models of agriculture, purely by the removal of the original obstacles to cultivation." Turn to England, and look at the cold clay lands of Norfolk, so improved by skill, energy and enterprise that the county has become conspicuous in the history of England's agriculture.

Difficulties breed enterprise, and obstacles foster skill. Look at the more barren, sterile and inhospitable portions of Scotland, and find now there some of the most productive farms in the world.

> "Rough is her soil, yet blest in fruitful stores;
> Strong are her sons, though rocky are her shores;
> And none, ah! none so lovely to my sight,
> Of all the lands that Heaven o'erspread with light."

The man who reads books on agriculture is too often met by those who pretend to despise book-farming with—

> "He who by the plough would thrive,
> Himself must either hold or drive."

That applies in principle, but there is driving with the head as well as with the arm. "One head is worth two pair of hands," we find to be an adage worthy of consideration, whilst a paraphrase of the above is not inapt, that—

> "He who by the plough would gain,
> Himself must work by hand and *brain.*"

Far be it from us to advocate what is known as "high farming" to the general run of farmers. "High farming" is associated with ideas of immense expenditure on high and abstract theories.

"High farming" requires a large amount of skilful expenditure of capital and deeply reasoned system of cultivation.

It would be as useless to expect to see the majority "high farmers" as to see the greater part of the world profound scholars. But what we advocate is, such a general knowledge of other people's ideas, real and idealistic, as shall form a basis upon which to work out practical improvements, and by which to adapt the cultivation of our land more closely to the ways of nature as revealed by the researches of wise and scientific men.

In Canada, where labour is expensive and very difficult to be obtained, if we would find a profit in farming it becomes especially necessary that we raise *larger crops per acre.* This end cannot be obtained except by further enrichment of our lands, nor can those elements taken away by the exhaustive cereal be returned to the soil, for the use of a future crop, except through the medium of a liberal application of manure. If we have a field from which we gather in our one crop all its richness, we must make some return ere we again tax its energies to supply food for the subsequent crop. Manures are various; any substance that contains in itself any elements of plant food, is a manure, be it in a putrescent, animal or vegetable, in a mineral or fossil, form. Of these several forms of manures we shall now more fully treat.

FARM-YARD MANURE.

A portion of our agricultural readers may, on glancing at the caption of this chapter, be inclined to pass it by as of so ordinary a nature that they can see no knowledge attainable in the discussion of a subject so common, and one to the application of which all farmers devote time sufficient.

From our personal and practical knowledge of farmers and of farming, we know that there are many in Canada who will be apt to set aside such reading as commonplace, possibly as stale and unprofitable. Should this chapter catch the eye of any such men, we beg at once to take issue with them, and assert positively that not only is a profound knowledge of manuring, and practical appliance of such knowledge, of the most fundamental importance to every tiller of the soil, but that no subject of agricultural education has been so sadly neglected as that of the knowledge of the effects of vegetable, animal and mineral manures upon our soils and upon our plants.

Though it is true that manuring has been generally practised wherever cultivation has been attended with any marked success, yet its principles are not thoroughly understood by our most eminent agriculturists; how much less then by the ordinary run of farmers.

The perfect exposition of the practical effects of manure upon plant life rests with the analytical chemists, and it is to such men that we must look as our leaders in research.

We do not desire to convey instruction in this work by any fine theories or abstruse disquisitions on the analytical and chemical properties of manure, but propose to dwell shortly on the first principles of nature, trusting that such may induce more attention to the great importance of the manufacture of manure among the careless, and may strengthen the thrifty in their plans for the enrichment of the land.

Cultivation for the growth of artificial crops, such as are nearly all the farm products of America, has but two main objects in view. One is, to provide food for the sustenance and growth of the plant; and the other, to place that food in the most tempting way before the tender root, so that its delicate mouths may find their food close by them. It is a common law, that "when the mountain would not go to Mahomet, Mahomet had to go to the mountain." The tender rootlet has little power to stretch far for its food, so that food must go to the root.

This food is provided in three distinct and separate modes: **1**, By so cultivating the soil that the external atmosphere and food-laden rain shall penetrate downwards, and moisture shall, by the process known as capillary attraction, work upwards from the subsoil; 2, By providing all the elements of plant food, in the form of putrescent or decomposed animal matter; and 3, By stimulation of the soil itself.

There are manures which act directly upon the plant, and there are those which act solely as stimulants.

The object, then, of putrescent animal or vegetable manures, is to provide food directly, and in a soluble form, to the mouths of growing plants. Some of these mouths are in the roots and others in the leaf, and upon the various positions of these mouths in different plants we base the several advantages of top-dressing and of ploughing under manure.

All those various substances which appear in the category of vegetable and animal matter contain in their ordinary state all the different elements of plant food, but they have to go through a process of fermentation and decomposition ere losing their respective fixed conditions; they become assimilated in one saponaceous mass, and are in such a state that the plant can seek out the peculiar food especially required for itself. In their ordinary state, or under partial decomposition, the several chemical elements are held firmly together and fixed; total decomposition unbinds these various elements, and each becomes eligible for the sustenance of plant life.

BARN-YARD MANURE.

Manure *par excellence* is that of the dunghill—for in the constituent parts of this manure may be found all the elements which were originally required for the sustenance of the various foods, and which, having passed through the animals, form now the manure pile.

The dunghill is the best bank in which the farmer can invest his money ; any investment that will tend to the increase of the fertility of his land is one of perfect security to the farmer. Nature becomes his banker, and she will never fail to give good interest.

We would here call the attention of our farmers to the absolute injury caused by the exposure of our manure piles to the sun and air, by the following tabular statement, composed from actual experiment, which will convey some idea of the various changes wrought in a pile of farm-yard manure under the effects of exposure to sun and rain :—

	Put up Nov. 3.	Put up April 30.	Put up Aug. 23.	Put up Nov. 15.
Weight of manure in lbs.	2838·00	2026·00	1994·00	1974·00
Water	1877·09	1336·01	1505·03	1466·05
Dry matters	900·01	689·09	488·07	507·05
Soluble organic matters	70·38	86·51	58·83	54·04
Soluble inorganic matters	43·71	57·88	39·16	36·89
Insoluble organic matters	731·07	389·74	243·22	214·92
Insoluble inorganic matters	114·94	155·77	147·49	201·65
Total of nitrogen	18·23	18·14	13·14	13·03
Equal to ammonia	22·14	22·02	15·96	15·75

It will be observed that during the first or winter six months the loss was only in the insoluble organic matters—but in the six summer months the valuable portions, ammonia, nitrogen, dry matter and soluble matter, had undergone very considerable diminution.

The most valuable portion of animal matter is the urine, and it is the portion that we should put forth our most strenuous endeavours to save from waste and loss.

Though chiefly composed of water, urine contains the elements of vegetation in a peculiarly soluble form, and by the secretion of the vessels is combined with a large proportion of ammonia.

The analysis of its composition has shown it to be most favourable to vegetation when mixed with other excrements, and with straw and simiiar substances, because it occasions their better combinations, and moulds them into that form of manure of which we are now treating.

Straw consists of carbon, oxygen and hydrogen, with some nitrogen and earthy or alkaline salts.

The value of straw is chiefly as an absorbent of animal excreta and urine, though its mechanical effects are also beneficial, as forming tubes through which air is carried into the body of the soil.

Straw yields, when burnt, about 5 per cent. of ashes, and so far contains in itself actual fertilizing power. *Chaff* is very useful in the manure pile, because it contains a large amount of silica, the element that gives stiffness to the growing stalk.

Yards and Sheds.—In our travels through Canada, we have not unfrequently seen the very essence of manure trickling from a barn-yard into the road, where it goes to the enrichment of all foul weeds instead of to that of the farmer's crops.

All yards should be formed more or less hollow, and have an impervious bottom.

This may be rapidly done by the use of the plough and scraper.

If the soil is clayey, it is an easy matter to make the bottom water-tight. After having cleaned the yard out and thoroughly graded it, take advantage of the first wet day, and turning all the cattle in, drive them round and round until the mud is puddled to a depth of about eight inches. When that dries, the bottom of your yard is water-tight.

This principle may be still further improved upon by the construction of reservoirs to receive all ley and manure ; the contents might be pumped up and distributed over horse manure when its too great dryness occasions any danger of its becoming fire-fanged.

Few barns or barn-yards are so arranged as to save the liquid manure. The loss resulting from such a want of proper arrangement is a very serious one—more so than most farmers would imagine. In the first place, the quantity of liquid matter which might be saved from a pair of horses and half a dozen cows amounts to 80,000 pounds yearly. This is equal to about 10,000 gallons, which, diluted with an equal quantity of water, would furnish each year a dressing of 1,000 gallons per acre to twenty acres of land. Fermenting liquid manure needs this addition of water for the purpose of retaining the ammonia, which would otherwise pass off and be lost. The solid matter contained in the above quantity of liquid is equal to nearly three tons, and is worth as much as the best guano. The money value would therefore be about $200—an amount that is well worth saving. Much less than this amount would make the drains and tank required to save the manure, so that the outlay would be more than repaid the first year. Or, if proper absorbents were freely used, the whole of the liquids might be saved without any outlay at all.

When dung is to be preserved for any time, *the site of the dunghill* is of great importance. In order to have it defended from the sun, it should be laid under a shed or on the north side of a wall. To make a complete dunghill repository, the floor should be paved with stones, a little inclination being made from each side towards the centre. In the centre there should be drains connected with a small well, furnished with a pump, by which any fluid matter may be collected for the use of the land, for it too often happens that the drainings of the dunghill are entirely wasted.

Were roofs constructed over dunghills to protect them from the rays of the sun, as well as from the rain, there can be no doubt that, if put up at little cost, they would be found to pay.

There are those who advocate the keeping separate all kinds of dung, for, say they, each animal manure is especially adapted to various crops. While admitting the probable truth of this principle, there are other and great advantages which seem to point out the advisability of rather mixing the various dungs in one heap.

Foremost among such reasons is the different degree of heat found in various manures ; for instance, horse manure is very hot—and it will be found that the presence of horse manure in the cow dung will hasten the slow decomposition of the latter, while cow dung will be found to tone down the rapid fermentation which often proves injurious to the pile of horse manure.

Evaporation.—The question of evaporation from manure, whereby many of the most valuable gases are lost, is one upon which opinion is and has been greatly divided. In the works of Von Thaër, a man of scientific and also very practical knowledge, we find his summed up opinion to be, that "Not only are we taught by theory, but, during his own experience, he has very frequently observed that it is hurtful to remove manure whilst in a high state of fermentation ; for an essential portion of the most active substances of which it is composed are evaporated when exposed to the air while the process of fermentation is going on. But before the fermentation has arrived at its height, or after it has passed, the dung does not seem to lose anything by exposure to the air, or at least nothing but what it regains by some other means."

Management of Barn-yard Manure must differ according to season and soils.

How it should be applied has always been a fruitful source of opposition and argument amongst the most practical men. There are those who advocate the thorough rotting of dung before application to the soil, while others are in favour of placing it upon the land in its fresh, raw state.

We think that circumstances must regulate the matter, and that none are justified in laying down either principle as a rule of faith.

We know that fresh manure lasts longer in the land ; we also know that such is apt to foul our fields ; while, on the other hand, we know that certain crops require the manure in a thoroughly decomposed state. For instance, in growing turnips, we wish to rush the young plant out of danger from "fly" as soon as possible ; and to do this, manure should be applied in such a state that its tender rootlets can at once obtain sustenance.

Wheat, again, is a slow-growing cereal, and has about ten months in which to mature; there is then plenty of time for it to receive benefit from the food slowly given away by long manure.

Wheat and turnips, then, require their manure in totally different forms.

Again, much of the benefit of dung to heavy lands arises from the mechanical effect which it has in opening the land and loosening it up. This mechanical effect is best obtained by long strawy manure, each straw forming a channel through which air is carried to the soil.

Again, clay lands are usually cold by nature; fresh horse dung is hot, and helps to remove the coldness from the soil.

Also, if we apply manure to our turnips or other hoed crops, we desire that there should be no strawy material to impede cultivation ; while, if to our fallows, or before winter, we have a long season in which it may become incorporated with the soil.

We think that, between the two plans, it is advisable to steer a middle course, regulated by such a rule as this:—

When manure is applied directly to a crop in the spring, it should be well rotted; when applied to a wheat crop or to summer fallow, or in winter, it may be long. When the benefit is to be immediate, let short be used; when remote, coarse dung will be found the best.

Before leaving this part of our subject, we would, however, refer to the varying opinions of some of our best authorities, on which the individual farmer may base his own action.

The materials of which the great bulk of farm-yard manure is composed, consist chiefly of straw and other litter, which, being fibrous, can be only rendered soluble by fermentation; but chemical theorists say that this process should be perfected at least, if not commenced, under ground, for they insist that, if completed in the dung-hill, they would occasion a great loss of nutritive matter.

One very practical man, who has become converted to this notion, says that "although half-rotted manure will sooner disappear in the soil, and that the crop sown along with it may often be better than fresh dung improperly applied, there may be little doubt; but there can be as little that, during the time the latter is visible, it has afforded the greatest share of nourishment." And he then asserts that "the ravages of fermentation and exhalation are more to be dreaded, and ought to be more guarded against, than any other waste to which a heap of dung is liable."

In contradiction to this argument, another practical writer says : "The object of applying all kinds of manure is to nourish the seed sown in the earth, and we know from observation that its development is much accelerated by the immediate assistance of manure.

"If manure requires to be in a soluble state before plants derive benefit from it, it is evident the greater state of solution in which the manure is, the more easily will the plant be enabled to derive benefit from it."

This point is finely illustrated by the quicker efficacy of liquid than solid manure in nourishing the plant, when both are applied in equal strength. Now, if there is no way of making manure soluble but by fermentation, it is also evident a greater degree of fermentation will dissolve all the fibrous portions of putrescent manures the more easily.

This point is also well illustrated by a fermented dung-hill, the materials of which, if properly commixed, will heat strongly for a time, and then the fermentation will subside to a low degree, leaving the whole mass in that pulpy, sappy state, than which nothing can give a better idea of a soluble state of a fibrous body.

Whether any really nutritive matter is driven off by fermentation before the mass is brought to that pulpy state may be doubted; for the evaporation from such a dung-hill appears to be just a steam of water in a highly elastic state, glimmering like a hot haze in a sunny day, on looking across a ploughed field.

But even should some gaseous matter escape during fermentation, this undeniable fact remains untouched—that this fermented, pulpy, sappy mass of manure will go much farther in maintaining the fertility of land than the *same bulk* or *weight* of recent farm-yard manure.

We have, however, on hand an actual experiment made by an intelligent practical farmer on three kinds of manure, and on a cultivated soil without manure, each plot of ground measuring 20 square rods.

		Fresh stable dung in a strawy state, 3 tons.	Rotten dung, 8 months old, 2 tons.	Dry barley straw burnt on the ground 5 cwt.	No manure.
1st Crop	Turnips	31½ bush.	26 5-6 bush.	14 3-20 bush.	½ bush.
2nd Crop	Barley per a.	30 bush. 2 pks.	36 bush. 3 pks.	30 bush. 1 pk.	14 bush. 3pks.
3rd Crop	Clover "	20 cwt.	21 cwt.	18 cwt.	8 cwt.
4th Crop	Oats "	38 bush.	40 bush,	18 bush.	32 oush.

—*British Husbandry.*

As to the feed after the clover, it was about equal to the expense of getting in each crop respectively, with a small surplus on the plot manured with rotten dung.

The experiment is hardly as conclusive as it might have been, if the proportion of the weight which fresh stable dung would lose in eight months had been taken fairly into account; for three tons, at the expiration of that time, would in practice not amount to more than one-half that quantity of rotted dung.

Had the quantities been equal in weight, every crop would have been favoured by rotten dung.

Before leaving the subject we again quote from Sir Humphry Davy, in his Treatise on Soils and Manures :—

"That an immeasurable quantity of substance disposed for conversion into food for plants is suffered to escape in the form of drainings and vapour. During the violent fermentation which is necessary for reducing farm-yard manure to the state in which it is called 'short muck,' not only a large quantity of fluid, but likewise of gaseous matter, is lost; so much so, that the dung is reduced one-half, and from that to two-thirds or more in weight. Now, the principal elastic matter disengaged is carbonic acid, with some ammonia; and both these, if attracted by the moisture of the soil and retained in combination with it, are capable of becoming nutriment." And he goes on in another part to say: "Where farm-yard manure cannct be immediately applied, the destructive fermentation of it should be prevented as much as possible. For this purpose the dung should be kept dry and unexposed to the air, for the moisture and contact with the oxygen of the atmosphere tends to excite fermentation. To protect a heap from rain, a covering of compact marl or of tenacious clay should be spread over the surface and sides of it. Watering dung-hills is sometimes recommended for checking fermentation; but this practice, although it may cool the dung for a short time, is inconsistent with just views, for moisture is a principal agent in all processes of decomposition; dry fibrous matter will never ferment. Water is as necessary as air to the process, and to supply it to fermenting dung is to supply an agent which will hasten its decay. If a thermometer plunged into the dung does not rise above 100° Fahrenheit, there is little danger of much aeriform matter flying off; if the temperature is higher, the dung should be immediately spread abroad."

From all which facts the practical farmer will learn, by the conflicting opinions of these practical and scientific authorities, that there is a medium course in which to steer; that dung loses much of its value from leaking, and therefore that the bottom should be waterproof, and the dung protected from rain, and that too much heat should not be generated for a length of time in manure; therefore, it should be turned and drawn to the field when in a moderate state of decomposition—neither garden mould nor strawy dung.

As to watering dung-hills, *we know* that it is often of immense value, on the principle laid down by the great chemist, to equalize fermentation over the whole surface, and thus to prevent that white appearance of dung usually known as firefang.

It must also be borne in mind that there is more to be accomplished than the simple putrescence of farm-yard manure. All such contains a large amount of weed seeds. These should be germinated and destroyed after sprouting, by heat, if we would not have our fields befouled by every load of manure that is drawn from the barn-yard.

Whether the piling shall go on in the yard or take place in heaps in the field is a matter to be determined by the peculiar situation of each farmer.

When manure is to be used in the field and immediately upon the crop, we have always drawn to the field at odd times and in winter, and made our compost heap then and there, ready to enter into a state of fermentation as soon as warm weather sets in; but where manure is to be spread on the winter fallow, rotting is not so necessary, for it has time to decompose on or in the ground, and weeds may then be sprouted and destroyed before seeding or planting time.

There is one certain fact to be borne in mind, that there is no loss by evaporation when there is no fermentation, and that manure laid on the surface in winter, not being in a solid mass to heat, will lose none of its value by evaporation.

Nor does it lose any essential qualities by lying exposed to the sun, provided that fermentation was not going on when so exposed. All that is lost in such a case is a certain amount of moisture; and though it appears at first sight as if dried-out manure must be weakened, it is not so, and the next shower will restore all the water lost before by evaporation.

To rot our manures when such is necessary, and to do so without fear of those great losses shadowed forth by our scientists, we must take some pains in the manufacture and manipulation of compost heaps.

But before we proceed to this head, let us once more refer to the practical opinions of our American farmers.

We find in the *Canada Farmer:*

" Where the most immediate effect is desired on the crop to which the manure is applied, and where the soil has to be brought to a state of fine tilth, it will be found much more advisable to compost the manure, and make it as concentrated and finely divisible as possible, in order that the roots of plants can assimilate it at once. John Johnston, of Geneva, who for many years raised the heaviest crops of wheat and grass in America, always composted his manure, and applied it as a top-dressing in the winter or early spring. A farmer near London, Ontario, puts the manure as a top-dressing on his fall wheat in spring, before the frost leaves the ground. As a general rule, the sooner manure is buried in the soil, provided the soil is suitable to its mechanical action, while undergoing fermentation in it, the more organic material we add to the land; but this enriches the soil rather for the crop of the second and after years than that grown immediately on the application of the manure. On roots, barley, and, in fact, any crop requiring to be stimulated into a quick and vigorous growth at the start, a manure well decomposed and capable of immediate action on the roots of the crop is necessary."

John Johnston, of Geneva, New York, is a practical farmer of long experience, and one of the shrewdest of American agriculturists.

" If the dung be rotten, the effects will be quickness of growth, succulency, crispness and delicacy of flavour. I strongly suspect that the application of ill-digested manure to land is an evil productive of very great injury.

" Worms and grubs are multiplied thereby; the most noxious vapours are propagated; and probably disease in grain crops may originate in this circumstance. I cannot believe that the delicate fibres of a root, making an effort to penetrate a clod of putrefying dung, can escape uninjured; and vegetable diseases, I presume, often commence at the root. I have known recent manure check vegetation."—*Professor Thompson's System of Chemistry.*

COMPOST HEAPS.

All earths, especially clays and swamp mucks, and such matters as leaves, peat, moss, turf and all refuse, contain in themselves more or less of the elements of life and food required for the sustenance of our various cultivated crops; but in many of them such food is in an insoluble state; thus they are comparatively useless as applied in their natural form to the crop. To render their inert vegetable or animal matter available or soluble, they require to be decomposed, and there is no agent so effective in decomposition as the chemical action of heat. The shortest, most practical and effective manner of subjecting such matters to heat is by incorporation with a mass of animal manure.

Therefore, all such will be found beneficial additions to our compost heaps.

Composting makes our manure better to handle, and the food of plants is more evenly distributed over the whole mass.

To make a Compost Heap.—A bedding is first formed of earth, or of sods with grass up, upon which a layer of fresh dung is placed,—the fresher the better,—about a foot thick; upon that another layer of mould, equally as thick, is laid, if of sods, doubled, with the grassy sides turned in together. In this manner the whole heap is raised to a height of five or six feet, when it is entirely covered with earth or with sods, grass down. Form it narrow and high, so as to expose a maximum of surface to the atmosphere.

This heap is left to ferment until it becomes cool again. It is then turned, so that the upper portion is below and the outer side is in the centre, and all thoroughly mixed together.

The urine of the yard should be led in and around the heap (the heap having been formed in a basin-shaped spot). The number of turnings, and proportion of extraneous matter to dung, must be governed by the experience of each farmer.

The Norfolk proportion is:

Mould for the bottom,	160 loads.
Dung from bullock yard and stables—a load of each alternately,	112 "
Mould for next layer,	42 "
Dung for next layer,	48 "
Mould for top and sides,	42 "
Total,	404 loads.

This, when turned over twice, produces three hundred loads of manure, and is used on about twenty acres for turnips, or at the rate of fifteen loads per acre—about ten of our waggon loads.

Another plan is :—Turf, or any species of earth, is spread over the yard to the depth of about two feet, then laid over with straw, to which stable litter is all drawn, and the feeding cribs outside are then placed on this.

In this manner the dung may be allowed to accumulate all winter; it may then be either piled in the yard, covered with earth and left until required, or carted to the field and there made into a compost heap.

To manage manure in the yard in another form, W. R., of Royston Park, Ontario, says :

"A capital plan to decompose a manure heap in the cattle shed and yard, where there is a large straw stack, is to give the cattle the full run of the enclosure. Spread out so much straw every day for feed. What is not eaten is of course trodden down. Once a week, sow all over some salt, lime and plaster. By the time the fall wheat requires to be sown—that is, from the 1st to the 15th of September — you will have pretty well-decomposed manure to haul out for the seed furrow, and entirely free of heat. I adopt this system, and have sometimes had wheat straw from sixty to eighty acres to get rid of, before thrashing comes around again. No intelligent farmer will ever sell a load of straw; therefore it is all-important to get it into manure and fit for crops with as little expense as possible.

"The better way, however, is to take about three bushels of unslacked lime; dissolve a bushel of salt in water, and slake the lime with it—any quantity in about the same proportion. The salt and lime mixture is very valuable. It retains the ammonia and destroys the odour of putrefying animal matter. Let any one try this who has a dead carcase; put said carcase in the dunghill; spread it over with the mixture; throw on a lot of manure, then some plaster; cover up again with manure, and in a short time the whole mass, bones and all, will be decomposed."

We give W. R.'s receipt, but think that it would be more advantageous to leave out the lime, for the effect of lime is to set free ammonia; in other particulars his plan is very practical.

Into the compost pile should be thrown all the waste of the house (erroneously so called, for nature knows no waste), and all refuse of the farm, animal or vegetable, is of manurial value.

Another mode of saving all the manure is by the use of dry earth under the bedding of animals; dry earth being a powerful absorbent, will take up all the urine, instead of allowing it to soak into the plank floors.

R. Giddings, in his prize essay before the Illinois Agricultural Society for 1870, says in favour of this use of dry earth :

"*First*,—That it requires no apparatus or cash outlay.

"*Second*,—That the liquid manure of cattle is worth more than the solid, and is usually lost; but, under this practice, all is retained.

"*Third*,—The dry earth retains within it all the value, of which usually one-third or one-half is lost by fermentation, leaching, or evaporation.

"*Fourth*,—It gives much larger bulk of manure, each load of which is of double the value of ordinary farm-yard manure.

"*Fifth*,—That one ton of saturated earth is of more value than the same weight of even fresh-saved dung.

"*Sixth*,—That the aggregate amount of plant food thus saved from the stalls is fully double, and in much better condition for use."

Mr. Giddings also says:

"A covering of half an inch of soil will absorb every particle of escaping ammonia, but a thicker coating is desirable. A water-box on a one-horse cart is also used occasionally to stop a too active fermentation of the pile. There are other absorbents, rich in themselves, of plant food, which not only save but add both bulk and richness to the pile—muck, sawdust, coal ashes, &c. Go into your hen-house on a warm morning, and you will be oppressed with the effluvia arising from their droppings; spread over them a hod of coal ashes, or a basket of sawdust, and the air is sweetened as if by magic; and it will keep the hens in good health, besides increasing the manure, if followed up every few days."

To prevent firefang, it is recommended as follows:

"Manure may be prevented from heating by making the heap sufficiently broad, and placing it in a position where cattle will walk over it or feed while standing upon it, so as to tread it down solid. The amount of muck, loam or turf to place in layers with it, to prevent burning, must depend upon the manure, and the readiness with which it will ferment. We would much prefer using at least one-third as much muck as manure, or even more. It will make more compost, and be more certain to hold all the parts that might otherwise partly escape. The drier the muck or loam. the more efficient it will be as an absorbent. If the manure is trodden hard, the amount of muck may be little or much, as may be most economical."

Blackie on Farm-yard Manure says, at page 5:

"We will, however, admit that it would be an improvement if reservoirs for the drainage of yards were so constructed that their contents might be pumped up and sprinkled over horse litter, whenever its too great dryness occasions any danger of burning by too great fermentation. A watering pot with a large rose will be found to answer the purpose."

How to obtain Swamp Muck.—In the fall of the year, go out into the swamp and dig a ditch around a small patch, so that the surface water may dry out before the ground freezes; or, if we can dig out the muck at the edge of a swamp, and throw it up in heaps on the adjacent dry land, it will then get about half dried out and decomposition will set in partially, while exposure to the winter's frost will be of great benefit to it as for manurial use."

The Application of Barn-yard Manures.—When applied on the surface of the land, direct from the compost heap, manure should be covered lightly at once, because, as has been already shown, when in any state of fermentation there is loss of important strength by evaporation.

The lightest covering is sufficient, and therefore we advise the incorporation of such broadcast manure by the use of cultivator and harrows.

The old principle of ploughing down manure, except it be done very lightly, has been pretty well exploded

Manure that is once ploughed down deeply will never rise again. Every storm that falls will carry it downwards, and further out of reach of the growing plant.

It is possible to put on too much manure, and so increase the bulk of the straw at the expense of the head. It is customary on some farms to draw out the manure every year, on one or two fields that are handy to the barn-yard, and there to use it; because, forsooth, it saves the trouble of drawing a greater distance!

This is "robbing Peter to pay Paul." A few fields or acres adjacent to the homestead are so enriched that grain lodges every year, while this evil effect is attained at the expense of the balance of the farm. A proper rotation of crops will overcome this evil, as each field will thus obtain its fair share of manure, and the *status* of the whole farm will be kept up to an equitable standard of fertility.

Surface Manuring.—We prognosticate that surface manuring will before many years be a recognised principle over all Canada; already we find very many of our most intelligent and practical men have become converts to the system.

We clip the following correspondence from the *Country Gentleman*, as it contains, in a terse and concise manner, the advantages of this mode of application of barn-yard manure, and is written for American farmers, and from a portion of America similar in climate and soil to Canada:

"Having tried nearly all of the various modes of using manure, and finally concluded that surface manuring is the best, I propose to give some of the reasons for coming to this conclusion. In doing this I shall only refer to such manure as is made in the stables and barn-yards in Western New York, where a large amount of straw and other litter is mixed with the manure.

"The first one to discover fully the advantages of surface manuring was John Johnston, of near Geneva, N. Y. This was done accidentally, in this way. Having land badly infested with red root, he manured it early in the fall to induce the red root seed to grow, so as to plough it under in the spring, and thus clear his land of this pest. But he found a greater advantage in the fact that the succeeding crop was much the best where the manure was thus applied. This led to repeating the experiment several years, and until fully convinced that one load applied to grass or clover in the fall did more good than two used in any other way. Then he wrote accounts of his experience in surface manuring to the agricultural papers. These were at first doubted and disputed; but Mr. Johnston persevered, his heavy crops of wheat, corn and grass being the best evidence he desired. When men doubted the benefits described, he invited them to come and see for themselves. Many went, saw and were convinced; the very heavy crops for which Mr. Johnston is so widely and justly celebrated, were evidence that could not be doubted. Many tried surface manuring, and also found it the best course they had ever pursued, and not a few have also strongly recommended this system in the papers.

"Some of the reasons in favour of surface manuring are, that nearly all the valuable portions of manure being soluble, are washed out and taken into and completely diffused through the surface soil by the fall rains, so as to be in the best possible situation and condition to be used by the growing plant. And then there is little chance for loss, as when manure is spread all fermentation stops, and no more ammonia is formed or set free, but the strength of the manure is washed into and retained by the surface soil. The leading agricultural chemist shows that, as Dr. Cameron says, 'by a beautiful provision of nature—the absorbtive power of soils—they will be retained until required to nourish the plants.' Liebig also states that if 'water holding in solution ammonia, potash, phosporic or silicic acids, be brought in contact with the soil, these substances disappear almost immediately from the solution, the soil withdrawing them from the water.' But, perhaps, to the practical farmer, the best proof of all is that his crops find the strength of the manure just where and when they want it; that corn, thus manured the previous fall, comes up rank and vigorous, grows better and yields better, than when manured with the same amount of manure in any other way. This I have found to be the case on a heavy sod; but when manure is ploughed under it does not do so well. When the corn is small, and help is most needed to give the crop a start, the manure is mainly out of reach, and the corn, if on sod, looks rather yellow and poor; and it is said that it must have time for the sod to rot, and for the roots to get through to the manure, before the crop can do well. Besides, when covered up by the furrow the rains do not as readily reach and dissolve the manure, and spread it all through the surface soil, where it will be found and taken up by the roots of plants. Hence there is no way in which manure can be as thoroughly diffused through the soil, just where it is needed and easiest and best found by the roots of plants, as by surface manuring, unless it be by liquid manuring, and that is but another way of surface manuring.

"It is also found that manure spread in the fall is a good mulch; that it gives grass and clover a good start, and that this extra growth, together with the manure, is a valuable protection of the land and roots of the grasses through the winter. It is also found that when manure is applied to wheat, whether spread before sowing and worked into the surface, or finely spread soon afterwards, it answers the same purpose, giving the crop a better and a stronger growth, and making it less liable to freeze out; while the larger growth and the manure is a protection to both the roots and the soil. Grass thus manured in the fall will start much earlier and better in the spring, and may be made to furnish quite a growth to turn under for corn; while this green and succulent sod will rot much sooner and more largely help the crop; so that surface manuring in the fall has the threefold effect of enriching the land, mulching and protecting the soil and the wheat, clover and grass roots, and making a start for green manuring in the spring. Another advantage of thus manuring in the fall is, that there is time to pile, ferment and rot the manure, and thus put it in much better condition to be used as food for the plants. It is very generally known that the principal value of manure consists in the amount of available ammonia it may contain. Dr. Voelcker, an English chemist, who has investigated this point at great length, says 'perfectly fresh barn-yard manure contains but a small proportion of free ammonia, and comparatively but little nitrogen, and of course but little ammonia exists in fresh dung in a state in which it can be used by the growing plants.' Also, that 'most of the nitrogen is gradually liberated as the fermentation of the dung progresses—it being found that there is a regular increase of soluble organic matters, including nitrogen, which keeps pace with the progress of fermentation.' It also appears, that 'in fresh manures (with abundant litter) the larger part of the insoluble organic matter consists of straw in an almost entirely undecomposed state. In rotting manure the straw is converted into humus, the compounds of which, with potash, soda and ammonia, are soluble, and of a dark brown colour. The humus mostly fixes the ammonia that results from the decay of nitrogenous matters.' At the same time, other valuable matters are brought into a more soluble and available condition.

"True, it is said that there is a loss of ammonia by fermentation; and this may be the case when manure is spread out in the yard, or where there is no straw or other absorbent mixture in the pile; but with manure as made here, this is not the case. Dr. Voelcker says, that 'during the fermentation of dung, ulmic, humic, and other organic acids are formed, which fix the ammonia generated in the decomposition of the nitrogenized constituents.' Dr. Cameron says that it is an error to suppose that the manure loses by fermentation, if in a compact state; all that evaporates is water, and a small quantity of carbonic acid; hardly a trace of ammonia escapes. 'During the fermentation of manure, its nitrogen (for there is no ammonia in fresh natural manure) is converted slowly into ammonia; at the same time, other constituents of the dung—carbon, hydrogen, &c.—are converted into certain acids which combine with and fix the ammonia.' It is said that most of the foul odours that arise from such manure, when spread out, as well as in the pile, are due to the escape of carbonic acid, carburetted hydrogen, and other foul gases, that are of not much value in manure. As ammonia constitutes the larger part of the value of manure, and much more can be formed and saved by fermentation than can be secured in any other way, of course the system of piling, fermenting and rotting through the summer, and applying in the fall, may be expected to give the best results.

"That it actually does give much the best results, as shown above, is probably the best proof the practical farmer can have.

"In conclusion, I wish to state that my remarks relate solely to what is known as coarse manure. Where no litter is mixed in the manure, and no absorbents are used in the compost, there may be a loss by fermentation; and I am inclined to believe the sooner such manure is applied to the soil the better."—*F.*

"The same causes that produce ammonia from the fæcal matter generate an acid, called humic acid, from the straw. This relates to manure and its distribution. These having a mutual affinity unite, and the resulting compound is humate of ammonia, which is non-volatile, highly soluble; consequently, every dew or shower carries with it this compound, which is distributed to the plant. The soil has the power to take it up from the water and store it away, giving it up again to the roots of plants as required. This plainly shows that manure laid on lands is better than if ploughed in six inches deep; moreover, the humate of ammonia, being non-volatile, in my opinion is not deteriorated either by the sun's rays or action of frost."—*Charles Joseph Whitworth, M.R.C.V.S.L.*

On heavy lands.—We are advocates of strawy manures, provided that after-cultivation is such as to ensure the destruction of weeds.

If applied to summer fallow, and after being composted, there will be no fear of weeds; if, however, it is applied in a fresh state, or in only a partial state of decomposition, it should be remembered that although the mechanical effect of long manure is good in opening up the soil, yet there are many weed seeds contained.

It should then be drawn out and lightly cultivated in some time before the sowing, so that all weeds may start and be destroyed by the immediate cultivation for wheat. And here again we find an advocate for surface (*i.e.* just beneath the surface) manuring. If manure be on a summer fallow ploughed down deep, many weed seeds will lie below until the wheat has fairly got root, when they will start to grow and befoul the field.

Moreover, it has been found, by practical observation, that manure, well incorporated with the surface soil of a field of wheat, helps to preserve our wheat from being winter killed—a very important point, when, as of late years, this crop has been almost as badly destroyed on the high lands as on wet-lying spots.

When manure is applied in the fall, it should also be lightly covered and incorporated with the top soil. If ploughed down deep, by the time we plough again in spring, or perhaps only cultivate, the essence of the manure has been washed by fall and spring rains and melting snows far below the reach of cultivator or plough.

The early fall, if time can be obtained, is an excellent season at which to surface manure our meadows. At the very time when the growth of grass is sure to be very slow, the plant receives double nourishment from every shower, the clover root takes up the manurial soluble elements washed down to it, and we not only obtain a good aftermath and fall pasture, but if the sod is destined to be turned under, we have the manure fixed in the roots of the sod, and ready to be again distributed when decomposition shall take place under ground.

On heavy lands, summer fallow or fall ploughing, from ten to fifteen loads of coarse manure is a good dressing.

On light lands.—For turnips, manure must be applied in a well-rotted state. The best time of application for turnips is in the fall. We want the particles of manure so thoroughly disintegrated and incorporated with the soil that the tender young plant may obtain full benefit immediately, and so be pushed past that critical time when the " fly" is destructive. On these light lands the mechanical effect of long straw is bad, as far from requiring aerating such lands should rather be compacted.

On spreading manure.—The most economical time in which to draw out manure from the yard is in winter—on the sleigh. If it be then dumped in hillocks, there will be no loss as long as all is frozen up; but, as soon as spring opens, we must remember that the essence of the manure will be washed into the ground under each hillock, and thus we shall have a field of very unequal fertility; there will be too great richness under the sites of the piles, and at the expense of the balance of the field. These small piles should be spread immediately the frost will permit. When spread at that time of the year, there need not be great haste in covering lightly, for every gentle spring rain will wash the soluble parts into the surface, and this will greatly help to germinate weeds, whose destruction will be effected in the process of seeding or ante-cultivation for turnips.

On grass lands.—For the surface manuring of grass lands, manure should be thoroughly rotten and carefully spread. There need be no fear of loss of strength, for the soil will absorb all soluble matter; the coarser parts form a mulch to the plant, and any ammonia that may escape will be readily retained again by the blades and leaves of the grass, or washed down by the first rain.

When sod is used before a root crop, this method of applying manure is especially commendable, as the roots afterwards receive full benefit in a form in which their food can be easily assimilated.

Dung or compost should be laid on meadow land immediately after the hay is carried off; for, as at that time the ground is generally the driest of any time of the year, carting on it will not cut the turf; there is the least grass to destroy; it ensures a good aftermath; and the fall rains will wash all the manure into the soil, so that it will receive the whole benefit of the dressing.

Relative quantities of manure voided by animals.--The following experiment was made on a dragoon-horse: He was kept in a box stall with one hour's exercise each day for a week, in which time the quantity of fodder issued to him and converted into dung was as follows:—

Oats each day	10 lbs.	= 70	lbs.	in the	week.
Hay "	" 12 "	= 84	"	"	"
Straw "	" 8 "	= 56	"	"	"

He drank within the week 27 gals. of water; and during the time of his exercise, the loss of dung is supposed to have been 4 lbs. daily, or 28 lbs. in the week; in which period, then,

The total forage consumed amounted to	210 lbs.
And the dung and litter produced was	327½ "

Thus, if lost dung be added, yielding with the addition of the moisture imparted to the litter by urine, an increase of two-thirds beyond the weight of the solid food.

A large-sized milch cow was also put up, and was fed on 126 lbs. of fodder, composed of—

81 lbs. of brewers' grain,		
30 " raw potatoes,		126 lbs.
15 " meadow hay,		

She drank two pailsful of water, and the urine was allowed to run off. The weight of the solid dung was 45 lbs., or at the rate of 315 lbs. of dung per week.

These animals were supplied with no litter.

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Now, supposing that on ordinary feed these animals should produce in weight, including liquid, 400 lbs. of dung per week, all being carefully collected—for every cow, we might calculate on saving 400 lbs. per week for six months of winter, because they are always at home; while for every horse we might save two-thirds of that amount.

Each cow in our yards will then produce 9,600 lbs., and each horse 6,400 lbs. per winter. From this we may arrive at a rough estimate of the amount of manure that we may expect from a given number of head of stock.

This experiment is thus corroborated:—

"Carefully conducted experiments show that a cow of the average size will void about sixty pounds of manure in a day, measuring about one and one-sixth cubic feet, which is more than three cords, weighing over ten tons, for a year. It is the opinion of many good cultivators that three loads of peat or muck, mixed with one load of cow dung, make a compost quite as effective for top-dressing meadows as the cow dung itself. If this were done, we should have twelve cords of good compost from the solid excrements of one cow. It is further estimated that the liquid manure is quite as valuable as the solid. If this were carefully saved by peat absorbents, kept under the stable or in it, it would double the pile, or be equal to twenty-four cords of good compost. If this were spread upon two acres of run-down meadow, producing a ton of hay or less per acre, it would increase the crop probably to three tons to the acre the first year, and the effects of it would be seen in increased crops for five years longer. In those two acres it would make all the difference between profitable and unprofitable farming for five years. This compost, if sold in many good farming districts, would bring $4 per cord, or $96. Used on the meadow, it would produce much more in successive crops of hay. This estimate shows what may be done under favourable circumstances to increase the home supply of fertilizers. We have found that nothing pays better than labour applied to the compost heap."—*American Agriculturist.*

Quantity of farm yard-manure per acre.—An eminent Scotch agriculturist has put forth the following calculation as to the amount of manure produced after feeding, by several crops per acre, on land capable of producing 28 bushels of wheat:—

By turnips, cabbages, &c., fed to cattle....................	6	tons	manure.
" clover or " " " " first year............	6	"	"
" beans, peas, on part of seed being used again on the farm...	5	"	"
" ditto " " " " second year..	5½	"	"
" wheat, barley, &c., on an average of the whole........	5	"	"

We see, then, the value of green crops as enrichers of a farm;

and it may be observed that, by composting with muck and other rough vegetable substances, as mentioned before, the quantity of manure may be largely increased.

The usual produce of the various straws per acre in Canada varies from 15 cwt. to 20 cwt.

Supposing this straw to be moistened and rotted, it would thereby gain an additional weight equal to about its original weight, thus producing from 30 to 40 cwt., gross weight; counting in then the oats, refuse of grain and chaff consumed, we cannot reckon the amount of putrescent manure resulting from an acre of such produce at more than four tons.

Should we bring our land up to a productive capability of 28 bushels per acre, such as that on which the Scotchman's experiment was conducted, we might easily calculate on such an increase as would overrun his five tons per acre.

Repetition of manuring.—"Assuming that the general course of crops consists: on light soils, of the alternate plan of cereals and green or hoed crops; on clays, which do not admit of that system, of a proportionate quantity of grass land at intermediate distances of four or five years and in large areas.

"Light soils, in the common course of husbandry, rarely require the application of putrescent manures oftener than once in four years, and, in all cases where clover is allowed to stand during two seasons, it may be deferred without disadvantage for another year. Heavy soils may run without manure for six years, provided that the land be laid one year in fallow, and that there be sufficient meadow to be reckoned at least as one crop in the course."

We now recapitulate a summary of the chief points to be ever borne in mind in the manufacture and management of farm-yard manure.

1. To cover the bottom of the yard with muck or some other lasting absorbent.

2. To manage the feeding of outside cattle so that their dung may be dropped evenly over the whole yard.

3. To remove the dung from the yard at least once a year.

4. To turn and compost all dung until the fibrous and woody parts, and the roots and weeds contained, be thoroughly decomposed; at which time the greatest strength is attained in the manure.

5. To keep all dung in an even state of moisture, and thus to prevent partial arrest of fermentation or *firefang*—this to be done by wetting and treading down firmly.

6. To have dung more fermented when it is to be immediately applied to a growing crop, than when used in the fall of the year.

7. To use heavier dressings on cold soils than on the lighter; because clays require to have their natural acidity neutralized by

the warmth of dung, while too much hot dung is apt to burn up the roots of plants on dry, sandy or gravelly soils. Stiff land is also helped by the mechanical effects of the long fibres of unfermented dung.

8. To compost all dung for light soils with dry earth, peat, swamp muck, or other extraneous vegetable substances.

9. To spread manure with least possible delay in the field when carried out, and, if applied to arable land, to incorporate it with the surface soil as soon as possible.

10. To collect and preserve all stable drainage, urine and liquid manure, and, if not used directly on the land, to wet other manure constantly with it.

11. To experiment upon every possible occasion, and, being neither selfish nor sluggish, to give forth the benefit of the results to your brother farmers through the columns of the agricultural press, which are always open to practical experiences.

Whatever may be the respective merits of the disputed worth of dung, fresh or fermented, long or short, we may be assured that land to produce full crops must be generously manured. Whether the farmer favours the one kind or the other, let him collect all he can, apply it diligently; then, trusting to events, *let the land and the muck settle it between them.*

NIGHT SOIL.

Not only does it often become a matter of serious thought how to get rid of the noxious odours emanating from our privy vaults, but the waste of the matter contained therein is a leak in the pockets of every cultivator of the soil.

The saying is no less trite than true, that the stronger the food the stronger the manure ; and the ordure of man contains in itself more of the fertilizing elements of plant food, weight by weight, than any other animal manure of which we have knowledge.

Animal manure is always stronger than that obtained from digested and decomposed vegetable matter, and human ordure, composed of both animal and vegetable food, contains in itself all the elements of fertility for vegetation.

Now, when agricultural communities are daily becoming more convinced of the necessity of saving and applying all the manure that can be possibly gathered together, it becomes us to think whether we are doing right in allowing to go to waste yearly thousands of dollars worth of the richest and most fertilizing of manures.

In China, where the population is closely packed, and where very many mouths require to be fed, the agricultural average of the country is far ahead of that of Europe or America. They are advocates of, and devotees to, the principle of heavy manuring.

Where hand labour is so plentiful as in China, horses are seldom used in agriculture, while the art of stall feeding of cattle is not at all generally practised.

All their crops are nourished by human excreta. Thousands of coolies are constantly employed in the collection of the ordure of man, and it is as carefully gathered and regularly removed as the manure from our cattle stalls.

Yearly, immense quantities of guano are imported into Europe and America, and yet at our very doors we have a substance of an equal value, that only requires a little knowledge to utilize as readily as the former.

There is a natural repugnance to be overcome in the manipulation of night soil, and yet chemistry has shown us how it may be perfectly deodorized, when its smell is not perceptible, especially by the side of such foul-smelling stuff as Peruvian guano.

The following tabular statements, the one of an analysis of human excrement by Berzelius, the other an analysis of guano by Voelcker, placed side by side, will give some idea of the relative values of the two as manures :—

ANALYSIS OF HUMAN EXCREMENT, BY BERZELIUS.		ANALYSIS OF GUANO, BY VOELCKER.	
Carbonate of soda	3·5		
Muriate of soda	4·0		
Sulphate of soda	2·0		
Phosphate of magnesia	2·0		
Phosphate of lime	4·0		
URINE, 1,000 PARTS.			
Water	933·00	Oxalate of lime	7·0
Urea	30·10	Phosphate of lime	14·3
Salts of ammonia, with some animal matter	18·46	Clay and sand	4·7
		Animal matter, with small quantity of salts and water	32·3
Sulphate of potash	3·71	Sulphate of potash	5·5
Sulphate of soda	3·16	Sulphate of soda	3·8
Phosphate of soda	2·94	Phosphate of ammonia	6·0
" ammonia	1·65	" magnesia	2·6
Muriate of soda (common salt)	4·45	Oxalate of ammonia	10·6
Muriate of ammonia	1·50	Urate " "	9·0
Earthy matter, lime and silica	1·03	Muriate " "	4·2
	1,000·00		100·0

Professor Liebig says, in his " Chemistry of Agriculture : —

" In respect to the quantity of nitrogen contained in excrements, 100 parts of the urine of a healthy man are equal to 1,300 parts of the fresh dung of a horse, and to 600 parts of that of a cow. Hence it is evident that it would be of much importance to agriculture if none of the human urine were lost. The powerful effect of urine, as a manure, is well known in Flanders; but human excrements are considered invaluable by the Chinese, who are the oldest agricultural people we know. Indeed, so much value is attached to the influence of human excrements by this people, that the laws of the State forbid that any of them should be thrown away, and reserves are placed in every house, in which they are collected with the greatest care. No other kind of manure is used for their corn fields."

It has been calculated that the excrement of a man used as manure, aided by what plants obtain from the atmosphere, will produce sufficient wheat to support him.

How nearly then do guano and night soil resemble one another, each containing in great quantity those essential constituents of plant life which are most liable to be absent from our soils.

Of what glaring inconsistency are we then guilty. We throw away that which costs us nothing, and is yet so valuable, and at the same time incur an immense expense in the importation of guano from countries some thousands of miles distant!

The natural aversion to handling may be overcome by deodorizing the manure; this may be effected by an admixture of ashes, dried peat, or dry earth of a clayey nature, or soot. Lime should, however, never be used, as it injures the strength of night soil by driving off its ammonia.

About ten bushels of a compost will be a very liberal dressing to an acre.

To compost it, it is recommended that there should be first laid down about two feet of fresh earth, to which the night soil may be drawn, after which another layer of earth to the same thickness, then another of night soil, and so on.

It should then be regularly turned and thoroughly mixed, and may be used either for wheat or barley in the proportion of three loads of the mixture thinly spread abroad on an acre. It should be used more as a top-dressing.

It is sometimes also mixed with the yard dung to excite fermentation; this is not, however, advisable, for its effect is greatest when applied in an unfermented state.

The operation of deodorizing is, however, usually performed by the earth closet system, and this is well worthy of attention by all from a sanitary point of view.

AVERAGE AMOUNT OF EXCREMENTS VOIDED EVERY TWENTY-FOUR HOURS BY EACH MEMBER OF THE POPULATION; AND THE PROPORTIONS OF EACH OF THE PRINCIPAL CONSTITUENTS.—(*Lawes.*)

SEXES AND AGES.	FRESH.		DRY.		SALTS.		CARBON.		NITROGEN.		PHOSPHATES.	
	Fœces.	Urine.	Fœces.	Urine.	Fœces.	Urine.	Fœces.	Urine.	Fœces.	Urine.	Fœces.	Urine.
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.
Mean of Males under 15..	2·96	19·53	0·760	0·560	0·101	0·297	0 343	0·155	0·064	0·166	....	....
Do. from 15 to 20..	4·17	46·61	1 041	1·735	0·116	0·527	0·443	0·539	0·053	0·478	0·068	0·189
Do. over 50	6·20	42·05	1·160	2·260	0·228	0·340	0·480	0·748	0·088	0·383	....	0·142
Do. at all ages..........	4·24	41·38	1·034	1·703	0·131	0·451	0·432	0·510	0·059	0·397	....	....
Mean of Females over 16..........	1·24	36·66	0·330	1·380	0·044	0·323	0·148	0·495	0·028	0·294	....	....
Do. at all ages	1·24	31·04	0·330	1·380	0·044	0·323	0·148	0·495	0·028	0·255	....	....
Mean of both sexes at all ages.....	3·32	36·11	2·010		0·453		0·739		0·348		0·201	

THE DRY EARTH SYSTEM.

Build the house in the usual manner; under the seats set a drawer made of two-inch plank, well white-leaded at the joints, and made on a frame, so that a horse can draw it out from under at one end of the house. Cover the bottom with about three inches of dry earth. Clean out the drawer once a week, after covering the contents again with dry earth, and either place the contents by themselves or mix with the other manure (the former is the better plan). You may have your privy as near the house as you like under this arrangement; there will be no fear of any disagreeably perceptible odour.

It would be, however, more certain in its effect should the dry earth be handy, so that at least once a day some might be thrown down and thus thoroughly incorporated with the excreta.

The following contains the subject-matter of an able essay on the Dry Earth System, by Mr. Richard Postans, read before the Farmers' Club, at Ancaster, Ontario, on the 27th February, 1871:

"This system, which is destined to become a great boon to mankind, was discovered a very few years since by a clergyman in England, where it is rapidly coming into use. Perhaps it would be more correct to say rediscovered, for a similar system is commanded and described in the book of Deuteronomy, chap. xxiii. verses 12-13.

"The system, as applied to sewage purposes, consists in the introduction of a certain quantity of dry earth into the vault every time that the closet is used. This earth possesses both deodorizing and disinfecting properties, and so thorough is the action of these properties that all noxious gases are at once absorbed; and if the earth be properly applied, the air in the closet seems always as pure as that in any other ordinary room.

"The disinfectant qualities of dry earth are shown in a very marked degree by the remarkable cures effected in cases where severe wounds have become running sores, the clay having caused the discharge to cease, and the sore to take on a healthy appearance in a very short space of time. Its healing qualities have also been shown in its successful application to severe flesh wounds and to bad burns.

"The cheapest implement for applying the dry earth is an ordinary scoop shovel; but this is the most troublesome and the least effectual. A machine is now in use which has been patented by the Rev. Mr. Moule, the discoverer of this system, and no doubt other machines will shortly be introduced.

"These machines may be attached to any existing closet, which would require very little alteration.

"The best kind of soil to use for these closets is a pure or nearly pure clay; any soil, however, except pure sand will answer.

"Thus the entire rural, and the majority of the city population may obtain a thorough deodorizing material—*dirt cheap!*

"The earth requires very little preparation, and there is only one condition to be carefully observed, viz., that the earth be entirely free from moisture before it is used; and with our almost tropical summer, this can be easily done.

"In one of the long dry spells that occur in the summer, as much of the thoroughly sun-dried earth as may be required for one or even for two years' supply should be collected and placed under cover, so as to be thoroughly protected from the wet. Two or three good waggon loads will last an ordinary family a year, allowing that it is to be used only once. The fine and dry earth from any but macadamized or very sandy roads would answer very well.

"In stationary closets the vault may be made of such a size as to go for three, six, or even twelve months without emptying. Surface water should be carefully kept out of the vault. A small door at the side or rear of the closet gives access to the vault for the removal of its contents. The contents of the receptacle of the portable, or of the vault of the stationary closet, may remain until full without transmitting the slightest impurity to the surrounding atmosphere; and when they are removed the operation is attended with no more unpleasantness than if it were so much garden earth.

"In places where it is difficult to obtain a supply of suitable earth, the contents of the vault, after being dried by the sun or by fire-heat, may be again used, being entirely inodorous, having the appearance of pure earth, and acting as effectively as when first used. This may be repeated as many as six or seven times without impairing the deodorizing qualities, and each time greatly increasing the value of the material as a fertilizer. After seven-fold use the material will have become about as strong in fertilizing qualities as guano.

"Experiments have been tried with the earth by applying it to turnips; one hundred pounds weight of earth that had been used seven times was applied to an acre with the most marked effect, not only upon the roots, but the benefit of the top-dressing was very apparent on the succeeding crop, both crops being much in excess of the yield from an equal quantity of ground adjoining not thus manured; while the earth was applied with as little difficulty and unpleasantness as would be found in using so much bone dust.

"Every bushel of grain which is produced over and above the quantity necessary for home consumption, and which is in consequence sold out of the country, adds just so much to the wealth of that particular nation; and if every available fertilizer was returned to the soil at such a cost as to yield a handsome profit on the outlay, the profits thus secured would form quite an item in the annual exports of the country that might pursue such a course.

"It is estimated that the human manure wasted in the United States amounts to the annual value of *fifty million* dollars. This one fact is sufficient to clearly illustrate and prove the importance of this subject of agriculture.

"Farmers have been advocating through the various agricultural journals the advantages of co-operative societies, and have made a practical move in that direction in the case of cheese factories. Here is a good opportunity for co-operation. Let a number of enterprising farmers, who happen to live near a town or city, form a company, rent a suitable building for a store-house and drying shed; let each shareholder deliver annually a certain quantity of dry earth at the store-house, and receive his share of fertilizing material; let them employ men and horses to distribute dry earth to the closets and collect the waste earth again, and let them share the expenses thus incurred. If the size of the company and the extent of its operations be properly proportioned, the shareholders will thus secure an abundance of manure at a cost far below its actual value, and they will thus promote their own interests and the public welfare."

Mr. Postans went on to show the immense advantages, in a sanitary point of view, which would assuredly accrue from the adoption of this system, and thus do away with the thousands of festering pools of corruption, that like a many-throated monster send up their poisonous breath to pollute the surrounding atmosphere.

LIQUID MANURE.

The value of liquid manure, as such, is also very highly regarded by the inhabitants of China and Japan, the best gardeners in the world. The national plan is thus:

"Into a cask or jar put a collection of putrid animal substances, consisting of flesh, fish, blood, &c., to which is added a certain quantity of urine, but the vessel is not completely filled. A mandarin, or officer of Government, then attends, who, upon the vessel being closed, affixes his seal, and in this state it must remain for at least six months. When this or a longer period has elapsed, the mandarin removes his seal and grants his certificate as to the quality of the preparation, which is shown by the proprietor, who cries it through the streets as a manure for gardens, and it is sold in quantities as small as a pint. Before using, it is always diluted with four or five times its bulk of water, and it is extensively used for garden crops, but universally in drills." The writer adds that he was informed by several intelligent Chinese that human urine, thus prepared, forms a fourth part of all the manure employed in China, and is never used until it has reached a high state of putridity.

We pride ourselves upon being in the advance of civilization, yet we of the Western hemisphere might yet learn many a practical lesson of actual economy from the natives of the far East.

An immense amount of money is annually expended in our large cities of Canada in the removal of sewage, which is carried into rivers and lakes, there to destroy all fish life, and, at the best, is but an imperfect way of getting rid of the noxious vapours and effluvia that emanate from the ordure of man in densely populated cities.

The subject of the utilization of our sewage to the increased production of surrounding lands is one worthy of mature consideration on the part of our city authorities.

We will refer to a few of the marked effects of the system as carried out in England, and then, with a short consideration of the matter from the farmer's point of view, will hasten to our next chapter.

Mr. Morton, writing to the London (England) *Times*, says: "As you express regret, in the course of your very interesting remarks on the sewage question, that the results of the recent experiments conducted by the Metropolis Sewage Company, and quoted in the Report of the Board of Works, are not given more explicitly, you may perhaps be willing to find room for the following statement of their experience during the last summer.

"It is not only on the sand-plot at the North London Outfall that this experience has been obtained.

"They have there, as you appear to be aware, obtained great crops of grass and vigorous growth of wheat, mangold-wurzel, celery and carrots, by the use of sewage poured over about an acre of the Maplin Sand, which has been brought up by barge and spread thirty inches deep over a contractor's yard.

"But besides this, they have, since Lady-day, 1866, been tenants of 200 acres of light and gravelly land at Lodge Farm, two miles from the Barking Outfall, and on this, by pumping apparatus, they can deliver sewage at the rate of three hundred tons an hour. During the summer of last year about sixty acres of this land were laid out water-meadow fashion, some on the ridge and furrow, or, where the slopes were greater, on the catch-water plan. And from fifty-three acres of Italian rye-grass sown on this land, and watered with sewage in this way, they have cut during the last summer 2,480 tons of grass, which is at the rate of forty-six tons per acre. But of these fifty-three acres ten were sown this spring (April), and sixteen and a half acres were sown late last fall (October), so that only one-half of the land can be said to have been in full bearing power when the sewage reached it; and of this again, at least one-half, which was mown in December last, was nearly destroyed by the sharp frosts of January. . . . . . .

"Besides this large extent of Italian rye-grass, small experimental plots of wheat, mangold and other crops have been sewaged; and I may add the results of this report, notwithstanding that we cannot attach so much importance to them because of the small scale on which they have been obtained· six hundred bushels of mangold roots were weighed off rather more than one-third of an acre (at the rate of 1,733 bushels per acre)—more than twice the quantity on fields close by manured and cultivated in the ordinary way. And the plot of wheat (sixty-one rods) which received three dressings of sewage when the land was dry in spring and early summer, yielded fifteen bushels of grain, which is at the rate of forty-three bushels per acre, while surrounding this plot on two sides of it, 102 rods of similar land, in all respects similarly treated excepting only that it had no sewage, yielded eighteen and a-half bushels of grain, or at the rate of only twenty-nine bushels per acre."

The following table shows the construction of tanks for containing liquid manure, from which, at the Canadian prices of labour and material, our farmers may gather the cost:—

Quantity in Gallons	Depth of Tank.	Diameter of Tank.		Depth of Excavation.	Diameter of Excavation.		Cubic Yards of Excavation.	Bricks for Walls, Dome and Bottom, standard size.
	Feet.	Ft.	In.	Feet.	Ft	In.		
2,209	10	6	10	12	9	0	28	4,200
4,538	....	9	8	....	11	10	49	6,100
6,807	....	11	10	....	14	0	68	7,900
9,076	....	13	8	....	15	10	87	9,600
11,345	....	15	3	....	17	5	106	11,000
13,614	....	16	8	....	18	10	124	12,400
15,883	....	18	0	....	20	2	140	13,700
18,152	....	19	4	....	21	6	161	15,100
20,421	....	20	5	....	22	7	180	16,500
22,690	....	21	7	....	23	9	199	17,900

Our Scotch readers must know that the Craigentinney Meadows, near Edinburgh, furnish a convincing proof of the powerful effects of the application of sewage in the production of grass; whilst by the use of this class of manure as a top-dressing, the cold, thin, and sterile sands of Flanders have been brought to such a condition of fertility that the crops grown there vie in quantity with those produced from the best lands in any part of the known world.

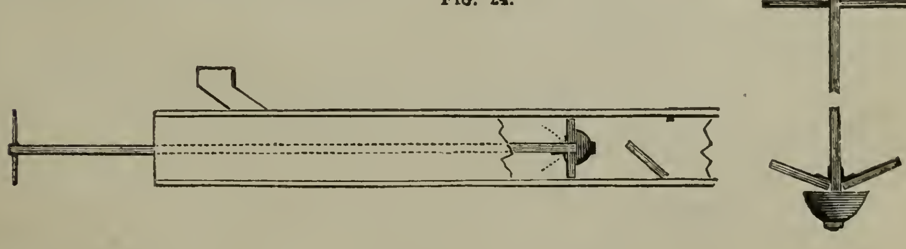
On this subject the *Canada Farmer* says, in its issue for March, 1869:—

"Our farmers have not yet experienced the great benefits to be derived from this mode of using manure, which would be so peculiarly applicable in our hot, dry summers, and we hope at no distant day to see tanks for the purpose of collecting manure for distribution in this manner become a necessary appendage to every well-cultivated farm. But, while we think this mode of applying manure to the soil, especially to grass crops, would be highly advantageous, and repay many times over the cost of tanks, water-carts, &c., we imagine that the construction of tanks or cisterns in the farm-yard, in order to collect the liquid drainings of the stables, cow byres, and even the rain from the roofs of the farm buildings, in order afterwards to pump out the contents and spread them over the manure heap, at intervals during the dry weather of summer, would prove of signal advantage to the cultivator of the soil. Ordinary farm-yard manure, as made in Canada, contains a large admixture of vegetable matters, such as straw, corn stalks, &c., which, becoming dried out in summer, resist the decomposing powers upon the small amount of excrements incorporated with them; so that by the time the farmer wants to haul the manure out on his fallow, or plough it in for root crops, he finds the undecomposed vegetable matter greatly in the way of the efficient incorporation of the manure with the soil. Dried-up manure heaps are also greatly liable to become firefanged, which destroys their value.

"In Belgium these manure tanks are usually constructed by bricklayers at a price proportioned to their capacity—the larger they are, the less the price in proportion: the usual size of a tank or cistern being of a capacity to hold 38,000 gallons. In Switzerland they make square holes in the ground, and line the sides with brick set in clay mortar. Where the soil is a tenacious clay, and there is no danger of the liquid manure percolating out at the sides or bottom, it is only necessary to construct the tank in such a way as will keep the sides from falling in, either from the effects of the action of frost or the trampling of animals near it. Where the soil is porous, it becomes necessary to make the bottom of stone flags, with the joints cut square, set on a puddling of strong clay. The wall is then to be built from and on this bottom, and hydraulic cement used instead of common mortar.

"The cost of a tank containing, say 25 square yards of brickwork, would be about $50."

FIG. 24.



Liquid Manure Pumps.—We find in the *American Agriculturist* a pump, and instructions to make, particularly well adapted for the use of liquid manure tanks, the ordinary pumps being apt to become choked in use by coarse particles of solid matter.

This pump can be made with the simplest tools.

The box must be fitted tight, so as not to leak. The valves are of wood, covered with sole leather, which projects a quarter of an inch over the edge, so as to ensure a tight fit. They are hinged with a pair of common butt hinges to the pump rod, so that they will open the full width to permit any solid matter to pass up without choking.

The pump rod is a strip three or four inches wide; at the bottom of it is fastened a hemispherically shaped piece of wood, which supports the valves when working.

Liquid manure is better in its diluted form for application to light lands. But for heavy lands it may to more advantage be used by distribution over the solid manure pile.

We may sum up the uses of liquid manure thus:

1. If applied in summer or fall it will increase the aftermath on grass land and keep it green through the winter. If used for pasture, apply in fall, as cattle dislike the smell when fresh put on.
2. Good to apply to clover sod before breaking up, very soluble, and readily taken up by the roots of the clover for the use of the succeeding crop.
3. Does well for wheat on light land, but its effect on clay is imperceptible; should always be laid on when the land is dry.
4. Not so good for barley, as it is apt to soften the straw and cause the crop to lodge.
5. Apt to make potatoes coarse, hollow and watery.

Lastly, the very best place for it is on grass, whether for meadow or to be turned under.

HEN MANURE.

Hen manure is home-made guano, and as such is of very great benefit to the farmer. We import an immense amount of guano, and many of our best farmers use it every year upon their roots. Now, our home-made hen manure is almost as good as the best of guano, while we know, when using it, that we have an unadulterated article.

In no article of commerce is there a greater amount of adulteration than in the manufacture and sale of artificial fertilizers such as guano, superphosphate of lime and the nitrates, and it would be to the interest of the sellers were they to obtain certificates from qualified analytical chemists as to the purity of the article.

There are few farmers who do not keep a sufficient number of hens from which to collect yearly some ten or fifteen hundred weight of hen manure, and guano would cost them at the rate of forty dollars per ton.

To Collect Hen Manure.—The droppings under the perches should be carefully covered from time to time with dry earth, ashes or plaster. These matters will have a powerful deodorizing effect, and will by no means hurt the quality, but rather render it nearly of the proper strength for application.

The droppings so treated should be from time to time drawn together in heaps kept under cover. If these heaps be watched, that undue fermentation does not set in, and from time to time turned with the scoop shovel, the hen dung, ashes, earth, &c., will work down to a powdery state, free from all disagreeable pungent smell.

Lime should never be used with them, for it has the effect of setting free the ammoniacal salts, which are amongst the most valuable ingredients.

The hen dung may be incorporated with the manure pile, and doubtless much of the benefit would be thus saved to the land; but it is better to work it separately by the plan above described, and thus to keep it by itself as a special fertilizer on especial crops. Thus will the maximum amount of good be obtained from its use.

It may be used with advantage on hilled corn or on potatoes or turnips.

It has, when applied in the hill, and lightly covered with soil, the effect of generating heat, and thus conduces to the speedy germination of the young plant.

This is of especial benefit to the young turnip, as we desire that its early growth should be as rapid as possible, in order to carry it into the rough leaf and beyond the attacks of the destructive "fly." In all these cases it should be again mixed with dry earth, ashes or plaster, as in its natural state it is too strong for immediate application.

Another of its effects is, as soon as heat and consequent fermentation is generated, to give off carbonate of ammonia, which, absorbed by the soil and through it taken up by the plant, quickens growth and imparts a dark green colour to the leaf.

It should not, if possible, be allowed to come into immediate contact with the seed, but be separated by from a quarter to a half inch of soil.

Some, however, have used it in a still more weakened state as a top-dressing on the first braird of turnips, finding that its pungency is very distasteful to the "fly."

SPECIAL MANURES.

These special fertilizers are concentrated manures, or fertilizers of great strength in small bulk.

They contain in a small compass large quantities of special plant food, and are very vigorous stimulants of plant life. Due caution is required, therefore, to be exercised in their use.

The cause of failure in the use of the concentrated fertilizers is often due to the *manner* in which they are applied. It is difficult for those who have been accustomed to use bulky manures to realize that the full fertilizing potency of a bushel of animal excrement may be held in a large-sized table-spoon, and that a handful of one adds to plant structures as decidedly as several shovelfuls of the other. A full dose of opium as given to patients furnishes quite a dark, bulky powder, or pill; but if we separate the alkaloidal principle upon which its hyponotic power depends, we have only a little delicate white powder which a breath of wind will blow away. The one-eighth grain of powder will affect the human organism as powerfully as ten times the weight of opium. If we were so forgetful of "potencies" as to administer as much, or even one quarter as much, of the white concentrated powder as of the bulky dark one, we should destroy our patient's life, or at least do great injury to his health. So if, in the use of genuine superphosphate, or guano, or ground bones and ashes, we forget their power, and apply too much, we endanger the life of our plants.

An experiment made upon corn affords an illustrative case in point. At the time of planting upon a field divided by a narrow strip of sward land, we directed that on one side a tablespoonful of the mixed bone and ashes should be placed in each hill and well covered with soil; upon the other, four rows were to be treated similarly; and upon the remainder, the hills should receive a double quantity. It is curious to observe the effects. The first field and the four rows were remarkably thrifty. The corn came up well, and manifested remarkable vigour from the start. On the other hand, the overdosed corn appeared for a long while as if it had been paralyzed by some wasting disease. It could not bear up under so much of a good thing. More free ammonia was formed at the start than could be appropriated by the tender plants, and many of them perished from over-stimulation and heat, produced by the fermentative changes of the active bodies in contact.

Whether it pays for the Canadian farmer to make use of these expensive special manures we must allow each man to judge for himself. We ourselves undoubtedly think it does when due regard is had to the proper mode of application, so as to receive full benefit to the crop.

Although the price at which these special manures is held appears at first to stagger us, yet when we consider the strength in relation to bulk and weight, their value would appear to assimilate more closely to that of ordinary manure.

At any rate, this chapter will indicate to the reader several of such manures, their method of action and mode of application, without attempting to lay down any certain profit to be derived when compared with expense.

It may be, however, well worthy of observation, that the majority of our more enterprising farmers seem to patronize the concentrated manures, are satisfied with the results, and so year after year cause an annual increase in the amount that passes through the hands of city dealers.

Guano.—This is simply and purely bird manure made in a country where little or no rain ever falls, and the deposits of countless generations of sea-going birds, which come to the islands every year to lay their eggs and hatch their young. These deposits are found in the islands scattered in the Pacific Ocean and on the coasts of Peru.

The fact that guano contains much more phosphoric acid than ordinary bird manure, is probably owing to the fact that the deposits are not only formed by the excrements of these fish-devouring birds, but also of their carcases and skeletons.

There is great variation in the several guanos, the nitrogen varying in them from 5 to 15 per cent., and their phosphates running up the scale from 25 to 35 in the 100.

Guano used at the rate of from 2 to 3 cwt. per acre is a most powerful manure—its effects are more readily felt in wet than dry seasons.

The most powerful guano the analysis of which has been recorded was found to contain in one hundred parts—water 20·53, Organic matter and Ammoniacal salts 7·59, Phosphates 31·69, Carbonate of lime 6·06, Alkaline salts 5·63.

If water be drained through guano we have a very strong form of liquid manure—but for immediate application to plant life it requires to be very copiously diluted.

The same rules are to be observed in the application of guano to turnips, corn, &c., as mentioned in regard to hen manure.

Nitrate of Soda.—On the use of this manure the *American Agriculturist* says:—

"Nitrate of soda at 4 cents per pound is the cheapest source of nitrogen in the market at the present time, and with wheat at $1.75 it might be used with fair profit. Sow 100 pounds per acre when the wheat is sown, and another 100 pounds if need be in the spring. On poor, sandy land, it would be better to sow 100 pounds of guano and 100 pounds nitrate of soda per acre in the fall."

Sulphuric Acid is used chiefly as an agent in the decomposition of bones, and of any other matter containing phosphate of lime.

Superphosphate of Lime.—The mineral phosphate of lime is found in Canada in large quantities, and of late years no small amount has been exported to Europe. It is abundantly deposited in the Counties of Leeds and Lanark, in Ontario, as doubtless also in many other parts of the Dominion. It is a very valuable manure for the supply of the phosphates required by nearly all vegetable life; but if we have bones about, we can manufacture a home-made article, and we may be assured that there is no adulteration in it when made under our own eyes. A ready way of manufacturing this important manure is to break up the bones as fine as possible, and then place them in a wooden box or barrel. Water, equal to about one-sixth the weight of the bones, may next be added, well stirred in, and left for a day or two to heat and ferment. Boiling water would be best for this purpose. Then add sulphuric acid, mixing well with a wooden spade (no metal should come in contact with the mixture) in the proportion of about forty pounds of acid to one hundred pounds of bones. Let it stand for about two weeks, stirring daily. If the mass is not then dry, add some absorbent, such as sawdust, dry earth or peat, but on no account use lime or ashes. This compound will retain its strength for a long time, but must be kept under cover. Dr. Nichols, in his Boston *Journal of Chemistry,* February, 1869, gives the following, which he recommends: Take a barrel of fine ground bone and a barrel of good wood ashes; mix well together and add three pailsful of water; mix the whole thoroughly, stirring daily; the mass will be fit for use in a week.

In the columns of the *Country Gentleman* we find:—"To make superphosphate of lime, I take 500 pounds of bone and 175 of vitriol. The bones I take to a pine block and cut them up small. (They don't fly so much when I use pine.) I put them in a pile and let them heat and dry. Then I take a large flagstone and put a frame around it. Then get a boulder with a flat bottom, fasten a ring to it, have a rope and pole, and let them work like a well sweep. The frame around the flag keeps the bones from flying off when the stone strikes them. I put the bones into a large kettle with twelve pails of water, and boil them six hours. I have a large box made of plank and put the bones into it, and then the vitriol. I keep them well stirred. When they are hot, dry off with dry earth. I don't dry with ashes—they are not good to mix with phosphate. I sell 2,000 bushels a year. A glass company takes almost all my dried ashes at my place, paying 25 cents a bushel, rounding measure."

Mr. Lyman Call, of East Durham, Ont., gives in the *Canada Farmer* the following account of experiments made with superphosphate of lime on various crops. He applied this manure to portions of a field of potatoes, leaving rows unmanured to note the difference. The quantity used was about one barrel to an acre, and it was applied in the hills, about a tablespoonful to each hill. The manured portion exhibited a marked superiority over the other in vigour of stalk during the period of growth, and at harvest yielded one-third more than the unmanured rows. In experimenting with the same fertilizer on meadows, he comes to the conclusion that a barrel of superphosphate will increase the hay crop by as much as a ton to the acre. On wheat he found less marked advantages, and believes that salt is preferable in this case, using about two and a half bushels of salt to the acre.

English experimenters also agree with Mr. Call, in that the benefits of superphosphate are not so marked upon wheat or grain of any kind as upon potatoes, roots of any kind and grass.

Before proceeding further with fertilizers, we would remind our readers that the cultivator requires to regard two essential matters for his guidance in the application of manures, special or ordinary.

First, what proportion of particular ingredients of plant life his several crops require; and secondly, what proportion of such particular ingredients are to be found in the various manures at his command.

The two following tables will afford a basis of information on each of these two necessary points:—

First.

The Weight of Incombustible Ingredients, given in Pounds Avoirdupois, in Every Ton of the following Crops :—

Crops.	Potash.		Soda.		Lime.		Magnesia.		Phosphoric Acid.		Sulphuric Acid.		Salt.		Sand.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Grain of Wheat	5	0½	5	6	2	3	1	9	8	15¾	1	0¼	0	3¼	2	4
Straw of Wheat	0	7¼	0	11	5	6	0	11½	3	14	0	11½	0	1	64	4
Grain of Barley	6	3¼	6	8	2	7½	4	0¾	4	12	1	15	0	4¼	26	7
Straw of Barley	4	0½	1	1	11	15¾	1	11¾	2	4	2	8½	1	9½	76	4
Grain of Oats	3	5¾	2	15¾	0	13	1	8	1	9	1	8¼	0	4½	44	5
Straw of Oats	19	7	A Trace		3	6¼	0	7	0	4½	0	8½	0	2¼	102	12
Swede Turnips	39	4½	26	2¾	18	11	6	5	9	2½	20	0	157	13¼	10	9¼
Turnips	1	11	2	7	2	13	0	4¾	1	9	0	14¾	12	7	0	13¼
Mangold Wurzels	33	2¾	71	3	6	6	2	15½	3	12	2	12	134	4	2	6
Potatoes	8	9	5	4	0	11¾	0	11½	0	15¼	1	3½	0	5½	0	3¼
Carrots	60	14	15	14	11	5	6	8¼	8	13½	4	10½	1	0¼	2	6¼
Cabbage	41	6	13	0	40	12½	4	8¼	9	12¼	17	7¾	11	9¾	11	13
Grain of Peas	18	2¼	16	8¾	1	4½	3	0¼	4	4	1	3	0	13¼	9	2½
Straw of Peas	5	4	......	......	61	2	7	10½	5	6	7	8¾	A Trace		22	3¼
Clover	9	6	2	7¾	1	9	1	8½	3	0¼	2	1½	1	11½	1	11¾

TABLE COMPILED AT THE MAGNETIC OBSERVATORY, TORONTO, SHOWING THE MONTHLY, QUARTERLY, AND ANNUAL MEANS OF TEMPERATURE, AT VARIOUS PLACES IN CANADA, DERIVED FROM THREE OR MORE YEARS.

—	Monthly Mean Temperature.												Quarterly Mean Temperature.				Year.
	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December	Winter.	Spring.	Summer.	Autumn.	
ONTARIO.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Goderich	23·9	23·5	27·3	41·8	51·6	62·9	68·0	66·9	59·5	47·9	35·7	24·7	24·0	40·2	65·9	47·7	44·5
Kincardine	20·5	19·0	26·9	43·0	55·9	67·8	70·9	69·7	60·4	49·8	34·5	21·2	20·2	41·9	69·5	48·2	44·9
Stratford	20·2	21·4	24·9	41·8	52·2	62·8	67·1	65·0	57·0	45·4	34·1	23·4	21·7	39·6	65·0	45·5	42·9
Simcoe	24·0	24·6	29·5	44·5	55·0	66·0	70·7	68·5	59·4	47·7	35·3	24·4	24·3	43·0	68·4	47·5	45·8
Windsor	24·3	25·6	31·1	46·6	56·5	67·8	72·8	70·9	61·8	49·9	36·4	24·5	24·8	44·7	70·2	49·4	47·3
Glencoe	19·7	21·7	27·9	45·4	58·1	66·6	70·5	69·2	57·4	49·9	29·0	19·1	20·2	43·8	68·8	45·4	44·5
Woodstock	18·8	19·7	26·3	41·8	54·1	64·0	67·8	67·6	56·8	46·6	32·0	19·7	19·4	40·7	66·5	45·1	42·9
Barrie	19·5	20·0	26·0	41·2	52·9	64·9	70·4	67·0	59·2	47·3	34·0	21·2	20·2	40·0	67·4	46·8	43·6
Stayner	19·9	18·6	25·2	41·8	52·7	62·6	66·2	65·6	55·7	48·2	31·3	20·2	19·6	39·9	64·8	45·1	42·3
North Gwillimbury	20·5	19·0	26·9	43·0	55·9	67·8	70·9	69·7	60·4	49·8	34·5	21·2	20·2	41·9	69·5	48·2	44·9
Gravenhurst	12·4	16·0	22·5	37·9	52·9	63·4	67·6	66·5	54·6	44·2	28·0	14·0	14·1	37·8	65·8	42·3	40·0
Hamilton	23·9	24·6	28·8	43·6	53·5	65·8	72·4	69·3	60·5	48·5	36·4	24·7	24·4	42·0	69·2	48·5	46·0
Dundas	22·3	22·6	28·9	45·1	57·7	68·3	71·0	70·1	59·8	49·5	33·3	24·5	23·1	43·9	69·8	47·5	46·1
Toronto	23·1	23·0	29·4	41·1	51·6	61·7	67·4	66·2	58·1	45·9	36·4	25·6	23·9	40·7	65·1	46·8	44·1
Peterborough	17·3	18·8	25·6	41·5	54·8	66·5	70·6	68·5	58·1	44·6	31·4	18·0	18·0	40·6	68·3	44·7	43·0
Cornwall	15·6	18·1	23·9	42·3	54·6	67·0	69·6	68·4	59·4	47·2	32·2	16·7	16·8	40·3	68·3	46·3	42·9
Belleville	18·8	20·4	26·7	42·7	54·0	65·9	70·8	68·2	59·0	46·9	34·1	20·3	19·8	41·1	68·3	46·7	44·0
Pembroke	11·3	12·9	24·0	39·4	53·1	65·7	69·5	67·2	57·1	44·1	29·5	12·3	15·5	38·8	67·5	43·6	40·5
Fitzroy Harbour	10·2	14·5	25·1	44·6	56·1	69·4	71·2	69·4	58·4	47·2	28·9	13·6	16·1	41·9	70·0	44·8	43·2
QUEBEC.																	
Montreal	16·8	18·6	26·9	43·5	57·2	66·4	72·2	69·8	60·8	47·5	33·6	18·9	18·1	42·5	69·5	47·3	44·3
Huntingdon	12·3	14·7	24·7	44·2	56·3	68·1	69·9	68·5	58·1	49·0	33·7	16·6	14·5	41·7	68·8	46·9	43·8
Quebec	11·4	14·3	24·2	37·6	51·1	63·6	68·4	66·0	57·3	44·4	32·0	15·8	13·8	37·6	66·0	44·6	40·5
NEW BRUNSWICK.																	
St. John	18·4	21·4	27·8	38·2	46·7	54·7	59·7	59·5	54·5	45·6	35·7	22·8	20·9	37·6	58·0	45·3	40·3
Bass River	13·8	14·8	24·9	36·9	46·2	61·7	65·9	63·2	53·8	44·6	31·2	16·7	15·1	36·0	63·6	43·2	39·5
NOVA SCOTIA.																	
Halifax	22·9	23·7	28·1	38·1	47·4	59·7	63·5	63·3	57·4	48·3	37·8	25·8	24·1	37·9	62·2	47·8	43·1
Glace Bay	21·6	20·6	26·2	35·8	42·0	54·1	61·9	62·8	56·6	39·7	36·8	27·1	23·1	34·0	60·9	44·4	40·6
Pictou	20·1	18·5	26·2	36·3	45·3	58·5	64·8	63·2	56·8	47·6	35·2	23·1	20·6	35·9	62·2	46·5	41·3
Sydney	24·7	21·9	26·2	35·5	43·8	54·2	62·8	62·2	55·0	47·1	36·3	25·9	24·2	35·2	59·7	46·1	41·3

TABLE COMPILED AT THE MAGNETIC OBSERVATORY, TORONTO, SHOWING THE AVERAGES OF HIGHEST TEMPERATURE IN EACH MONTH AND YEAR FOR VARIOUS PLACES IN CANADA FROM THREE OR MORE YEARS, WITH THE ABSOLUTELY HIGHEST TEMPERATURE IN EACH SERIES

—	January	February	March	April	May.	June.	July.	August	September	October.	November	December.	YEAR.	Highest Temperature in the years from which means are derived
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
ONTARIO.														
Goderich	45·1	46·2	52·8	72·3	78·5	86·6	87·0	86·2	81·2	72·3	57·2	44·6	89·1	92·4
Kincardine	46·2	48·7	51·8	69·1	79·5	87·0	87·9	88·2	85·9	71·5	53·2	42·6	90·2	94·0
Stratford	40·0	42·6	49·2	68·4	76·9	84·2	87·0	84·2	80·6	69·7	53·7	44·2	88·5	93·5
Simcoe	48·8	50·8	55·6	73·7	81·9	89·9	90·6	88·6	82·9	74·0	60·1	48·0	93·1	93·5
Windsor	48·9	53·5	58·5	78·6	83·6	92·0	93·6	92·6	89·1	78·6	61·8	48·4	96·1	98·8
Woodstock	47·3	51·2	52·0	77·5	85·5	89·6	89·6	90·9	85·6	73·1	50·9	41·2	92·8	93·8
Barrie	46·7	47·8	52·7	73·6	81·3	87·1	91·6	88·5	89·2	78·1	63·6	45·4	93·5	97·2
Stayner	54·0	45·1	48·0	76·7	84·0	94·7	94·3	91·8	90·1	76·6	55·2	44·1	94·5	96·0
North Gwillimbury	44·5	49·5	44·7	76·3	82·5	91·7	93·5	89·5	83·8	75·3	54·2	41·0	93·5	95·0
Gravenhurst	39·9	45·3	47·9	69·5	81·7	90·6	91·6	88·8	84·4	70·8	47·8	40·8	92·6	94·5
Hamilton	48·5	51·4	52·4	75·3	83·9	92·7	96·8	94·2	89·0	78·4	62·2	51·1	99·0	106·3
Toronto	43·3	44·4	51·6	66·4	76·1	86·1	89·2	86·4	80·9	68·9	57·8	47·6	90·7	99·2
Peterborough	43·3	43·8	50·5	72·3	83·2	90·5	92·2	91·3	86·8	73·6	56·8	43·9	94·2	99·1
Cornwall	41·3	46·8	53·0	75·3	84·7	89·6	90·4	91·5	87·1	76·6	54·9	45·3	94·5	100·2
Belleville	41·0	42·5	48·4	69·9	78·8	85·6	90·2	86·4	81·3	70·7	55·2	44·9	92·1	100·6
Pembroke	40·9	44·9	55·8	68·9	87·4	93·9	93·8	88·7	84·2	75·4	57·3	40·7	95·1	99·9
Fitzroy Harbour	42·3	43·9	49·5	69·0	86·4	95·2	93·7	91·7	89·5	72·0	45·7	41·0	96·7	97·0
QUEBEC.														
Montreal	40·7	43·3	52·8	73·8	87·1	89·9	92·3	90·1	84·1	79·9	58·8	44·6	95·0	96·1
Huntingdon	45·0	41·0	54·0	75·0	84·7	93·3	95·7	89·0	83·0	77·7	54·0	45·3	93·7	95·0
Quebec	38·2	37·6	43·7	61·4	81·9	90·2	89·6	82·5	78·9	69·2	46·4	38·5	90·6	94·4
NEW BRUNSWICK.														
St. John	40·8	41·0	45·8	56·8	67·2	73·4	78·6	76·2	70·6	60·6	54·2	43·6	79·0	82·0
Bass River	42.0	39·9	48·0	56·1	77·8	88·0	87·1	85·1	78·5	69·4	56·9	41·2	88·6	92·0
NOVA SCOTIA.														
Halifax	47·4	45·7	52·1	63·6	78·9	83·2	86·1	86·4	81·0	72·4	59·1	48·3	88·3	93·1
Glace Bay	48·2	42·2	47·2	57·0	70·4	80·0	85·9	82·9	76·2	69·4	55·8	48·2	86·7	89·5
Pictou	49·3	44·1	48·3	60·6	73·4	81·2	84·9	83·9	78·7	70·7	59·3	47·8	84·9	87·3
Sydney	43·7	43·3	49·2	57·2	75·4	79·5	83·4	84·0	75·0	69·2	56·9	48·1	85·6	89·0

TABLE COMPILED AT THE MAGNETIC OBSERVATORY, TORONTO, SHOWING THE AVERAGES OF THE LOWEST TEMPERATURES IN EACH MONTH AND YEAR FOR VARIOUS PLACES IN CANADA FROM THREE OR MORE YEARS, WITH THE ABSOLUTELY LOWEST TEMPERATURE IN EACH SERIES.

—	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.	YEAR.	Lowest Temperature in the year from which means are derived.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
ONTARIO.														
Goderich	-1·3	-1·1	2·1	21·6	28·4	39·1	46·4	44·5	36·3	28·8	12·9	-2·9	-8·8	-12·6
Kincardine	-6·3	-4·6	3·8	23·7	34·5	43·3	51·1	48·2	40·2	31·8	16·5	-2·2	-9·7	-12·0
Stratford	-8·1	-8·9	-3·6	19·9	29·3	37·9	44·3	39·8	31·8	24·3	10·9	-7·6	-15·4	-20·0
Simcoe	-3·9	-5·7	5·6	25·2	31·1	40·5	47·5	44·4	34·2	27·2	11·0	-10·3	-13·3	-23·5
Windsor	-5·6	-7·9	1·5	23·0	33·4	44·9	48·8	48·3	35·4	25·7	11·9	-7·4	-14·8	-21·0
Woodstock	-7·6	-13·0	5·2	22·2	28·5	36·0	42·2	44·1	29·6	20·2	1·1	-15·5	-18·2	-21·0
Barrie	-17·4	-13·7	-6·1	18·0	27·0	37·6	46·6	42·1	34·1	25·3	10·8	-19·9	-26·5	-38·1
Stayner	-10·5	-10·0	-0·3	22·3	30·7	41·0	47·7	40·7	36·3	29·0	3·5	-20·5	-20·5	-29·0
North Gwillimbury	-15·5	-9·7	-1·7	23·0	39·2	51·2	56·3	52·2	44·7	32·2	11·8	-15·7	-16·3	-28·0
Gravenhurst	-29·3	-23·7	-14·3	16·0	32·4	46·1	50·6	44·4	32·1	23·4	3·3	-32·2	-36·3	-41·0
Hamilton	-8·1	-5·1	-2·2	19·5	29·3	37·0	47·0	43·1	32·3	22·1	9·5	-7·7	-13·6	-19·5
Toronto	-7·6	-7·9	2·5	19·3	30·9	38·8	47·1	44·4	34·6	25·0	15·2	-3·3	-12·3	-26·5
Peterborough	-20·7	-15·5	-11·1	16·3	27·1	36·7	43·2	36·7	28·2	16·3	1·0	-22·8	-25·9	-38·5
Cornwall	-15·9	-13·4	-9·9	18·8	29·7	41·0	47·4	41·5	32·2	23·6	7·1	-17·1	-20·7	-28·5
Belleville	-16·2	-11·1	-2·4	21·0	32·0	43·1	50·8	44·7	34·9	25·3	9·6	-15·1	-18·4	-19·9
Pembroke	-32·7	-26·5	-23·2	11·0	26·8	36·1	44·4	37·8	30·0	20·3	0·0	-26·8	-37·3	-45·0
Fitzroy Harbour	-29·0	-26·9	-8·0	22·0	40·0	49·7	56·2	43·8	36·7	26·5	4·0	-26·8	-38·0	-41·0
QUEBEC.														
Montreal	-18·2	-12·2	-9·5	27·4	37·2	49·7	53·4	52·0	41·2	28·9	3·5	-12·3	-17·2	-28·0
Huntingdon	-23·7	-19·7	-17·0	23·3	32·7	48·0	53·3	46·7	35·3	25·3	8·3	-23·0	-26·7	-30·0
Quebec	-20·3	-17·8	-8·9	17·5	30·9	42·2	46·6	45·5	36·4	25·6	3·4	-16·8	-23·5	-30·5
NEW BRUNSWICK.														
St. John	-11·0	-6·4	-1·2	20·2	31·8	43·2	49·0	48·4	41·0	25·0	12·8	-5·8	-10·6	-21·0
Bass River	-20·2	-15·2	-3·4	17·4	25·4	40·0	47·8	41·6	33·7	20·0	7·0	-12·5	-22·6	-28·2
NOVA SCOTIA.														
Halifax	-6·2	-3·0	-0·7	19·8	25·8	37·6	50·2	44·3	36·5	25·7	16·7	1·9	-8·8	-13·7
Glace Bay	-3·6	-4·7	-0·1	16·5	24·8	33·6	40·2	44·2	37·0	25·8	19·6	6·2	-7·5	-13·0
Pictou	-12·7	-13·5	-2·4	17·2	28·2	38·2	44·5	45·5	36·8	30·3	14·5	-5·8	-13·2	-20·0
Sydney	-6·3	-5·3	-4·3	14·7	25·0	32·3	38·3	41·4	33·6	24·7	19·7	-5·1	-9·8	-10·5

TABLE COMPILED AT THE MAGNETIC OBSERVATORY, TORONTO, SHOWING THE MONTHLY AND QUARTERLY AND ANNUAL RAINFALL IN INCHES, AND THE TOTAL ANNUAL DEPTH OF RAIN AND SNOW REDUCED TO WATER.

—	Monthly.												Quarterly.				Yearly amount of Rain.	Rain and Melted Snow.
	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.	Winter.	Spring.	Summer.	Autumn.		
ONTARIO.																		
Goderich	1·66	0·55	1·39	1·81	2·39	3·38	2·94	2·78	3·28	2·46	1·44	0·84	2·05	5·59	9·10	7·18	23·92	32·56
Kincardine	1·38	R.	1·58	1·87	2·24	2·07	3·21	2·56	4·67	3·36	1·66	0·81	2·19	5·69	7·18	9·70	25·42	39·52
Stratford	0·61	0·73	1·48	2·17	2·78	3·89	3·04	3·20	3·76	2·72	1·79	1·02	2·36	6·43	10·13	8·27	27·19	38·15
Simcoe	2·11	1·70	3·30	3·17	3·70	3·28	3·51	3·64	3·68	3·12	2·83	2·31	6·12	10·17	10·43	9·63	36·35	40·64
Windsor	1·19	1·14	1·56	1·87	3·15	3·63	2·41	2·14	1·69	1·76	2·42	0·82	3·15	6·58	8·18	5·87	23·78	31·72
Glencoe	0·63	0·37	1·41	1·86	1·91	3·11	4·33	2·00	1·41	0·58	0·77	0·50	1·50	5·18	9·44	2·76	18·88	25·20
Woodstock	0·59	0·58	1·31	1·60	2·45	3·04	2·96	4·41	2·93	2·64	0·95	0·82	1·99	5·36	10·41	6·52	24·28	31·28
Barrie	0·01	0·18	1·12	1·66	2·37	2·84	3·01	2·28	2·85	2·35	1·42	0·63	0·82	5·15	8·13	6·61	20·71	32·15
Stayner	R.	R.	0·37	2·99	1·99	2·82	3·94	1·23	3·38	2·83	0·69	R.	R.	5·35	7·99	6·90	18·20	37·80
North Gwillimbury	0·12	0·10	0·51	1·36	1·50	2·11	2·23	1·98	3·31	2·92	1·18	0·35	0·57	3·37	6·32	7·41	17·67	28·01
Gravenhurst	0·72	0·59	0·91	2·82	2·07	2·10	3·15	2·03	4·04	2·93	1·94	0·02	1·33	5·80	7·28	8·91	23·32	36·47
Hamilton	1·94	1·22	1·94	1·56	2·71	3·26	2·95	2·35	3·50	2·17	1·84	1·99	5·15	6·21	8·56	7·51	27·43	35·48
Dundas	0·46	0·40	2·00	1·94	2·10	3·11	3·21	2·46	3·18	2·66	1·08	1·26	2·12	6·04	8·78	6·92	23·86	29·44
Toronto	1·20	0·88	1·59	2·45	3·21	2·98	3·22	3·00	3·68	2·42	2·93	1·62	3·70	7·25	9·20	9·03	29·18	36·09
Peterborough	0·64	0·36	1·01	1·89	2·03	1·96	2·45	2·60	3·22	1·93	1·81	0·65	1·65	4·93	7·01	6·96	20·55	30·31
Cornwall	0·00	0·66	0·26	2·12	3·59	1·29	2·97	1·89	3·45	2·52	1·82	0·15	0·81	5·97	6·15	7·79	21·72	29·31
Belleville	1·02	0·80	1·29	2·21	2·64	2·60	2·16	2·38	3·71	2·76	2·62	1·72	3·54	6·14	7·14	9·09	25·91	36·41
Pembroke	0·15	0·15	0·56	1·33	2·28	3·06	2·51	2·36	3·21	2·58	1·09	0·21	0·51	4·17	7·93	6·88	19·49	28·38
Fitzroy Harbour	0·41	0·09	1·14	1·18	1·63	2·42	2·89	2·15	2·15	3·55	0·76	0·26	0·76	3·95	7·46	6·46	18·63	25·83
QUEBEC.																		
Montreal	0·64	0.42	1·41	1·30	3·01	2·26	3·62	3·42	3·92	3·75	2·66	0·85	1·91	5·72	9·30	10·33	27·26	37·54
Huntingdon	0·83	0·00	1·04	2·56	1·83	1·80	3·54	3·35	2·76	4·59	2·01	1·08	1·91	5·43	8·69	9·27	25·30	32·19
Quebec	0·25	0·00	0·42	1·17	1·11	2·52	4·27	2·87	2·81	2·89	0·95	0·00	0·25	2·70	9·66	6·65	19·26	31·84
NEW BRUNSWICK.																		
St. John	2·13	2·86	2·23	3·14	4·51	3·00	3·45	3·89	4·38	4·68	5·33	2·67	7·66	9·80	10·34	14·39	33·27	43·12
Bass River	1·30	0·61	0·92	2·13	2·83	3·30	2·53	3·77	2·58	4·88	3·78	1·15	3·06	5·88	9·60	11·24	29·78	40·91
NOVA SCOTIA.																		
Halifax	3·66	3·59	2·91	3·10	4·17	3·04	2·37	3·51	3·69	5·02	4·68	3·44	10·69	10·18	8·92	13·39	43·18	51·08
Glaco Bay	4·29	4·35	3·96	4·22	4·50	3·49	3·95	4·27	5·37	6·44	5·69	4·96	13·60	12·68	11·71	17·50	55·49	66·00
Pictou	1·97	0·85	0·60	1·50	3·09	3·30	3·89	3·57	3·65	4·11	4·42	2·05	4·87	5·19	10·76	12·18	33·00	49·23
Sydney	3·49	3·16	2·20	4·03	3·16	3·46	3·42	5·07	5·48	5·04	6·88	4·03	10·68	9·39	11·95	17·40	49·42	63·93

The Chemical Ingredients of Plant Food, in Pounds Avoirdupois, contained in One Ton of the following Manures:—

Manures.	Chlorine.	Sulphuric Acid.	Phosphoric Acid.	Soda.	Magnesia.	Potash.	Ammonia.
	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
Farm-yard Dung	1 9	1 4	5 1	1 10	18 3	2 4	13 5¾
Night Soil................................	3 0	2 3	120 0	4 10	2 7	6 7	47 15¼
Fresh Bones.............................	....	....	580 0	....	....	....	145 5
Dry Blood................................	....	....	....	....	....	....	444 3
Guano	62 0	93 8	283 9	36 15	....	66 8	221 9¼
Soot	22 9½	194 3¼	5 12¾	2 11¾	8 11¼	7 1¼	50 2
Salt, Common............................	1344 0	....	....	833 0	....	....	....
Gypsum....................................	....	1317 0	....	....	....	....	....
Mixed Urine, per 100 Gallons..........	1 6	3 8	2 6	5 9	....	2 0	18 3¼
Nitrate of Soda.......................... ...	....	....	....	8 3	....	....	364 0
Sulphate of Ammonia	....	1357 0	....	....	....	....	470 0

A comparison of these two tables shows us that swede turnips have in one ton no less than 157 lbs. 13¼ ounces of salt, and we know as a matter of practical experience that salt appears to have a better effect upon this crop and mangold wurzels than upon any other. By reference to the table it will be seen amongst other things that phosphoric acid and lime enter largely into the composition of roots of all kinds. Bones have by the other table a large proportion of phosphoric acid in their composition—thus is inferred by science and proved by practice that the phosphates are peculiarly adapted to the quick growth of roots—also of guano. By further comparison of the two tables it will readily appear what manures are specially adapted to particular crops.

Colonel Daniel Needham, in a speech in the Massachusetts Senate, advocating the passage of a Bill to provide against the sale of adulterated commercial fertilizers, by requiring that they be analysed and each barrel, &c., be labelled with such analysis, said in the course of his remarks, that "a most valuable fertilizer could be made by taking four barrels of ground bone, one carboy of sulphuric acid, and one of ashes. He said that the expense of this fertilizer would be only about $18 a ton, and that he had no doubt the fertilizer thus made would be as valuable as any purchased in the market for $40 per ton. He stated the expense substantially as follows:—Four barrels bone at $2 50 per barrel, $10; one hundred and seventy-five pounds sulphuric acid, $5 25; two barrels ashes, $2 50; total, $17 75. "The process of mixing," he said, "was very simple. He would take the ground bone, and, after wetting it thoroughly, allow it to heat, which it would do in a short time, then pour on the sulphuric acid, and afterwards mix with the mass two barrels of ashes." Which is all quite correct in practice, except that the barrels of ashes should decidedly be left out. There is yet one other preparation of phosphate of lime, known as

Bone black, which is made by charring bones in close vessels, by which process most of the strictly animal matter is driven off. They are, however, more easily reduced to powder than before.

When dissolved in sulphuric acid they make a good fertilizing agent, but not equal to common superphosphate, where all the ingredients of the bones are used.

Caustic soda-ash will work down or dissolve ground bones.

It has been also recommended, to pile bones and burn them with the trimmings of fruit trees and weeds, &c.

Bones may either be used as they are, with the simple aid of pounding or grinding, or their action as fertilizers may be hastened by dissolution in strong acids—they then become superphosphates, of which we have already spoken.

For accelerating the growth of grass and green crops bone manure is of great value. Within the last twenty years this manure has excited great attention throughout the length and breadth of Great Britain, and is now in almost universal use for raising turnips in all the greater turnip-growing parts of that country. Of late years it has been looked upon with favour amongst the better class of Canadian farmers.

Long before the advantages to be derived from the use of well-crushed bones were generally known, many persons were aware of their fertilizing properties. At first they were reduced to ashes by fire, but in this process there was great waste, for the oil and nutritive matter were considerably diminished by calcination.

Bones contain more than fifty-three per cent. of phosphate of lime, some phosphate of magnesia, carbonate of soda, and over seven per cent. of nitrogen. To the quantity of phosphates contained is due their principal value, for these salts are largely removed by feeding cattle and the exhaustion of successive crops. Another way of reducing bones to powder has been to partially break them with a hammer, and then decompose them by the effect of urine at the bottom of the farm-yard. Mills may now be obtained at a reasonable price, in which to reduce the bones directly to powder, and by this plan much waste may be avoided.

When bone dust is used for the turnip crop it is usually sown in the drills with the seed, or it may be spread to advantage, especially with ashes, along the drill when the young turnip puts forth its virgin leaves.

With regard to the durability of this manure, it has been asserted that on a field, part of which was boned forty years ago, the crops were on that portion, during fifteen or sixteen years, visibly better than on the remainder, although the land was all of the same quality, and the part not boned was manured with barn-yard dung. In another case reported to the committee of the Doncaster Agricultural Association, about three acres of light sandy land were dressed in 1814 with 150 bushels of bones per acre, since which time the land is said to have never forgotten it, but is nearly as good again as the other part, farmed precisely in the same way, with the exception of the one application of bones.

Upon the lighter and more calcareous soils the benefits of bone dust are more marked and more permanent.

This manure should be laid upon grass as early in the spring as the land becomes dry.

That bone manure has little or no effect upon wet land is generally conceded. It has been affirmed that broken bones have a mechanical effect in loosening heavy soils, but I think that a less costly application, say chip manure, would be equally beneficial. Upon thin sandy land, a liberal application of bone manure will be of great advantage, not only to the immediately succeeding crop, but in the improvement of the land for many years, and in the efficiency, in the succeeding courses, of a smaller quantity of manure to ensure a crop.

For general use, particularly upon turnips, manufactured bones —that is, bones boiled and ground—are most easily handled by the farmer; but farmers, at least in England, have found themselves imposed upon by adulteration on the part of the manufacturers, or more often by the deprivation by manufacture of the gelatine and oil which bones in their natural state contain.

There is yet another way in which to make this article at home. Even as flesh, if buried in the ground, will not bring its fertilizing powers to bear upon the earth until decomposition has set in, so it is necessary that bones should have begun to ferment before they become available for the use of the soil. To attain this fermentation, the formation of a compost of bones with earth and other substances will be found quite practicable. Mix twenty bushels of bones with four or five of barn-yard muck, cover the heap well, and the mixture will soon become decayed and pulverized. In this you will have the *bona fide* bone manure, with all its gelatine, phosphate, and nitrogen conserved. This practice has been recommended by several very intelligent farmers and we have it from a farmer near Guelph that its effects upon the turnip crop have been very decided.

Bones have the advantage of being easily procurable in our cities, and are compact for carriage. One hundred bushels will be found equivalent to thirty waggon loads of barn-yard manure. They may be collected and drawn home in the winter time, and can be preserved for a long time if kept dry. Moreover, they have one advantage over barn-yard manure, in that they carry no weeds to the field. They are most suitable for turnip culture, and a successful crop of these will indirectly benefit the farm in succeeding years. We have numerous instances of turnips with ordinary manure laid under them being destroyed by the fly, while those sowed with bone dust have escaped the ravages of this pest.

A dressing of 250 pounds per acre on grass land, especially if it is occasionally pastured, would undoubtedly pay. As a dressing for grape-vines, pear trees, and for general garden use, it may be used at the rate of three to five hundred pounds per acre profitably.

The method recommended by Mr. A. Gordon, of Fitzroy, in the Co. of Carleton—a Canadian farmer, is:—"The bones to be used should be broken as small as possible; they cannot be too small, as the smaller the pieces the greater the surface presented to the action of the acid, and consequently the more rapid and perfect will be the solution. Having broken the bones into pieces from one to two inches in length, place them in a large cask or sugar hogshead, add a quantity of water sufficient to moisten the bones, and allow them to soak in it for three or four hours before adding the acid; if the water be boiling, so much the better; then add the acid, and stir it well with the bones. Sulphuric acid is the acid most commonly used; its specific gravity from the manufactory ought to be 1·845; it should be kept in close vessels, as it attracts moisture rapidly from the atmosphere, and becomes weaker. When strong acid is added to water, a considerable amount of heat is produced. If we mix vitriol and water in the proportion of 5 lbs. of acid to 2 lbs. water, the temperature will rise to 266 degrees.

The proportion of acid to be used in making vitriolized bone manure is *one hundred-weight* of acid for every *two hundred-weight* of bones, and the proportion of water should be fully three times that of the acid. The water must be applied first to the bones, afterwards the acid. The reason of this is, that when undiluted sulphuric acid is poured upon the bones, violent action ensues, but continues only for a short time, as a coating of gypsum, which is the first new compound formed, covers the surface of the crushed bones with a crust, which prevents the acid from coming in contact with the unaltered portions, and consequently prevents a perfect solution. But by applying the water first, and afterwards adding the acid, the action is complete. This is strictly superphosphate of lime.

Caustic lye may be also used to dissolve bones, its action being, however, slower than that of sulphuric acid.

To accomplish this, a rough but tight box, not over eighteen inches deep, is needed. Procure sound, unleached wood-ashes, mix a peck of slaked lime and a peck of sal-soda to every barrel of dry ashes. Pack the ashes, &c., with the bones in layers (ashes first) until the box is filled. Saturate the mass with water, and add from time to time more water to preserve a constant state of moisture. In four or six weeks the bones will have become so much softened that they will crumble to powder with a slight blow. The mass may then be mixed up and beaten fine with a shovel, and an equal quantity of fine soil added and thoroughly intermingled. This compost is too strong for direct application to the seed, and in using it for corn some earth needs to be mixed with it previously. If the quantity of ashes is increased, the process is proportionately hastened.

A correspondent of the *Country Gentleman* says: "Take a water-tight box or cask of a suitable size, and in the bottom put a layer of ashes, say three inches in depth, then on this a layer of bones, and so on alternately until the cask is nearly or quite full, the last layer of bones being well covered with ashes. I then have my family pour upon this all the urine from the house every day, and on washing days pour on a quantity of the strong soap-suds.

In a few months this can be taken out with a shovel all dissolved, except it may be the large enamelled joint bones, which may have to be broken and put through another sweat in the like manner. It is understood that the ashes *must* be good hardwood ashes, *unleached*, or the undertaking will prove a failure.

There is one great difference to be observed in the application of bones simply broken up and ground, and when reduced by strong acids.

Bones may be applied directly on the plant without fear in touching the seed, whilst superphosphate should be incorporated in the soil without actually coming in contact with the seed—for the action of the latter is stronger, in that it is more rapid than that of bones in a natural state

That the turnip has a great affinity for the ingredients of food contained in bone, we have ourselves seen very frequently illustrated by the growth of a turnip root *through* a solid piece of broken bone.

The value of bones as manure may be generally summarized as follows :—

That on dry sands, limestone, chalk, and light loams, bones are a very highly valuable manure.

That they may be applied to grass with great good effect.

That on arable lands they may be laid on fallow for turnips, or used for any of the subsequent crops.

That the best method of using them, when broadcast, is previously to mix them up in a compost with earth, dung or other manures, and let them lie to ferment

That if used alone, they may either be drilled with the seed or sown broadcast.

That bones which have undergone the process of fermentation are decidedly superior, in their immediate effects, to those which have not.

That the quantity should be about twenty bushels of dust, or forty bushels of large, increasing the quantity if the land be impoverished, and also if the bones have been manufactured.

That upon clays and heavy loams it does not yet appear that bones have any marked effect.

Farmers, do not waste bones, but collect all you can !

Soot is another valuable manure, thousands of bushels of which are annually wasted in Canada alone

Soot is made up of carbon in the purest state, and is full of volatile parts.

The soot from bituminous coal is generally considered of more value, weight for weight, than that obtained from wood.

"This is an excellent manure , but, as in many other cases, one must know how to use it. It is, first, good for all fruit trees, for meadows overrun with moss, and for clover. In the kitchen garden, reserve it for the onions. For other vegetables it is more hurtful than useful. Use it with moderation. In small quantities, soot produces good results ; in large, it disorganizes the plants burns and cauterizes them, eats both leaves and roots. On a rainy day, give your soil a weak dose; prudence says, mingle earth and mud with it. Above all, do not make use of it in hot and dry weather."—*La Gazette des Campagnes*

SWAMP MUCK AS MANURE BY ITSELF.

We have spoken of the use of swamp muck as an auxiliary to the composite heap of barn-yard manure It may also often be used with advantage by itself. Originally most of our swamps were lakes or large ponds. The accumulation of decaying vegetable matter, however, gradually raised them, until they became in the half-dry and periodically wet state in which we now find them.

A great depth of soil on these is composed of alluvial deposits and pure decayed vegetable matter. This is rich in the elements of plant food, but as a manure is in its natural state next to useless, owing to its acidity and the consequent fixed state of its most valuable ingredients.

In order then to render these ingredients soluble to plant life, the acidity in muck must be corrected, and no agent is so powerful for this purpose as lime.

As we have before said, if near enough, it will often pay to haul into the barn-yard and there draw out in the compost heap all the vegetable food which has for generations been preserved from entire decay by perpetual moisture; but to use it by itself on land, it may be manufactured into manure upon the edge of the swamp.

Throw it up in heaps on the adjacent dry spots, and mix liberally with it, as it is piled, lime. The action of the lime shovelled into the muck will be to set up the action of fermentation. Its rapidity will depend greatly upon season, and upon the state of decomposition in which the muck may be found.

If used on the soil, it will be found a powerful and lasting fertilizer, though its action will be far slower than that of barn-yard manure.

In soils destitute of lime and alkalies, this muck will act very slowly; for when these ingredients do not exist in the land, the benefits of rotten wood or vegetables are purely mechanical.

Therefore, even on stiff clays, it would have the effect of mechanically loosening the soil, although for that purpose it would hardly pay to go to the expense of manufacturing, hauling and spreading, when other substances, such as chips, &c., far more effective to open up heavy land, could be obtained.

It is peculiarly adapted to the use of light land, giving to such a greater consistency.

Like charcoal, it absorbs moisture and retains it for the use of the growing plant.

Depend upon it that, as a rule, money and labour laid out in the use of such additions to the consistency of light lands will pay better than when expended on more acres.

"In a discussion before the Little Falls Club, Mr A. L. Fish stated that twelve years ago he drew out three thousand loads of muck, and applied it at the rate of fifty loads to the acre, pulverizing and mixing it with the soil. The result was good crops without further cultivation Two years later he drew out four thousand loads, and applied it at the rate of one hundred loads to the acre, spread with a plank to which was attached a tongue to hitch the team. The land was planted to corn. After taking two crops from the land, it was put down in meadow, and it has produced at the rate of two tons of hay per acre ever since, though before the application it did not yield one ton per acre. It did not act so quickly as manure, but was more lasting."—*Rural Home.*

A good compost may be made in the proportion of three bushels of lime to a cord of muck. If a peck of salt be added it will greatly help to correct the acidity and hasten the action of the manure upon the crop

Muck is a good top-dressing for grass. If drawn out in winter and laid on wheat, it will not only help the wheat through the alternate frosts and thaws of spring, but be of great benefit to the growth of grass seeds.

If it be required to use it for spring crops, it should be drawn out by sleigh and spread on the winter fallow.

In these ways we may find lots of profitable work for team horses that would otherwise be "eating their heads off" in winter.

SAWDUST.

This has been too often called valueless. Its value is not great, but where handy will often pay the hauling. We once saw a very good crop of potatoes growing on a patch of old pine sawdust, *but it was well rotted* It should be heaped and well rotted. It is injurious to the land to plough it under, in any quantity, in a fresh state.

Better use it for bedding, and allow it to undergo a process of fermentation before using Thus it will be found a valuable adjunct to the manure pile for there is no better absorbent obtainable.

Hardwood sawdust is more valuable than that made from pine.

It is also useful spread upon the surface in the neighbourhood of the roots of trees—prevents the surface of the earth from crusting, and retains moisture in the soil. Its action in this case is not manurial, but purely mechanical.

On heavy soils it will also help to keep them open

It might help grass as a mulch, retaining moisture and protecting the roots through winter.

SEAWEED.

This is a valuable manurial agent, and is largely used in countries adjacent to the ocean.

It is used in two ways: either it is gathered, spread and ploughed under when fresh, or piled in heaps and burnt. The ashes are rich in fertilizing elements, containing twelve per cent. of potash, twelve per cent. of soda, twenty per cent. of salt, ten per cent. of lime, five per cent. of phosphates, and twenty-four per cent. of sulphuric acid, besides a trace of chlorine.

It is used by the Lower Canadians in great quantities along the shores of the Gulf of the St. Lawrence, and by them is ploughed under green, or burned to ashes and spread broadcast, or deposited in the potato hills.

PEAT OR TURF AS MANURE.

This is not of great value except as a top-dressing for grass, for which purpose it must be reduced to a finely divided state by a similar process and by the use of lime, as already given under the heading of "Swamp Muck for Manure."

It is, however, far more useful in the barn-yard manure compost heap.

TALLOW-CHANDLERS' REFUSE.

This consists of the muscular parts and membranes of fat after it has been tried for lard. There is much animal matter in the scraps, and they contain about thirteen per cent. of ammonia, with no inconsiderable quantity of sulphur and phosphorus.

As manure, it is generally broken up fine and composted with good muck; about a hundred pounds to a cord of muck; after becoming well heated, the heap requires to be turned over and well mixed. It may be applied with advantage to almost any crop.

HOUSE-SLOPS

Should never be wasted. Not only are they when thrown promiscuously out of doors a source of annoyance and a well-spring of noxious odours, but there is contained in them a large amount of good manure.

Pour them daily on a compost heap, or, after free dilution with water, apply directly to garden crops, peach trees, &c.

WOOL WASTE,

Such as drops from the carding machines of woollen factories, is a rich fertilizer, being saturated with grease or oil, and is used to a great extent, mixed with ashes and lime, in England, by hop growers. The mixture is worth, on most soils, more than ordinary ashes.

HAIR

Contains a large amount of nitrogen, and is therefore a rich fertilizer.

It decomposes in the soil very slowly, and so its results are not very marked, but they are lasting.

It is several times more enriching than common barn-yard manure.

We see the farmer who does not believe in books, sneer when we advise him to save carefully all the combings from the teams. Such a little matter to look after! We wish the farmer to try it; he will be astonished at the amount collected from a few teams in a season's grooming.

LEAVES

Of particular vegetables are the best manures for those vegetables, because they contain more or less of the special ingredients of food required by them individually. This is nature's law, and requires no special knowledge of chemistry to appreciate.

They are, when handy, well worth collecting. In the barn-yard they will be found valuable as absorbents of liquid manure, besides containing in themselves great manurial qualities.

The value of the leaves from hardwood trees is greater than from pines.

These matters when viewed singly are small, but in the aggregate an immense amount of addition of valuable material may be made to the "farmer's bank"—the manure pile—by attention to these minor details

"Mony a mickle maks a muckle," the Scotchman says.

The ashes of leaves will be found largely composed of soluble salts, earthy phosphates and carbon, also a very large amount of silica, the straw-supporting requisite for cereals.

ASHES.

Amongst mineral manures there are few of greater importance to the farmer than ashes. All ashes may, in one manner or another, be made of great use upon the farm.

The ashes of coals and cinders are of benefit in a mechanical way by loosening and making friable tenacious soils, whilst they render light soils more compact.

In Canada, in the country, wood is the fuel; farmers therefore have the means of collecting every year large quantities of wood ashes. By chemical analysis it is found that wood ashes contain in large proportion most of the more essential elements necessary to plant life, with the exception of ammonia.

On the European continent the value of ashes and their powerful effect, especially upon young clover, are fully recognized.

In Germany, grass lands are kept in a high state of productiveness by the exclusive use of this manure. Indeed the question has been frequently mooted whether it would not pay the British farmer to import wood ashes from Canada for the purposes of agriculture. The chief and most important of the elements necessary to plant life, contained in wood ashes, are potash and earthy phosphates.

Their quantity varies with the different kinds of wood, the hard woods containing a greater amount than the soft.

We have some very complete analyses of the ashes of different kinds of wood by eminent chemists.

It is advocated by some to burn the stubbles and thus make ashes. To effect this, burnt stubbles must be left long, and it then becomes a question whether the benefit of the ashes will counterbalance the loss of straw for our long winter's use. For our own part, we are inclined to think that the benefit (if any) of this practice arises more from the effect of the fire in the destruction of weeds and insects than from the small quantity of the ashes produced.

Let the farmer think as he will on these matters, yet he can hardly doubt the efficacy of wood-ashes as a top-dressing for his meadows

In the Netherlands, where their clover seldom if ever fails, ashes are looked upon as necessary for top-dressing

Numerous individual instances of their beneficial effects have been recorded, and Sir John Sinclair adds the public declaration of eighty-three practical Flemish farmers, that—

"They know by experience that when clover is not manured with Dutch ashes at the rate of 25 cuvelles per hectare (equal to nineteen bushels per acre), the following crop is very bad, notwithstanding any culture that can be given the soil; whereas they always have an excellent crop of wheat after clover, and doubtless in proportion to the quantity of manure above-mentioned being used."

The farmers who subscribed this declaration must have been deeply impressed with the importance of these ashes; for, besides being brought through the canals from Holland, they must in most cases have been afterwards carried from forty to fifty miles by land.

When ashes are used to top-dress meadows in Canada, it is customary to mix them with gypsum, and lay on in early summer.

We think, however, the better plan would be to lay on the plaster by itself in spring, and the ashes in the fall by themselves;

thus we shall secure a more liberal application of each of these valuable but differently constituted manures. Wood-ashes are so valuable to the farmer that it becomes a penny wise and pound foolish proceeding to sell them for the penny bars of inferior soap which are often received in exchange from the peddling ash-man.

Let us rather keep our ashes for our own use; it will in the long run pay far better.

Good wood-ashes weigh about fifty pounds to the bushel—of this $6\frac{3}{4}$ lbs. are soluble in warm water.

We find in the Boston *Journal of Chemistry*, the editor of which is also a practical farmer in New England:

"Of the soluble constituents of unleached wood-ashes there are little more than $4\frac{1}{2}$ pounds of potash and soda, the remainder being the sulphuric, muriatic and carbonic acids, with which the alkalies are combined.

Forty-three pounds are insoluble in water, and consist of;

Carbonate of lime...............	32 pounds.
Phosphate of lime..............	3 "
Carbonate of magnesia.........	4 "
Silicate of lime..................	3 "
Oxides of iron and manganese	1 "
	43 "

In leaching, the only change in ashes is in removing the soluble portions and adding about one pound of quicklime per bushel. There is not much change in bulk, but considerable addition to the weight from the quantity of water absorbed.

As to the commercial value of the ashes before and after they are leached, it is said:

In the dry state,

$4\frac{1}{2}$lbs. of potash and soda are worth 6 cents per lb.	27 cts.
Other soluble constituents..	3
32 lbs. Carbonate of lime..	3
3 " Phosphate of lime..	6
3 " Silicate...	0
Iron and manganese	0

This estimate gives the value per bushel of unleached ashes at thirty-nine cents. By leaching, thirty cents of the commercial value is removed; this leaves a bushel of leached ashes worth nine cents for its fertilizing constituents, though there should be also added silicates, which, having no commercial value, are useful as plant food.

A bushel of unleached ashes judiciously employed will return in most seasons sixty or seventy cents worth of produce. The leached ashes are also worth more to the farmer than nine cents per bushel. A good, honest bushel of moist leached ashes will give a return to product for the first year of fifteen or twenty cents.

These estimates are only rough ones, but still afford some clue to the relative agricultural values of leached and unleached ashes.

Something also depends upon the nature of the land upon which they are applied, being peculiarly beneficial to the lighter soils, especially such as have been deprived of phosphates.

Spread round trees they are of special benefit, not only as manure, but also as destructive to insect life.

One of the most efficient applications is found to be on potato hills.

We find reported the following remarks from Mr. Quimby, at a meeting of the Rochester Farmers' Club, on the value of leached ashes; they may well be read with care by those who are fond of speaking of the utter worthlessness of ashes after leaching :—" Leached ashes are good for all crops ; for corn in the hill, and especially valuable as top dressing for wheat and clover fields, and meadows generally. During the past three years he had drawn 10,000 bushels on his farm, which he spread on land at the rate of 200 to 300 bushels per acre. He had covered forty acres in this way, and meant to ash the entire farm. They had doubled his wheat crop and wonderfully increased his crop of grasses, especially clover. Land which had been run down too much to seed with clover, produced heavy crops when manured with leached ashes. He got a good catch of clover where he applied leached ashes last year on his wheat and rye, while the balance was a failure. He could see a great difference in the growing wheat where the land was manured with ashes and where it was not."

A successful orchardist being frequently asked how he made his apple trees grow so fast, replied, " I give them plenty of soap-suds and ashes ; so the potash manures them, renders them luxuriant and kills insects." The same says also : " From one-fourth of an acre of ground I raised last year (1869) sixty-five bushels of potatoes, which was a remarkable yield for an unfavourable season."

The secret of this product was a liberal manuring with ashes and soap-suds.

"A Subscriber" sends us the following as his experience in using wood ashes, viz., that in quantities of only eight bushels per acre they have a marked effect; that they push the wheat forward several days, thus getting it ahead of that critical period when it is so apt to be attacked by rust; that they strengthen the stem and increase its solidity.

The very best time to spread ashes, regardless of season, is as soon as they can be procured ; they can be spread at once from the waggon or sleigh in which they are hauled as easily as at any other time, and one time is almost as good to apply them as another —*i.e.* on grass lands—although we individually prefer fall and winter. " Having made this season some experiments with hardwood ashes and bone phosphate, side by side, on potatoes, I take the liberty to send the results obtained to your excellent farming journal.

"The experiments were made on about half an acre of Early Rose potatoes, in the following manner: In two rows, when planted, I put about one gill of phosphate; in next two, the seed was planted without any fertilizer in the hill; in two rows next to these, I put one gill of hardwood ashes in the hill, and thus this operation was repeated on the piece. The rows that were served with phosphate came up first, and looked the best the fore part of the season; but the latter part, the rows containing ashes were ahead. The rows that had to depend on nature alone were visible for a long distance, owing to a smaller growth of tops The land was loamy, and bore potatoes last season, consequently not in very rich condition to produce heavily.

"I dug the potatoes a few days ago, and found the rows in which the ashes were put to produce the largest and the most in quantity; the rows in which phosphate was put produced a fair quantity, but they were not so smooth and large as the rows containing ashes, the rows that simply drew their nourishment from the soil alone, produced quite a quantity, but nearly one-half of the potatoes were too small to cook. Planted two bushels and one peck of seed; dug twenty-seven bushels of cooking potatoes and seven bushels of small ones

"I have used ashes, both leached and unleached, for several years, and find that unleached pay me pretty well on corn, potato, wheat, &c. I can buy good hardwood ashes for twenty-five cents per bushel, while phosphate costs from one dollar fifty to two dollars fifty per bushel, showing, if ashes will produce as heavy a crop as phosphate, a large balance in their favour."—*Carlos, in Country Gentleman.*

PLASTER OF PARIS—GYPSUM, OR SULPHATE OF LIME.

"Gypsum," "Sulphate of Lime," or, as it is generally known, "Plaster of Paris," is used greatly, and with usually beneficial results, by the majority of our Canadian farmers. The fertilizing powers of this manure upon certain crops and on certain soils have been very favourably reported upon by many eminent American and British agriculturists

The name "Plaster of Paris" was given when gypsum first came into general notoriety, from the fact that large beds were found and worked in the hill of Montmartre, near Paris

The analysis of gypsum shows it to contain, of

	Parts.
Pure calcareous earth or lime, about	30 or 33
Sulphuric acid	32 " 43
Crystallized water	38 " 24
	100 100

Its dissolution in water, owing to the presence of a large proportion of sulphuric acid, is a process of slow accomplishment, requiring from four hundred and fifty to five hundred times its own weight of water. Its purity varies in different beds, and hence chemists have not well agreed in their respective analytical reports. A good test of its purity is obtained thus: Put the ground powder in an iron pot alone, over the fire; when it becomes heated it will give out a strong sulphureous smell, accompanied by a rapid bubbling; if this ebullition is brisk, and the substance will admit of a straw being thrust with ease to the bottom, it may be considered pure.

Traces of the discovery of gypsum are discerned in the writings of the ancients; but not until the last centuries were its properties generally known in Europe At that time some experiments of its use were reported on by eminent German agriculturists to the Economical Society of Berne, in Switzerland, when it rapidly spread over that country, France, and many other parts of Europe. It was, however, in America that its merits became most generally recognized. Indeed, it was exported to America in large quantities, and from the Delaware was conveyed as much as one hundred and fifty miles by land carriage, until discovered in the State of New York.

The stone, when ground to powder, produces from twenty to twenty-five bushels per ton.

Experiments were made in England of the relative values of plaster simply ground and when calcined. It was thought that by burning, much of the water contained might be expelled, and thus the proportionate weight be greatly reduced The water cannot, however. be expelled from the sulphuric acid except by the most violent heat, and thus the attempt was found practically useless, and was consequently abandoned; also, experiments upon the use of plaster when calcined proved that there was an almost imperceptible difference between its effects when burned and when simply ground

Upon our light and sandy soils the effect of gypsum seems to be most rapid and lasting, and in Canada we find that the farmers on the lighter soils apply it more generally than those on the clay lands. Upon wet land this manure has little or no effect. The growth of young clover is very materially quickened by a good top-dressing of plaster, and its benefits are more particularly observable in its application to all leguminous plants This manure, like lime, is a stimulant.

We have seen it used on fall wheat with various results. No doubt, it stimulates and starts a young wheat crop, but it also gives the young plant an unnatural push, which weakens its strength, and thus materially reduces its power of standing a long and severe winter. Its application in the spring on winter wheat we believe to be of great benefit. Not only does it push forward and revivify the young wheat plant after its long torpor, but it is upon the ground for the benefit of the clover crop.

Its exact means of action upon the growing plant yet remains clouded in much doubt and uncertainty. It is very generally supposed that its effect is due to its power of attaching moisture to the plant upon which it rests. Sir Humphrey Davy, however, contradicts this, for he says that even allowing gypsum to have a great attraction for water, yet the same substance, owing to the large proportion of sulphuric acid, also retains its moisture most strongly, and therefore would give it off very slowly indeed to the leaves and roots of plants with which it may be brought into contact. Moreover, this great chemist denies the fact that gypsum has a strong attraction for water, and gives the following experiment in support of such denial: One and a half ounces of gypsum were exposed for three foggy nights to the air, and on the third night, being weighed carefully, it was found that the increase was not quite half a grain.

It has also been urged that, when applied to clover just before rain, its effects were not perceptible. No doubt this has been owing simply to the fact that the rain has washed it off the plants into the ground, where its effects upon the plant by the root would not be so observable, because not so rapid; and yet it is well known that that part of the field upon which it has been spread invariably retains the dew for some time longer in the morning than those parts upon which gypsum has not been laid.

Even with these contradictory reports and opinions before us, we may, at any rate, be certain that its benefits are great upon many crops—wheat, spring grain, corn, turnips,—but more especially upon clover and the grasses. For our own part, we consider that in this very power of retaining moisture consists the great value of gypsum as a top-dressing in this country.

When all other sources from which moisture may be drawn fail the plant, the gypsum is giving out its moisture, very slowly it is true, but in sufficient quantities to keep the plant supplied, and growing from dew to dew and from rain to rain. In England, where they do not often suffer from a too dry atmosphere, the opinions of farmers upon the use of gypsum are very varied, and it does not seem to have anything like as proportionate a value as it has upon this our drier continent.

At one of the regular meetings of the Ancaster Farmers' Club, last winter, when speaking on the subject of plaster, brought forward in an able essay by a gentleman of that locality, although some difference of opinion appeared to exist as to the time of application and the immediate action of this manure, yet the immense benefit to be derived from a generous use of gypsum on many crops, and more especially upon clover, was most cordially endorsed, and proved by reports of different experiments by the majority of the most successful farmers in that locality.

On the time of application the *Canada Farmer* says:

"There is great diversity of opinion in regard to the best time to sow plaster. Much will depend on the state of the weather during the season. If the spring is dry and warm, early sowing would be best, say as soon as the clover leaves are expanded. If wet, cold, or backward, it would be best to defer sowing till dry, warm weather sets in."

From one and a half to two bushels of plaster is a fair dressing for clover.

Plaster, it is said by some practical farmers, is hard on land. Growth is hard on land, and nothing can be said more truly in favour of the use of plaster to increase growth than to assert that "it is hard on land."

But the farmer should remember that he not only sows plaster to increase his crop of clover for hay, but also to make a better growth to plough down.

That if he increases the growth of his corn fodder, hay, &c., he may thereby also increase the size of his heaps of barn-yard manure.

Practical men tell us that they can sow plaster on a field of clover in the shape of their written name, and the writing will be plainly marked by a rank dark growth, and we believe them. Our best Indian corn raisers always use plaster, and it is found beneficial on trees, vines, vegetables, potatoes, turnips, &c., &c., and upon all grain.

Salt, for the use of the land, has now for many years occupied the attention of leading agriculturists, and many and various have been the results deduced from frequent carefully conducted experiments in different parts of the world. These results have varied upon different soils, and under different conditions as to climate and modes of application.

Owing to the several forms in which salt has been discovered, there has arisen a difficulty among scientific men as to calling it a mineral, but we shall not be far astray when we class this product among the mineral manures.

Salt, as a stimulant, is various in its action, according to the mode and quantity of its application. If used in great quantities, it has a tendency, like lime or any other energetic stimulant, to destroy and rapidly disorganize all vegetable matter with which it may come in contact. When, however, this substance is used moderately, or mixed with compost, its action is that of a gentle stimulant, giving increased vivacity to the vessels of the plant, even as it does to those of the human body, consequently promoting vegetation and acting as a useful manure.

Upon a naked fallow it has been recommended in large quantities, in order to hasten the decomposition of any existing vegetable matter or putrescent manures. Its effect is in this case precisely similar to that of lime, and its quantity, when applied to fallow thus, will have so far diminished by incorporation with the soil by the time that grains are sown, as to act upon the crop with moderate stimulating power.

Salt is plentiful in Canada, and it is a matter of regret that we have not more practical experiments on record as to its use for manure from our farmers, especially those in the neighbourhood of Goderich and salt-producing parts of the country.

Salt supplies soda and chlorine to vegetation, and is capable of entire absorption by the growing plant. It also imbibes water very freely, and retains it for the use of vegetation—keeping the soil with which it is brought in contact in a moist state.

It renders soluble many of the earthy salts contained in the soil, and, as it is very penetrative, finds its way rapidly down to assist in the decomposition of deep-lying vegetable matter.

It is also a corrector of acidity and dissolves silica , for the latter reason, it cannot but be of use to the stiffening of straw

Its effects seem to be of little use on heavy lands. This, however, requires more test from actual experiment ere it be made a positive assertion.

If added to dung, it, like lime, hastens fermentation, but does not, as the latter, let free ammonia and other volatile parts of barn-yard manure. When in combination with Plaster of Paris, it forms and sets free soda and sulphuric acid.

By the tables on pp 132 and 137 it will be found that both swedes and mangolds require a large amount of salt in their composition. And experiments made in England under Dr. Voelcker go to show an immense increase in these crops, as the result of liberal applications of salt

When applied, the rate generally recommended is from five to ten bushels per acre—a wide variation, but opinions on the beneficial influence of this article differ as widely

It would appear that salt is particularly effective on wheat crops, when incorporated by cultivation with the seed bed.

Lime.—All matters which, when applied to our soils, increase their fertility either by mechanical action or by the supplying of certain elements of plant food, may be fairly considered under the head of "Manures." Lime may, then, be termed a "calcareous manure," and is often of great benefit to our soils. By the discoveries of science, and the experience of practical men in the application of those discoveries, we have learned the great usefulness of lime as a manure.

Lime may be used in one of two states—*quick* or *slaked*. After limestones have been subjected for some time to the action of intense heat, they burn into a substance very caustic, and having an immense effect in causing the rapid decomposition of vegetable and animal bodies. This substance is *quick lime.* If water be applied to this quick lime, or if it be simply exposed to the air, it loses with more or less rapidity, according to which process be adopted, much of its caustic or burning power, and becomes "slaked" or "effete."

Now, the difference between quick and slaked lime is simply in rapidity of action upon substances with which they may be brought in contact—the former hastening decomposition much more rapidly than the latter. When the object of an application of this manure is to destroy and hasten the rotting of vegetable or animal matters, the quick lime has the best effect.

The action of lime is almost entirely mechanical, although it does directly impart a certain element of food to plants, as is proved by chemical analyses, in that calcareous earth is found in the ashes of all vegetables, and in large quantities in those of wheat or clover In 100 parts of wheat straw there are found 5 parts, and in wheat 3·35 parts, of phosphate of lime. On the other hand, seeds planted in a pot of carbonate of lime will grow very feebly —in clear lime, will die Partly fill with garden mould and cover over with lime, and the plant will put down its roots through the lime to the mould, without throwing out branch rootlets until it arrive at the mould.

Great care must be used in the application of this manure, for it has different effects upon different soils and under different conditions. These conditions are so contrary, that while in many cases lime has been shown to have a most beneficial effect, in others its application has been fatal to all vegetable growth.

Lime has a strong affinity for acids. Its application to land, therefore, is beneficial in the following ways: It either renders harmless or converts into usefulness substances lodged in the soil, which, by their acidity, or, as named by farmers generally, "coldness," may be injurious to the growing crops, and thus prepares the land for the reception of seeds; it also greatly increases the rapidity of decomposition of putrescent manures, thus making them more easily available for the nourishment of vegetable life.

Lime has a great effect upon decayed and decaying vegetable matter, or. as we know it, "mould." There is no doubt that its application is of great benefit on "sour clays," for it corrects their acidity, and warms that sour mould which has been useless hitherto to plants, because it has required a quickening power to stimulate its further decomposition; also to land which has been at some time previously well dressed with "dung," without any addition of calcareous matter, by hastening decomposition and rendering every particle of the rotting or putrescent manure available to the growing plant.

Now, in all arable lands, however much such may have been "run out," there still remains a large proportion of mould. Lime applied upon such land will quicken all that plant food which is lying dormant, and will greatly benefit the ensuing crop.

Let it be borne carefully in mind that lime has the effect of drawing out and placing within reach of the crop all the strength of the land, and it becomes evident that, if its application be not followed by more manure, it will have the effect of rapidly exhausting the land.

It is useless, and indeed injurious, to lime too often; for if our land become surcharged with lime, having no putrescent matter to act upon, it will act too directly upon the crop itself, and greatly injure it.

Many farmers have, by advice, used lime on certain lands, and found that they have thus increased the yield of the ensuing crop. From this result they have deduced the truth that it is a grand manure, and have again and again applied it without further barn-yard or green manure, to the utter exhaustion of the soil and the certain failure of future crops. Lime is a stimulant, correcting acidity and quickening the action of vegetable and animal manures, and, like all stimulants, is good when used in moderation, but fatally exhaustive when taken in excess.

Low lands are immensely benefited by a free use of lime. Our low lands are generally rich, with a deep black mould, but owing to their coldness, crops are not as heavy as the richness of the soil would lead us to hope. These soils contain in themselves all the component parts of the best soils, and are rich in decayed and decaying vegetable substances, but the manurial qualities in these lands are sluggish and inert, and will not freely give of their richness to the growing plant until stimulated by a free use of lime.

Heavy clays are often deficient in calcareous earths. In such lime is needed, and has often, too, the purely mechanical effect of making the soil more friable, and less subject to run together after rain.

Upon sandy land, which seldom contains much vegetable matter, lime has a contrary but good effect, attracting moisture from the atmosphere and giving more consistency to the sand, even as sand and lime become mortar.

"But if the soil consists of clay and sand," as Finlayson says in his Practical Essays on Agriculture, "containing animal or vegetable matter in a torpid state of decay, then lime would be preferable to dung. The state of the soil should therefore be minutely inquired into before lime is employed, and it should only be used to give effect to the inert substances with which it may be conjoined"

We cannot but think that a very free and liberal application o lime, ploughed in with our new lands when broken up, would increase their fertility wonderfully, for such lands are rich in vegetable matter, but are cold, inert in action, and acid. On such land we should use quick lime, as its effects are the more rapid, and it will destroy weeds and injurious plants.

The authority quoted above also says:—"There is this difference between the actions of lime and barn-yard manure upon land: The former, being more stimulant and corrective, helps the farmer to an abundant crop at the expense of the land alone, while the latter furnishes the land at once with fertilizing fluids, and will ensure a good crop on a place perfectly barren before and after the application of lime."

Lime is of great value to pasture land. So great an affinity has it for acids that it will greatly sweeten the herb. Indeed, if lime be spread upon a tuft of grass that has been refused by cattle, it will be found that they will soon detect the greater sweetness, and will eat it close down. When used for this purpose it must be slaked, for quick lime would be apt to burn the grass if used in any but very small quantities.

In the "General Report of Scotland," it is remarked, that "In the best cultivated counties, lime is now generally laid on finely pulverized land, while under a fallow or immediately after being sown with turnips. In the latter case the lime is uniformly mild —in the former, quick lime, as pernicious (in a certain extent) to vegetation, may be beneficial in destroying weeds, and some experiments have been recorded showing it to have a very powerful effect upon the fly Sometimes mild lime is applied in the spring to land, and harrowed in with grass seeds, instead of being covered with a plough; and under this management a minute quantity has produced a striking and permanent improvement in some of the hill pastures of the south-eastern counties. Its effects are yet conspicuous, after the lapse of nearly half a century In some places lime is spread on grass land a year or more before it is brought under the plough, by which the pasture in the first instance, and the cultivated crops subsequently, are found to be greatly benefited. But in whatever manner this powerful stimulant is applied, the soil should never be afterwards exhausted by a succession of grain-bearing crops—a justly exploded practice, which has reduced some naturally fertile tracts to a state of almost irredeemable sterility."

Lime may be, and often is, used as a top-dressing on wheat, and the results of this proceeding have been various. Lime will have a better effect if applied to the land before it is shallow-ploughed the last time, or sown broadcast, and harrowed in with the wheat. Strewn sparingly over the young turnip plants, it is stated that it prevents the attack of the turnip-fly; and harrowed in when the ground is naked, if the quantity be considerable, slugs and wire-worms disappear from its effects.

Many Canadian agriculturists have experimented with lime.

Some have given us results in the Canadian agricultural press. Let us have more experiences, and thus ventilate the subject, and give us the bounds within which we may steer, in order that we may improve the fertility of our lands without exhausting our soil or ruining our crops.

Under a system of deep cultivation, such as is now generally adopted in Great Britain, lime is laid on in very heavy quantities at long intervals of ten or fifteen years apart.

But as our system of cultivation in Canada is usually shallow, if lime were laid on in very large quantities, a great amount would, before eight or ten years have elapsed, find its way through the soil, it being of an exceedingly penetrative character, and be lost to the use of vegetation by incorporation with the hard pan below. The better plan in Canada is to apply at the rate of from ten to thirty bushels per acre, at intervals of say five to seven years, the best time being in the regular rotation on summer fallow before wheat, or, where no summer fallow is adopted, by incorporation with the surface soil of the fall wheat seed-bed

Upon soils that are wet, and retain a large amount of moisture, the benefit from lime would be found *nil*. Such lands must be first thoroughly drained.

It has been thought that lime, slacked for a length of time, is valueless as manure. This is, however, far from being the case. Suppose lime to have lain exposed for six months; about one-half of it will have become converted back to carbonate of lime, whilst the remainder is equally as good as fresh burnt lime; moreover, carbonate of lime is exceedingly valuable as plant food.

The lime rubbish from under old houses, or refuse of builders about newly-erected stone and brick houses, is full of nitrates, and, consequently, of no mean value as a manure. We find it highly valued as such by gardeners.

The idea has very generally gone forth, that land in the neighbourhood of and over limestone rocks does not require the addition of lime for artificial purposes. Now, should such soil be itself of a calcareous nature, there is less need for the application of lime; but as a matter of practical experience, we have often found land lying directly over a limestone rock to be very deficient of lime in its composition.

On this point we have also the evidence of Dr. Voelcker, analytical chemist to the Royal Agricultural Society, England, who says:

"In the analysis of some soils from the Cotswold Hills, in Gloucestershire, I was surprised to find that they did not contain more lime. These soils being the products of the decomposed strata on which lime predominates, the presence of lime in large quantities would be naturally inferred." He explains the matter thus: that a large proportion of the calcareous matter is being constantly dissolved and carried down into the sub-strata by the infiltration of rain water charged with carbonic acid.

Similar observations on land over limestone ridges are very frequently reported from Pennsylvania, New Jersey, and other States in the Union, whilst we have ourselves observed the same apparent anomaly on the limestone ridges on either mountain to the north and south of the Dundas and Hamilton Valley, in Ontario. We believe that the opinion of Dr. Voelcker must be now modified, since the days of deep cultivation in England. It is a strong point in favour of general and judicious deepening of cultivation, that it brings up lime with other ingredients of the soil where such are present.

Lime is of great benefit in moderate quantities, and incorporated with the surface soil around the roots of growing fruit trees.

To spread on land, haul out lime in a quick state to the field, in the fall, and dump it in small heaps, as a basis of quantity per acre, one bushel every four rods each way will give a dressing of twenty bushels to the acre.

Exposure will soon slake this lime, so that it becomes quite powdery, when it may be spread evenly over the land.

It should be incorporated with the soil by means of cultivator or harrow, and should never be ploughed down deep; for, as we have already said, lime is very penetrative in its action, and will work downwards into the subsoil.

Great care should be exercised that, before spreading, the lime be in a pulverized state; if it is lumpy, much of the benefit is lost to soil and vegetation.

Lime at twenty-five cents a bushel, covering expense also of hauling and applying, is not a dear fertilizer. When we consider that professional lime burners can manufacture and draw eight or ten miles for twenty-five cents per bushel, surely lime can be utilized by the large farmer who has a limestone ridge within easy distance or on his property, for a very much less sum per bushel.

In portions of Pennsylvania, near the coal regions, many farmers burn their own lime at a cost of three cents per bushel. A farmer who has limestone upon his farm could hardly do a better thing for himself than to visit western New Jersey and Pennsylvania. The sight of the blooming wheat and clover fields, and of the corn fields of thirty to forty acres each, turning forty or more bushels to the acre, would, without much doubt, convert him to the liberal use of lime upon his own acres.

As a summary of foregoing, the following general rules may be worthy of careful consideration:

1st. Land must be thoroughly dry before it is in a fit state to receive lime.

2nd. It may be laid on the land at almost any season, but during dry weather in the fall is the best time.

3rd. Should not be used until reduced to a powdery state, and then should be incorporated with the surface soil

4th Clays and strong soils will require a fuller dose than those of a lighter nature.

5th. Lime being a strong stimulant must not be used too much. Requiring to decompose *some* matter, care must be taken that there be vegetable matter or manure in the land upon which it is applied, else it will act directly on and destroy crops.

GREEN CROPS FOR MANURE.

Succulent growth of plants, such as clover, buckwheat, rape, vetches, &c, ploughed under, go by the name of green manures.

The ploughing under of such plants has been found of immense benefit in increasing the fertility of soils, especially of those of a gravelly, sandy and generally light nature. The practice is now fully recognised in Canada, and, when adopted, is attended with excellent results.

The question, whether it would not pay better to cut the green crop off and feed it to cattle, returning the manure to the land, rests solely upon the relative cost of making, hauling and applying farm-yard manure, and the value of meat.

As meat so frequently falls to a very low price in Canada, it is very doubtful whether the increase of animal matter in manure, and the value of our stock, will counterbalance the above-named expenses resulting from the manipulation of manure. This is, however, a point to be carefully weighed by each farmer for himself

The chemical effect of ploughing under succulent plants is simply the return to the soil of all plant food, such as ammonia, nitrogen, carbon and the constituents of water, absorbed during growth by the thousand mouths of many-leaved plants from the atmosphere.

The gradual decomposition of such vegetable matter likewise affords a constant and steady supply of manure to the soil, which renders the effects of green manures more lasting than those of such as is made in the barn-yard.

It takes several seasons for green manure, such as clover, to thoroughly rot in the ground, and until that end is consummated it is giving forth plant food to the soil, and in a form readily soluble to vegetation.

Clover has been called by one of the most celebrated of the agricultural chemists of the day the "great renovator," and as such it is looked upon by the intelligent Canadian farmer.

The fact is patent to the most ordinary observer that the Canadian farmer has not enough of the "muck-heap" to supply the yearly wants of his soil, and as an addition he properly looks to green manuring.

Professor Voelcker says that "A good crop of clover which has produced one heavy crop of hay, and which has been allowed to stand for seed, will add to the land a fertility for wheat which could not be attained with the heaviest practical dressing of guano; but to do this in the best possible manner, the clover must be allowed to come to perfection; must be treated so that it will produce and leave on the ground the greatest possible amount of leaf and root, for in those two portions of the plant consists the virtue of the clover crop."

We in Canada find that unless the clover be ploughed under very early in August, it will not rot sufficiently to benefit the fall wheat. This difference between our system and that adopted in the British islands is doubtless owing to two facts: one, that our climate is much less humid than the English; and another, that we have to sow our winter wheat earlier than there.

For this reason we find the best time in our rotation for the ploughing under of green clover to be for our root crop, or for summer fallow, or to be followed by peas as a cleaning preparation for fall wheat.

Clover is the very best application for manuring steep hills. In our own neighbourhood, some of our best farmers work very steep conical shaped hills; they clover heavy to the very top, plough it down and manure on top; they then obtain excellent crops of wheat on the very crowns of their hills.

Clover ploughed down on hill tops is a manure of a nature not easily washed away.

And if dung be applied on the clover before turning under, its strength will be absorbed by the plants and held at the top of the hill for the use of the succeeding crop. We shall speak more fully on this as a green manure in the pages devoted to the grasses.

Turnips as a green manure.—Whether it would pay to grow turnips for manure we are not prepared to state, but we find the following observation from a practical farmer, Mr. A. B. Ball, Stanstead, Canada, on the effects of a crop of turnips that were frozen in the ground by the early advent of winter. He says in the *Canada Farmer:* "I had two acres of turnips frozen in, and another acre of ground on which I had grown corn for fodder.

"On these three acres I sowed what is called mixed grain; that is, one-half oats and a quarter of each peas and barley: this is grown and used for provender. From these three acres I harvested three hundred and three bushels, and this without any further manuring than that given to the crop the previous year.

"The acre where the corn grew was not nearly so stout as that where the turnips had been; the straw being shorter, and the heads not nearly as well filled nor as long.

"The yield of this mixed grain is usually from fifty to sixty bushels per acre, sometimes seventy-five; consequently you can see that I had an extraordinary crop on the turnip grounds—from one hundred and fifteen to one hundred and twenty bushels per acre.

"I mentioned this crop to my neighbours; but as only a few had any turnips, and fewer still had lost them, they had not had an opportunity of witnessing the result produced by a turnip crop frozen in and used as a manure."

Buckwheat may be used in certain cases as a ploughed down green manure to great advantage.

The fertilizing power is not so great as that of clover, nor is the raising of buckwheat for a manure as practical or profitable on ordinary land as clover. But, owing to the coarseness of its stem, it may be often used in this way very effectually upon heavy clay lands; such as, from want of careful cultivation, have run together and become closely compacted.

The big coarse straw keeps apart the atoms of soil, and thus admits air and thorough percolation of water; while the slowness of its decomposition keeps the land thus opened for a long time, and gives every opportunity for making it friable by thorough cultivation.

The ground, to be generally benefited by the application of green manures, should be capable of bringing them forth with such an abundance as to produce a complete shade to the surface during their growth, and a large enough mass of vegetable matter to cause rapid and constant fermentation when buried by the plough.

By this means we secure two desirable results—an increased amount of fodder or pasture, and a great bulk of rich manure of a very fertilizing nature.

Where the green manure system is adopted in Canada, the operation should be repeated so often that at no time, in the course of a rotation, should the decaying vegetable mass be imperceptible in our soils.

FIELD CROPS.

"The autumn fields are fringed with gold,
The autumn breeze is sighing;
The swallows flit to foreign climes,
The summer flowers are dying;

"The lanes are strewn with falling leaves,
The sky is overclouded;
The pattering rain falls ceaselessly,
The lake with mist is shrouded;—

"All, all around us Nature seems
To weave a web of sorrow,
And winter comes with stealthy pace,
To deeper shade the morrow;

"Yet shall the autumn's gloomy days,
And winter's deeper sadness,
Prepare the coming of the spring,
And summer's brighter gladness."

Wheat.—Wheat should ever be the keystone of Canadian farming. To bring his land up to a condition fit for the growth of large and abundant crops of wheat, should be the object of the agriculturist. The food of the world depends upon the growth of wheat; and we find that when wheat is plentiful, all manufactures flourish, and nothing has the same power to affect general markets as have the rise and fall of the demand and supply of bread—the staple of life.

Canada is essentially a wheat-producing country. Her climate and soil are well adapted to the growth of this cereal, and she has at command great facilities for placing her grain upon the markets of the world.

There was a time when wheat grew and flourished in Canada without any uncertainty; when crops were great and diseases unknown.

The rich virgin soil, formed by the decayed vegetable matter of countless years, appeared to be inexhaustible. The surface had "but to be tickled with the plough to laugh into a crop."

But year by year the natural richness became exhausted. Nothing was returned to the land, and the soil in the older parts was taxed to that extent, that its productive power fell to a low ebb indeed. So debilitated at last became the farms, that their produce was weakened, disease and parasites stepped in, and completed the downfall of wheat from the category of successful and paying crops.

Yet our soil is of that superior nature, and our climate so well suited to the wants of the wheat plant, that Canada is capable of producing as heavy crops of wheat, acre by acre, as the best cultivated lands of the old countries or the virgin prairies of America.

Not only has our soil, in the more civilized parts, been worn out, but the seed has also greatly degenerated—become prone to disease, and fallen a victim to the attacks of the parasite.

The Canadian farmer, if he would see his land produce a paying crop of wheat, must look well to its cultivation and to the nature of the seed employed. We have just recovered from a fearful visitation by "the midge;" let it be a warning to the slovenly, for assuredly our crop was rendered more subject to its baneful influences by weakness of the soil, deterioration of seed and the consequent inability of the plant to grow rapidly and stoutly in *spite of "midge."*

We regret to have seen, in more than one number of the English agricultural press, accounts in disparagement of the wheat growing capabilities of Canada. Writers on the world's production of breadstuff have of late years, looking at our returns, had too much reason to assume that we cannot produce a supply adequate to our area and population.

This is not, however, the fault of the capabilities of our soil and climate, but of the carelessness of the cultivator. The soil is now gradually coming back to her primeval strength, and in the hands of many of our more intelligent practical farmers, crops are yearly increasing per acre. Hasten the day when we shall stand where we ought, at the head of the wheat-producing nations of the world! None doubt the quality of our produce. May the time arrive quickly when quantity shall be commensurate with quality!

*A*1 Canadian stands at the head of flour brands in the Liverpool markets.

Many an old farmer can tell us of the times when Canadian soil has yielded thirty, forty, and even fifty bushels per acre. We are afraid the average to-day is hardly up to twenty bushels per acre.

We must raise more crop per acre, or our farms cannot pay a fair interest on capital invested. When we raise better crops per acre, the capitalist will think of investing in agriculture.

In England, wheat has averaged for the last fifteen years about one dollar and a half per bushel, with labour at, say, forty or fifty cents per day; while in Canada the prices have been, of wheat about one dollar, and of labour from eighty cents to a dollar per day.

There will in the future be little fear of wheat falling below an average of one dollar and twenty-five cents per bushel, for the increased circulation of money and the rapid multiplication of the population of the North American Continent will keep up the value of Canadian wheat, while increased facilities of cultivation and of exportation will cause an ever-increasing demand.

Continental summer heat carries wheat and corn far north in America, while a winter of some severity seems to be demanded for the best class of wheat all over the world.

Canada and parts surrounding them owe much to the beneficial effects of the great lakes, which equalize the naturally changeable climate of these portions of North America.

These lakes absorb solar heat during the very hot months, and give it forth to the use of surrounding territory when there is a deficiency of warmth upon the land.

Fall Wheat is divided into two general species—*red* and *white.* The red varieties are generally more hardy, and are less subject to the attacks of rust and insects than the white. The outer husk is of a coarse nature, varying in degree in proportion to the humidity of the soil. It is therefore less valuable to the miller, but of late years has been more productive, because more hardy, than the white sorts in Canada.

It will be found, attacks of midge and disease set aside, that the red or hard varieties do better on heavy lands, while the fine wheats require a more friable soil to secure a profitable return.

The varieties in use in Canada at the present date are: Diehl, Soules, Wildgoose, Treadwell, Red Chaff (nearly obsolete), Mediterranean, Midgeproof, Lowe, White China, Kentucky White, Hack, Boyer, Michigan Amber, &c.

Of these, the most common have been for the last few years the Diehl, a white wheat, and the Treadwell, a reddish wheat.

The Diehl has short stiff straw and very plump well-filled ears; it is an agreeably deceptive variety, usually thrashing better than it promises in the field.

At present, not only in Canada, but in the States, it is next to impossible to obtain the seed pure and unmixed with other varieties.

The Treadwell (red) is a more hardy variety, stands the winter better and stools out freely. It is also proof against the midge, and if sown late will come out in the spring far better than any variety now at our command.

Mr. Zimmerman, of Nelson, Ontario, gives to the *Canada Farmer*, 1870, the yield of several of these kinds on his own farm in the previous year. It is worthy of note as affording a practical comparison:

Diehl	32	bushels	per acre.
Soules	30	"	"
Treadwell	25	"	"
Red Chaff	20	"	"
Wildgoose	16	"	"
Midgeproof	16	"	"
Mediterranean, only	10	"	"

He, however, gives the preference to the Treadwell, as a generally profitable crop for the farmer.

Mr. Cull, of Toronto, thus writes to the same paper in 1869:

" My object in sowing the different kinds of wheat this year was chiefly to test the liabilities of each kind to the midge; and also to see whether a wheat stubble field of which the soil was a poor blowing sand, if well manured, and sown again direct, would produce a crop.

" The different sorts were White China, Soules, Treadwell, Kentucky White, Midgeproof, Mediterranean Midgeproof, Club-shaped Ear (name unknown), and common Red Midgeproof. The Treadwell does not seem any earlier than either the White China or Soules; the Kentucky White was almost all winter killed; having sown it now three years, I would not advise any one to do so hereafter. The Soules, of course, is, as usual, excellent; the Club-shaped Ear also good; the White China also; but the Treadwell is best of all. The other sorts, although very rank and tall, have badly-filled heads. No midge has made any perceptible inroads on any of the seven varieties."

Good wheat land should always possess a certain degree of consistency, and as a rule the clays, supposing them to be passably dry, are the best adapted for its growth.

Though the gravels and even sands often produce an excellent quality of wheat, as instance the plains between Paris and Woodstock, in Ontario, yet are large yields more certain from the heavier soils.

The majority of the annual prizes given by the Canada Company at our Provincial Exhibitions have been gained by farmers from clay regions, particularly the Township of Scarborough, and in the neighbourhood of Richmond Hill, to the north of Toronto.

Yet if we have a sufficiency of lime in our sandier soils, to the amount of not less than fifteen per cent., we have an excellent soil for wheat; but such must also contain a sufficient amount of *humus*, or mould, to render it of sufficient consistency.

Pure sands are unfavourable to the growth of wheat, for such are deficient in that degree of firmness which is necessary to support the roots.

The crop is liable to failure on such land, both from the severity of winter and from drought in the hot months.

We would not, however, be understood to assert that sand is always unfit for wheat, but only that such is the case in pure sand.

The sandy soil may, by good cultivation, and the use of clover freely ploughed down, be changed into the nature of a loam, having the necessary amount of mould or decayed vegetable matter to render it firm and to supply plenty of nourishment to wheat.

There appears to be a general prejudice against the growth of rye, but it is the best fall crop for very sandy lands.

Cultivation.—On lands of a heavy nature, the summer fallow is the proper mode of cultivation for wheat. In our chapter on cultivation this is fully treated of. We would now only add :—

The land intended for wheat having been duly prepared during the summer, by a summer fallow, or the cultivation of some preparatory crop, as peas, barley, or clover, the finishing touch is given about a week before seeding time by a last reversal of the soil with the plough. This is a matter of some moment, and should be not only carefully done, but a due regard given to the requirements of the soil and the crop. If a sod has been turned over for the summer fallow, or pea crop, it is usually ploughed under to no great depth; at the cross ploughing the implement is run deeper, so as to break up the hard pan and stir up the subsoil; and this raw material having been subjected to amelioration by a succession of harrowings and by exposure to atmospheric influences, the last turn of the soil before seeding should thoroughly intermix this with the now decomposed sod, and form a seed bed containing a due admixture of both mineral and vegetable food for the support of the wheat plant.

The lay of the surface and nature of the subsoil should regulate in a great degree the last ploughing of land to be sown with fall wheat.

Where land is not under-drained, there will invariably be spots where water is apt to lie. This is, during the spring, in which we write, very observable all over Canada, a large area of fall wheat having been killed out during the winter last past in just such spots.

On heavy land the ridges require to be rather narrow, and very gently sloped from crown to furrow, and we have always preferred to run the furrows diagonally across the slope of the land—this plan saves many extra water furrows.

It is in the gradually rounding of the lands that the good ploughman shows his skill.

A free outlet must be given at the lower ends of slopes for the escape of surface water run off by furrows.

If furrows require to be ploughed out, the dirt thrown up should be levelled off on each side with a hand rake; it is a short job, and we have seen water often dammed back on wheat by the banks of furrows that were drawn for the very purpose of carrying off the surplus.

Where wheat is killed out in fall and winter, in the majority of cases its place will be taken by a growth of chess and other foul weeds.

Men reasoning purely upon scientific grounds are assured that the best position of wheat is on a clover sod. Dr. Voelcker tells us:

"I believe a vast amount of mineral manure is brought within reach of the grain crop by growing clover. It is rendered available to the roots of the grain crop, while otherwise it would remain in a locked up condition in the soil. Clover, by means of its long roots, penetrates a large mass of soil. It gathers up, so to speak, the phosphoric acid and the potash which are disseminated in the soil, and when the land is ploughed the roots are left in the surface, and in decaying they leave in an available condition the mineral substances which the wheat plant requires to enable it to grow."

The practice is universally adopted in the southern parts of England, but let us mark in the north of England it has been entirely discarded.

The same reasons that led to its discontinuance in Yorkshire and Cumberland have force to a still greater degree in Canada.

Clover in order to benefit wheat must be to a considerable degree in a state of decomposition.

A sufficiency of time and wet weather must be obtained between haying and sowing to rot the sod at all. These two qualifications we cannot attain in Canada.

We can seldom find time to plough down clover before the middle of August, nor do we usually have rain in any quantity at that season, and we must have our wheat sown early in September.

We have seen individual instances of successful crops of wheat on a clover sod, but in every case the young clover was ploughed down very early. If, however, our sod be ploughed down for a summer fallow, then have its roots and stems had plenty of time to decompose into the form of mould ; then "the very best preparation, the very best manure for wheat, is a good crop of clover."

"Sometimes a farmer is tempted by appearances which indicate that it will be a lucky hit to plough sod ground as late as August and even September, and sow to wheat. And if a paying crop is realized by such culture, it may be regarded indeed as a mere 'lucky hit,' and not as the result of suitable culture for the crop. It would be desirable in many instances to sow wheat on a field that has been mown the same season, but experience teaches it is very unsafe to do so. There may be cases, as where a field is very fertile, and under a clean clover sod of only one year's growth, in which the soil can be put in fair condition for the wheat crop if ploughed after the clover is mown. But even then it is only a second-rate way of preparing the soil to grow an important crop ; and if the sod be timothy or red top—old and firm—the chance for a crop of wheat by ploughing it after haying will be poor indeed.

"In the first place, there is not time to kill the grass roots by working the land before the time of sowing, and as a consequence considerable grass will make its appearance in the crop the following season. The grass roots, not being decayed, furnish but little food to the wheat plant, and the whole soil is in fact in too crude a state to promote vigorous growth in the wheat. It may be rich enough, but the richness is not available.

"Wheat needs a soil that has been thoroughly worked, and in which all the plant food, whether it comes from barn-yard manure or sod, is reduced to a condition to be available in growing the crop. Hence it requires a summer fallow, or it must follow some spring crop which has been well tilled, and which has taken the crudity out of the land and fertilizers. The manures for wheat should be fine, well decomposed, and not such as might be used with good results on corn, like fresh barn-yard manure. As wheat is the most delicate grain, so it needs the finest and most perfect culture."—*Rural Home.*

As to the best stubble for wheat, we should prefer that of the pea ; this decidedly, as we have known it to do as well as the best summer fallow. The pea seems to enrich the land—in this respect related to clover. Its long haulm and the *debris* it deposits, its shade,

&c., are all favourable to the improvement of the soil. Especially where there is a sod turned down is this the case. Barley comes next, and oats last. We now speak from our own experience. Where the various grains have been in one lot, the pea always took the preference ; and the heavier the crop the larger would be the yield of wheat. This especially when plaster was used on the pea. Between barley and oats there was but little difference, though some, the oat land yielding generally a dirty, unsatisfactory crop. But this being the poorest soil, should be considered. Such soil, if no manure can be used, and it is persisted in putting it to wheat, should have at least a dusting of ashes. Apply any quantity ; no danger there will be too much ; this especially with leached ashes, which are nearly as good as the unleached, and will feed the crop while it lasts, and be a benefit to the seeding, where that follows, for years

The following is the substance of an essay read before the County of Northumberland Agricultural Society, by Mr. C. Powers, some forty years ago, and lately given to the farmers of the Province in the columns of the *Canada Farmer :*

" Although it may be raised to considerable advantage on several kinds of soil, still a clay, mixed with what is called a vegetable or black soil, is undoubtedly the best. That kind of soil which has the greatest absorbent power with respect to atmospheric moisture is the most fertile.

" In making your fallow, grass sward is preferable to stubble of any kind, and should be turned over in the fall or early in the season, if the tiller intends to make it fine ; otherwise the grass will not be properly subdued, and the undecayed sods be a great preventive to a good crop. But if the pressure of other business has delayed you from breaking your fallow till August, do not despair even then of growing a tolerable crop. In this case it should be pasture land, turned well, first dragged, then sowed on the furrows, and well put in. It will be less apt to winter-kill, and frequently gives a good crop. A good coat of manure is not only highly requisite to the ensuring of a bountiful harvest, but the best possible preventive to winter-killing.

" In respect to the seed you sow, I would recommend old in preference to new. New seed, if it be contaminated with smut, will have a more natural tendency to transmit the disease to the succeeding crop. Old wheat, if it should be smeared with smut, has had more time to evaporate, and thereby disengage itself from its infectious qualities. Experienced farmers are aware that little is to be apprehended from smut after seeding with old wheat ; besides, they will tell you that it is more excellent and abundant in its growth.

" Procuring your seed from a distance, or changing it from a poor to a more fertile soil, is also of considerable advantage. The idea that shrunk seed is as good as plump, fair seed, is very erroneous. To plant the shrivelled corn from the unmatured ears would do as well. The absurd idea that wheat occasionally turns to chess has most astonishingly gained credence among many farmers. This is physically impossible, and must have been a fabrication of some slovenly farmer, to excuse himself for his negligence in not procuring and sowing clean seed. Equally marvellous is it that some farmers attribute the cause of smut to its being sowed in the waning of the moon; others to a cloudy day or a dewy morning; others to a mealy bag, or pestilential hand from which it is thrown. These are idle whims; idle as the transmutation of wheat to chess. Smut in wheat is natural to most climates and soils in North America, and I believe as far as the cultivation of wheat extends. This cereal has a strong inclination to smut in low vegetable soils.

"To prevent the destructive effects of smut and the wheat insect, one process is a remedy for both. The application of a solution of lime is too common to need explanation. A pickle of salt mixed with ashes is also applied in a similar manner, and answers the same valuable purpose. I think a still more convenient and sovereign remedy is lye from wood ashes, sufficiently strong to amalgamate with oil. Every farmer makes his own ashes, and in that respect it is not only a convenient, but an independent process. It may be drawn from the leach during seed time at pleasure, and mixed in a tub or other convenient vessel, by pouring on the lye and stirring it with a broad stick, or even the hand, till the grain is completely tinctured and turns yellow, and the husk will clean from it by rubbing it in the hands. It is then prepared for sowing, and five pecks to the acre, from the 1st to the 20th of September, are sufficient."

Whatever may have been the nature of wheat forty years ago, the present experience of practical men is against the use of old wheat for seed.

Of the application of manure for wheat we have fully spoken in the chapters devoted thereto.

The mulching of fall wheat may, however, be sometimes found advantageous as a protection to the roots and as against winter-killing.

On tops of hills liable to kill by exposure to winter, we have found mulching to have an excellent effect, but it is rather an expensive operation over a whole field, unless, indeed, the mulching be used as the regular dressing of manure to the crop.

Mr. Henry H. McAfee, farm superintendent of the University of Wisconsin, furnishes the *Western Farmer* with the results of his experiments on the university farm, which are as follows:

"Experiment No. 1, Series 1871.—Twelve thousand one hundred and forty-one square feet of ground were sown broadcast with twenty-nine pounds of White Touzelle winter wheat, on September 10th, 1870. November 26th, coarse straw manure was spread over the wheat, pretty thoroughly covering it. July 8th, 1871, cut; July 10th, bound and shocked; July 14th, stored in barn; gross weight, one thousand one hundred and ninety-one pounds; August 10th, threshed with flail; clean grain, three hundred and ninety-two pounds; weight per stricken bushel, fifty-nine and three-quarter pounds; yield per acre, 23·38 bushels. The clean grain was thirty-two per cent. of the gross weight; yield for each pound of seed sown, 13·51 pounds. Quality, No. 1, large grain, white.

"Experiment No. 2, Series 1871.—Thirteen thousand one hundred and thirty-eight square feet of ground were sown with twenty-nine pounds Red Soisette winter wheat broadcast, same date as Experiment No. 1, and treated the same throughout. Gross weight, one thousand two hundred and eighty-seven pounds; clean grain, three hundred and ninety-nine pounds; weight per stricken bushel, sixty-one and a quarter pounds; yield per acre, 22·01 bushels. The clean grain was twenty-three per cent. of the gross weight. Yield for each pound of seed sown, 13·76 pounds. Quality, No. 1, large grain, red.

"The results of the experiments would have been more conclusive had similar tracts been planted and left unmulched, to test the usefulness of a mulch for winter grain more fully and fairly; but the favourable results of these experiments, though not conclusive, are yet encouraging, and from former experiments with straw and long manure as a mulch for winter wheat, I feel sanguine that by this means a fair crop of grain may be raised, at least two years out of every three. I believe it fair to recommend to farmers generally, to try winter wheat in limited quantities with a reasonable winter protection. Care should be exercised not to get the mulch too thick in spots, as that cause killed out quite a lot of the young plants in the above experiments.

"The variable character of our winters prevents uniform results with most experiments in winter mulching wheat fields, but the average benefit is so decided in all places exposed to severe winds, that it should be adopted as an uniform practice at such places. There are two remedies for the great drawback known as winter-killing: under-draining and mulching. The former is the cure on low, wet spots; the latter on exposed knolls. Some years ago, when the Mediterranean was the variety of wheat most sown, we directed a tenant farmer to spread a thin dressing of the surplus straw over a field of wheat, leaving one uncovered strip, by way of experiment and comparison. But he was negligent, and spread but two strips with straw. This was done early in winter, after the ground had frozen hard, and before snow had fallen. The winter proved severe, with but little snow; and the result with this field was, that the mulched portion yielded the following summer at the rate of about twenty-five bushels per acre; the rest of the field, fully exposed, was not worth harvesting. This, of course, was an unusual and extreme case; but the frequent liability to severe injury from full exposure, which would be prevented by a covering enough to protect the bare ground from the sharp cutting winds, renders it wise to ensure the crop, when practicable, by a suitable covering, even with varieties of grain less likely to be winter-killed than the old Mediterranean.

"A modification of the course here indicated consists in substituting manure for straw. This is especially beneficial on the poorer portions of the field, or on knolls, which not only need protection from winds, but which would be improved by the additional enriching thus received. The common practice of top-dressing wheat fields with manure after ploughing the last time in autumn, and before the final harrowing, is especially beneficial by way of enriching the soil; and it also affords a slight protection as a mulch. But if the early autumn application has been omitted, or has been insufficient, a thin coating of manure early in winter imparts a double benefit, as already explained. The soluble portions of the manure soak into the ground; and early the following spring, the fine pulverization of the lumps of manure and of the crusted soil, by means of a suitable harrow, together with one or two subsequent harrowings, we have found has increased the wheat five bushels and upwards per acre; while the new bed of fresh earth has induced the best catch of the clover seed, even if sown a month later than usual."—*The Cultivator.*

Seed.—Much depends in the production of a good crop of wheat upon the seed sown.

Imperfect seed may germinate; plants from such will appear to grow well at first, but they will have a sickly and imperfect growth, which will be especially observable when coming into flower, and the grain will be small in quantity and of inferior quality.

Under the same conditions of soil, climate and cultivation, it will be found an unchangeable law of nature that the most perfect seeds will produce the best crop.

No seed can produce a healthy plant unless it is the result of a strong and healthy plant itself, and unless it be so fresh that its power of germination is unimpaired.

Good seed may be recognised by its plumpness and size, its glossy surface and the absence of odour.

Plumpness and weight will assure us that it is the produce of a healthy and vigorous plant; glossiness of the surface shows it to be healthy; and an absence of odour or mustiness proves that it is fresh, and its germinating power is unimpaired.

A change of seed is in nearly all cases beneficial. The change should, if possible, be invariably made from off a poorer to a richer soil, and from a light to a heavy soil.

We have never in practice been in the habit of, nor would we in print advise, the giving of extortionate prices for every new-fangled wheat which, under some fine name, and advertised in fancy-coloured circulars by enterprising seedsmen, is brought before the notice of the farmer; but good seed should always be obtained, and there are always men in the community who are especially noted for their painstaking care in the selection of seed for sale.

It is as poor policy to sow bad seed as to feed musty oats to your horses, and thereby bring on a train of diseases, accompanied by long farriers' bills and many other resultant losses.

The free use of the fanning mill will help us wonderfully with seed. We never yet used seed bought from the most reliable dealers without passing once more through the mill, and we have always succeeded in cleaning out of such many inferior kernels.

In a preceding page we gave our own opinion upon the use of old wheat for seed ; one of the most reliable seed firms in America thus corroborates our views :—

" We drilled in old wheat last fall instead of new, for the reason that it was much better-looking grain, the new being very much shrivelled. As a consequence, hardly two-thirds came up. A neighbour did the same, with as bare results. Another neighbour planted twenty-four grains each of new and old wheat before sowing, to test its vitality : all the new grains came up but two, while only seventeen of the old came up. Why did not we do the same ? The old wheat was run through the fanning mill once, and thrown from one bin to another during the hot weather, to prevent heating."

In our own neighbourhood, two years ago, a neighbour sowed old wheat seed, notwithstanding that he sought our advice, and we strongly opposed his plan. The result attained was that in the spring of the year he had to plough under his fall and re-sow with spring wheat.

A very small amount of fermentation will destroy, or at any rate greatly weaken, the germinating power of wheat; and it is almost impossible to know for certain whether wheat that has lain for a length of time in bin has been subjected to undue heating.

If we sow old wheat, it may be safe, but we run a great risk.

An excellent plan to secure a good and certain seed for the future is, to go over the fields before cutting and glean the earliest, largest and most perfect ears of wheat, as a stock from which to grow seed. A few quarts gathered in this way and sown will in two or three years yield enough seed for the farmer's own use.

The time of sowing fall wheat depends somewhat upon season and circumstances; but, as we have already laid down, the earlier it is sown in September the better.

Every season appears to require earlier sowing, as the country is more thoroughly cleared up.

Of late years we have not been able to place dependence upon the fall rains that used to come so regularly at that period, while winter appears determined to set in for good early in November.

The only objection that can be advanced as against early sowing is the risk of too heavy a growth for wintering; but as this is a less objectionable feature than too little root, we feel that we do not do wrong when we urge our farmers to put forth strenuous efforts to secure an early growth of wheat in the fall of the year.

Our fields are more often bared of snow in winter than they used to be, and a heavy growth of plants appears to be more necessary than formerly in order to protect the root.

We have heard vague talk of too great top-smothering of the plant under heavy snow. Why then does our wheat always come out the best upon the sides of fences where snow lays for the greater part of winter from four to six feet deep, and is tightly packed by drifting?

Unfortunately, we have very few actual results on record in Canada as to the relative advantages of thick and thin sowing.

The controversy has raged hot and heavy in the old country, but arguments used in that climate have little practical bearing on this point in Canada.

Alderman Mechi's wonderful advocacy of the thin sowing system may apply in the humid climate of old England, but in our drier climate, and under the vicissitudes of a Canadian winter, we should be sorry to risk our crops by pinning our faith to any such theories.

The great question at issue is, whether rich or poor land needs the most seed. Our view is, as far as regards wheat, barley and oats, that the richer soil requires the less seed, for the plants will stool out far more.

The principle is reversed in the case of Indian corn or any plant growing by a single blade, or in which it becomes necessary to reduce the number of stalks or suckers by an arbitrary rule. Now, what do we understand by rich land? On that, much of the pith of the controversy must rest.

If by rich land is meant a soil in which the vegetable food is in a state immediately soluble to the plant, and in which there is more food, so available, than is actually required by the growing crop,—why then a small amount of seed is required, and the quantity should be regulated in a reverse ratio to the amount of excess of plant food contained in our soil.

The fact is, that the true solution of this, as in most abstract arguments, rests in this: that a medium quality of land requires a full supply of seed; while on overly rich or exceedingly poor soil thin seeding would be most profitable; for in the latter two cases, should we sow thick, the plants would either be so rank and coarse as to impede a due exposure to atmospheric influence, or there would be so many more than the soil was capable of feeding, and in consequence the surplus would be simply wasted.

As our land in Canada may generally be classed, even on the best cultivated farms, within the range of medium soils, we do not consider that at present any improvement can well be made on the system now in vogue, of about two bushels per acre broadcast, and from one bushel and a peck to one bushel and a half per acre when sown with the drill.

The depth of sowing also varies. From one to two inches upon ordinary soils appears to be the practice of our best farmers, and such in our own experience is the most advantageous depth at which to drill.

There can be no special rule to regulate the depth when sown broadcast; this must depend upon the state of the seed-bed.

Petri sowed equal portions of seed at different depths, and found that—

½	inch	came up	in	11	days—	seven-eighths of the seed grew.
1	"	"	"	12	"	and all grew.
2	"	"	"	18	"	seven-eighths of the seed grew.
3	"	"	"	20	"	three-fourths " " "
6	"	"	"	23	"	one-third " " "

This experiment was conducted on English soils. We think, however, that results would be relatively the same in Canada.

Spring Tillage.—But little is practicable in Canada. In countries where labour is cheap, they hoe their wheat in spring. Would that we could do so at a profit in Canada; but as, owing to the high price of labour and hurry of work, we cannot, the next best thing is the use of the harrows, in the spring of the year, upon fall wheat. Owing to the running together of our heavier lands by the mechanical influence of the snow and spring rains, our wheat fields often come out of the winter season in that state most expressively described as hide-bound. A free use of the harrow over our wheat in the spring has a very beneficial effect.

When spring has fairly set in, and the land has become sufficiently dry to allow the harrow teeth to work through the soil without clogging, let the harrow be passed freely through the wheat. The crust which tightly encircles the wheat plant is thus broken, and the coronal root has an increased freedom given to it to extend in every direction to seek for its proper food, and obtain a good foothold upon the soil. This operation may be performed with advantage upon almost any kind of soil, the weight of the harrow being greater or less according to the consistency of the soil in which it may be worked. It is especially adapted to the stirring of wheat that has been sown by hand and upon the heavier soils. The harrows not only break the crust of the earth, but drawing the fresh mould upon the wheat plant, they thus give a perfect top-dressing.

Many have been "scared" by the appearance of their wheat field after the operation, but as long as the scarifying of the wheat has not been so severe as to tear out a great number of the plants (and it is, as a matter of fact, almost impossible to tear out a great many), it will have the desired effect of pulverizing the upper soil, and will most certainly tend to give a rapid start to the growing plant.

It should, however, be executed when the plants begin to re-vegetate, and care and personal supervision must determine that point.

If the work be done when the plants are yet torpid they may be rotted, and if done too late their growth may be checked.

There is yet another great advantage in the operation. If we intend to seed down our wheat, and the operation has not been performed on the last fallen snow, after the harrowing is the next best time to sow grass seeds.

They will fall in a good bed, and the next smart shower will cover and sprout them.

It occasionally happens that our wheat has too full a growth in the spring, and we desire to check it. We are particular to say occasionally, for we ourselves have observed but very seldom any wheat in Canada that required to be thinned after once it had grown.

In such a case, the best method of thinning (if the harrows be not sufficient) is to turn on sheep, in March, on frozen ground, or as soon as the ground is dry enough to bear them without poaching. Sheep bite off short, and do not pull out in bunches, as do cows, and more especially horses.

The sheep bite off the frozen blades, and make room for a new and vigorous stool from the crown.

It has been recommended to roll fall wheat after the last harrowing. We cannot endorse the opinion—first, because the ground, when left smooth, will not hold the winter's snow as well; and, secondly, the action of the frost on ground that is a little cloddy will be to mellow it down, and cover up such wheat roots as may be partially thrown out by frost and thaw ; and, thirdly, when we harrow in spring we should have no soil to harrow *down*.

Spring Wheat.—Perfect cultivation is the great requisite in a successful growth of spring wheat. For several years back this crop has been one of such uncertainty in Canada that the faith of our farmers in it has been much shaken.

As in our coming chapter on barley and oats we shall speak more fully on spring seed beds, we need only say here that spring wheat may be sown with more impunity when the ground is cold than any other spring crop.

Indeed, it becomes a choice between two evils, whether we sow late and run the risk of our crop being eaten up with midge, or earlier, and risk the seed rotting in the cold soil.

Of the two, we prefer the latter, for wheat seed is very hardy, and will seldom rot.

Spring wheat requires to be sown thicker than the fall varieties.

The kinds common to Canada are : *Black Sea, Siberian, Canada Club, Ohio Club, Golden Drop, Fife, Midge-proof,* and *Californian.*

Diseases to which Wheat is Liable.—These are usually, in Canada, *Smut* and *Rust.*

Rust we are very subject to, not only on wheat, but on oats, and sometimes on barley, and it is of much the same nature as mildew.

> "Shield the young harvest from devouring blight,
> The Smut's dark poison and the Mildew white."

Rust seizes on the stalks and leaves; the dust gathering on these stops the free circulation of sap, so that they are unable to come to full size. The berry suffers accordingly, and is found to be more or less shrivelled up.

Rust is more often found in "gleamy" days about the time of ripening. If the attack of rust takes place when the plant has fully ripened, it will only injure the straw; but if previous to that time, the grain will be much injured and shrunk. Our opinion is, that rust and mildew are so alike in their results that we may fairly class them as one and the same disease.

Rust is rarely felt in warm, dry seasons, or upon high, dry land.

The disease is generally considered to be caused by the presence of numberless sporadic fungi which fasten on the crop in certain states of the atmosphere. We know that we may certainly expect rust when the evenings, about harvest time or before, are cool and foggy, or when we have a succession of storms followed by intensely hot intervals. Such is known as "blighty" weather.

The only remedy that we have is under-draining, for it is an undoubted fact that the disease is more prevalent in the neighbourhood of low, swampy spots than elsewhere.

Spring wheat is more liable than fall wheat to this disease.

The *Canada Farmer* says :

"No remedy has yet been discovered for it; but reasoning from analogy that salt is a well-known destroyer of parasitic fungoid growth, it may be possible that sowing salt on the land, or even on the crop, in very moderate quantity, when the weather is such as to render the appearance of rust probable, may act as a preventative of its ravages.

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"We once saved a valuable and heavy crop of wheat from it by the simple experiment of having two men pass through the crop, in the early mornings, drawing a long rope between them over the wheat. This bent down the heads, and shook off the accumulated moisture to the ground before the sun evaporated it."

Smut is seen in the grain, when the husk, instead of containing healthy farina, is filled with a black, stinking powder, rendering it utterly unfit for flour.

It is the cause of an injury which may be justly regarded as a disease.

It is a minute parasite, or fungus, living on the grain of wheat, and is propagated by spores, which answer the purpose of seeds. These are so minute as not to be observable to the naked eye in seed, and when sown, in some way reach up to the heads of the wheat, where they grow and flourish by converting the farinaceous portion of the kernel into a black nauseous powder.

The only preventive is the destruction of these spores in our seed wheat.

Salt is a destroyer of all fungoid growth; so that we may destroy these spores by *steeping seed* in salt or sulphate of copper.

Dissolve common salt in water until a brine is made strong enough to float an egg, or, if sulphate of copper (blue vitriol) is used, put one pound to about 10 gallons of water.

Put the pickle in a tub; pour seed slowly into it, so that all light grains will float—these may be skimmed off,—let the seed soak for a few minutes, then spread it out to drain on the barn floor; after draining, sprinkle it with *thoroughly slaked lime,* or safer, *plaster of Paris,* until dry, and sow as soon as possible. The sulphate of copper is a deadly poison; care must be taken that none of the grain, if vitriol be used, is left within reach of pigs or poultry.

Smut is usually found worst under and in the neighbourhood of trees and dirty fence corners, after old sods and foul stubbles. Clean fallows are most free from smut.

Of one thing we may be certain, sow smutty seed and the result will be a smutty harvest.

Wheat Flour is of the best quality from grain that is cut before it has come to full maturity, being whiter and softer, and such flour carries a better figure in the market.

A bushel of 60 lbs. of wheat should yield —

Flour 48 lbs.
Shorts 8 "
Bran 4 "

But it must be remembered that the coarse or thick-husked grain will yield more bran and less flour than the above.

The best time in which to cut wheat is as soon as the berry is solid and the straw is yellow, but before the berry has hardened

The general use of reaping machines now makes it quite within the reach of the farmer to cut his wheat at exactly the right time.

Cost of producing an acre of wheat:—

Rent of one acre	\$3.50
Ploughing twice	3.00
Harrowing twice	1.00
Seed $1\frac{1}{2}$ bushels, at \$1.40	2.10
Sowing with drill	0.50
Reaping	1.00
Binding	1.50
Carrying, about	1.00
Thrashing, say 25 bush. at 8c	2.00
Cleaning up, &c	0.50
Teaming and cost of selling	1.50
	\$17.60

If summer fallowed, add the extra cost and one year's rent to above.

Wheat and Chess.—The author of this work has heard of chess actually growing out of the same stem and head as wheat. He has often desired to *see* such a phenomenon, but has never been satisfied by such a sight. By others, rewards have been offered to any man who could prove that such a thing ever existed; those rewards are, as far as we know, yet unclaimed.

Until we see and examine for ourselves a plant showing distinctly wheat and chess, the result of the same root, or a grain in which the two are plainly intermingled, we shall refuse to acknowledge as proven the frequent claim that wheat degenerates into chess.

THE CULTIVATION OF BARLEY.

Barley in Canada is confined to the one kind, namely, spring barley. In more moderate climates there is also a kind known as winter barley, or bere. There are again subdivisions of summer barley into two-rowed and six-rowed. It is termed "two-rowed" or "six-rowed," according to the number of its fertile florets. In six-rowed barley, three rows on each side of the spike are fertile, and consequently three rows on each side are perfected. Slightly examined, indeed, six-rowed barley often presents the appearance of four-rowed, but this is really only in appearance, for such barley has always three rows on each side perfect, although in poor soil and under unfavourable circumstances two of the rows will run into one another, and thus the mistake may arise.

Soil.—Barley requires a rich, mellow and friable seed-bed. Land may be heavy as long as it is free from wet, coldness and tenacity. It cannot be grown upon a tenacious clay, except under such peculiar circumstances of cultivation and climate as shall render the land friable. It is a very tender plant, and will not stand the slightest amount of coldness in the soil. For this reason barley soil should never be touched when wet, nor should barley be sown before warm rains have fallen upon the seed-bed. We may sow spring wheat early with comparative impunity, as the seed is very hardy, but when once barley has been committed to the earth, it must either grow or rot; if the soil be too cold to allow of its rapid germination and steady growth, then will it most assuredly rot in the ground. Land containing from fifty to sixty per cent. of sand and the balance of clay, provided that it lies dry, is the very best for barley; after it may be ranked the lighter soils. It may also be grown successfully upon clay, provided that such contains a sufficient proportion of mould to render it friable, while the presence of chalk is very beneficial as having a tendency to correct any natural acidity that may be present in the soil; but the chief point upon which to depend for a successful crop of barley is thorough cultivation.

Cultivation.—Barley is probably the most shallow-rooted crop that we have. It does not, like wheat, send down a tap-root towards the subsoil, but its roots keep near the surface and there seek for food. For this reason cultivation to the depth of three or four inches is ample. Again, its rootlets are very tender, and its growth rapid, so that the soil requires to be broken up into as fine a tilth as possible. A quick growing crop requires plenty of food, and food so applied that it is immediately available. The usual position of barley in all rotations is after hoed crops. The objects attained by this position are two-fold. The land under hoed crops usually then receives a heavy dressing of barn-yard manure. The roots or corn do not by any means exhaust this manure, and the large balance left in the ground, after their removal, has become thoroughly rotted, and in the processes of cultivation for barley will become distributed through and incorporated with the surface soil. This manure, thus mixed up with the soil, is in a form the most available to the wants of the tender barley root. Also, the land is thoroughly cleaned and freed from weeds by the use of the hoes, and as such is especially adapted not only to the reception of barley, but also for seeding down with grass, which is usually done on barley. Barley is, however, not unfrequently grown upon a wheat stubble. When such is the course proposed, the stubble should be ploughed in the fall. The advantage thus attained is the beneficial effect of winter's frost upon the soil—the frost, by expansion and contraction, so breaks up the clods that when the cultivator and harrows are passed over the ground in the spring, the soil will be found to break up into the fine state of garden mould. In England the best barley ground is that upon which, when in turnips the preceding year, sheep have been folded. The sheep manure the ground and compact it by their treading. After ploughing shallow in winter, and exposure to frost and rain, the cultivators and harrows break it into a shallow, rich, mellow and friable seed bed. Under this plan, the crops of barley raised in Norfolk are immense. It is a matter for regret that the severity of our winter precludes us from the adoption of the same system in Canada. After fall ploughing, the land should be cross stirred, by means of a two-horse cultivator or gang plough, to a depth of about four inches; this, when harrowed over, will leave the land in very fine tilth. Of course, when broadcast sowing is proposed, the land need not be harrowed before sowing, but will, after sowing, require several strokes. When the drill is to be used, the finer the tilth can be brought down the better. The use of the roller is very effective on land under cultivation for barley—the roller breaks the little lumps, whilst the harrows simply push them on one side. Before drilling we always roll our beds.

As to the use of the roller after sowing—If the seed has been broadcasted, the roller will doubtless help to cover it, and from the fine state of tilth into which the land should have been brought, will be better for the purpose than any after passage of harrows.

If, however, barley has been drilled, it is a mistake to roll immediately.

We desire to place no obstacles in the way of the rapid appearance of the blade above ground—but the roller compresses the soil, and makes it more difficult for the blade to pierce through to the light. This is particularly the case in land that verges upon the "strong" side; but after the blade has shot through it will be found advantageous to roll, compressing the earth firmly round the roots, and helping the soil in its retention of moisture for the use of the young plant.

Seed and Sowing.—The colour of seed is immaterial if the berries be plump and hard. It has been recommended to steep the seed in soft water for twenty-four hours. The advantage claimed is, that any seeds and light grains will come to the surface and may be removed, and that the seed will germinate more rapidly and evenly when covered in the ground. We leave this to the opinion of our readers; for our own part, we consider the advantage very slight, and fully counterbalanced in the weakening of the germinating power of the grain. The usual time for sowing in Canada is in the latter part of April or commencement of May, but the point must perforce be always regulated by the peculiarity of the season. No matter how fine the weather may be overhead, or how warm the sun may beat down on the new turned soil, the seed-bed of barley can never be in a fit state for reception of the seed until after a fall of *warm spring* rains. We have seen many a field of barley sown when the ground appeared warm, but there was no growth in the soil; the barley sprouted, and slowly showed through the top soil; it was then stunted, weak and yellow, and barley, when once retarded in its early growth, will never recover lost ground. There is no crop so susceptible to the evil effects of a check in growth, and none upon whose after life an early check has so certainly a damaging effect. The blade is moreover often checked by late frosts, and this, if possible, should be avoided.

The quantity of seed varies in Canada from two bushels to two and a half bushels per acre when sown broadcast, and about one and a half bushels per acre with the drill. The richer the land, the less seed is required, as in such land it will tiller more than in poorer.

The mode of sowing is by broadcasting or drilling. There are yet to be found plenty of advocates for the broadcast; for our part, we consider that there is no comparison between it and the system of drilling. The drill possesses two great and important advantages in its use, namely, a saving of seed (for every grain is covered), and the distribution of the seed at an even depth; while the passage of the drill itself acts as an excellent cultivator. The opponents of the drill claim that it is a slow job. But although a man can sow more land by hand than can a team and man with the drill, yet one if not two crossings with the harrows are saved. The drills should be from seven to eight inches apart, and the quantity of seed may be fully half a bushel per acre less than that used under the broadcast system of sowing. It is customary to sow grass seeds along with the barley. For this purpose, a clover sower is attached to the drill, which should sow *before* the drill, not, as we have seen some, *behind* it.

Barley is the most troublesome grain that we have to harvest. A single rain will destroy its colour after it has been cut, and not unfrequently when standing ripe, and will reduce its value in the market very materially. In Canada it is seldom long enough to bind. Moreover, when binding has been possible, we have found that bound barley does not thrash out as well as the loose.

This is doubtless owing to the carelessness of the feeders of thrashing separators, who, being in a hurry to put through a large quantity of grain, are in the habit of constantly letting pass through the cylinder, without unbinding them, many of the small sheaves of barley; and a bound sheaf let into a separator is never thrashed out cleanly.

It is well, in harvesting barley loose, to put it into moderate-sized cocks in the field, for such as have been so cocked will not sweat in the mow or stack.

Loose barley should always be handled with the wooden barley fork. The use of the rake breaks it up, and if at all ripe will cause it to shell out

Another advantage attained by the cocking system is, that very much larger loads may be built from the cock than when taken from the ground in bundles, as left by the machine, or in swath by the scythe.

Barley must be cut before it is dead ripe.

Oats.—Oats will flourish on almost any soil, and being of a far hardier nature than barley, are found very useful as a spring crop, to fill up a rotation in spots which are not well adapted for the cultivation of spring wheat or barley.

The only soils upon which they appear to be a failure, are those of too dry a nature.

They will grow well on a tough meadow sod or fresh-ploughed old pasture. As for a full crop, they do not seem to require that the sod should be thoroughly decomposed. For this reason we often sow oats on the same land for two years in succession, and where the seed-bed rests on an inverted old sod, the second crop has frequently proved a better one than the first.

Oats are sometimes seeded down with grass, and we have ourselves had in this way excellent catches; but there is considerable risk in the plan, for oats are apt to grow very rank, and oftentimes to lodge, and in either way the young grass stands a strong chance of being smothered.

We have found oats a very useful crop to sow with vetches, as a green food for soiling purposes. Not only are green oats very excellent fodder, but growing among vetches they help to hold the latter up from the ground, thus allowing of the permeation of air, and light, and rain throughout the whole crop.

They will do well in cold, moist places, and will grow rankly, and turn out a good yield in swampy spots utterly unfit for the growth of any other cereal.

Oat straw is a valuable fodder, and is generally more relished by cattle than that from wheat. It is not, however, actually as nutritious, but its superiority for feed doubtless arises from the fact that it is usually cut greener than wheat, and at a cooler season of the year, in consequence of which the straw has retained all its saccharine juices and is more of the nature of hay.

As to the sowing of oats, there is no crop upon the thick or thin seeding of which there has been greater diversity of opinion.

It is observed, that oats standing thinly are far more liable to rust than when the ground is well covered.

At one season, when we were sowing a field of oats broadcast, the wind blew very hard, and we made, in consequence, a very irregular job. In one place we made too wide a cast, and across the whole field a strip of some inches in width was left upon which the seed was deposited not one-fourth as thickly as upon the land adjoining.

At harvest this strip was green and very badly rusted, whilst the rest of the field was bright-coloured and fit for the cradle.

This liability to rust is the great objection to thin sowing. The best crop of oats that we ever grew was broadcasted, at the rate of three bushels per acre.

Of course, some difference must be observed with different varieties of seed, as some stool out far more than other kinds.

The new varieties of oats come fast and thick before the notice of the farmer.

In a few years it is probable that all our present varieties will be known as oats of the past. We shall therefore only shortly review the oats now come and coming into general use; and we cannot do better than to quote the report of experiments made by the noted nurserymen, Messrs. Hicks and Son, of New York State, in the season of 1871:

"*Eds. Country Gentleman*—We drilled in seven varieties of oats, April 7th and 8th. The previous crop was corn on inverted sod.

"Mr. Newton, of Henrietta, N.Y., sent us the White Probsteier; the other varieties were procured of Mr. Fanning and the Department of Agriculture. The White Schonen did so well the season before, under very favourable circumstances, we desired to procure as much as possible from the seed; having about five pecks, we drilled it on an acre. It stood very thin; double the seed would probably have given over a third more yield. The other varieties were sown at the rate of seven to eight pecks, except Norway oats, when only six pecks were used.

"Below is given their yield by weight, 32 lbs. to the bushel:—

	Bushels.	Weight of bushel.	Weight of sheaves.
Norway	39	32 lbs.	3,050 lbs.
Surprise	36	40 lbs.	3.000 lbs.
White Probsteier	38	30 lbs.	2,700 lbs.
New Brunswick	31	31 lbs.	2,475 lbs.
Excelsior	31	38 lbs.	2,340 lbs.
White Schonen	20	28 lbs.	1,220 lbs.
Common	28	29 lbs.	1,980 lbs.

"An acre of Norway, well manured and sown two weeks later, yielded forty-five bushels to the acre, and the sheaves weighed three thousand seven hundred pounds.

'Our common oats in 1869 yielded forty-one bushels to the acre; this season twenty-eight bushels—we accordingly estimate the above yields to be two-thirds a good crop.

"In examining the different varieties before reaping, the Norway stood the highest, three and a half feet; and the Excelsiors the shortest, two and a half feet. To a casual observer, the Norways did not look as though they would yield near as much as the Surprise, growing side by side—we could see through the Norways down to the ground so easily, and hardly at all through the Surprise; the stalks of Surprise were smaller and more numerous.

"We asked our neighbour, who was extolling the Surprise, to pick out a few of the best stalks and count the grains, while we would do the same with the Norways. The grains on a stalk of Surprise were out on the end of little branches from two to four inches long, leaning off in every direction from the main stalk; consequently the surface was evenly spread with grains, preventing seeing through them. The grains on a stalk of Norway were all on one side, and not over an inch from it, giving plenty of room to see through them, and making them appear to poor advantage. Our friend counted from thirty-five to fifty grains on his stalks of Surprise; while our Norway stalks, the double grains counting but one, gave us eighty-five to one hundred and one grains. The Excelsior, New Brunswick and Surprise were ripe July 14th; White Schonen, Common and White Probsteier four days later; and the Norway a week later. The Surprise were the most broken down, caused by weak straw and heavy grain. Having rolled the field, we were enabled to reap without waste or extra trouble.

"The Excelsior, New Brunswick and Surprise are a short chunky grain, and in examining them a few days ago, found their hulls to be thicker and stiffer than the other sharp-pointed long grains."

The result of experiments made at the Michigan State Agricultural College was:—"Excelsior oats, from England, yielded at the rate of sixty bushels to the acre; Somerset oats, from England, ninety-four bushels to the acre; White Schonen oats, from Hamburg, sixty-two bushels to the acre; Black Swedish, also from Hamburg, sixty-six bushels an acre; Prince Edward Island oats, sixty-two bushels per acre; Brooks' oats, from Michigan, sixty-eight bushels per acre; Norway oats (the seed from Jones and Clark, New York) yielded fifty bushels; and the Surprise oats, at the rate of thirty-eight bushels to the acre. The weight of the Norway oats was only twenty-eight pounds to the bushel, while the same measure of the last-named variety weighed forty-six and a half pounds."

Oats must be cut early. If left to ripen on the ground, there is no crop that will shell out as badly. Moreover, the straw, being very valuable, makes excellent fodder when cut well on the green side.

If oats be allowed to become dead ripe when standing, a large proportion of the saccharine matter contained in the growing stalk is lost for the purposes of fodder.

BUCKWHEAT.

This is a good crop to fill up blank places in a rotation. It is not very generally grown, but is by no means an invaluable crop. Land that has been allowed to run to waste has often produced an excellent yield of buckwheat, when no other cereal could, with any degree of certainty, have been raised. This is doubtless owing to the fact that for a very large proportion of its sustenance it is dependent upon the stores contained in the air.

It is found a useful crop on a summer fallow. From the dense luxuriance of its foliage and straw, it effectually smothers weeds, and where a heavy growth is secured, even the Canada thistle has no chance among it.

So great is this faculty, that there would even appear to be something in its roots and stalks absolutely poisonous to plant life.

It forms a fair green manure, and ploughed under stiff soils, is very beneficial; for not only does it contain much nitrogenous plant food, but from its coarseness acts mechanically in opening out and admitting air and moisture to such soils.

It luxuriates in a dry, warm sand; although it will often grow on apparently worn-out lands and without manure, yet there is no crop that responds to generous treatment more rapidly.

It is not, however, advisable to have land too rich for buckwheat, because such soil is fitted for more profitable crops, and too great richness of land will cause it to grow altogether to straw.

The time of sowing is usually from the last week in June through the first week of the succeeding month. This in our Canadian climate may be considered an arbitrary rule, *i.e.* when the crop is grown for grain.

If sown too early, it will, when in full flower, receive the very dry weather of the latter part of July, and such is injurious to the formation of the berry. If, again, the crop mature too late, it may be caught by late frosts and utterly ruined ere it has come to maturity.

The quantity of seed should be not less than one bushel per acre. Whatever be the nature of the land, it should be made mellow for a seed-bed. Buckwheat matures very rapidly; nine to ten weeks being the usual length of time between germination and maturity.

We have seen thirty bushels and more, and almost under any circumstances we may rely on at least fifteen bushels per acre.

Harvested usually with the cradle, being laid in swathes, the follower of the cradle then rakes it up into fair-sized sheaves, and giving their heads a twist stands the bundles up on their butts to dry.

Drying requires some time, not only because the stems are naturally green and juicy, but the season of harvest is usually cool. The less handling that it receives when ripe the better, for it is a grain that shells with very little shaking.

To thrash buckwheat the best plan is :—

"Where it must be thrashed by hand, a floor may be prepared in the field, by scraping and sweeping a piece of ground or by laying down sheets. Lay over this a bed of rails an inch or two apart, raised from the ground sufficiently to make room for the grain when it is thrashed. On the rails throw the straw as it is brought from the stacks, and thrash out the grain, which falls through the openings between the rails. The straw can thus be removed and separated from the grain very quickly. When all is thrashed, remove the rails, and the grain may be cleaned on the ground if desired without removing it to the barn. It is absolutely necessary to clean buckwheat as soon as thrashed, or the chaff being damp will heat and spoil the grain in a few days."

If possible, it should not be stacked; for it is exceedingly easily heated in the mow or stack.

It is better to thrash straight from the field, either by the plan above, or by hauling on to the barn floor, stamping out with horses or thrashing with the flail. It should be cleaned up immediately after thrashing, spread and turned over to dry.

Flour.—A bushel of good grain should yield about twenty-five pounds of fine buckwheat flour.

The grain is a good feed for hens; for horses it is not good except when chopped and well mixed with oats.

It is a very heating feed, and will be found good for pigs preparatory to feeding for the butcher.

It is satisfying, and will keep up the animal heat and growth, but will not make firm pork.

For hens, from its heating quality, it is a great promoter of good laying.

An objection taken to buckwheat is frequently, that the shellings of harvest lie dormant in winter, and sprouting the next spring become mixed with the then growing crops.

If it precede a hoed crop, this will not matter, for cultivation will destroy it.

If it is to be followed by a cereal, the better plan is:—As soon as it has been removed from the ground in autumn, put a pair of heavy harrows on and thoroughly scarify the stubble. Should we, after that operation, have but a few days of warm or wet weather, all the shed buckwheat will sprout, and, after the seed has once germinated, winter frosts will destroy it.

PEAS.

The faith of Canadian farmers has of late been sadly shaken in the cultivation of field peas as a profitable market crop; and, were it not for the value of the grain for *pork* producing, and of the straw as fodder, we doubt not but that the crop would ere this have been almost entirely discarded.

At the present day peas are raised chiefly as food for pigs, and as such are very valuable, for they produce hard and firm pork—such as delights the eye of the dealer.

A loamy soil is the best for the cultivation of this crop, but success is generally attained on land of a heavier nature, and some varieties do passably well upon sands and gravels.

Varieties in common use are :—

Crown.—A good sound pea, of which a farmer in the neighbourhood of Ingersoll, Ont., says :—

" They are larger than the common pea, command a higher price, and will yield a third more. They are especially suited to rich, strong soils, as they do not run to straw and lie down. They can be cut like hay. I cut mine with a mowing machine. The straw is much liked by stock, and they ripen earlier than most kinds. I have grown them for the last four or five years, sowing at the rate of three bushels of seed per acre."

Golden Vine.—One peculiarly adapted to the lighter soils.

Black-eyed Marrowfats are good heavy yielders, but mature slowly and ripen late.

Daniel O'Rourke are a very superior large pea. They, however, require better cultivation than the common pea. They do not yield a heavy crop of straw, but are better bearers of grain.

Small Canada or *Common Pea* is a very hardy variety : a heavy yielder even under inferior cultivation, but is extremely subject to the attacks of the " bug," or pea weevil.

We have an experiment before us of several new varieties of early peas :

" Laxton's Alpha came up in	12 days.
Philadelphia Extra Early, in	14 "
Kentish Invicta, in	16 "
Carter's First Crop, in	17 "
Laxton's Prolific, in	19 "

My soil is gravelly, with subsoil of hard clay."

Sowing.—Early and late sowing have each their advantages and disadvantages.

Early-sown peas will usually bring a heavier yield, but are more subject to bugs. Moreover, early sowing frequently brings the field into harvest at about the same time as wheat and barley, which is often very awkward to the farmer.

Late-sown peas are more free from the attacks of the weevil, but will not yield as well.

Peas should be sown heavily, to cover the ground well and keep it damp, and to yield a nutritious straw. From 2 bushels with drill, to 2½ bushels and 3 bushels with the hand, are the best quantities of seed.

Cultivation.—The drill is the best instrument for the sowing of peas. They are thus deposited at an even depth, come up together, and grow and ripen evenly.

It is difficult to cover peas that have been sown broadcast, a heavy rain, shortly after sowing, will sometimes expose two-thirds of the seed.

When broadcast sowing is adopted, the only safe plan of covering is to plough the land first and level it down with one harrow stroke, filling in the furrows well (if the ploughing has been performed in the previous fall, so much the better); then sow the seed and cover it in by a shallow ploughing. This is most effectually done with the gang-plough or two-horse cultivator.

This plan applies to stubble or root ground. In sod, we have seen the peas sown on the surface and ploughed under with a light cut furrow slice. The pea is a vigorous grower, and easily forces its way through the grass roots to the surface.

The better way is, however, to plough the sod first, and then, levelling off well, use a drill; or in ploughing set the sod well up on end, as recommended for heavy land on page 53; and the peas, even if sown by hand, will fall in between the furrow slices, and their crowns may then be dragged in to cover the seed, when the crop will come up in perfect drills, just as wide as the furrow slice has been cut. If possible, peas should be covered to a depth of at least three inches.

It is not advisable to apply fresh dung to the seed bed, for we look upon this crop as a land cleaner, and rank manure is apt to induce a coarse growth of haulm at the expense of the grain.

As a Cleaning Crop, peas are by many highly approved of, and often form the preparation for fall wheat.

By their luxuriant growth, they keep the ground shaded and moist through summer, smother weeds, and, gathering a large amount of sustenance from air and dew, do not exhaust the land, but rather leave it clean, mellow and friable, well prepared for the reception of wheat seed.

As a green manure they have been highly recommended. By some they have been thought equal in fertilizing elements to clover, whilst they exceed clover in quantity of matter. Though we do not agree to this proposition, we have no doubt that they contain, when decomposed, no mean amount of plant food.

Green peas are, however, very difficult to cover with the plough, and are, therefore, when designed to be so treated, better mixed with oats, around which they twine and are prevented from trailing along the ground and lying in heavy bunches. The use of the chain on the plough will be found efficient in rolling the crop into each furrow before the mould board.

The land should not be again ploughed until the mass of covered vegetation is well decomposed.

As a green crop for hay, peas are valuable.

They should be cut when the lower pods are well formed, and the upper blossoms in full flower; it is well in this case also to mix oats with the seed, for the same reasons as above stated. In this case, two bushels of peas and two bushels of oats to the acre is not too heavy a seeding.

For fodder, the peas and oats may be allowed to grow together until ripe; these thrashed and ground make an excellent feed, especially for horses and cattle, and the straw is almost as nutritious as any timothy hay, and far more so than much of the hay that we have seen fed or taken to market.

The ordinary mode of harvesting is with the scythe, by which the peas are pulled out, breaking off close at the roots, and are then rolled into heaps; this is slow, but clean.

The revolving horse rake is sometimes used, and the pea crop, torn up by the roots, is deposited in bunches laid in wind-rows. This is, however, a dirty plan, for much dust and soil is gathered with the crop; and as the fodder value of pea straw is very great, should not be resorted to except under special circumstances of haste or want of sufficient help.

Peas usually lying in one way may often be cut on three sides by the mowing machine; and though we have thus seen very excellent and clean work done, it can only be accomplished for certain with such particular kinds as grow well up off the land.

How Bugs get into Peas:

"After the pea vines have flowered, and while the pods are young and tender, and the peas within them are just beginning to swell, the bugs gather upon them, and deposit their tiny eggs singly in the punctures or wounds which they make upon the surface of the pods. This is done mostly in the night or in cloudy weather. The grubs, as soon as they are hatched, penetrate the pod and bury themselves in the opposite peas, and the holes through which they pass into the seeds are so fine as hardly to be perceived, and are soon closed."—*Insects Injurious to Vegetation, by Harris,* p. 63.

Strange to say, there are peculiar sections in Canada where the farmer is not troubled at all by the pea weevil; and it is from these parts that reliable dealers obtain their seed.

The bugs in peas may be destroyed by dipping the peas in scalding hot water; but as it is quite possible to destroy the germination of the pea by boiling, they should only be left for a very short time—about a minute—or the pea will be ruined as well as the weevil destroyed. Of course this plan applies in practice only to small quantities; our only remedy as farmers is to obtain our seed from localities that are not infested, and to sow late.

The latest season at which peas for a crop may be safely sown, may be computed from the fact that the growth of the pea from germination to maturity averages about ninety-seven days.

CORN.

The varieties of corn are usually divided into two general classes,—the *yellow* and the *white,*—and for general Canadian agriculture such classification is full enough.

There are in America an immense number of varieties of corn, but as only a portion of these are suitable to our more northern climate, it is not designed to dwell at length upon them in this work.

The *Dent*, the *Large Western*, and the *Early Prolific* are the kinds in general use north of the forty-second parallel.

The *Sandford*,—a white variety,—has been generally tried in various parts of the Dominion, but has hardly been found sufficiently valuable, under our climate, to form a staple kind for general cultivation.

Our own experience of the Sandford has not been practically favourable.

It is in warm parts of America a very heavy yielder, and its kernels are of a superior nature, but the only value to us is in the profuse growth of its stalks and leaves, making it a desirable crop for fodder or for soiling purposes, under which heads we shall speak of it again. With us, as a crop, we found it late, and liable to be caught by early frosts in the fall. It is possible that, when acclimatized, it might be brought more rapidly to maturity. We also found the ears very liable to become smutty.

The Dent Corn is a hardy variety, well suited to our climate, and early.

The Early Prolific is a bright yellow eight-rowed corn, with stalk of a moderate size, and a fair yielder.

Culture.—The cultivation of corn is peculiar, partaking in its essential elements of the modes of culture both of roots and of cereals. Like roots, it draws nourishment largely by leaf from the atmosphere; and like the cereal, it is a shallow-rooted plant.

The roots of corn extend for a long distance upon every side along the ground, and ever seek to keep near the surface. For this reason it becomes necessary that the soil (as in barley) be mellow and rich near the surface, and that all manurial food be supplied from near the top of the seed bed.

It loves a loose, light and friable soil, and will not grow on compact lands, in cold soils, nor upon such as are retentive of surface water.

It can only be grown on clays with any certainty when such have been thoroughly drained and worked to a mellow and friable condition.

It does excellently well upon a clover ley or even upon an old sod; but such should, when turned up in spring, be ploughed very shallow.

If we would apply barn-yard manure, the fall of the year is the best season. A practical American farmer says that "he has no hesitation in saying, that twelve loads to the acre, spread in the early part of October, and allowed to lie until planting time before being turned under, are equal in the effect they produce to twenty loads applied and ploughed in, in the usual way, in the spring."

We take this with a grain of salt, merely remarking that something depends upon the state of the manure, whether long and unfermented, or short spit-dung.

The better plan, when manure is fine and of the nature of mould, is to put a shovelful of such short manure in each hill and cover with dirt before planting the corn ; but as this is a long job, we prefer to spread our short manure all over the surface, and work it in with cultivator and harrows.

As we said above, the corn throws out roots to a great distance along the surface, and it will come in the way of manure along each root.

Doubtless the hill manuring will push on the crop faster at first, and that is a great matter ; but the latter will give more lasting benefit all through growth, and the succeeding crop will find the land more generally and evenly rich.

We prefer, with long manure, to apply it to the previous grass before turning down the sod.

On one point all practical men agree, that corn requires plenty of air and light, and, consequently, must not be sown too close or thick.

Hills versus *Drills.*—Steady and far has raged the controversy amongst corn growers on the respective advantages from planting in hills or in drills.

At one time the advocates of the drill take the agriculturist's mind by storm, at others the hill men triumph.

We believe in hills for a matured crop, and in drills for fodder.

Opposed to our own practical observations we find the opinions of a number of worthy authorities.

The Michigan Agricultural College has made experiments, and reports :

" The plots for trial were forty-eight rods long and two rods wide. The rods were four feet apart ; the corn, Yellow Dent. The plants were thinned, so as to leave the same number of stalks on each plot. The soil and manuring, and the cultivation, were as nearly alike as practicable. Both were cut up at the same time, the corn husked, and corn and stalks all weighed separately. The drilled portion produced $74\frac{1}{6}$ bushels of shelled corn per acre, and that in the hills $62\frac{1}{2}$ bushels. The drilled plot yielded stalks at the rate of three tons per acre ; the other at the rate of two and two-thirds tons." In all published American works and periodicals, and in those of our own Dominion, we find strong advocacy of both sides of the question.

Sowing.—The old saying is, plant eight kernels to a hill : " Two for the worm, two for the crow, and four will be left for the farmer to grow."

If we plant in hills, four kernels are ample to grow, and unless land be very rich, three will be found sufficient to thrive well.

Of one thing we may be certain, deep sowing will not do; the corn must be planted shallow; the nature of its roots demands that it shall grow near the surface. From one and a-half to two inches is deep enough ever to plant corn.

Hills should be not less than three feet apart each way. In hills we have sun and air accessible to the plant from four sides, and we can cultivate the land both ways—a very important feature if the corn has been planted on a foul sod or dirty stubble.

Weeds rising up most assuredly do the crop much harm, and we must acknowledge that " what the corn loses in its early growth is lost for ever ; the stunt goes with it to the end."

After-culture.—Stirring of the surface soil is essential to the successful growth of corn.

Weeds must be kept out of sight, for the corn roots, being near the surface, are brought into direct competition for food with young weeds. Stirring of the soil gives it more power to retain moisture, and allows the air to go down to the roots.

Shall we hill up or not ?—The practice of moulding up corn has been discarded by many practical men in Canada. There is something to be said for the retention of the plan, and also as against the system.

While the hilling helps to prevent the corn breaking down at the lower part of the stalk in windy weather, after the top gets heavy, the passage of the plough, in the old-fashioned way, cuts into the long spread roots and so weakens the anchorage of the plants.

Our own experience is in favour of hilling up, provided the work is done in a reasonable manner. Instead of running a plough along the centre between the drills and cutting in three inches or more, we have now horse hoes that will mould up by gathering the soil from close to the stalks and at a depth of a little over an inch. A very excellent after-manure is a handful of ashes and plaster to each hill, when the plants have attained the height of five or six inches. Very marked effects are to be observed in corn fields thus treated. Cultivation with the horse hoe should be stopped as soon as the tassels appear upon the corn.

Harvest.—Corn should be cut for a crop as soon as the cobs have become glazed and before they are dead ripe. Corn will harden when standing out in shock, and, if cut early, all the saccharine juices are retained in the stalks, which then make a valuable addition to the store of winter fodder.

The process of cutting and shocking is too commonly known to need description in a Canadian work.

Husking.—It is customary for a man to husk, on job work, for every tenth bushel. Supposing a man requires to make one dollar fifty cents per day, and corn is worth seventy-five cents per bushel, he would require to husk twenty bushels of shelled or forty bushels of cob corn in a day; and many a man has done it.

Fodder corn.—Now that hay and all kinds of fodder have been for some time back very high priced, and that appearances indicate a good price for these articles for many years, corn is beginning to be looked upon as a valuable crop for fodder.

When we are late with our planting, rather than risk a crop after the last week in May, we should advise the farmer to sow for fodder.

Immense crops of fodder have been raised from corn, and there is on record an instance of nine tons to the acre. The land upon which such a crop was raised must have been *gorged* with manure; but by generous treatment and careful husbandry we may, each one of us, produce a very heavy weight to the acre.

Corn stalks contain an immense amount of sugar, and being far superior to straw, are little below the value of the best hay as cattle food.

But when the corn is allowed to mature we lose much of the saccharine juices, and by so much, the value of the stalk and leaf is impaired as fodder.

The best fodder is that which is thickly grown—being finer in texture, it is more relished by live stock.

We should advocate cutting corn when it arrives at the blossom, were it not for the difficulty of storing it without danger of heating.

No doubt, at this stage the crop will be at its best for food; but, owing to the difficulty just mentioned, it is practically far more safe to wait until the leaves begin to have brown and yellow stripes upon them. The half-formed ears and nubbins are still valuable as food, mixed with the stems.

The U. S. Department of Agriculture has issued a statement presenting a long line of testimony from various sources on the value of fodder corn as a supplementary feed or soiling crop for milch cows in summer. The conclusions deduced from the testimony given are :

"1. Green-corn fodder is neither worthless nor the poorest of all soiling material.

"2. It is the best when planted in drills or hills, not so thickly as to prevent normal growth and development; cultivated to destroy weeds and grasses, and cut between tasselling and earing, when the elements elaborated for production of the ear are stored in readiness for immediate use.

3. It is probable, both from the *rationale* of the case and from facts presented above, that in the more northern latitudes a mistake has often been made in sowing thickly southern corn which cannot mature, the fodder from which fed in August must be very nearly worthless. On the contrary, the fodder from northern corn, especially sweet corn, drilled and cultivated, and fed just before earing, is found to be very valuable.

"4. Its value, compared with lucerne, millet, the best grasses, and other plants containing a larger percentage of nutriment, taking into consideration the quantity produced and the cost of its production, has not been determined fully, and should be decided by a series of thorough and exhaustive experiments.

"It is evident from all that is conflicting in the opinion of different feeders, that the differences are mainly due to the degree of maturity or soundness of the corn. That from thick sowing, immature, colourless and watery, is unfit to place before the cows of any well-regulated dairy. It is probable that half that is fed is either improperly cultivated or in a state of growth not productive of the highest results. If this should be the case, how stupid to condemn the maize for the ignorance of the cultivator. If it is found to contain too little nutriment for its bulk, or too small an amount of the flesh-forming element, the suggestion found in the practice of some, of giving a small amount of more highly concentrated nutriment in connection with corn fodder, is eminently wise. This is a deficiency easily remedied. While corn is our national crop, less fastidious in the circumstances of its growth than almost any other, and capable of yielding so largely under the proverbial neglect which characterizes our culture, let not this fodder be discarded until something of greater practical value is found, the superiority of which has been actually demonstrated under local circumstances of soil, climate and cultivation."

The drill husbandry is undoubtedly better for fodder than broadcasting, allowing more spread for roots laterally, providing more sun and air to the growing corn, and permitting cultivation by hoe.

"Stalks were collected from a field where the seed was sown broadcast, and also stalks growing in drills upon the same field, and they were dried in a drying closet to expel the moisture. Both specimens were planted at the same time (the 6th of May), and it was found that the plants from the broadcast sowing contained ninety-two per cent. of water, those from drills eighty-three per cent. of water. Thus it was shown that the difference of solid matter in the two was relatively as eight to seventeen per cent. The solid matter was composed of starch, gum, sugar and woody fibre. There was almost an entire absence of sugar and gum in the stalks from the broadcast sowing, while the stalks that had grown under the influence of light and air held these nutrient principles in considerable quantities. The stalks were collected at the period of growth just before the ear begins to form, a period when most farmers commence to cut the fodder for their cows."—*Boston Journal of Chemistry.*

In order to secure the greatest amount of benefit from the corn planted exclusively for fodder, experience has led us to adopt the following rules:

1st. To sow so thickly that cattle will eat the fine stalks.

2nd. To sow in drills, so that horse-culture may be freely given.

3rd. To cut at the right time, as already designated.

4th, and last, but not least. To cure as perfectly as possible, inasmuch as sweet, green fodder is better than black, water-soaked, half-fermented or mouldy fodder.

The greatest difficulty in the manipulation of the crop in this form is that of properly drying before it is stowed away.

One plan is: To start in the field and reach round a number of tops with both arms, and bind a hill or as much as can be reached in a drill; let this stand fast; then cut round and set up all round this shock, until it is just so big that it can be readily bound.

The middle part, that stands fast, will remain dry, while the stalks piled around will dry perfectly. Before winter they may be all drawn in. No fear of heating from the small proportion of those in the middle, for they will have dried out standing. Neither will such shucks be blown down by fall winds.

Broom Corn, though not general in Canada, has been grown successfully in parts of this Dominion.

It requires much the same soil, cultivation and climate that are suitable to the large western corn, or to *Sorghum.*

About five hundred pounds of broom per acre is a fair average yield, and from this will usually be cleaned about fifty bushels of seed.

It must ripen early enough to escape fall frosts when in the ground.

General cultivation similar to that of any other field corn.

If planted in hills, it should be thirty inches apart one way, and eighteen the other.

About thirty seeds are planted to a hill; thus taking seed at about the rate of three pecks per acre.

It requires to grow thick to ensure fineness of the stalk,—a quality desired by the brushmaker.

The seed should weigh forty pounds to the bushel.

The *Canada Farmer* thus describes the securing of this crop:

"As the seed as well as the brush is of value, and the first autumn frost kills the plants, the operation of harvesting should be performed as soon as the seed is ripening and before frosts come. The stalks are bent down at a height of two feet from the ground, laying those of two opposite rows across each other obliquely, leaving a clear passage between every other two rows for the convenience of passing through when it is ready for cutting. After it has been so bent over, the brush will cure sufficiently in from four to six days to be cut, which is then done with a sharp hook or sickle, leaving about one foot of the stalk, or even less, in the ground. After being cut, it is sometimes laid out to dry still more; but if the weather has been very favourable, and the brush is dry enough not to heat or get mouldy when packed away, it is carried to the barn. If it is bound in small sheaves, there will be less trouble in getting off the seed. If not perfectly dry, the brush must be spread out on scaffolds in the barn till dry. The process of extracting the seed is called 'scraping the brush;' this is done in a machine invented for the purpose. It is an upright implement of elastic wood or steel, fastened to a bench of the requisite height for an operator to sit at. The brush is taken in hand, and the top part, as far as the seed extends, is brought down on the top of the machine, forced through between the teeth, and drawn outwards toward the operator. This separates the elastic portion of the brush, and when drawn out the seeds are scraped off in the process. If the stalks are cut before the seed is ripe, the brush is stronger, and more elastic and durable; but the value of the seed then lost is a serious item, and unless the grower can make certain of obtaining as much higher price as will cover the loss of seed, he will not submit to the sacrifice. The seed weighs forty pounds per bushel, and is said to be valuable for feeding stock, though we have had no actual experience in that way to enable us to judge.

"Sometimes the broom-makers will contract to take the whole crop on the ground, and attend to the cutting and curing themselves, when they desire to take pains to have a particularly good article of brush."

To keep birds from corn when first planted, the following plans are recommended:

Put the corn, say half a bushel, into a tub, and pour in hot water enough to cover the seed; let it stand a few minutes, then strain off the water, and pour over the corn a little gas or coal tar, which has been previously warmed until it is thin; with a stick stir it thoroughly, which will give every kernel a coating of tar; then dust over it dry plaster to prevent the grains sticking to one another, and stir it up again.

No birds will touch it after such a dressing, and though the seed will not sprout quite so soon, yet no injury has been done to it.

The following is from Brown's "Book of Manures:"

Saltpetre, one pound; copperas, sul. of iron, three pounds; dissolve each in six quarts of water, in separate vessels (rain water is best). Put eight quarts of shelled corn into a tub, and over it pour the two liquids; stir the whole well together, and allow it to remain twenty-four to thirty-six hours. Just before planting, drain it off. As soon as the corn is dry enough, coat it lightly with coal tar and dust it with plaster, and then plant. Seed prepared in this way is not liable to be attacked by birds or worms, will give the young plants an early start, a vigorous growth, and an early maturity. If crows or other birds attack it, they will not try more than a hill or two; and if they eat what they have pulled, will be found on the ground dead or dying.

But the surest way, and we have succeeded with the plan over and over again, is—

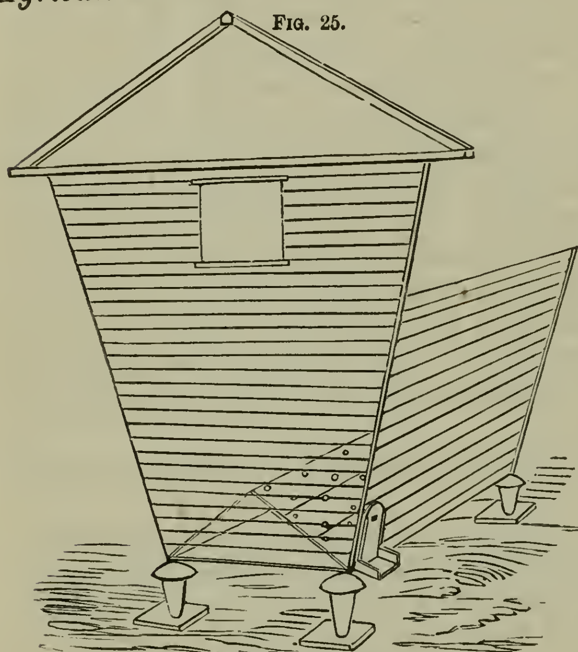
"String" the field with white cotton twine; fasten it to short stakes, and cross it about every three rods. The crows are "scared" of a trap, and keep at a respectful distance.

There is a use for corn-husks not generally adopted. Dried and torn into strips, they make excellent mattresses—clean, sweet, soft and elastic.

Plaited into a rope, and wound round, they make good door mats.

Corn-cribs.—We extract the following from the *American Agriculturist:*

FIG. 25.



Improved Corn-crib.

"Corn-cribs might be improved in a double way by a somewhat similar arrangement of the floor. Generally, if any mould occurs in a crib, it is on the floor, as here is found the first corn put in, which is generally dampest, and here the least ventilation takes place. A floor raised "roof-shaped" (Fig. 25), and holes bored in it for ventilation, would effectually prevent dampness or mould in that part of the crib; and if slide-doors are put here and there at the bottom, at convenient places, the crib may be emptied, or nearly so, without taking a shovel or scoop into it. We have found that rats may be excluded from the crib by a peculiar form of post, turned smoothly in the lathe. The shape is somewhat like a mushroom, the stalk smallest at the bottom. The blocks (sunk in the ground) are of wood, with holes made to receive the posts, which enter four or five inches and fit tightly. This causes the crib to stand firmly. When the posts are made smooth with sandpaper, no rats or mice will mount them."

Estimated cost and profit from an acre of corn;

Rent of land	$3.00
Ploughing in fall	2.00
Hauling out manure	2.00
Cultivating in spring	.60
Harrowing twice	.60
Planting	.50
Cost of seed	.30
Cutting, husking and cribbing	5.00
	$14.00

Credit.—40 bushels shelled corn, at 70c $28.00

Leaving a profit of $14.00 per acre, with the corn fodder thrown in, and the land in first-class order.

Soiling.—For this purpose corn is one of the best fodders that can be grown. The best recommended kind for this purpose, on the continent, is Stowell or Evergreen Sweet Corn.

The Sanford is an excellent variety, as it puts forth a profusion of leaves, stalks and suckers, and is a very rapid grower when young.

There are a great many varieties of early sorts, suitable for soiling purposes, amongst which we may mention—

The *Sioux, Dutton, Mandan, Sugar, Tuscarora, Adams, King Philip,* and the *Chinese Tree.*

The subject of soiling will be treated more fully in the pages devoted to cattle.

FLAX AND HEMP.

Flax.—"It is strange that so many professing to take a deep interest in agricultural matters neglect this valuable branch altogether. It only requires a visit to the Counties of Wellington and Waterloo to convince the most sceptical that the growth and manufacture of flax is one of our most important interests in the new Dominion. At St. Mary's will be found the produce of not less than five hundred acres; at Woodstock, at the fine mills of Mr. Brown, the produce of seven hundred acres, three hundred of which, I am told, were grown by himself at Elora; the produce of other five hundred acres at Baden, Conestoga, Stratford, Maryboro', and several other places. The most active operations are being carried on. Employment is given to from twenty to thirty hands at each of those mills, and a much larger number during the grassing season, which continues several months.

"While we are all most anxious to make the most of our lands, flax presents itself as another of the crops well worthy the attention of the farmer, from the fact that it is bringing as high a price, when ready for market, as it did during the American war; and it only fluctuates in price like all other products.

"Farmers have often been urged through the press to sow this crop, each on at least a couple of acres on his farm. This would soon be the means of flax mills for scutching being established in every part of the country.

"From the experience of every man that has tried flax in this country, it has been found to answer best when it is early sown, so that it may get a *clear month* before drought overtakes it. To those who have not made the trial before, I would say it is desirable to put flax in a piece of the cleanest and richest soil on the farm; clay loam is preferable to any other when the soil is deep and friable. On such land you may safely sow two bushels of seed to the acre.

" If you want to seed down, do so by all means with flax; there need be no apprehension about the clover plant being removed on pulling the flax. On the contrary, it moulds the plant and causes it to spring up with more vigour and freshness.

" Let not the pulling deter the farmers from growing flax any longer, as they can as readily obtain a machine for pulling purposes as they can a reaper for taking off their grain, and at the small cost of seventy-five dollars or eighty dollars each.

" I should have said, while speaking of the proper kind of soil to sow flax on, that nothing can beat a piece of old ley, and if ploughed in the autumn, it may be sown in the spring with great certainty of a good crop. Let the ridges be made as wide as possible, with as few furrows as you can get along with, as the plant invariably grows more in length along the edges of the furrows, and it is most desirable to have it all as near one length as possible.

" During the last two years the price of this article has been much reduced, owing to the great fall in cotton since the American war; while barley, wheat, and indeed most other crops bringing high prices, several of the enterprising scutch millers have been induced to abandon the enterprise for a time.

" What is most wanted at the present time is an established market at some convenient point for shipping, and I have little doubt some of our enterprising neighbours will soon fill up this want also, so that we shall not have to depend on the periodical visits of those buyers who only find their way here when the article is scarce in other countries.

" There are now at work at least twenty scutch mills. Some will produce this year fifty tons of clean scutched flax. At Woodstock, St. Mary's, Maryboro' and Elora, a much larger quantity will be produced, but in round numbers say each of those twenty mills will produce fifty tons. This would make one thousand tons. At current rates—three hundred dollars per ton, or fifteen cents per pound—this would net the handsome sum of three hundred thousand dollars, foreign capital brought into the country in a few months. The value of the seed also will amount to another large item, the price per bushel being from one dollar and a half to one dollar and sixty cents for every fifty-six pounds.

" In looking over the map of the Dominion, I find there are over forty counties that have as yet to give the cultivation of flax a trial; but if each of those counties would only produce an equal amount to that now produced in Wellington or Waterloo, we should have a handsome revenue coming into the country annually of from eight to ten millions of dollars for fibre and seed, to say nothing of the increased employment it would create, and help in a great measure to bring an industrious, skilful class of immigrants to our shores."—JOHN A. DONALDSON, G. I. Agent, *in The Canada Farmer.*

Hemp.—The following is an Essay to the *Canada Farmer* for 1869, on the Cultivation and Preparation of Hemp, by H. G. Joly, Esq., M. P. :—

"It is necessary that I should begin by stating, for those who may not be acquainted with the fact, that the male, or fecundating flower of the hemp, and the female, or seed-bearing flower, grow upon separate and distinct plants. So that hemp, unlike flax, whose every plant bears seed, is divided between female, or seed-bearing plants, and male plants, which do not bear seed, but are indispensable for the fecundation of the female plant.

"I have never read nor heard that it was possible to distinguish the sex of the plant in the seed of hemp ; male and female must, therefore, be sown and grow up together. There is nearly an equal quantity of each ; if anything, the female slightly predominates. The male ripens about three weeks sooner than the female. It is known to be ripe when its stem and leaves assume a yellowish hue. That colour makes it easily distinguishable from the female, which at that time is still perfectly green.

"There are no two countries—scarcely two localities in the same country—where hemp is treated identically in the same way ; but I think all the various modes of treatment can be safely classified under one or another of the two following heads—the old-fashioned European, or the new-fashioned Kentucky mode.

"The choice of the ground, the way to prepare it, the sowing of the seed, and the cultivation between seed-time and maturity, are the same in both these modes of treatment, which, in fact, differ but on one point, the harvesting of the crop.

"*Choice and Preparation of the Ground.*

"I will quote some good authorities on that subject, whose words will carry much more weight than mine, merely stating that, from experience, I have found them to be perfectly correct.

"Mr. Bradford, of Kentucky, says :—

"'The soil for hemp must be a strong, calcareous, deep, warm loamy, and perfectly dry one, deeply and thoroughly prepared by ploughing and cross-ploughing, according to its previous condition, until a fine state of tilth is produced.'

"Henry Clay says :—

"'The lands which produce hemp best are those which are fresh, or which have lain some time in grass or clover. Manuring is not much practised yet (in Kentucky). Clover is used in lieu of it. Fall or winter ploughing is practised with advantage. It is indispensable in old meadows or old pasture grounds intended for producing hemp.'

"Sebastian Delamer says :—

"'Hemp gives but a very unsatisfactory return on soils of too sandy or clayey a nature, on shallow soils, on those which are apt to be scorched by the sun, or are unable to receive their due share of atmospheric influence. Fresh broken lands, in the midst of woods and forests, are favourable to its growth.'

"*Sowing the Seed.*

"We sow hemp, in the district of Quebec, about the first week in May. You can safely sow yours, in Upper Canada, at least a fortnight sooner. Sow it broadcast, about one bushel to the acre (for hemp grown for rope-making, which is the only kind, I think, that can be advantageously raised for the present in Canada). Harrow before sowing, and harrow and cross-harrow lightly after sowing.

"Never sow seed older than the preceding summer's growth, for it is admitted by every one that hemp seed loses its vitality rapidly. The seed must be plump and full, and rather dark in colour. Whitish and greenish seeds are always bad.

"Last year I imported seed from Piedmont, north of Italy. It came to an absurd price, but, with proper management, it ought to be got here for four or five dollars a bushel. This year I import Kentucky or Missouri seed (I think it is the same), for which I expect to pay, delivered in Quebec, from three to three dollars and a quarter per bushel. Mr. Wm. Evans, of the Agricultural Warehouse, Montreal, imports all my seed. From experiments made last year, I am, so far, inclined to give the preference to the Missouri seed over the Piedmontese. Some of the plants from the latter are, it is true, much taller than any produced by the former; but the crop yielded by the Missouri seed was a good average length, and much more equal in height and thickness than that from the Piedmontese seed.

"There is no cultivation whatever required between seed-time and maturity; the rapid growth of hemp chokes up all weeds; in fact, it weeds itself.

"*Harvesting.*

"I have now reached the point at which the European and Kentuckian modes of treating hemp begin to differ from one another—I mean the harvesting—and I will proceed to show in what that difference consists.

"In Europe, when the male hemp has become ripe, it is pulled by hand, plant by plant, allowing the female plant to stand, in order that its seed may ripen, which takes about three weeks from the time the male is pulled. After being pulled, the male plants are laid out to *ret*, or, as it is more generally called in the country, to rot, either on the ground or in water, like flax. The same process of retting is followed both in the European and the

Kentuckian treatment of hemp. When destined to be retted in water, hemp is put up in bundles, which must not exceed ten inches in diameter or thereabouts at the thickest part, so that the water may act easily on the centre of the bundle. Five or six days in stagnant water, when the weather is still warm, is generally sufficient. It takes much longer in running water. When the water is cold, owing to the lateness of the season, it is better to ret on the ground. It takes from one month to six weeks to ret on the ground—the time depending completely upon the greater or lesser frequency of rain.

"When the bark which contains the fibre can be easily detached from the wood, in long strips uninterrupted, from the root to the top of the plant, the retting is completed. Hemp ought not to be spread upon the field to dry the moment it is taken out of the water, for it is then soft and brittle, and might be injured. The bundles must be put up standing along a fence, a wall, or, if neither be quite convenient to the pond, some light scaffolding erected for the purpose, after slackening the ties, which can be readily done by pushing them up towards the thinner part of the bundles. They are left standing for a day or two, until the water has run out of them. The plants are then fit to spread on the ground in thin layers. When dried on one side, turn them over, and a few hours of sunshine will complete the operation. Do not take them in unless thoroughly dried.

"When the seed hardens, the female plants ought to be pulled. It would not do to wait until the seed is quite ripe, because the bags containing it will then burst, and the seed drops on the ground, and is lost. The seed is allowed to ripen for a few days on the field, care being taken to prevent the head of the plant, which contains the seed, from resting on the ground. It must not be beaten out with the flail. It is too soft for that, and would be crushed. The best plan is to bring barrels or boxes to the field, hold the handful of hemp with one hand, the heads of the plant placed inside the barrel or box, and with the other hand, armed with a small stick, beat the heads until the seed drops, after which operation the female plants are retted in the same way as the male plants.

"When the seed is extracted, it is taken under shelter, and laid in very thin layers, not more than a couple of inches thick, for it is very apt to heat when not thoroughly dry. It is well to turn it over from time to time. After a month or so, when well dried, the seed is winnowed and put up in bags or barrels.

"Such is the European mode of harvesting. Now for the Kentuckian. In Kentucky, Missouri, and other parts of the States, the whole crop of hemp, male and female, is pulled, or more often cut, at one and the same time. The period chosen is about half-way between the maturity of the male and the female plants, say about ten days after the male has ripened. The instrument used for cutting hemp is something like a reaping-hook, only the blade is much stronger, nearly straight, with the slightest inward curve, and about twenty inches long; the handle is straight, two feet in length.

"If the crop is to be cut with the hemp-knife, the operator is required to cut at once through a width corresponding to the length of the hemp, and as close to the ground as possible, spreading the hemp in his rear, in an even, smooth swath. It is afterwards spread out on a meadow for retting. This is 'dew retting.'

"I think you will agree with me that the Kentucky mode is preferable, for the following reasons :—

"1st. Because it does not exhaust the soil, the seed not being allowed to ripen; but if it stands for seed, it is on all hands acknowledged to be an exhausting crop.

"2nd. It saves one pulling, both male and female hemp being pulled or cut at once; and that one pulling saved amounts to more than one-half the work of harvesting. It speaks to common sense that the first pulling alone, according to the European system, when you must choose and pull the plants one by one, takes more time than a general pulling or cutting of all the plants at the same time; and when they come in Europe to the second pulling, that of the female plants, as they do not stand quite close together (the male plants having been removed), the work does not proceed quite as rapidly, in proportion to the number of plants pulled, as it does in Kentucky.

"3rd. When it is intended to ret hemp in water, the warmer the water is, the more rapid and perfect is the retting. Now, as the season advances towards autumn, the water cools rapidly. The ten or twelve days during which the female hemp is allowed to stand after the male is pulled, and the time afterwards required for hardening and ripening the seed, and taking it off (which is often protracted to one or two weeks by rain, for the seed cannot be knocked off unless the plant is perfectly dry), may cause a long delay, during which the water often gets too cold for retting the female plant (as happened to me last fall), and then you must ret on the ground, when the colour is not so fine. This applies more particularly to Lower Canada, where the seasons are shorter.

"4th. I think the fibre of the female plant is stronger when pulled before the seed is ripe.

"The high price of labour on this continent accounts for the new mode of harvesting adopted in America. The Kentucky hemp is quite as strong as the Russian, but its colour is not as clear, owing to its being retted on the ground, and it accordingly compels the rope-maker to employ tar of a lighter colour, which is more expensive than that required for the Russian hemp. The water in Kentucky is not soft enough for retting hemp.

"The Kentuckians sacrifice the seed, but they have found out that the saving in labour both in the pulling, and afterwards in the curing of the seed, more than compensates for the loss of the seed. In other places, where labour is cheaper, it may be otherwise. We have still a great deal to learn from experience.

"For those who will try the European plan (as both plans ought to be fairly tried) and save the seed, I will state that, taken equal weights of flax-seed and hemp-seed, hemp-seed will yield in oil two-thirds of the quantity that flax-seed does. This statement, however, must not be looked upon as conclusive. It is merely a personal opinion, based upon the results of one experiment made this last fall at Messrs. Turcotte's oil mill at Beauport. Those gentlemen had never worked hemp-seed before. As we gain in experience we may expect more favourable results. But, even calculating upon that, if an acre of hemp yields, say, twelve to fourteen bushels of seed—and I think it will do that if carefully worked—that yield would be an important item, well worth the farmer's consideration, where cheap labour can be obtained. The oil is employed, in Europe, for painting. I got ours tried here by a reliable painter, and it gave much satisfaction. It appears, however, to change the colour of white lead a trifle more than flax oil does, but it is just as good for every other paint. The hemp cake is fed out to cattle with the same results as flax cake.

"We have seen that by following the Kentucky mode of harvesting, the seed is sacrificed. In order to procure the seed necessary for the next season's sowing, they lay out a small patch of good land in hills, a couple of feet in diameter, disposed in straight rows, three feet apart each way. They plant seven to eight seeds in the hill. The same rules observed for the cultivation of Indian corn will apply in the after culture of hemp-seed. Those plants with plenty of room to expand laterally, will throw out, in every direction, branches covered with seed. Of course, their fibre is quite worthless, owing to those same branches, but the yield in seed is extraordinary. I took myself, from two plants, about one pint apiece of clean seed. You can form an idea of how small an area of ground would be required in order to yield one bushel of seed.

"As to the pecuniary returns from hemp, grown for the fibre, per acre, I must base my calculations upon the price paid our farmers last summer, namely, half a copper a pound for unretted hemp, and one copper for retted, delivered at the mill. One man was paid at the rate of sixty dollars per acre, irrespective of the value of the seed, but that was the highest. Those who had well selected the land generally ranged between that rate and thirty-five dollars. The drought in our part of the country was extraordinary. The hemp crop suffered very severely from it, as did the flax, so that our success was far from complete. Some farmers, who had sown their hemp in good soil, but such as Sebastian Delamer describes as 'apt to be scorched by the sun,' were disappointed. Some others, who pitched it carelessly in poor soil, without due preparation, and expected a miracle, were more than disappointed. One must be prepared to meet these checks with patience. However, the general results of last summer's trial, allowing for the great damage done by the unusual drought, which at one time made me fear that all was lost, were of such a nature as to encourage those upon whose help we must mainly depend—the careful, intelligent and enterprising farmers, whose example will tell in the course of time upon the others.

"When the male and female plants are pulled separately, the female being kept for seed, the price of half a copper a pound for unretted hemp is not unfair to the manufacturer. Both plants are then brought to him ripe; the sap is dried up; the leaves are gone, and in that state it will not lose more than half its weight in retting, which will bring it to one copper per pound for retted hemp. True, the manufacturer has the trouble of retting it, but it may be worth his while to have ponds, and ret it in water, which will give him a superior article, the farmer generally retting on the ground. But that same price of half a copper a pound for hemp not retted, when both the male and female plants are pulled at once, is more than the manufacturer ought to pay; for while the male is dry, and worth that price, the female is still green and loaded with leaves, and will lose more than half the weight in retting; there ought to be some deduction in that case, say one-fifth or one-sixth on the whole; if the crop has been cut down with the hemp knife, the deduction ought to be much smaller, if any, because the manufacturer has not then to pay for the weight of the roots, which is a considerable item. For my part, until the whole business is more practically understood by us, I would prefer it if the farmer were to ret his hemp himself, even on the ground, and deliver it at the mill at the rate of one copper a pound, as some have done. At that rate one acre, well cultivated, ought to yield him about fifty dollars. It would not impoverish the land if both male and female plants are removed at one time, and would prepare it for wheat.

"Of course, it is useless to start the growth of hemp on a large scale, where you are not prepared to dress it. In Europe they dress it by hand. Labour is too expensive here for such a slow process. We must have recourse to machinery, as they do in the States. A hemp mill worked by water, such as I put up at Lotbiniere last fall, given the motive power (water-wheel, steam or other; it appears that in Kentucky they use horse-power, in the absence of water-power), and a shaft on which to hang two pulleys, one for the break and one for the scutchers, will cost from $300 to $350 at the most.

"The whole machinery consists in a six-roller break (Sandford & Mallory's pattern), manufactured by Mr. Wm. Moody, at Terrebonne, near Montreal, and sold by him for $240, and of two scutching pulleys, with five knives on each (the pulleys made of birch and pine, and the knives of well-seasoned maple or spring steel). Hemp requires much less scutching than flax: I think two scutching pulleys, with five knives each, will be sufficient for the former, where five such pulleys are required for the latter. Put over the machinery a covering, consisting merely of a roof without sides, so that the dust will not trouble the men.

"The scutching pulleys, with the knives attached to them, must be raised off the ground a good deal higher than for scutching flax. The shaft of those pulleys ought to be at least four feet from the floor of the mill, the men who scutch standing on stools. The reason is that, if you leave your scutching knives as low as for flax, the ends of the hemp will lie on the ground (it is often eight or nine feet long), when the knives, in their swift revolutions, pick them up. The hemp then gets entangled, and ultimately rolled up round the shaft, and is lost, as I found out to my cost.

"The outlay of $300 to $350 for the machinery of a hemp mill, though not very considerable, is more than one would like to incur for the simple experiment of a new thing, especially when undertaken with some doubt as to the final success. But, without incurring any expense, the trial can be made—as I made it before building the hemp mill—either at any flax-dressing mill, or, in the absence of such a convenience, with the common old-fashioned flax-break, worked by hand, so well known to every farmer. If there be a flax-dressing mill at hand, you can make use, for your experiments, of the flax-break, taking care to slacken a little the screws that keep down the upper rollers. Hemp, being thicker than flax, requires more room between the rollers. If your flax-break is not very strong, to avoid injuring it, it will be well to cut off the roots of thick hemp before passing it through the break, but you are not obliged to go to that trouble with a regular hemp-break. Once broken, scutch the hemp with your flax scutching knives, on revolving pulleys, taking great care that the long ends do not get entangled; or with a common hand scutching knife. Six pounds of retted hemp, at the rate of one copper a pound, cost the manufacturer five cents, and will produce one pound of clean dressed hemp. The cost, delivered at Quebec, of Russian hemp of the same quality as our Canadian hemp, was, last fall, about 9c. per pound, which I am told is not a very high price in this market. This would leave a margin of four cents a pound for dressing and delivering here; and I think we could give it cheaper than the Russian, hemp requiring much less scutching than flax. It is indispensable that it should be sufficiently retted, whether that be done by soaking in water or exposure to dew.

"We are now beginning to dress our stock of hemp at the mill, for Mr. Onslow's rope-walk at Quebec. By the spring, I shall be able to state with more accuracy the cost of dressing hemp, and the yield of retted hemp in dressed hemp. I should not be surprised if, on an average, it took something less than six pounds for one. Some people tell me that they have found it to be five pounds for one. Experience will show.

"I earnestly trust that the results of these experiments will be such as to encourage the cultivation of hemp on a large scale, and that it will be found profitable both to the farmer and to the manufacturer in Canada, as it has been found in so many countries."

ROOTS.

POTATOES—(*Solanum Tuberosum*).

"Let the sky rain potatoes." *Shakespeare.*

The history of the potato is shortly this:—

It is a native of America, and was unknown to the ancients; it is no unworthy reward to the inhabitants of the old world for the daring and energy displayed in the discovery and colonization of the new.

The word Potato is said to be a corruption of the Indian word *batatas*. In English it reads *potato;* in Spanish, *battata;* French, *patate;* and in Mexican, *papas.*

It has been found growing wild in Central America and Mexico, and a species now grows upon the Rocky Mountain slopes, from which the present Colorado potato beetle has so thickly emigrated.

It is supposed to have been first introduced to Spain by Sir Walter Raleigh, and thence to Europe generally and to Great Britain from 1650 to 1740.

As food it is a most valuable esculent, and, whether for man or beast, may be ranked as an agricultural production next in importance to that of wheat, the place of which it, to a great extent, has taken as an article of diet with both rich and poor, European and American.

It has become an universal article of food, containing great nutriment; it has been proved alone to sustain life longer than any other kind of food; its fat-producing qualities are very great; and it can be grown under any climate and upon any soil in the known world, although it luxuriates in a temperate clime and light soil.

The general cultivation of this crop has prevented any wide-spread famine on the old continent, for when all crops have failed the potato has generally proved reliable. In Canada, the chances of a famine are reduced to a minimum, for our climate and soil are admirably adapted to the raising of both flour and potatoes.

The following Table shows the comparative value of the potato as a food :—

Nutritive Elements.	Potato.	Wheat.	Corn.	Rye.	Rice.
Starch - - - - - - - -	64·20	73·8	71·2	64·00	86·9
Dextrin - - - - - - -	2·25	4·7	0·4	11·00	0·5
Sugary matter - - - - - -	13·47	7·0		2·25	
Albumen - - - - - - -					
Casein - - - - - - - -	5·77	13·5	12·3	10·5	7·5
Gluten - - - - - - -					
Fatty matter - - - - - -	1·00	....	9·00	3·5	0·8
Fibre or Husk - - - - - -	13·31	1·00	5·9	8·0	3·4
Salts and loss - - - - -	....	....	1·2	1·75	0·9
	100·00	100·00	100·00	100·00	100·00

The ashes of the potato are thus divided by chemical analyses made by Professor Morton—

—	Potash.	Soda.	Magnesia.	Lime.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Peroxyde of Iron.	Common Salt.
Tuber - - - - - -	55·75	1·86	5·28	2·07	12·57	13·64	4·23	0·52	7·10
Haulm or Tops - - -	28·02	16·26	7·09	16·96	7·62	6·88	3·85	1·05	12·33
Totals in 200 parts - - -	83·77	18·12	12·37	19·03	20·19	20·52	8·08	1·57	19·43

Or, according to an analysis made by Sir Humphry Davy, the avoirdupois pound of 7,000 grains of a potato contained—

Of soluble Mucilage	970	grains.
Of pure Starch	695	"
Of Fibre	622	"
Of Water	4713	"
	7000	"

The proportion in which the nutritive ingredients exist in different species of potatoes doubtless varies, but the above analyses show, to a certainty, how valuable an addition this tuber has been to the health and food of man and of beast.

As wood ashes contain a very large proportion of potash, it is reasonable to infer that these must be very valuable as fertilizers for the potato crop ; and experience teaches us, that we have at home a fertilizer which is capable of superseding to a marked degree the expensive foreign importations known as *special manures*.

The effect of applying wood ashes on the grass previous to ploughing down for potatoes will be, that the clover takes for its share the greater proportion of phosphates, leaving a large residue of potash for the use of the succeeding crop.

Soil.—Potatoes may be grown with success upon almost any soil, except such as have run together, or are very retentive of surface water.

Immense crops have been recorded from the clay lands, where such have been rendered dry by drainage and have been cultivated up to a friable state.

Swamps, when reclaimed and thoroughly relieved of stagnant water, have produced immense crops ; while new lands, especially where the timber fallows have been burnt, being richly filled with potash, are very superior lands for the potato. Indeed, owing partly to the hoe cultivation that it must necessarily receive, and where the top soil is bound in by a hard sod, potatoes are the very best crop to grow on new land for the first few years.

Some idea of the varying adaptability of differently constituted soils to the wants of the potato crop, may be gleaned from the following experiment :—

The produce of four eyes cut from one species and planted on five different soils was :—

On a piece of new land, hardwood ridge	36 lbs.
" a strong rich loam	34 "
" a light loam, rich	26 "
" a good gravelly soil	20 "
" a good sandy soil	16 "

Of course, this is only partially indicative of the capabilities of these soils in the production of potatoes ; much depends, in actual practice, upon the variety of seed, the thorough cultivation both before and after planting, and the climate.

But it strengthens the position that we have always assumed, that the heavy lands are the greatest yielders, provided that capital be invested in bringing them into a loamy or friable condition.

The exhaustive cry is raised upon all sides, against every crop ; and some have asserted, and been backed too by excellent authorities, that the potato crop is very exhaustive of all soils.

Our experience points to the contrary. No crop that we know of (except the clover) is so certain to leave the land in good heart.

Turnips are very exhaustive, and, if not well manured, leave the ground yellow and impoverished ; but this is not the case with potatoes, and a good crop of this tuber is certain to be followed by a heavy cereal crop.

Although not as exhaustive, neither is this crop as good a cleaner as turnips.

If potatoes received, at the hands of the husbandman, the same care and tender nursing as he is perforce obliged to devote to his turnip crop, they would produce three or four hundred per cent. a better yield than is at present the average return in Canada.

Culture.—The best position in rotation for this crop is after sod, a young clover ley being the best antecedent crop. This needs no scientific illustration ; it is consonant with the experience of every practical farmer.

It is better always to plough for potatoes in the fall: where a sod is turned, it has a chance to rot better; and where a stubble is to be prepared, the winter frosts help to ameliorate the soil.

Coarse manure should, if possible, be kept out of the field; nor is it generally advisable to apply manure directly to the potato crop. Too great richness of barn-yard manure is apt to make the plant grow greatly to top, and to render the tubers hollow and stringy.

Where manure is to be used, it is best to make it in the yard, by piling as it is drawn from stalls and byres, then draw it out in winter on the sleighs, and spread it as early in the spring as frost will permit.

Or, it is sometimes laid in the bottom of the drills, the potatoes laid on it, and the whole covered by splitting between the drills.

In this latter case the manure should be thoroughly well rotted, and it is, at best, an inferior plan, especially upon the lighter soils.

We have before us the experience of a Quebec farmer from Pontiac, on the raising of potatoes, which we commend to the attention of our readers. Our authority says he has never failed to raise from four hundred to five hundred bushels to the acre:—

"He selects the earliest and best potatoes of the variety he wishes to grow, in the fall, and lays them away for seed. He fall-ploughs the land eight inches deep, and cross-ploughs it in spring four inches deep, thus leaving the seeds of weeds, &c., at the bottom of the seed bed. He plants about the 12th of May, cuts his seeds into from three to six pieces each, a week before planting time, and is careful not to have the eyes sprout before planting. He has the ground well harrowed and levelled, marks rows both ways two and a half feet apart each way, by means of a wooden rake with four large teeth in it, each the required distance apart to mark the rows. He drops three pieces of potato at each cross mark, and does all the afterwork by means of a plough, which he runs both ways between the rows; and harvests his crop of potatoes fifteen to twenty days ahead of any of his neighbours. He grows potatoes on the same land for three years in succession, and then puts in wheat, of which he always gets a good crop after potatoes."

The experience of another practical farmer is thus worded:—

"Experiments started to ascertain the comparative value of various fertilizers.—Those planted upon the barn-yard dressing are taken as a standard by which to measure the results of the others. Barn manure we will call one; the ratio of yield of the other fertilizers will stand thus: Hen manure and plaster, one half pint per hill, gave an increase of one-fourth, or rates at one and one-fourth; leached ashes, one pint per hill, one-half less; no dressing, two-thirds less.

"Recapitulation.—Barn dressing, one; hen manure and plaster, one and one-fourth; leached ashes, one-half; nothing, one-third. My potatoes were but little affected by the rot—no observable difference upon different fertilizers—but where a low place occurred the rot was particularly at home. I have been saving my fowls' droppings with zealous care for several years, and experimenting upon various crops with them. Plaster I find the best substance to mix with them, and would advise its use freely, even to the 'half-and-half' point. I think this compound, home-made and easily handled, as the old codger observed of the cat race, 'a leetle ahead' of all other farm-produced fertilizers, all things considered.

"J. W. LANG."

Mode of planting.—Some difference of opinion has always existed in regard to the relative advantages of planting in hills or drills.

The hill system is recommended for the reason that cultivation with the horse hoe can be afterwards performed in both directions across the field; whilst the advocates of the drill consider that a greater yield can be obtained from the acre under the same circumstances of cultivation.

One plan.—Where the ground is rich enough without manure, or the manure has been spread broadcast, the potato sets are dropped, either in hills or drills, in every third or fourth furrow, and by this method, when the ploughing is finished the potatoes are also sown. When the plants appear above ground, a light harrow is put on, and the surface of the soil mellowed around the tops; this is also done to advantage under any system of planting, as by means of the harrows the weeds on the surface are destroyed or thrown back, so that no more cultivation is needed until the tops are well out of the ground.

As regards hills or drills, perhaps the better rule to lay down is, that when the land is rough and difficult to work, hills will be found the most advisable, while a better yield may be generally expected from drills where the land is free from stumps and the surface smooth.

Drills should be twenty-eight inches apart.

Time of planting must be regulated by circumstances. From the day when the frost comes thoroughly out of the ground, planting may go on at convenient intervals until the middle of June. If there be favourable weather, some one planting must get the full benefit. The most important time in the growth of a potato is its season of blossoming. If the weather is favourable at that time, the crop may be counted upon as secure.

A common mode practised in Ireland, and in some parts of the north and west of England and Scotland, is that known as the *lazy-bed fashion*, which consists in planting the sets in beds of a few feet in width, covered from trenches formed with the spade.

The manure is spread upon the land when ready for planting, and the beds are formed of various widths—from three to five and seven feet—the trenches being dug to a width of eighteen inches to three feet, and to the depth of one foot to twenty inches, according to the nature of the soil. The sets are then placed in drills upon the dung, nine or ten inches apart, and at various distances between the rows, and covered with soil from the trenches. About three weeks afterwards, as soon as the sprouts begin to appear, the beds are covered equally with two or three inches of dirt, dug also out of the trenches. This operation is not only beneficial to the plant by giving an addition of fresh mould, but has also a tendency to check the growth of, and indeed in a great measure to destroy, the couch and other weeds which make their appearance on the land; and it is repeated, so far as earthing up the plants, without covering them after bloom.

Seed.—There is probably no crop grown by the farmer that in yield and quality degenerates more rapidly than the potato. This is apparent when we consider the faded glories of those varieties that we were wont to consider the princes of the pot some ten years ago. Where are the Cups and the Messhanocks gone (the latter so rare that we hardly know that we have even spelt the name right)? But as the crop degenerates quickly, so is it capable of very great and comparatively rapid improvement.

Seed-bulb.—The manner in which new kinds of potatoes are raised is by the apple or seed bulb, which grows attached to the stalk and above ground.

These apples require to be gathered in October and November, and planted out again by themselves in the succeeding spring. When they have grown two or three inches above ground, they require to be moulded up and afterwards treated as an ordinary potato crop. When the potatoes, thus raised from seeds (and which are seedlings from the variety on which the balls or apples grew), have come to maturity, careful selection should be made of those from which it is intended to propagate the new variety; gathering from beneath the haulms that are most healthy and vigorous, and that have ripened early. It will take about three years to raise a variety to put upon the market. There is in this method very great risk; for out of one hundred seedlings so raised, it is quite possible that but one or two will have any distinctive advantageous qualities over the parents.

Whole or cut potatoes for seed.—The controversy on this point has waged rancorously for the last fifty years. No matter how old the book that the student may take up; if there be any information on the cultivation of the potato, he will find the controversy taken up between the advocates of planting whole tubers and those of growing from cut seed.

For our own part, we consider that the point, notwithstanding the flood of editorials and of correspondence that is constantly poured into the agricultural press, rests mainly upon the healthiness and variety of the seed, and the method of cultivation by the husbandman.

Of one thing we must be careful, not to let sprouts grow too long on potatoes before planting; they weaken the vitality of the seed.

We will shortly touch upon the point at issue—whole or cut potatoes for seed.

Dr. F. M. Hexamer, who has devoted much time to the history and habits of the potato, and who is always looked upon as one of the best authorities on any subject connected with that plant in America, in a lecture delivered to the Cornell University, says upon this particular part of our subject:—

" It makes no difference how potatoes are cut for planting, The sprouts may be broken off, and they will grow again. If the piece has no eye, it will nevertheless nearly always grow; and even if the eyes are all cut out and the potato planted, it will grow; because the branches of the medulla, which end in the eyes, are still there, and, like the branches of a tree when the points are cut off, they sprout out anew and grow. The eyes may be cut out and planted, and the potato used for food, as is often done when they are scarce and dear. If a very choice variety is scarce, the eyes may be cut out and divided and subdivided, and they will grow and produce large potatoes."

In this way the lecturer said he had raised $600 worth of potatoes from $10 worth of seed

The chief objection to the planting of whole seed has ever been that such will throw up too many sprouts, in the same manner as would thick-sown corn; and will, in consequence, yield too many small potatoes.

The summing up of the very many experiments that we have seen recorded, and from the few that we have ourselves made, has led us to believe that sets *cut from full-grown healthy tubers* are as productive as the whole tuber; and there is undoubtedly effected a saving of seed.

Of one thing we are convinced, that it is a sad error to pick out the small potatoes and plant them for seed. " Like produces like" is the universal law, and as we require to grow a medium-sized potato of each sort, neither big and coarse nor small as a marble, so should we use seed of a medium size.

From a great variety of experiments carried on for many years, it has been recorded that " the heaviest crop of potatoes, and those most profitable to the grower, will, in most soils and seasons, be obtained from tubers of considerable weight, and will be found least subject to decay in wet and cold seasons. It is, however, probable that, when the soil is very dry, so as to preclude all grounds of fear of the cuttings decaying, more regular and better rows of plants might be obtained from single eyes placed at short distances, with a moderately large portion of the matter of the tuber, than the whole tubers."

This last opinion we cordially endorse from our own observation. A neighbour grew the finest crop of *Peerless* last year from sets cut to a single eye out of good medium-sized seed, that it has ever been our lot to see taken up.

Seed and tail end.—There is a difference in the nature of the eyes or beads which appear on the surface of the potato, those at one end being more prolific than at the other. A great difference of opinion exists as to the use of the seed end or of the tail end.

The stems which spring from the nose of the potato are more vigorous than such as spring from that end of the potato into which the fibre which connected it with the mother plant, and from which the potato itself is grown, germinate but feebly, and do not attain the size of those coming from the seed end.

In every field of potatoes that we have seen, where the cuts were taken for seed from both ends indiscriminately, some of the stems grow with much more vigour than others, which undoubtedly proceeds, in the majority of cases, from planting weak sets cut from the tail end of the potato.

Our own opinion halts midway between Dr. Hexamer's one-eye theory and those who throw away the seed end.

And we have observed, invariably, that the most regular-growing and even-ripening crops of potatoes are those from sets that have been made by splitting the tuber from nose to tail.

After-culture.—As we before observed, a stroke of the harrows immediately after the top comes through is as effectual as a hand hoeing, and breaks the mould round the young plant; there is no fear of dragging off the plant with a light pair of harrows.

The after-culture consists simply of the free use of the horse hoe and moulding up the potatoes, all of which should be done for the last time before the potatoes bloom.

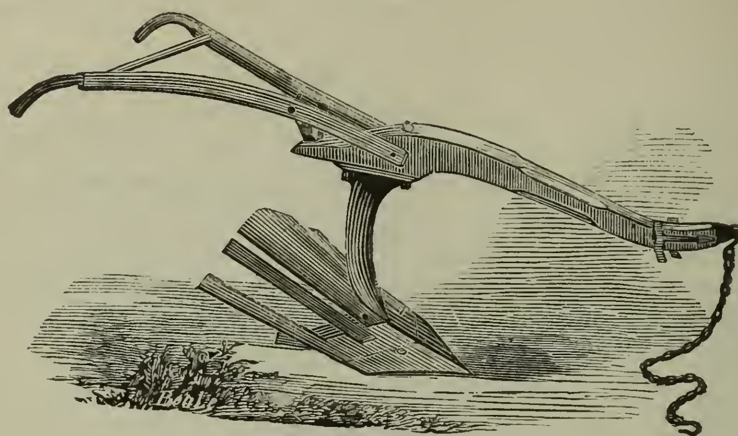
It has been asserted by Sir John Sinclair, that "*the plucking of the flowers ensures a greater weight of crop.*" And another authority says it has been proved by many other persons, as well as by himself, that "if the *blossoms of a potato plant* be picked off as soon as they may become visible, the quantity of potatoes will be considerably increased."

We should prefer to see the experiment tried on some other farm than our own.

Digging.—We are adherents of the good old fashion of lifting with the fork, believing that by the time potatoes have been ploughed, picked from the ground and cultivated and harrowed for a second and third picking, there is little saving effected over the old-fashioned plan; whilst the work is most assuredly not as cleanly performed.

We have ourselves had no opportunity of witnessing the operations of the potato diggers, but we know them to be impracticable in any but well-cleared fields. The accompanying is an engraving of this implement.

FIG. 27.



Potato Digger.

Storing.—All potatoes should be dug as soon as thoroughly ripe, that is, as soon as the tops can be detached by pulling from the bulbs. They should be left upon the surface of the ground, if the weather be open, until the earth upon them is perfectly dry. Upon lighter lands, two hours will often suffice for this purpose. They should then be piled or pitted in small heaps containing from twenty to forty bushels, and left to sweat until there be danger of injury by frost. This sweating process has to be undergone somewhere, and it is far better that it should take place in small heaps outside, than when stored in large quantities in a cellar.

If potatoes are to be left out through our long Canadian winter in pits, such pits should be dug in a dry spot, from two and a half to three feet deep, and great care should be exercised in the formation and covering of the heaps. We are no advocates for large pits. We consider fifty bushels to be the best size, and our reasons for so thinking are, that our risk of loss by excess of heat or frost is thus reduced to a minimum; that such is a handy-sized pit to open and pick over during the snatches of fine weather that we may have in winter or early spring, and that fifty bushels just about make a convenient waggon load.

Lay the heap upon a very light bottom of straw, just sufficient to keep the root from contact with the earth. Pile up neatly; cover with a foot of loose straw and six inches of earth firmly compacted with the spade. Build in a ventilator, and leave it until the very severe weather sets in. Long ere that time the potatoes will have been thoroughly sweated. Then take away the ventilator and make all snug.

We would recommend every farmer to hang one or more thermometers in his root cellar. They can be bought at fifty cents apiece, and the cost is well repaid by the knowledge that our cellars are neither too hot nor letting in the frost. In entering a cellar from the outer air upon a cold winter's day, it is impossible to tell what is the temperature inside by the *feel*. An atmosphere in which the temperature is at 26° will feel warm after leaving the open air, where the thermometer stands in the neighbourhood of zero.

We have found it an excellent plan to keep potatoes in barrels, and any that we have intended to hold over for seed we have always so kept in the cellar

Diseases.—The common disease of potatoes, although not so bad as in the old countries, is yet very prevalent in Canada, and is known as *Rot.*

The disease arises from the existence of innumerable and infinitely small particles of moisture in the skin of the potato; and from this knowledge, it would appear a natural suggestion, that heat applied to the skin of a diseased potato would absorb such moisture, dispel it and prove a cure.

The presence of rot is generally accompanied by mildew of the stalk; indeed, experiments in proof of this have been tried and have resulted successfully.

"The vines should be watched closely, and on the first appearance of the disease, plaster should be applied; not merely sowing it broadcast, but dashing it over and under the vines, bringing it in contact with the stalks, using a handful to three or four hills. Plaster for this purpose should be very dry and powdery, and should be applied when the air is still. One application is seldom sufficient; it should be renewed as often as circumstances require, Examine the vines about three days after a cold night, or about the same length of time after a heavy rain. If the leaves begin to curl and wither, apply plaster at once, and, in short, whenever the vines show any signs of drooping; be the causes bites of insects, excessive humidity of the atmosphere, or sudden change of temperature—drooping from any cause whatever indicates the approach of mildew, which should be promptly met with an application of plaster.

"As before stated, plaster the vines as soon as they are up; again after the last ploughing and hoeing; after that, one, two or three times, as circumstances indicate. By this method the vines are kept of a bright, lively green, and the tubers are kept swelling until growth is stopped by frost. Another point gained is, potatoes so grown are so sound and free from disease as to be easily kept for spring market, without loss by rot."—*Dr. H. Compton, in Utica Herald.*

The remedy as applied to the potato itself was effected by a

Russian physician, who took in a quantity of potatoes with the object of converting them into sets for the following season, and, for want of other accommodation, they were placed against the wall which separated the kitchen fire from the room adjoining (this was in England). A strong heat from this fire, which was daily lighted at an early hour, and kept well supplied with fuel until a late hour at night, was diffused amongst the potatoes, and produced the unlooked-for effect of absorbing the moisture contained in the skin of the potato.

Quite unaware of the process which the potatoes had undergone, the doctor had them cut into sets and planted them, and when taken up for use, he was much astonished and highly delighted to find that he had not an unsound potato in the entire crop, whilst the crops of his neighbours, on every side of him, were totally unfit for use.

It has been suggested that by laying out the potatoes, either before or after cutting them, upon the drying-floor of a malt-kiln, or on the floor of a bakehouse, all the good effects above named may be obtained.

Doubtless the action of covering the potato sets with plaster, as performed in Canada, has to a limited degree a precisely similar effect.

Computation of Crop.—Taking up a three-ounce potato, we should call it a fair tuber; a five-ounce, we should call a fine one; and an eight-ounce, we should call an extra root. Probably the average will not be over three ounces for the ordinary seed potatoes.

Now, suppose we grow our potatoes in ridges, twenty-eight inches apart from centre to centre, there will be eighteen thousand six hundred and seventy lineal feet of ridge in the acre. Let us put the sets nine inches apart the one from the other along the drills, and we shall have twenty-four thousand eight hundred and ninety-three sets to the acre; and if each set produced three potatoes weighing three ounces apiece, or an aggregate weight of nine ounces to a set, the acre would produce fourteen thousand and two pounds, or two hundred and thirty-three bushels.

We will now take smaller seed on inferior soil, and see what a vast difference a slight variation in the productive power of each seed will make in an acre's yield.

Supposing one potato to only average two ounces; we have, as before, twenty-four thousand eight hundred and ninety-three sets in an acre, and if each set produced only two potatoes of two ounces, or an aggregate weight of four ounces to a set, the acre would produce six thousand two hundred and twenty-six pounds, or one hundred bushels.

From the reverse process it will readily appear that where a crop only yields one hundred bushels to the acre under the drill husbandry, twenty-eight inches between drills, and nine inches between sets, each set produces an average yield of four ounces of potatoes; whilst the result of two hundred and thirty-three bushels per acre points to an average yield of nine ounces to each set.

Let us now take the first, or four-ounce yield to each set, and figure out what the yield should be of the crop when sets are placed at six inches apart.

We shall thus have thirty-seven thousand three hundred and forty sets, which, yielding each four ounces, would give us nine thousand three hundred and thirty-five pounds, or one hundred and fifty-five bushels, which is probably the average yield in Canada under good cultivation.

Now, from this it would appear that, with our estimate of the yield of the average potato for seed at two ounces, we shall, with drills twenty-eight inches apart, and six inches between the sets, require thirty-seven thousand three hundred and forty sets to the acre.

If each seed potato makes four sets, we shall require nine thousand three hundred and thirty-five potatoes, weighing two ounces apiece, or one thousand one hundred and sixty-seven pounds, —equal to twelve bags per acre.

Table showing amount of seed potatoes required, when cut or uncut, and when set at different distances apart, in drills twenty-eight inches from crown to crown.

Whole, and planted	....	6	inches	apart	77	bushels	per acre.
"	"	9	"	"	50	"	"
"	"	12	"	"	38	"	"
"	"	18	"	"	26	"	"
"	"	24	"	"	19	"	"
Cut into two sets	"	6	"	"	38	"	"
"	"	9	"	"	25	"	"
"	"	12	"	"	19	"	"
"	"	18	"	"	13	"	"
Cut into four sets	"	6	"	"	19	"	"
"	"	9	"	"	13	"	"
"	"	12	"	"	10	"	"
Cut into five sets	"	6	"	"	15	"	"
"	"	9	"	"	10	"	"
Cut into six sets	"	6	"	"	13	"	"

The advantages, then, of cutting average-sized potatoes, or planting them whole, is the question: whether it is better to plant whole potatoes at a distance of twelve inches or eighteen inches from one another, or cut them into sets and plant them nearer to one another.

We favour the latter plan.

Varieties.—There are several hundred varieties of potatoes; we shall content ourselves with allusion to a few best tried on this continent.

Early Goodrich have fallen off considerably in the last two seasons; *Harrison*, large and prolific yielders; *Garnet Chili*, good red winter kind, well liked in Canadian market, and hardy as against rot; *Californians*, hardy but very coarse; *Early Rose*, seedling of Garnet Chili, originated in 1861, first introduced to farmers in 1868, suit Canada well; large white-fleshed, good cookers, but already show great tendency to degenerate; *Gleason*, good yielders, and very superior for the table; *Peachblow*, late, very uncertain yielders, much sought in Canadian market for winter use; *Idaho*, a new kind, not well tested yet in Canada; *Peerless*, excellent white flesh and abundant yielders.

Amongst the early kinds for the garden, we find *Ash-leaved Kidneys, Early Handfield, Myatt's Prolific, Early Shaw*—all small, and quick growers.

Amongst the medium earlies are *Buckeye*, and amongst these may also be, perhaps, classed *Early Rose* and *Early Goodrich.*

New Kinds.—Amongst the new kinds (1873) we have—*Bresee's King of the Earlies*, or No. 4. This is, without exception, the earliest variety in cultivation, having been carefully tested by many agriculturists in various parts of the country the past season, and by them pronounced from five to ten days earlier than the celebrated Early Rose, and fully its equal in quality, productiveness and general appearance. Vines quite dwarf, averaging from ten to twelve inches; leaves large; tubers large and handsome, roundish, and slightly flattened; eyes small and somewhat pinkish; skin flesh-colour, or dull pinkish white; flesh white, floury; cooks well, and is of the best quality for the table; has thus far proved very hardy, and the earliest in cultivation.

The Climax is a seedling of the Early Goodrich, and originated with Mr. D. S. Heffron in 1864. It has a stout erect stalk, large leaves; tuber about medium size, smooth, cylindrical form, swelled out at centre; eyes shallow, but strongly defined; skin considerably netted or russet, rough white; flesh entirely white, solid, heavy, brittle and never hollow; boils through quickly, with no hard core at centre; is mealy, of floury whiteness and of superior table quality. It is equally productive with the Early Rose, *but a few days later;* earlier than the Early Goodrich; while its keeping qualities are as good as those of the Peachblows.

Bresee's Peerless.—The latest and best of all Mr. Bresee's seedlings for the main crop. This is also a seedling of the Garnet Chili, and originated from the same seed-ball as the Early Rose. Skin dull white, occasionally russeted; eyes shallow, oblong; flesh white, mealy; grows to a large size, often weighing from one and a half to two pounds, and enormously productive. At a-trial before a Committee of the Massachusetts Horticultural Society in September last, this variety obtained more votes as to quality than any other of Bresee's seedlings.

Late Rose.—A sub-variety, or a sport of the Early Rose. The parent hills of the *Late Rose* were found a few years ago, in Washington County, New York. It was observed in digging a field of Early Rose that some of the vines had not ripened with the main portion of the crop, and on digging, their tubers were found to be much larger and more numerous than those in the ripened hills.

It is two or three weeks later than the Early Rose; has yielded in the last season from two hundred and fifty to three hundred bushels per acre; is hardier, healthier and a better keeper, retaining its good qualities till new potatoes come in. It also grows to a larger size than the Early Rose.

From the above we should consider this new variety as a very valuable addition to our keeping potatoes.

Extra Early Vermont.—A seedling raised by Mr. George W. Woodhouse, of West Rutland, Vermont, in 1866, from a seed-ball of the well-known Jackson White. A patch of the Garnet Chili was growing near them, and it is the opinion of experts in potato culture, that the blossoms of the Jackson White must have been fertilized from those of the Garnet Chili, as it strongly resembles many seedlings of that variety. The habit and growth of the new seedling are much like those of the Early Rose, as well as its general appearance. Vines of medium height, somewhat spreading, the tubers growing very compactly in the hill. For four years they have been grown side by side with the Early Rose, both under the same treatment, and have proved from seven to ten days earlier than that favourite sort; they are more productive; fully equal if not superior in quality; flesh very white, dry and floury; an excellent keeper, and in every way a most promising variety.

Patterson's Bovinia, or Cattle-Feeder Potato—Imported to Canada from Mr. Patterson, of Dundee, Scotland; is very rich in farinaceous matter, and can be grown on ground that is too rich for turnips.

This potato has actually yielded, in Scotland, the enormous product of twenty tons, or *six hundred and sixty-six* bushels to the acre.

Mr. Patterson, of Dundee, indeed affirms that forty tons per acre have been grown with extra culture.

We have ourselves examined and weighed some of these potatoes at the store of the Messrs. Bruce, of Hamilton, and can readily give credence to this apparently extraordinary yield under special cultivation.

We believe that this potato is destined to come into general use as a cattle feeder; the amount of nutritious food yielded from an acre of such, at an average rate in proportion to size, would give many times more good food for our stock than any other known kind of field roots.

The following are a few experiments on the potato crop, taken from the Canadian agricultural press.

A farmer from Brampton, Ontario, sends the following:—

"Soil, rather light loam. Ploughed from sod in spring of 1868, and sown with peas. Cross-ploughed after peas taken off, and ploughed again in the fall. Manured last spring, about fifteen loads to the acre, and ploughed and harrowed. Furrows for seed run with the plough twenty-seven inches apart, and from four to five inches deep. Seed cut into pieces with two or three eyes in each (Early Rose only one eye in a piece). Planted from 20th to 28th of May, about a foot apart in the furrows, and covered with the hoe. Ground harrowed down smooth immediately after planting, cross-harrowed about two weeks afterwards, and harrowed again lengthwise after the potatoes were up. Horse-hoe run through twice afterwards. No hand-hoeing or earthing up.

"Some of the varieties rotted very badly, and none could be said to be entirely free from the rot.

"In the subjoined Table, the first column gives the names of the several varieties grown; the second, the rate of yield of sound potatoes per acre, in bushels, ascertained by actual measurement of ground and crop; and the third, the amount per acre in bushels of potatoes injured and decayed by rot, according to careful estimation:

Cuzco	415	8
Harrison	411	11
Gleason	397	4
Early Goodrich	385	12
Calico	302	23
Early Rose	301	43
Garnet Chili	257	45
Peachblow	235	78
Buckeye	197	71
Mercer	133	15
Mixed lot, chiefly Cups	126	140
Myatt's Ash-leaved Prolific	98	5
Kidney	91	130
Early Handsworth	84	6."

A farmer from Orillia, Ontario, says:—

"I planted fourteen kinds on sandy loam, once ploughed, without manure; previous crop, oats.

"I tried their qualities for the table in May, before planting, and in October after taking them up, and also weighed an equal number of hills of each, so as to test their relative productiveness.

"The first and second columns give the quality, the third column the quantity:

KINDS.	May.	Oct.	Bush.
Buckeye	1	1	20
Maiden's Blush	4	1	23
Wild Mexican	2	1	17
Buckley	2	2	25
Meshannock	2	1	12
White Garnet Chili	3	2	12
Red Garnet Chili	4	2	20

KINDS.	May.	Oct.	Bush.
Banff Cup	1	1	22
Black Diamond	4	2	20
Early Goodrich	3	2	20
Cuzco	5	4	23
Harrison	4	2	23
Calico	4	2	23

"The Early Rose under this treatment, or want of care, produced sixty pounds to each pound planted, and from one middle-sized potato of the Gleason variety, cut into eyes, I dug sixty-one pounds.

"No rot observed, except in a very few potatoes of Meshannock, Mexican, Buckeye, Early Goodrich and Early Rose.

"With manure, the relative quality and productiveness of some kinds would possibly have been different.

"Of the above varieties, the best late appear to be in the order named, Banff Cups (or Rough-skinned Cups), Carters or Buckeyes, Meshannock, Mexican, Buckleys. The best early, Early Rose, Early Goodrich, Buckley, Mexican, Black Diamond.

"The most productive, Gleason, Buckleys, Early Rose, Harrison, Cuzco, Maiden's Blush, Banff Cups, Red Garnet Chili, Buckeyes, Early Goodrich, Black Diamond, Mexican.

"Early in the spring I spread over it a light coating of manure which was not very well rotted. It was then ploughed some six or eight inches deep, and harrowed smooth. I then made drills three inches deep and two and a-half feet apart. I then cut twenty-five eyes or sets from twenty varieties, the sets being as nearly equal in strength as possible. These I planted in the drills, one foot apart, making twenty rows of twenty-five sets each, covering the sets about three inches deep. They were all planted on the 10th of May.

"The following were the varieties planted:

"*American Varieties.*—Early Rose, Early Goodrich, Climax, Bresee's Prolific No. 2, Bresee's King of the Earlies, Harrison, Vandervere, and Garnet Chili.

"*English Varieties.*—English Fluke, Royal Ashleaf, Cotter's Early Kidney, Wheeler's Milky White, Early Racehorse, and English Ashleaf.

"*Scotch Varieties.*—Patterson's Victoria, Baron's Perfection, King of Potatoes.

"*Irish Varieties.*—White Rock.

"*Canadian Varieties.*—Early Shaw, Bennis' White.

"They were well cultivated, and no weeds allowed to grow, and the following table gives the number of potatoes and weight of each variety.

	Potatoes.	lbs.
Early Rose	122	29
Early Goodrich	145	29
Climax	195	40
Bresee's Prolific No. 2	154	26
" King of the Earlies	101	13½
Harrison	230	52
Vandervere	90	26½
Garnet Chili	80	26
Patterson's Victoria	112	15
Baron's Perfection	80	6
King of Potatoes	122	7
English Fluke	122	21
Royal Ashleaf	108	4
Cotter's Early Kidney	78	4
Wheeler's Milky White	154	12½
Early Racehorse	150	12
English Ashleaf	72	4
White Rock	150	23½
Early Shaw	115	17½
Bennis' White	74	16

"From the above results I arrive at the following conclusions: For poor land and ordinary culture the American varieties are far the most profitable potatoes to grow; that all the European varieties require land heavily manured and good culture, especially those of the Ashleaf or Kidney family, of which are Cotter's Early Kidney, Royal Ashleaf, English Ashleaf, Patterson's Victoria, Baron's Perfection, King of Potatoes, Early Racehorse. These are calculated more expressly for garden culture, and require forcing in order to yield largely. I find also that nearly all the European and Canadian varieties can be grown on heavily manured rich land, and still be dry and mealy when cooked; in fact, many of them do not show their good qualities unless grown in very rich soil, while on the other hand most of the American varieties are almost spoiled for table use by growing in rich or heavily manured soil. The King of the Earlies is an exception, however, to this rule; like the European varieties, it requires a rich soil, and is far better adapted to garden than field culture. As it would be occupying too much space to give my judgment of the qualities of the different varieties, I will let that pass."—*J. H. Thomas, Brooklyn Ontario, in Canada Farmer.*

Potato Grafting.—Take any two sound potatoes of different varieties whose good qualities you wish to retain. Cut out all the eyes of one of them entirely with a common pocket-knife, then cut a piece out of this potato in the form of a wedge or of any other shape, and substitute for the bit so removed a piece having a good eye or two, nicely sprouted, about half an inch long, then tie firmly together with a piece of bass matting or string, having first run a couple of ladies' hair-pins clean through both potatoes. These hair-pins will prevent the tie from slipping off the potatoes, as well as assist in holding both parts together. The fit must be a good one, and the bark or rinds of each must meet, as in any other mode of grafting. The operation must be performed quickly, and the grafted set must be planted as soon as possible, as the sap would dry up if exposed for any length of time to the air. I have my trench opened and manured ready to receive the grafted tubers, and they are placed therein and covered up level with soil as quickly as I can get them ready. As some of the grafts may fail, it is best to graft at least a dozen or more sets, which will produce round ones and kidneys from the same root. Pink-eyed and mottled ones, purples and reds, are also produced of various shapes and sizes. Some are early, some late, some large, and some small. All the produce, both large and small, must be kept in bags and planted out the following year, for until they have been planted it cannot be told whether the varieties are early or late. The early ones can easily be discovered by the early decay of the foliage. These should be marked with a stick. The produce of each, or such of them as look promising by their shape and general appearance, should be put into separate bags or boxes, and numbered in the usual way. Let it be perfectly understood that not every one can graft potatoes successfully. The operation should be performed by a person who thoroughly understands grafting fruit trees. Then there is a chance of success.—*Cor. Gardener's Chronicle.*

A novel experiment was tried by a neighbour this season. He took an Early Goodrich potato, cut out every eye, and inserted in their place the eyes of the old-fashioned red potato. He made only one hill of the grafted potato, and he dug from that one hill sixteen pounds and a half of potatoes that were neither like one nor the other, but like Jacob's cattle, ring streaked and speckled.

Corn and potatoes together.—We are informed by an experimenting farmer, that he obtains more corn and potatoes from a field, by planting them in alternate rows, than by planting the corn and potatoes separately in different parts of the field. The rows of corn have more room, and may be planted thicker in the row. The rows being three and a-half feet apart, each two corn and potato rows are seven feet. He plants the potatoes quite early in the first place, and when they are just peeping, or about the usual corn planting time, cultivates well between the rows and plants the seed. There is some diversity of opinion on the propriety of this practice of mixing, and it is doubtful if there would be any gain where the usual distances for the hills are maintained for the two crops ; but if their dissimilarity admits of each being more closely planted in the row, there may be a decided advantage.

ON TURNIPS.

Upon all the lighter lands of Ontario, the culture of turnips, and of roots and hoed crops generally, is looked upon as the fundamental basis of a successful and clean system of farming. The introduction of the culture of turnips into the British islands, which is supposed to have taken place in the County of Norfolk nearly two centuries ago, and from which county it spread into all portions of the British islands, was the keystone of that system of farming which has been since so successfully built up. Before their general adoption, the farmer was at a loss to know how to successfully manage a proper rotation of crops, and was thrown back upon the plan of laying down land for an indefinite period as pasture. It is not so very many years since the first Swedes were raised in Canada, and since their introduction our farmers have been enabled to engage more largely in the raising and fattening of cattle, and have in this manner not only found a profitable employment for the farm all the year round, but have increased by the manufacture and application of a large amount of barn-yard manure the fertility of their lands. It is an observable fact, that the progress of the agricultural status of those parts of Ontario where the raising of roots and the fattening of stock have been prosecuted upon a large scale, has been very much more marked for the last twenty-five years than in other portions where these means have not been generally adopted. Where hay was formerly used up wastefully for the purposes of wintering stock, it is now found that stock can be well put through the cold season by straw, with the help of turnips.

Soil.—The soil best adapted to the growth of turnips is any of a fertile nature, and sufficiently dry free and loose to shut out the probability of baking. Indeed turnips can be raised on any soil in Canada, but upon those of a clayey nature there is required far more labour, and consequently a more expensive tillage, than upon the sands, gravels or loams. The plant also delights in a cool, dry climate; but although it was once thought a Canadian summer was too dry, it has been found that not only can the crop be raised successfully here, but that, although perhaps smaller in size, yet turnips here are more solid, and contain a greater amount of food in comparison to water than those raised under a more humid clime.

The kinds of this root are very various. Though known as white, green, and purple-topped, the "Norfolk" and the "Globe," they may be for our purpose divided into two kinds, the white and yellow turnips and the Swedes. The White Globe, or Norfolk, is the turnip of greatest antiquity—well suited to very light soils, can be sown late and used early, produces a very heavy yield, and is very sweet. It, in company with all white turnips, is very tender, and will not, as a rule, keep in cellars much after Christmas although the writer has used them up to February, but towards the last they became stringy, and were not very much relished by the cattle—if sown too early, the white turnip is apt to run to seed, and is then useless. The "Nimble Dick" is a white turnip well known to Canadians, and one of the best kinds produced. The "Yellow Aberdeen" is between the "Globe" and the "Swede," and is a very valuable species; it is of a hardier nature than the white, and of slower growth; it is of fine texture and great specific weight, and is adapted to keep well into February and March. The advantage of the Yellow Aberdeen is that it will do well on land too strong for the certain growth of other kinds. The "Greystone Turnip" partakes more of the nature of the Swede than the Yellow Aberdeen, is a very heavy yielder, and must be sown late in the season. If planted too early they will become hollow and stringy. They will keep to the end of February in a well-ventilated root-house. In their cultivation they must be thinned in time. When the plants are too big, thinning checks their growth, and once checked, they are so tender that they will seldom, if ever, recover their growth. The Swedish turnip is the hardiest species known, and defies the influence of any ordinary frost. The genuine and original sort has yellow flesh and no stem; it has, in its various kinds, more or less degenerated by the flesh turning white and the crown running up to stem of more or less length. We often hear complaints of Swedes being stalky. Its bulb is not only much more solid and heavy than the turnip, but (although this is not of great value) its leaves are very much better relished by all kinds of animals. Its keeping qualities place it in the first rank for feed, and now-a-days, as a marketable commodity, it is one of the best paying crops that we can raise, within reasonable distance of cities. The Swede requires richness of land and thorough cultivation; land must be manured at some time, and none is better than before a turnip crop, because nearly all manure contains an immense number of weed seeds; these will grow and be destroyed by hoe cultivation.

CULTIVATION.

Preparing for Turnips.—Whatever be the nature of the soil, thorough tilth is the grand secret of success in the cultivation of turnips. About the time for sowing turnips in Canada, the sun invariably beats down with terrific heat, and is very often accompanied by hot drying blasts of wind. This heat will penetrate a very great depth into the ground, and in rough cloddy earth it will penetrate more deeply than in mellow soil. It is well known that as all earth has great power to absorb water, so earth in a finely divided state will retain moisture much longer than such as is lumpy and shallow. A good early tilth, say ten days or two weeks before the time of sowing, will start into growth nearly every weed contained in the soil, and these may be killed before turnips are sown, by the use of cultivator, harrows and exposure to a wilting sun. We cannot grow turnips and weeds together except at great disadvantage to the former. When land has been ploughed and manured in the previous fall, one cross-ploughing early in the spring, and a constant tearing up and disintegrating of the bed thus formed, from time to time until seed time, is all the actual preparation of the land required. When, however, manure is to be applied in the spring, there are two ways in which to perform the operation—spreading on the surface or spreading in drills. By the latter we receive more immediate benefit to the turnip; by the former, more even manuring of the land. If manure be short, the broadcast plan will be found to answer well; if long, it may be applied in the drill. We may remark, however, that the system of spreading in the fall, and ploughing under shallow then, is the best adapted for successful turnip culture in this climate and on the lighter lands. Having got our land into a fine tilth, we drill it up into ridges from twenty-six inches to thirty inches apart. Draw the dung to the field and lay it in small heaps along every third drill; from these heaps it may be spread by hand into three drills. Never draw out more dung than can be spread and covered by splitting the drills, as you go along, so as not to leave the heaps too long exposed.

If manured on the level, the manure should be spread and incorporated with the soil by the use of the cultivator, when it may be drilled up immediately for turnips. Unless the manure be short and well rotted it cannot be used in this way, for the plough will gather the manure, and we cannot set up our drills right.

Turnip ground cannot be too rich, provided tilth be thorough.

Mode of Drilling.—The proper implement for setting up ridges is the double mould-board plough, which in its passage up the field makes each time the halves of two ridges, equivalent to a ridge in each passage. While, however, the single mould-board is used, it is customary to throw out one side of the drill, and then to use a second stroke for the completion of each drill, thus necessitating the passage up and down the field for the construction of each drill.

Artificial Manures.—Those used for turnips are bones, superphosphates, and guano. The benefits of these artificial manures are that they contain in an easily soluble form every ingredient of plant food necessary to the use and growth of turnips. The young plant is thus pushed forward vigorously, sprouts before the dry weather can hurt it, and is carried on to the rough-leaved state in the minimum of time, and when once in the rough leaf, the turnip fly cannot injure it.

How to apply.—There are three ways. Spread broadcast and harrow in—good; sow by hand or drill before second half is made, under the double-stroke system—better; with a drill made for the purpose, or by hand in the groove on top of the ridge and just below the turnip-seed—best. The young turnip plant must reach the artificial manure immediately on sprouting. So great is the affinity of the turnip plant root, that the fibres are often found growing through a piece of bone.

Best time to sow.—This depends somewhat upon the nature of the soil, and upon the particular season. We may take it as a rule, founded on experience of our best turnip growers, that the best times are on the heavier lands from the 5th to the 15th of June, and on the lighter soils from the 10th to the 20th of that month.

Quantity of seed.—This also varies according to soil and season. In damp weather and upon sandy soils, 2 lbs. is about the quantity per acre; in dry weather or on clayey soils, 3 lbs. are required. If you alter these quantities, put in more, but never less. The depth should be from one inch to one and a half inches below the surface—the deeper in dry weather. It is better for plants to come up thick, as they grow faster when close together, affording one another mutual support and moisture, and thus escape the devastation by the "fly." But, on the other hand, if too thick they spindle.

Modes of Sowing.—There are two methods—on drills and on the level; on drills is far the best; far larger crops can be obtained, and weeds more easily destroyed; the cost will also be very much easier to harvest Drills should be at least 26 inches apart; many prefer a distance of 30 inches. The latter distance the writer believes the most advantageous.

AFTER CULTIVATION.

Thinning.—After growth, the first operation on a turnip crop is this:—Take your horse hoe and pare down drills so close as to leave the braird or plants set on a crown of about four inches wide. The plants are ready for this when two inches high; damp weather best for the operation. With a hoe thin out (by the push and pull process), levelling down the drills, and leaving the plants *single* from 12 to 15 inches apart; use a hoe not less than 9 inches wide. The single plant should be knocked down, and left hanging by its roots; a plant knocked down will grow to a better turnip than one left standing up in the drill, like a transplanted beet The time of thinning is very important—it should be done when the plant is about two inches high If thinned too soon, plants will not stand the shock, and will wilt; if left too long in thick growth before thinning, plants will be spindled, weak, and will assuredly become necky turnips. The richer the land, the wider apart may the plants be left. Why? Because the turnips will be bigger, and will require more room to expand laterally. When a good braird has been secured, and the turnip plants singled (this singling is very important, for if two plants be left together, neither will come to a decent sized bulb), nothing more is required but constant stirring of the soil; for, as has been already stated, loose soil will absorb and retain the greatest amount of moisture attainable, and the stirring ensure the destruction of every weed. If the ante-cultivation of the ground has been good, this may be effectually accomplished by the horse hoe alone.

Insect Enemies.—The chief and only enemy to be feared is the "fly" (*Haltica memora*), and the best remedy against its attacks is any and every process by which the young plant can be carried rapidly into the rough-leaved state; in that state the crop is comparatively safe. As a dressing, however, sprinkle lime, ashes, soot, plaster, or even road dust, on the plants early in the morning when the dew is on.

Harvesting.—The Swede turnip grows more after the first frost than at any time, so we must not harvest too soon. Many have, however, been caught in their harvest by winter. This was notably the case in the fall of 1869, when hard, sharp frosts setting in early in November, hundreds of acres of turnips were left in the ground all winter and lost as fodder to the farmer. The best time to secure turnips is, in Ontario, during the first week of November; the amount of growth after that date is not worth the risk of total loss. There are two modes of harvesting:—First, the old-fashioned method of topping and tailing with a knife; second, cutting off the tops with a sharp hoe, and harrowing up the bulbs. The first is so far the better plan that nothing but special circumstances can warrant the use of the harrows.

THE SUGAR BEET.

We refer our readers to a work on the Sugar Beet by J. A. Cull, Esq., of Toronto, in which will be found a very full and particular account of the beet.

We shall barely have space in this work for other subjects of importance to the farmer, and we therefore feel that there is no need of apology for skipping the cultivation of the beet for sugar. In our article on the Mangold Wurzel will be found all information respecting cultivation of beet for cattle food.

CARROTS AND PARSNIPS.

These two tap-rooted plants are in their nature and habits so like one another, that any remarks made upon the habits and cultivation of the carrot will apply to those of the parsnip with equal force. We shall confine ourselves, therefore, to a consideration of the carrot crop.

The carrot appears to have been known to agriculturists in

Europe before the turnip, and was first brought into general notice in Great Britain during the Elizabethan era.

The advantages of carrots as a field crop to the farmer are, that they stand the droughts so prevalent in Canada, and are very seldom injured by the attacks of any insects, while both top and root make most excellent food for horses, cattle, sheep and pigs. For milch cows they are specially valuable, as they impart no unpleasant taste to the milk and butter, such as is often observable when turnips are fed in any quantity ; should the red or orange varieties be used as food, they impart a rich tint to the butter.

Their culture is attended with some difficulty, for their growth is very slow at first, giving noxious weeds a chance to push ahead ; and they are a tedious crop to thin and attend.

Yet, in this as in many other cases, the tedium and slowness of the operations to be performed may be in great measure overcome by careful planning and good ante-cultivation of the bed.

The carrot is not an exhaustive crop—not so much so by far as turnips—and the reason is doubtless to be found in the fact that the long tap root gathers a large proportion of its food from the subsoil, without encroaching upon the stores contained near the surface, and thus rendering the latter available for the use of such crops as usually follow in rotation.

They will yield more per acre, under careful cultivation, than either mangolds or turnips ; and as animal food are more nutritious, weight for weight.

They are particularly excellent for horses, acting as a diuretic upon the kidneys, and imparting to the coat a healthy and glossy appearance.

For the reason that they are in their effects diuretic, they are peculiarly valuable as a spring diet; and, for the same reason, care should be exercised that they are not fed too freely.

From four to seven bushels per horse each week is an ample supply ; added to the above uses, they are very beneficial to newly weaned calves and colts, and to young store beasts.

Pigs are extremely fond of them, and there is no better food on which to winter store hogs or to put through breeding sows.

Varieties.—Of these there are several ; some are used as field carrots, whilst others are more generally grown, as being of smaller size and more tender in the flesh, for the uses of the house.

Of field carrots we have three varieties of general credit in Canada. First ranks the *White Belgian,* then the *Long Red* or *Orange,* and occasionally the *Altringham* are cultivated.

The *White Belgian* is a free yielding variety, and hardy. Its superiority to the *Orange* rests on the fact that it is far more easily lifted ; for the latter showing very little above ground, and thus forming no handle, is difficult to raise, especially upon soils bordering on the tenacious. But we believe that the *Belgian* is inferior to the latter in amount of nutritive matter contained ; while the leaf or top of the Orange is more luxuriant, and more effective in keeping the soil moist and in smothering out young weeds.

The *Altringham* is a variety much patronized in England, but not a great favourite in Canada. It partakes largely of the nature and possesses all the characteristics of the Orange or Long Red.

Soil.—The carrot delights in a friable soil and, so far, is similar in its requirements to all other root crops ; but from the nature of its long tap-rooted growth, it must have depth of soil. For this reason, depth of cultivation must be an essential consideration in the preparation of the land for this crop.

Cultivation.—The better plan is to manure, and plough in the fall of the year as deeply as possible, and if time permits subsoil at that time.

As early in spring as possible, this should be again cross-ploughed. It should then be brought to a finely pulverized state by a free use of cultivator and harrow.

It is now ready for drilling. The drills should be not less than thirty inches apart. Ground in fair order would supply plenty of nourishment to a carrot crop grown in drills from eighteen to twenty inches apart, and even nearer to one another; but the object of placing the drills so great a distance apart as thirty inches, is to afford plenty of room for the free use of the horse hoe. This, of course, only applies to the cultivation of a field crop, and not to that of the garden patch. If time has not, however, been found in the previous fall to subsoil the land all over, it will be well now to do so in the process of drilling. Drill up as usual, then run the plough up and down between the drills, split them, and cover so that the carrot may send down its tap root into the subsoiled portion of the field.

The subsoiling will give us a long even-shaped carrot. If, on the other hand, the cultivation has not been very deep, we have invariably found that as soon as the tap root of the carrot has in its natural course grown downwards and struck the hard pan, it is impeded, turns to every side, and either grows a deformed root or throws out a number of side roots to make good its hold upon the ground. What we desire in carrots is an even taper from crown to tip, and it is this kind of root that ever should receive the commendation of our show judges.

Manure.—The application of manure should, if possible, be made in the fall, to give time for its thorough incorporation with the soil; but if used in spring it should never be *long.* For this there are three excellent reasons—1st. Long strawy manure invariably renders the seed-bed more susceptible of the effects of drought ; 2nd. Carrots encountering such manure are apt to grow stringy and to throw out a great number of side roots, and even to fork at the bottom ; and 3rd. Such manure is invariably full of foul seeds, the weeds from which, being quick growers, are apt to come up and smother the young carrot in its early and very slow growth. The use of well-rotted manure will, however, overcome all these difficulties—is very much more easily handled, and does not prove an obstruction to good work in the preparation of a seed-bed.

Seed.—Carrot seed has, owing to its hairy attachments, a great tendency to cling together in bunches. This may often prove a serious obstacle in sowing. To overcome it, mix the seed with fine dry sand before using. It also takes a very long time to germinate, and thus allows any weed seeds that may be in the soil,—and in all land there are some,—to obtain the lead; and when once weeds get a fair start, it is difficult to prevent them from keeping it.

This points to the advantage of the plan that we have always adopted—the encouragement of weed growth at all times before the last ridging up,—and by this means the destruction of many may be encompassed without fear of disturbing our own crop. It has been recommended to soak the seed before sowing. Our own opinion is divided upon the wisdom of such a plan. No doubt the germination or sprouting of the seed is hastened, nor can there be any question but that its vitality is also thus somewhat impaired. We have grown our carrots both from dry seed and from that which has been swelled and sprouted, and from our own experience we do not feel justified in giving a decided opinion upon either side.

Some soak it in warm water, spread it, dry it and roll it in dry sand or ashes or plaster; we should prefer the sand.

Another plan is to have the seed and dry fine-sifted sand or road-dust well mixed together and laid in small heaps in a warm place, screened from the rays of the sun, which should be wetted with drainings (well diluted with water) from the stables.

Time of sowing extends over a long period. It may be sown as soon as the earth is fairly warm, or at any time up to the 1st of June. We had last year an excellent crop sown on the 29th of May, but our experience leads us to consider from the 15th to the 24th of May, or earlier than that period, to be the most certain time of sowing.

On high lands, subject to drought, it should be sown early; on alluvial soils later.

The quantity of seed must depend entirely upon its quality; if raised by the farmer himself, or obtained from men upon whom he can place implicit reliance, three pounds per acre, on land drilled as we have recommended, will be found ample; if, however, there should be any doubt as to the vitality and freshness of the seed, from fifty to one hundred per cent. more should be deposited. Naturally, less will be required if the season is damp than in a dry spell, and in moist than dry land ; indeed, it is a safer rule never to sow less than five or six pounds. Sowing is performed by many of our new seed drills well, but the hand process is the safest.

After Culture.—If the land has been well cleaned previous to planting, much after cultivation will have been saved. The carrot sometimes fails to put in an appearance for as long as two or three weeks, while there is under the most favourable circumstances seldom any show before the tenth day. They are not ready for thinning for about ten days or two weeks after that period, and in all this time any weeds that are present have been taking full advantage of their opportunity. Remember, nature makes no distinction between weeds and plants—all are equally her children—and a friable state of the land hastens the growth of the weed as well as of the plant.

When ready for thinning, the plants should be singled to a distance of from six inches to nine inches. This must be done by hand ; but time may often be found in mornings and evenings, and after wet, in which the men may be advantageously put in at this job ; while, if boys are willing or are well watched, they can make good wages at thinning. Care must be exercised to *single.* Two carrots left together will neither of them grow to perfection ; but, before this operation, as soon as the row or braird of young carrots can be distinguished, it is well to pare away the soil from each side of the drill. This is often done by the horse hoe, but if there is time it will be found advisable to let the horse hoe cut up all weed growth in the centre, while the drills themselves are pared by hand hoeing. The latter can be performed closer up to the carrots, and with less fear of destroying them. It requires a very steady horse and a very good man to pare away close, without cutting into the carrots, even with the best of horse implements.

We can thus leave the carrots standing on a ridge about an inch wide, and the weeds in such will not hurt the growth of the root.

The ground between carrot drills requires to be frequently stirred by the use of the horse hoe, through the early part of their growth. Carrots grow slowly at first, but very rapidly in the autumn ; all the aim of cultivation should then be to push them on in the early part of the season.

Lifting.—For this there are several ways. Cut off the tops with a sharp hoe as they stand in the ground, and collect them out of the way. Then run a subsoil plough along the rows, when the carrots may be lifted and pitched straight into the waggon.

Our own plan has always been to run a swing plough close alongside the outer row, throwing the dirt from the carrots outwards, then haw round, and in the same way come down the outer row of any sized patch that you may wish to take up ; let the men and boys follow, and pulling out the carrots by the top, throw them into heaps just far enough from the next row to be out of the way of the plough. Continue this operation. Then top your carrots in the heaps at pleasure, making separate heaps of the carrots and covering with tops; leave these for a few days that the carrots may sweat, and draw into cellar. Carrots, when in the ground, will stand a great amount of frost, but when once thrown out must be carefully covered if there is fear of night frosts; neither should they be long left exposed to the rays of the hot sun.

Produce.—We are afraid the average produce of the carrot crop in Canada does not come up to three hundred bushels per acre, but they are capable of producing and we have seen eight hundred bushels to the acre, while a thousand bushels has been recorded in our Dominion.

Carrots sown in the fall.—We once sowed our carrots in the fall. The seed must be sown late enough, so that it will not germinate before spring. The advantage expected was an early growth in spring, and in consequence a "big crop;" but in this hope we were miserably disappointed, and such has invariably been the result to any who have tried the experiment in this northern clime.

They came up all right in the spring, but were terribly hard to hoe and thin; about one-half ran to seed, and the rest did not make up half as many bushels, nor were they as fine carrots as those sown alongside upon the 23rd of May. Our climate is as well adapted to the growth of carrots as that of England. The yield of carrots by a Somersetshire clergyman, at the rate of two hundred and sixty-seven bushels off a quarter of an acre, has gone the rounds of the papers, as worthy of special notice.

Raising Carrot Seed.—We wonder that more Canadian farmers do not raise their own seed, especially those living at a great distance from reliable dealers.

We do not say much money is saved by so doing, but the farmer has the satisfaction of knowing that his seed is fresh and unadulterated.

Select some of the most healthy carrots from the field. Cut the tops off to the length of an inch, and pack them in the barn cellar in straw. In the following spring, as soon as the ground is dry enough, set the plants in a well-prepared and heavily-manured seed bed in holes. Put four roots in a bunch—on about a foot square of land—and let these bunches be set at a distance of three feet the one from the other; keep them well hoed and hilled up during the summer; they will ripen very irregularly. As the seed heads become ripened, they may be cut off and carried to the barn; they may then be thrashed with a flail; they will require three or four thrashings, passing the seed through a series of sieves, each finer than the preceding one.

The quantity of roots planted per acre will be in this way about

80 bushels, or 10 bushels to twenty square rods—and the produce of seed should be from 600 lbs. to 1,000 lbs. per acre ; or, if a bushel of roots be planted, the farmer may expect to obtain from eight to twelve pounds of seed.

Mangel-wurzel.—Mangel-wurzel, or more properly Mangold-würzell, is now grown over a very much larger area than formerly, and is deservedly regarded as an excellent root for the use of milk cows in winter. The late Dr. Lettson introduced this variety of esculent some 80 years ago into England as a field crop, and since that time it has been steadily gaining for itself confidence amongst the largest stock raisers.

Mangel-wurzel will suit itself to any land which is moderately moist, and although it will grow to great size even in wet lands, yet in such it becomes watery, hollow, and will rot quickly. The young plant is very easily killed by frost, and should not therefore appear above ground previous to the middle of May. Land should be ploughed deeply, and if manured, we should advise the working of the manure in with the land, rather than manuring in drills in spring and splitting. The land should be ploughed early and kept well stirred until ready for planting, for as we force forward the weeds and kill them off at an early date, so will our trouble be the less in keeping the after crop clean.

Doubtless the best plan of cultivation is by autumn ploughing and manuring. The manure is thus thoroughly incorporated in the soil, the spring work is lightened, and the action of the winter's frost, followed by the cultivator and harrows in spring, will be certain to secure a thoroughly pulverized and clean seed bed. The plan very generally adopted in England answers well in our soil and climate. In the fall the land is ploughed and ridged up 26 inches apart, and the manure spread in the drills. These drills are then split before winter. In the spring all to be done is to again split the drills in which the manure has lain all winter, and we are ready to plant. These drills will work very fine, for the frost has thoroughly penetrated them, and we thus save a great deal of time in spring, our " thronging" season. A liberal supply of superphosphate of lime (but it must be genuine) will be amply repaid in crop.

The rows should be at least 26 inches (or in rich, well-prepared land, 30 inches will be none too far) apart. The seed may be either drilled upon the top of each row, or dibbled in at intervals of from 15 to 18 inches. Sow about the middle of May, thus escaping the frost ; moreover, if sown too early, the root is apt to run to seed early in the fall. From 4 lbs. to 6 lbs. per acre should be used. In Canada the dibble is too expensive a process ; drilling and thinning becomes our only practical plan. The seed is very easily buried, and should not be covered by more than half an inch of earth. Two or three plants generally spring from each grain of seed, and great care has to be exercised in thinning that we leave the plant firmly rooted.

The after cultivation is such as applies to all root crops. Keep the land thoroughly clean, and wage perpetual war upon all weeds. They must be harvested early, before there is any chance of frost, for this root is very tender and easily frozen. Many growers recommend that the mangold be not tailed when taken up ; and when the land is light and the bulb pulls up, clean tailing is an unnecessary addition to the trouble of harvesting. The chief drawbacks, then, to the cultivation of the mangold are that more labour is required in the thinning, and that they are extremely susceptible to the effect of frost. It may assist us, in making a comparison of the two principal root crops, to state here the peculiar advantages possessed by each—Mangolds and Swedes—as practical field crops :—

THE MANGOLD-WURZELL.

1. Is neither liable to " fly" nor to " wire-worm."
2. Produces a greater weight of root per acre.
3. Does not taste the butter when fed to milk cows, and is a better and stronger food in late winter and spring.
4. Will grow on *stiff* land with more certainty than the turnip

THE SWEDE.

1. The " thinning out" is less expensive.
2. Can be planted later.
3. Is less liable to be hurt by frost.

Ruta Bagas.—The growing of ruta bagas, both as a field crop for feeding to stock, and as a garden crop for culinary purposes, is becoming much more general in some localities than it was a few years since. The proper time for sowing the seed is governed largely by the latitude, soil and its condition. Often it may be put in later than is generally practicable, and a good crop be realized. As a second crop, following an early one, removed by the first week in July, it is often a success, although the safer and more advisable course is to plant during the month of June. These roots will bear transplanting equally as well as cabbage, so that there is no excuse for any vacant spaces in the field, as those thinned out may be reset, or a bed may be sown designedly for transplanting.

The ruta bagas, and other like root crops, do not throw out any fibrous roots to collect plant food far away; consequently, do immensely best when the soil is put in the finest possible condition of tilth and fertility. A clay should be ploughed in the fall, having manure ploughed down, and left till spring for amelioration.

Early in May it should be ploughed again, and after lying some days be harrowed thoroughly; be ploughed again a few days previous to sowing the seed, having received one or more harrowings during the intervening time. These three ploughings and several workings will put the soil in excellent condition for depositing the seed. It is now ridged, with centres two and a half feet apart. The soil ought to be so well worked that there are no lumps, &c., to interfere with drilling the seed. Fresh seed will not need over one and a half pounds per acre; that of which there is any doubt will need more. With good quality of seed the plants will be well up in ten to twelve days from sowing. Now is the time to give the first working with a scarifier. The cultivator disturbs the soil, leaving the plants free to grow. This and a few weeks later are the important points in culture to obtain advantage of and keep down weeds. When the plants attain a growth of an inch they should be blocked or chopped out, leaving the bunches four to six inches apart. As soon as they are out of the way of the fly, &c., thin to a single one in a place. Cultivate sufficiently to keep down all weeds, the soil mellow, and the plants well growing. By August the tops should cover the ground so as to shade and keep down all weeds, &c.

On a sandy loam, more easily worked, two ploughings in spring, and in some instances one, with suitable harrowing, is all that is needful to put the ground in condition. The ground is fitted and the seed sown as before directed. For domestic use the later sowing gives the more suitable sized roots, as a medium size is much preferable to the larger; but for feeding purposes, the larger the roots grow, the better.

When there is a prospect of a short hay crop, prudent farmers will put in a few ruta bagas, or some other timely root crop, to provide for the deficiency.

Cabbage as a Field Crop.—For some years past, in Canada, owing to droughts, winter-killing of clover and other causes, there has been a short fodder crop: as we are never perfectly safe against a recurrence of the same casualty, it would be well to look to all crops that will help to eke out food for our long Canadian winter.

We know of no crop that will yield a greater amount of food to the acre, of the best quality, than the cabbage. The work of setting out appals many farmers, but it need not. There is time enough before haying or the middle of July. We should take advantage of rainy weather to set out our plants. The land should be rich and thoroughly cultivated. The plants should be set in rows, two and a half feet one way and two the other. The plants are then dibbled and puddled. It is a good plan to make a mixture of clay and dung, saturated with the drainings from the stable, into which to dip the roots before planting.

Take the dibble in the right hand; let a boy carry the bunch of plants, and separating a single plant, hand to the dibbler, who makes a hole which is filled with water by another boy carrying a water can ; the plant is placed in the hole, and the dibble again driven into the soil close to the hole, and the soil pressed against the root of the plant.

In placing a cabbage plant, the hole should be made deep and the plant lowered as far as possible, and then slightly drawn up before pressing into position. The sides of the hole catch the small fibres that are attached to the tap root, and thus give them a slightly downward turn, which is their natural position. A smart man will thus plant from four to five thousand in a day.

In the fall, when pastures begin to fail, cabbages make an excellent feed, and are a good preparation for cattle intended to be put up to stall.

Let the soft heads be then pulled and fed, and leave the firm ones for winter keep.

The method of keeping is very simple : place them on a dry spot, head down, and cover with straw and earth, leaving the root and part of the stalk exposed.

In winter they are much relished as a change upon turnips by fatting cattle, are greedily eaten by pigs, and are the very best of green food for milch cows.

Deep cultivation for all root crops.—"We raise our root crops on land cultivated too shallow. This is a great, a general, a crying evil. The soil requires deep tillage, the subsoil plough used thoroughly—an implement used too little now-a-days, and when used, not sufficiently. Fine the land for twenty inches or more. If all this depth is mellow, yet compact somewhat, draining itself readily, yet admitting the air, and if the crop is put out early—as early as possible—so as to get the start on the prospective drought of midsummer; if weeds are kept out and the soil in good motion, stirring it well and often; if withal the land is rich—if all these things are rigidly seen to, there will not, there cannot, be a failure of a good crop. A severe drought will not prevent it, nor a rainy season; the cool fall will perfect what the summer advanced. The great depth of soil is good for the moisture, where the roots have a chance to penetrate and luxuriate even with a raging sun overhead. But the land needs to be fertile, and if the manure is put down it will not hurt it for that crop; the roots will find it, and the work will go on with vigour. The manure should be spread and permitted to lie for some time—for weeks, better for months. The soil immediately below will then have received much of its strength, and when it goes under, soil and manure are both rich, and will form a good bed for the roots. The best success we ever saw was with a field treated in this way, horse manure being turned down. The soil was deep; there was a great drought, but in the fall it pushed forward, the manure then drove, aided by the rains. It is the depth of cultivation and the manure that have a wonderful virtue, the very things that are neglected. We use manure, but not enough, not rotten enough, not mixed with the soil sufficiently, through its juices first, and then by the plough.

"We like sod for roots, but let it be well rotted and made mellow by after-ploughing and cultivation.

"This last has been among our best experiences.

"We can then secure a root crop with certainty. Why not do it? Why run risks? We know what they are; in too many cases they are a loss, and this no one can afford, for the loss is not a common one according to the amount of land used; good soil is selected, unusual labour expended. Make the soil still better, devote more labour to it, judiciously, and this loss will be avoided; in its place will be a crop that will pay for all, with a fair margin to boot; and such a crop, where the drought is fought, is more nutritious than where water has been imbibed; there is more concentration, more excellent stuff. As the seasons now run, we must expect drought, and depth of soil for moisture, and manure to drive, must be relied upon to overcome it."

RELATIVE FEEDING QUALITIES OF VARIOUS ROOTS.

Of real food in one hundred parts of—

Potatoes there are	22·0	parts.
Ruta Bagas	12·7	"
Mangel-Wurzels	11·0	"
Parsnips	9·9	"
Cabbage	9·4	"
Rape	9·4	"
Carrots	9·2	"
Swedes	7·9	"
White Turnips	7·1	"

Rape is an excellent green manure, or it may be used in Canada, in the fall of the year, up to severe frosts, to turn on sheep and fit them for Christmas mutton. The leaf is exactly like that of a turnip, but is more luxuriant, whilst the plant has no bulbous root.

It will grow on any land; the richer the better; nor is it at all subject to attacks of insects such as affect turnips or cabbages.

Usually sown broadcast, late in June or early in July, at the rate of about two quarts to the acre, and then left to its fate, bestowing no hoeing or more cultivation. The ante-culture should be the same as for any description of roots; thorough ploughing and pulverization. It is well after sowing to roll and thus cover the seed.

Some, however, cultivate it in drills, hoe and keep clean, and thin out the plants to a distance of six or eight inches. By this means the plants acquire great vigour, and the crop serves the purpose of a thorough cleaner.

It is doubtful whether the quantity of food available to sheep, feeding on this in October and November, is more than two-thirds of that secured by a crop of swede turnips. But as a green manure it is one of the very best known.

We close with the following hints to root growers:

If possible, plough and manure in the fall; get on your land as soon as possible in the spring. When manure is to be spread broadcast in spring, have it done early, so that any weed seeds contained in it can be sprouted and destroyed by cultivation previous to planting time.

Thorough pulverization of the soil, and constant battle with all weed life, are the essential elements in the successful culture of all crops, and more especially of roots..

If the land is *clean* before planting time, the difficulties of success in root growing will be greatly reduced.

HOPS.

The English word "hop," though probably derived from the Saxon *hoppan*, signifying to climb, was immediately adopted into our language from the German *hoppe*, its botanical name being *humulus*.

The earliest records that we have of its cultivation are found in old French works, where *humolariæ* are spoken of, evidently alluding to what are now known here as hop-gardens; and we learn from Beckmann, that "the first positive notice of the use of hops begins in the fourteenth century, when it appears that they began to be regularly used in the Netherlands."

The English, at a still later period, seem to have had their doubts as to the effects of the plant upon the human system; for we find, in the annals of the house of Henry VIII., an order to his brewer "not to put any hops into the ale." And at a still later period the Common Council of the City of London petitioned Parliament against the use of hops, "in regard that they would spoil the taste of the drink, and endanger the people." In the reign of Henry VI. they were petitioned against "as a wicked weed."

They were first brought into general cultivation in England about 1520, and we find a distich in "Baker's Chronicles" which runs thus:

> "Turkies, carpes, *hoppes*, piccarell and beere,
> Came into Englande all in one yeare."

Only one species of hop is known to the botanist, though of this species there are in Europe several varieties. Whence the variety now cultivated in Canada was drawn, whether *Gouldings, Canterbury Grape, Mayfield,* or *White Bine,* we have been unable to find recorded.

We rather think from its nature that the descent comes through the *Flemish Red Bine,* which, although a coarse species, is hardy, and does better than the generality of other hops upon a bleak exposure.

The nature of the hop.—It is a perennial plant, and its roots strike very deep into the ground. The stalk grows spirally, naturally upwards, but may also be trained horizontally. It is also a twining plant, and thus takes its own hold upon the pole or string. The plants have sexes, male and female; and whilst the presence of the male is necessary to fructify the other plants, the female bines alone are serviceable to the brewer's use.

The females produce their flowers in the form of a cone, in shape like that of the fir, whilst the blossoms of the male are like those of the currant bush.

It is quite possible to propagate hops by seed, but it is usual to grow from nursery plants raised in beds, or from slips taken from the stem, or from old roots, the latter being the mode usually adopted in Canada.

The object of the addition of hops to beer is not only to correct the insipid sweetness of the barley malt, but also as a preservative. Many substitutes have been tried to attain these results, but none have proved equal to the hop. So great is the power of preservation of the hop, that it is not uncommon for brewers to dry-hop summer beer, *i.e.*, to put hops through the bung-hole into the cask after the beer is made, and when ready to send out.

Soil and aspect.—The quality of the hops depends greatly upon the soil in which it is raised.

As a rule, the stronger the land, the more bitter and strong the flavour and quality of the hop. From such land they are in great demand amongst brewers of porter.

On lighter lands, although the hop may grow luxuriantly (when land is well enriched) and produce abundantly, they usually contain a less amount of farina and are of what is technically called a lesser "*condition,*" and this quality of hop is also in demand by the brewers of the lighter kind of table-beer.

The criterion of the strength of the hop is the amount of odour emitted and the degree of stickiness felt when moved together in the hand.

A good free, friable and dry clay loam is the very best soil in Canada for hops. In the plant upon such land are comprised quantity, quality and duration.

The duration of a hop-field depends in great part upon the nature of the subsoil; that of a calcareous nature is capable of supporting a hop-field through the greatest number of seasons without renewal. The situation of the hop-garden is not so essential as its care, but protection from the cold winds of winter and spring is an object to be sought after.

A southern aspect is the best, for it is the cold spring easterly winds that are the most injurious.

The hop takes three years to come to perfection, although a moderate crop is usually secured in Canada in the second autumn.

Preparation.—The land must be clean, dry and rich—these are essentials. In a poor crop of hops a large amount of money may be sunk, while there is no crop from which such a handsome return can be secured, given a fair yield and good price.

The chances are that the price of hops will never again deteriorate as it has done to the neighbourhood of five cents.

Some years ago, in America, we overdid the thing. A hop-fever set in amongst farmers, not only in Canada but in the United States also, and the consequence was, that the market was, with a full crop in England and France, glutted ; down tumbled the price ; and many a grower who could not stand his losses ploughed up his gardens, never in all probability " to go into hops again."

Those few who stuck to the growth realized well from last year's crop. Indeed, so careful must be the cultivation, and such is the first cost of a plantation, that there are but few men of means and energy sufficient to make the crop a success.

We said above, land must be clean, dry and rich. For the first essential no preparation is equal to a thorough summer fallow ; although many growers prepare their hop-garden by a well-tilled and thoroughly-cleaned root crop.

For the second object—dryness—under-draining is necessary ; and for the third, the liberal application of manure in a well-rotted state, in the manner that will be presently explained.

When manure is first applied on the summer fallow, from ten to twelve large two-horse waggon loads are required per acre—more would do no harm—and this manure should be lightly ploughed under and thoroughly incorporated with the soil.

Let the land be well water-furrowed for the winter. If the ploughing and manuring have been put off to the spring (*i.e.*, after a root crop), the land should then be very thoroughly water-furrowed, so that all surface water may be immediately removed.

Marking out for plants.—This may be done with a surveyor's chain, tying pieces of rag on the links at the required distances. Small white stakes are set in the ground, to mark the hills, at distances respectively of seven feet the one way and eight feet the other. The object of this difference of distance each way we shall presently explain—or the distances may be carefully drawn out with the plough, and the intersections of the furrows marked with small wooden pegs.

The latter plan is far more rapid than by the use of the chain, but requires a thoroughly good ploughman and a steady pair of horses. The man and team that can set out lands *well* for ploughing sod, are capable of performing this operation also.

The time of planting is usually in the latter part of April or in the beginning of May; in fact, about the same time as the seeding of spring grain.

The sets used have been cut from the root of an old crop by the process of grubbing and pruning, which we shall explain hereafter. These cuttings should be six inches long, and care should be exercised that every cutting or set has eyes or buds upon it.

The manner of planting is thus:—A hole is dug at and around each stake, the hole to be about one foot deep and the same square. Into this hole is then thrown two good shovels-full of well-composted manure, earth is filled in, and the whole well mixed together.

The spade is then driven into the hill perpendicularly to its full depth, and worked forwards and backwards until a crack is formed of the same width and depth as the spade (before this has been done, the hill should have been tramped pretty solid). Then take four of the six-inch sets, and carefully place them in this crack, one set at each extremity and two between, and at equal distances from one another. The sets must be planted with the *buds up*, and be put down full-spade depth, so that when earth is again compressed round them, they may be about an inch below the surface.

After setting, the small stake should be put back in the centre of the hill.

It is necessary that a certain number of male plants be also set in the field. The custom is to make each tenth hill in every tenth row a male hill.

Where roots are bought, dependence must be placed on the word of the seller as to which are male plants; but in the field it is customary, in order to distinguish the males at pruning time, to leave the poles around them all winter—or a great many other methods of marking them may be adopted.

The first year's management depends entirely on keeping the field clean. This may be done by the free use of the horse hoe and it is not uncommon to grow a crop of Indian corn in the field this year. The corn is planted intermediately between the hop rows, and thus whilst a crop is secured the hoe may be worked constantly and the land kept from becoming foul.

In the fall of this year the hills should be manured; this is done by putting on the top of each hill a couple of shovels-full of well-rotted barn-yard manure, which not only acts as a protecting mulch for the crown of the plant, but enriches the soil around it.

Second year's management.—As soon as ever the frost is out of the ground in the second year, the operation of root pruning or grubbing is performed.

A boy goes first and cuts off all that remains of last year's vines above ground, and puts them off the hill ; then follows a man with the grub hoe, who spreads the manure that was put on in the fall, and using his grub all round to draw away the earth from the hill, cuts off all side roots, drawing them out and cutting them as close to the main root as possible; the earth is then drawn carefully around the root again. This pruning is a very important operation, for if not done, the roots would spread and lace over every inch of the hop-yard.

Poling.—As soon as convenient the poles may be set, and judgment and care are both very necessary in this operation.

Two poles are used in every hill, and are set exactly one foot apart, and across the eight foot width between stakes. Thus, after poling, the width to be cultivated between the hills will be reduced to seven feet each way—this is the object had in view when we recommended above, that in setting out the rows they should be eight feet apart the one way and seven feet the other ; the placing of the poles one foot apart in each hill equalizes, for practical purposes of cultivation, the width of the rows in every direction.

The poles, set firmly in a hole made by a man with a long octagonal pointed crowbar, should slant slightly outwards. This is very important, as affording far more sun, air and light to the vines than should the poles be upright.

Poles should run from twelve feet to eighteen feet in length. The next operation is—

Tying up the hop vines.—As soon as the vines have made from eighteen inches to two feet of growth, they are ready to tie to the poles ; this is generally from the middle of May till the middle of June ; the work has to be done at odd times, for the vines come ready for tying very unevenly ; we cannot wait to go through the operation without intermission.

Three vines are tied to each pole ; fine soft twine is the best for the purpose.

Cut strings to a length of ten inches. To do this rapidly, take a piece of wood the required length, wind the twine round it, and then cut through each end with a chisel or other sharp instrument.

Hang the strings on your coat ; let a boy take up a vine, wind it round the pole and hold it while you tie ; the string must never be tied in a knot, or it would soon cut through and destroy the growing vine ; but after passing the string around vine and pole, give the ends a twist together between the finger and thumb.

By the time the vine has grown large enough to open out this twist, it will be of sufficient strength to cling and wind round the pole without assistance.

Always wind the vine round the pole from *left to right, or fol-*

lowing the course of the sun. If this precaution is neglected, the vine will in its growth unwind from the pole and fall to the ground.

The vines that are not tied to the poles should be drawn out and cut off as close to the root as possible.

Cultivation is this year effected not only with the cultivator but by plough. To plough between the rows requires four slices, and always thrown towards the centre and from the plants. With two horses the two centre furrows may be turned; then one hor e must be used with short whippletree well covered at the extremities, so as to get the plough close to the hills.

After this ploughing, the between rows should be again smoothed down level with the cultivator.

A small crop is usually harvested this year, running from three to five hundred weight per acre.

It will be well in the fall again to manure, as recommended for the first fall, and indeed to repeat it every year as forming an excellent mulch for protection against the cold weather of winter and spring.

The third year's management is exactly similar to that already explained to take place in the second, but as this year the crop should come to full perfection we shall proceed to speak of—

Picking, drying and baling.—The crop ripens from the 1st to the 15th of September, varying in different seasons.

When the seed is fully formed, and the flower covered with pollen, we know that the vine is ready to be stripped.

The hops are picked usually by women and boys, into boxes or bags—the former are now almost entirely discarded. Strong frames of wood, like a skeleton box, called " bins," or " cribs," are placed in the field ; these frames are about nine feet long and four feet wide, standing about three feet and a-half from the ground. They are made large, so that several can stand around them. In the centre of the frame is hooked a large coarse canvas bag, into which the hops are picked. The particular part for the " boss" to watch is that the women, and especially children, pick the hops clean, and throw no more leaves than possible into the bags. The vine is cut off about three feet from the ground, any lower being considered injurious to the root from the profuse bleeding which it occasions, and the pole is then wrenched from the ground and placed over the " crib" frame, when the vine is stripped by the pickers. As the poles are often very fast in the ground, much difficulty is sometimes experienced in pulling them out, and a wrenching instrument is sometimes found necessary. The one made use of in Kent, England, is the best that we have ever seen for the purpose.

It is constructed of a strong, tapering wooden handle, about three inches in diameter, and about five feet long, at a distance of about twelve inches from the lower and larger end of which a small bar of iron, a foot long, is clenched; and being bent in the middle into an acute angle, the inside is roughened at the forge into something like teeth, which, when fixed upon the lower end of the hop pole, bites, and holding fast, is used as a lever to wrench it loose from its anchorage in the soil. This instrument is technically known as a "hop-dog."

When smaller bags, baskets or boxes are used, it is customary for a woman to engage one or more for herself and family.

The weather considered most favourable for picking is when it is neither too hot nor moist, but as in Canada time always presses and hands are scarce, we cannot be over-fastidious. But it will not do to pick in rain.

Hops must be dried as soon as possible after picking, or they will heat and become discoloured. One day's picking is therefore always dried at the kiln before the next day's lot comes in.

Drying.—The operation of kiln drying is one of great nicety, and requires experience—the hop grower should always superintend it himself.

It is the simplest thing in the world to reduce the value of a hundred of hops several dollars, by improper drying.

We cannot here enter into a full description of a hop kiln. Any man proposing to build one should go and examine personally those already constructed. There are, however, one or two important points worthy of special consideration in the building of a hop kiln.

The floor (slatted strong enough to hold men tramping) must be high up in the heating room. This room should then be at least from fifteen to eighteen feet high.

A room for storage of hops should be provided up stairs and alongside the drying-room, but it may be at a lower level—and there must be a room for baling in, below the store-room.

As a general rule, it may be assumed that a hop kiln of 20 × 15, full ground plan, will be of capacity sufficient for from three to four acres of hops.

Hops, when brought in, should not be spread too thickly upon the floor; about one foot is the medium thickness—if they lie heavier it becomes hard work to turn them.

The temperature should never be over 170°, for fear of scorching. Indeed, if we can accommodate next day's picking, or have time, it were better that the heat should be even very much less.

When it is necessary to have one day's picking dried before the next comes in, and the heat to be kept between 150° and 170°, the time usually required is from 15 to 20 hours.

When dry, the seed of the hop must be shrivelled; this knowledge cannot well be imparted by reading, but must be learned from experience—for it is a knowledge on the accuracy of which the quality of the hop, when brought to market, in great measure depends.

Sulphur is generally used in drying, to improve the colour, making a yellower sample.

Baling.—It is better to leave the hops at least two or three weeks after drying before they are compressed into bales. In that time they imbibe a certain amount of moisture, which keeps the colour fresh and adds to the weight.

The hops are then passed down through a pipe into canvas set in a press. The men that work the press below, also stamp the hops in with their feet and sew up the sides; the size of the bale is usually about 5 ft. 6 in. × 1 ft. 6 in. × by 2 ft., and contains from 150 lbs. to 250 lbs. of pressed hops.

The usual yield of hops in full bearing in Canada is from 5 cwt. to 15 cwt. per acre. We have heard of one ton to the acre, but have never had our eyes refreshed by the sight of such a crop.

The attacks to which the hop crop is most exposed are, chiefly, of some of those numerous tribes of insects known as *plant-lice*, which are the *hop-aphidæ.* They are, in certain weather, generated in vast numbers, and, covering the plant, suck the leaves, and cause them to curl downwards, black, sickly and dying.

Another very rapacious enemy is the wireworm, who acts below with such effect upon the roots, that sometimes one-third of them will be destroyed.

Attempts have been made to destroy the aphidæ by burning rubbish, sulphur, old tobacco, &c., on the windward side of the garden, but such remedies are of little avail. Of one thing we may be certain, that the hop-grower has no friend equal to the "*ladybird*," whose black larvæ feed upon the "*fly*."

The "mildew," a common disease in England, we are glad to say has never been prevalent in Canada.

We now come to a consideration of the cost and profit of the hop crop.

Our estimate must necessarily be very rough, for there is such a variation in the cost of poles, of labour and of production, that it is impossible to come at closer estimates than the following:

COST AND PROFIT ON ONE ACRE OF HOPS.

CULTIVATION.

First Year—	Rent of land (being under-drained)	$5 00
	Ploughing in fall	2 00
	Ten loads of manure	5 00
	Ploughing in spring	2 00
	Marking out and staking	2 50
	Sets, at $2 per bush. and 4 bush. per acre	8 00
	Planting: Two men for three days	6 00
	Twelve loads rotten manure	6 00
	Cultivating twice	1 70
		$38 20

Contra.		
By 40 bush. Indian corn, at 60 cents	24 00	
	——	$14 20
Second Year.—Fall manuring on hills, 12 loads	$6 00	
Rent	5 00	
1,600 poles at 8 cents, extending this charge over 8 years, say	16 00	
Sharpening poles	8 00	
Trimming, grubbing, pruning and poling, three men and one boy, for one day	3 50	
Tying bines, a man four days altogether	4 00	
One ploughing between rows	2 50	
Cultivating twice	1 70	
	——	46 70
Third Year.—Same expense of cultivation as in the second year		46 70
Total expenses of cultivation for first three years		$107 60

PICKING, &C., COST OF.

Say crop yields 12 cwt. in 3rd year, and 5 cwt. in 2nd year, or total yield of 17 cwt. to the acre in first three years:

Picking.—At 3 cents per lb. (usual price)	$51 00	
Drying.—At $1 per 100 lbs	17 00	
Baling.—Two men and one boy can bale and sew 600 lbs. per day	7 50	
Rent of Kiln, costing $400, at 12 per cent.	4 80	
Total cost picking, drying, &c.	——	$80 30
Total expenses	$187 90	
Contra.		
17 cwt. hops, at 20 cents	340 00	
Profit from one acre		152 10

It thus becomes apparent that, given a fair crop and price, the growth of hops is very profitable.

We must also bear in mind, that in the estimate above set down every item is charged at its highest cash value. Not only labour but manure is charged at a far higher rate than would be proper when the farmer of a large holding simply devotes a small portion of his property to the cultivation of hops.

Every year succeeding the third the profit becomes very much greater, for, as will be perceived, the first year is one of outlay with no return, whilst the crop picked in the second year is of little value.

Thus the third, or first year of perfect crop, is charged with no less than three years' cultivation, while the profit on every succeeding crop will be only chargeable with the cultivation of one year.

The hop crop is one that requires considerable capital in the commencement, careful culture, and patience to wait for some years ere the full interest be realized. The want of either or all of these requisites has ruined very many hop-growers both in England and in America.

Like the generality of businesses in which profits are very great, there are immense risks to run, and, therefore, the man who is not provided with stamina enough to stand a year's dead loss, and to wait for future crops to make up any deficiency so caused, had better keep himself and his purse clear of the risky though profitable culture of the hop.

It has been well said, that "hop culture is one of the most hazardous investments connected with farming, and is indeed regarded by many persons as a species of gambling, only to be indulged in by those who have capital sufficiently large to withstand successive failures."

Although this is rather strong language, yet we heartily endorse the meaning of the writer, that a man without capital may easily ruin himself by too extensive a rush into hop culture.

Trellis-work instead of Poling.—Many of our hop-growers have given up the system of poling, and have adopted trellises of string.

The advantages claimed are: the plant obtains more sun and air, is more spread out, and therefore less liable to *fly* or *lice.*

The poles are shorter, cost less, and stand better against high winds.

The plant is more accessible, and can be examined and trained more easily.

The crop is picked without cutting down, thus preventing all bleeding.

The price of hops has varied in the last few years through every gradation from 6 cents to 35 cents and yet higher per lb. The cause of the sudden decline in the prices some four and five years ago, was the rush made into hop-culture of which we have already casually spoken, and the consequent forcing upon the European market of a great quantity of American hops of inferior quality. English brewers must have good hops, for much of their beer is sent to hot countries, and to keep, must have been made from the very best of materials.

ARTIFICIAL GRASSES, HAYING, &c., &c.

We now come to a consideration of the grasses grown for meadow and pasturage in Canada.

These grasses, whether made into hay or fed upon the ground, form the most important forage for cattle, and also, by the manure made in their consumption, help to maintain more live stock upon an arable farm, exclusive of the product of grain, than upon an equal amount of land solely in pasture.

Without the use of these artificial grasses, it would indeed upon our light soils be impossible to continue a mixed course of husbandry embracing a yearly proportion of wheat.

We find, on reference to botanical works, enumeration of a great number of varieties of pea-blossomed plants under the names of "Trefoil" and "Melilot," but they all belong to the one class, and, cultivated in Canada, are simply divided into red and white clover.

These clovers are most of them indigenous to our climate, and indeed the oily seeds of white clover will remain dormant, especially when covered in calcareous soil, for ages, and then appear to spring up spontaneously and naturally when least expected, or when, perhaps, particularly undesired.

It is a perennial plant, lying so close to the ground that it is not unfrequently known by the name of "creeping clover," but the great luxuriance of its growth, its nutritive quality, and the sweetness of its flavour, give it rank as the most valuable for pasturage amongst all our natural grasses.

The broad-leafed red clover is also to a certain extent indigenous, but it has been imported so generally, and so improved by cultivation, that it now may be fairly ranked amongst the artificial grasses.

No better step has been ever made in the general agriculture of this continent, than the general growth of this plant. As a green manure it is unsurpassed by any other crop, affording shade to and retaining moisture in the soil during its growth, and returning much plant food when ploughed down and in a state of decomposition. It is a biennial plant, not arriving at perfect maturity until the year after it is sown, and dying in the next season.

Clover is not an exhaustive crop, and the reason is very concisely put in the following passage from the pen of Professor Liebig :—

"Clover differs entirely from the cereals in this respect, that it sends its main roots perpendicularly downwards, when no obstacles stand in the way, to a depth which the fine fibrous roots of wheat and barley fail to reach ; the principal roots of clover branch off in creeping shoots, which again send fresh roots downwards. Thus clover, like the pea plant, derives its principal food from layers below the arable surface soil, and the difference between the two consists mainly in this, that the clover, from its larger and more extensive root surface, can still find a sufficiency of food in fields where peas will no longer thrive. The natural consequence is, that the subsoil is left proportionably much poorer by clover than by the pea. Clover seed, on account of its small size, can furnish from its own mass but a few formative elements for the young plant, and requires a rich arable surface for its development, but the plant takes comparatively but little food from the surface of the soil. When the roots have pierced through this, the upper parts are soon covered with a corky coating, and only the fine root-fibres, ramifying through the subsoil, convey food to the plant.

"The value of the *root* is equal to that of the leaf and stalk to the farmer. As Dr. Voelcker's experiments clearly prove, there remains in the soil, after the removal of the crop, an enormous weight of clover *roots*, which on their decomposition supply, in an available form, a large amount of plant food that this vigorous feeder has collected largely from sources that would have been inaccessible to the finer tendrils of wheat roots. Furthermore, clover roots penetrate deeply into the subsoil, and when they decay they leave open a well-furnished and inviting channel by which the roots of more delicate plants can descend beyond the influence of drought. This is in addition to the accumulation of nitrogen in the substance of the roots, and in the fallen leaves of the crop. Whatever the reason may be, the fact is most obvious, whenever I have been able to observe its effect, that the growth of clover has *invariably* added to the apparent fertility (the available fertility) of the soil. The good effect is much more obvious after two years' growth of the clover."

Many American farmers believe so heartily in the efficacy of the clover plant as a renovator of land, that they are willing to lose one whole crop in order to ensure a thoroughly good crop of wheat in the succeeding year, thus going a step further with this subject than we have in Canada. We as yet have only gone to the extent of ploughing in the year's crop of clover, and generally trust to the influence of the decaying roots alone, after having taken off either one or two cuts of grass or hay. American farmers take the bull by the horns at once. They seed down wheat with clover, do not allow the young clover to be fed off on any account, then for the next season close up the field fences altogether, and neither feed nor cut the crop. The entire clover plant is allowed to grow, and is often over two feet high, a solid mass of flowers and seed, and is allowed to rot down on the ground, and lie all the winter. The next spring the clover starts again, and is allowed to grow till in full flower. The whole of the result is then ploughed under as a preparation for wheat, either with or without a fallow. If spring wheat is to be grown, the ground is fallowed during the remainder of the season, after ploughing, and regularly prepared for spring wheat. If for fall wheat, the clover is ploughed under, the land heavily rolled, and cultivated so far as to keep down thistles and weeds, and the fall wheat sown. A noble crop may be expected, to be again seeded down to clover. By these means the ground becomes filled with clover seed, and the peculiar elements produced from rotten and decayed clover, and this ensures a thorough crop of clover so often as it is used. The originators of this system claim that it is one of great economy. The outlay is very small, the cost of labour comparatively nothing, the smothering effect of the clover kills all weeds, and the double crop so ploughed in is done by one ploughing and a slight cultivation of the soil between the time of ploughing and wheat sowing. They say that you have the ground more cheaply and better manured than you can have it in any other way, and ensure a thoroughly good crop of grain. In case of growing spring wheat, the plan might be further supplemented by a crop of buckwheat ploughed under after the clover, or a crop of green mustard. Either of these would be ploughed in, the last thing in the fall.

Clover will grow upon almost any kind of soil, from the most sandy to the stiffest clay, but on the lighter lands it appears to be more at home. Indeed, it is generally considered that if a crop of clover can be secured upon a field very much worn out, the first step has been taken in the reinvigoration of such land.

When sown.—Generally along with spring wheat, barley or oats, and upon fall wheat in the spring of the year.

Sowing.—In the sowing of clover, the most important point to be considered is the condition of the seed. It must be borne in mind, that good red clover seed is dark-coloured when thoroughly ripe; so that in proportion as there are present in the sample a great number of light-coloured seed, so there will be greater risk of a proportion not generating. To illustrate this point more fully: if the light-shaded seeds in a sample be picked out and planted, many will be found to fail, whilst *all the dark-coloured* will germinate.

The quantity per acre is a subject on which there has been much difference of opinion. We have ourselves always favoured thick sowing, and we have yet seen no reason to change our opinion upon the subject. Something may, however, depend on the condition of the seed bed, as in a mellow, rich, friable surface soil, doubtless the seed will have the best chance to grow *quickly.*

The three objects to be attained in the sowing of clover are nutritious fodder, a heavy growth to plough under, and the formation of dense shade for the ground.

The practical experience of farmers is adverse to thin sowing of clover. The plants come up far apart, and if, owing to a very favourable state of soil and season, we have a good crop, the stalk grows very coarsely, and is apt to become dry and brittle after curing, stacking and mowing away. Extra seed should not be grudged if by its use a sweet, soft, fine-stemmed clover can be secured.

It is passing strange that the practice of thin sowing should be so frequently carried out in Canada; for even in Great Britain, where there is far greater humidity of climate, and where the state of cultivation is very perfect, it is the general practice to sow not only clover, but all grass seeds, much thicker than we do here.

As we sit writing and cast our eyes into an adjoining field, which was last year a garden, there is a patch upon which clover seed was sown very thickly; probably over twenty pounds to the acre. The spring has been excessively dry (1873), and the clover is generally very backward. Our patch is thick and luxuriant, springy to the tread of the foot, and the ground beneath, notwithstanding there has been no rain for about three weeks, is moist.

It is quite evident that the early and vigorous growth of a mass of stem and leaves has covered the ground well, prevented the escape of moisture, and also, in all probability, of many fertilizing gases. The sun is streaming down with intense heat upon the head when walking upon this green carpet, but the feet feel moisture and coolness. Where the clover is thin in the fields, the ground is bared to the action of the sun, is scorching hot to the hand, the spires of the plants are dried and the leaf shrunk. No after rain can ever cause such to make the growth that will be found in one thick-sown piece ere the blossoms are out and the crop fit for the scythe.

In the one case, a crop of at least three tons per acre will be cut, and with the very best of weather we cannot expect more than twenty hundred weight from the other.

The hay from the one acre will be worth, at ten dollars per ton, thirty dollars; while from the other it will be only ten dollars, under the best circumstances of weather that may supervene between the present time and haying. The difference of seed used on the two portions was probably nearly ten pounds, or, at six dollars per bushel, only one dollar. Thus, for a saving of one dollar at one time, is lost hereafter twenty dollars. This may be called "*dollar wise and twenty dollar foolish.*"

It is, then, not the thick growth of individual plants, but the heavy growth of the whole, that protects the crop; for it gives the crop a good start in early spring, and a growth luxuriant enough to form a dense shade over the ground ere drought can take effect upon the soil.

"It is held that heavy crops evaporate moisture all the more. This is true. But much of this moisture is retained by the heavy mass 'entangled in its folds,' so that the escape—actual escape, from the grass as a body, is considerably less, in proportion, than that set free by the more scattered growth. Here the air drinks rapidly from the slim plants exposed fully to it, and carries off what it takes. In the dense mass it cannot do this; it cannot penetrate it.

"But the greatest harm in a drought is, the direct exposure of the soil to the sun and the hot, *dry* wind. This, indeed, is the cause, more or less, of all drought. What is the evaporation of plants compared to this? Well, this is avoided, wholly avoided, in a dense mass of verdure. It needs but a start to occupy and cover in time, as now. The contrast is interesting—a cloud on the one hand, barrenness on the other."

The quantity of seed per acre should not be less than ten pounds, or a bushel to six acres. We have often put on fifteen pounds, or divided a bushel between four acres, and have never had reason to repent of such a liberal use of seed.

Less is probably required when sown early on fall wheat, than upon spring crops.

The time of sowing depends, of course, upon the crop with which it is sown, and also upon the state of the weather.

On Fall Wheat.—It may be either sown before the frost is out of the ground, or when the land is ready to go on with horses. We have had excellent "catches" by sowing on the last snow, *i.e.*, the late spring flurries that we usually have after the back of winter is broken. The advantages are that the broadcast sower finds it more easy to sow evenly, for he can see his tracks up and down the field, and the melting snow sinks the seed into the ground and gives it an early start. If the operation, however, is put off later, it is a good plan to sow as soon as land is moderately dry, and the wheat has begun to put forth a growth for the summer. Then harrow the wheat, as was recommended in the section devoted to the culture of wheat, and the passage of the roller after this harrowing will help to cover in the seeds. Last season (1872), when a great number of farmers failed to secure a "catch" on fall wheat, we adopted this plan and were successful.

A bush harrow, following sowing, will also be found a very excellent implement for covering clover seed, for it should not be deep in the surface soil.

The success of the clover crop depends in great measure upon the state of the weather, both when sown and afterwards when standing for a crop.

It requires gentle rains to sprout it rapidly and to give it a good anchorage before the summer droughts set in, though in this climate we always run the risk of losing our clover by the burning heats of summer, no matter how favourable to its early growth may have been the spring rains.

The farmer too often, however, blames the weather for his lost crop; but given soil clean and under good tilth, a liberal supply of sound, fresh seed, and nature will, in the majority of cases, respond with a bountiful crop.

It is useless to sow clover on foul land. Most of our noxious weeds are fast and stout growers, and in the tussle for life our domestic plant must go to the wall.

Not only does a fine friable state of the bed give the clover a chance to strike its tap root firmly and deeply down, but in such ground the temperature is always cooler.

When sowing clover seed along with spring grain, in drills, the clover sower should run in front of the implement. The teeth of the drill only stir the soil, and so *just cover* the grass seeds; while if the seed follows, it will fall and roll into the drills and be covered nearly the same depth as the grain, which will be fatal to a large proportion of grass seeds.

After clover seed is sown with spring grain, the roller should always be used to cover in such seeds as may have remained on the surface.

The Americans have recorded instances of a successful "catch" of clover on corn ground.

A. G. Kirk, Dickinson Co., Kansas, says he saw in Columbus County, Ohio, last April, a fine stand of clover in a corn stubble, and on inquiry found the owner of the land was in the habit of sowing clover seed when he worked the corn the last time, for the purpose of supplying manure for the crop of oats, or barley, or wheat, which was to follow. This farmer evidently was one of the progressive sort, who believes in putting all he can on the land. We have done the same, pasturing the clover with sheep, and had a good crop of wheat after it.

Sowing clover alone.—That grass seed will come to a good crop when sown alone, is now a well-established fact. Indeed it was brought under our own observation in a very marked manner.

We seeded down a field of oats; the oats were drilled in, and the grass seed was dropped by a clover sower attached to the hind end of the two-horse drill; the seed was covered with a bush harrow. For some reason the grain drill did not work well, and several of the spouts missed sowing in two or three places through the whole length of the field. In one spot the whole drill missed for some yards. Upon these bare spots the grass seeds have, notwithstanding the extreme dryness of the season, far excelled in luxuriance of growth those upon the land where the oats have grown regularly.

This goes to prove that the clover and timothy will do well when sown by themselves.

Whether the farmer would approve of losing one year's crop off his land, he may judge for himself; but on low spots such grasses as timothy may be sown to advantage by themselves in the fall, and will come to a good crop in the succeeding year.

We would, however, repeat our opinion that if the land be not in good heart and thoroughly clean, it will be worse than useless to sow timothy and clover alone.

Should land, however, be in a fit state to receive the seed next year, let it be ploughed in the fall and left rough; cross-ploughed or thoroughly cultivated and harrowed down very finely in the spring, and seeded down thickly with equal bulks of timothy and clover.

If manure be used, it must be fine and thoroughly rotted, so that all weed seeds have been killed, and it should be incorporated with the soil by spreading on top, and working in with the cultivator in the early spring. A top-dressing of ashes and plaster will be of great benefit at almost any period of its growth. Or let him plough early this fall and sow timothy seed alone, and in the spring drag with light harrows; sow clover seed, harrow again, and top-dress with fine rotted manure, plaster and ashes. Of the two courses we prefer the former as the more safe. The only advantage to be obtained from the latter course is that the first year's hay will have a good admixture of timothy in it.

When clover is used with the intention of keeping the meadow for two or three years, it becomes necessary to use another kind of seed to take the place of the clover, which, being a biennial plant, disappears in two years. For this purpose timothy is used in Canada. While we believe that there are other grasses of a sweeter flavour and more luxuriant growth than timothy for this purpose, and suited to the climate of Canada, yet experiments, as recorded, have been so meagre that we hardly feel qualified in advising the supersedence of timothy by them. We shall speak of these other grasses hereafter.

It was customary at one time to sow clover by weight and timothy by bulk. The present and more practical plan is to sow a given bulk per acre of the two, mixed in equal quantities.

Before leaving this subject, we may mention the common practice of cutting cereal crops, amongst which grasses have been sown, too close to the ground. Undoubtedly a larger amount of straw is thus obtained, but on the other hand a fair length of stubble affords considerable protection to the young plant, and breaking down in winter acts to some extent as a mulch. We now come to a consideration of the main principles to be observed in the securing of a superior article.

HAY.

We will here condense from a treatise on haymaking, by Mr. Sibson :—

" Haymaking, though essentially merely a process of drying, by which the feeding principles of the grass are brought to a condition capable of being preserved, is accompanied by minor changes which materially influence the result. The chief of these is the production of the peculiar flavouring principles of hay, which probably contribute much to the value of this produce as a choice article of food. Again, the grass in drying is exposed to certain sources of loss in nutritive materials, so that the hay made from a

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given weight of grass does not contain so much nutritive matter as the grass in a fresh state would do.

" This loss may be accounted for : 1. By the seeds, flowers and finer leaves, especially of the clovers, which become very brittle on drying, shaking out to some extent, during the making, even when carefully managed.

" 2. By incipient fermentation, which proceeds in the moist grass as soon as cut, and proceeds while drying in the field as well as in the mow or stack.

" 3. By the washing out of its soluble constituents by dew and rain while lying in the field, especially when arrived at the condition approaching to that of hay. The extent of this loss, of course, depends on the weather during the operation, being in wet seasons very considerable, and is the principal reason why fine weather is of so much value in haymaking.

"The quality of hay as food, apart from that determined by the manner in which it has been got, depends of course mainly on the character of the meadow which produces it, and also much upon condition as regards the maturity of the grass when cut. Up to the period of flowering, the nutritive juices of the grasses continue to increase, especially in sugar ; in many species notable quantities of this valuable constituent of food are present. As the process of fructification proceeds, these bodies diminish, being drawn upon to supply the flowers, pollen, &c., much of which is thus lost, whilst the amount of woody fibre in the stems rapidly increases, also at the expense of nutritive principles. For these reasons it is certainly *better to cut grass for hay too early than too late ;* for although by waiting longer a heavier crop may be obtained, beyond a certain period this increase in quantity will be greatly at the expense of quality."

We give analyses of clover hay and ordinary mixed meadow hay :—

MEADOW HAY.

	Per cent.	Per ton.
Moisture	16·64	333 lbs.
Fatty and waxy matters	5·01	72
Albuminous compounds*	8·08	140½
Gum, sugar, &c. &c	44·86	965½
Woody fibre	17·64	355
Mineral matters †	7·77	134
	100·00	2000

		Per cent.	Per ton.
* Containing	Nitrogen	1·30	29 lbs.
† "	Phosphoric Acid	0·43	9½
"	Potash	2·02	45

CLOVER HAY.

	Per cent.	Per ton.
Moisture	17·05	341·9 lbs.
Fatty and waxy matters	3·74	43·8
Albuminous compounds*	14·34	281·2
Sugar, gum, &c	30·76	649·0
Woody fibre	26·61	556·1
Mineral matters †	7·50	128 0
	100·00	2000·0

Both meadow and clover hay contain a considerable proportion of fatty and waxy matters, all of which are probably available for animal wants.

One-sixth, however, of the weight of hay, and a little more in clover hay, it must be observed, is water. It is doubtless owing to the greater amount of nitrogenous matter and phosphates that clover is a better fertilizer than mixed grass.

It has been argued by some that slight heating in the stack or mow does not injure the feeding qualities of hay ; but the smell emitted from hay in a state of fermentation would lead us to consider that there must be a loss in the process of no small amount of sugar.

The practice of salting hay, when about to mow away, is undoubtedly a good one, for it tends to amalgamate the soluble nitrogenous compounds, and these are, undoubtedly, the originators of that fermentation which, if allowed to proceed, will cause such evolution of heat as to destroy the feeding properties of the hay, and in some cases cause actual combustion.

Clover has, undoubtedly, a larger amount of feeding quality when green than any other kind of artificial grass ; but owing to its brittleness when drying, it becomes dusty, and for this reason is dangerous feed to an animal from whom speed, and rapid action of the lungs and organs of breath are required.

Signs of Rain.—Many of our farmers regulate not only the time of haying, but also the setting of posts and many other farm operations, by the phases of the moon.

Now, whilst we can hardly perceive any analogy between the moon and a fence post, it is yet probable that the moon acts as a chronicle of certain times in the year in which rain is more or less prevalent. It is observable that there is, on an average, a symmetrical fluctuation in the amount of rain at certain given seasons in each year, and these seasons are chronicled by the phases of the moon, such phases showing the relative position of the sun, moon and earth.

		Per cent.	Per ton.
* Containing	Nitrogen	2·28	51·1 lbs.
† "	Phosphoric Acid	·53	11·9
"	Potash	1·83	41·0

We would call our farmers' notice to the fact that in nearly every year there is more rain in the first two weeks in July than in the latter part of June or of July.

A natural barometer is noted in Macdonald's "Hints on Farming," as discovered by a gentleman in England, being the spider's web. When it is about to rain and be windy, the spider shortens considerably the last thread to which his web is suspended, and leaves it in this state while the weather remains variable.

If the insect lengthens its threads, it will be fine, and the fineness may be guessed by the length they attain. If the spider remains inactive, it is a sign of rain; if, on the contrary, it begins to work whilst it rains, it betokens a speedy change for the better. The spider alters his web every twenty-four hours, and if these alterations are made a little before sunset, the night will be fine.

The following quaint reasons, forty in number, are given by the late Dr. Jenner as sure signs that rain is near:—

1. The hollow winds begin to blow,
2. The clouds look black, the grass is low,
3. The soot falls down, the spaniels sleep,
4. And spiders from their cobwebs peep.
5. Last night the sun went pale to bed,
6. The moon in halves hid her head ;
7. The boding shepherd heaves a sigh,
8. For see a rainbow spans the sky.
9. The walls are damp, the ditches smell,
10. Closed is the pink-eyed pimpernel.
11. Hark ! how the chairs and tables crack—
12. Old Betty's joints are on the rack.
13. Loud quack the ducks ; the peacocks cry,
14. The distant hills are seeming nigh.
15. How restless are the snorting swine ;
16. The busy flies disturb the kine.
17. Low o'er the grass the swallow wings—
18. The cricket, too, how sharp he sings.
19. Puss on the hearth, with velvet paws,
20. Sits wiping o'er her whisker'd jaws.
21. Through the clear stream the fishes rise,
22. And nimbly catch th' incautious flies ;
23. The glowworms, numerous and bright,
24. Illumed the dewy dell last night.
25. At dusk the squalid toad was seen,
26. Hopping and crawling o'er the green.
27. The whirling dust the wind obeys,
28. And in the rapid eddy plays.
29. The frog has changed his yellow vest,
30. And in a russet coat is dressed.
31. Though June, the air is cold and still,
32. The mellow blackbird's voice is shrill.
33. My dog, so altered in his taste,
34. Quits mutton bones on grass to feast.
35. And see yon crows ! how odd their flight,
36. They imitate the gliding kite,
37. And seem precipitate to fall,
38. As if they felt the piercing ball.
39. 'Twill surely rain ; I see with sorrow
40. Our jaunt must be put off to-morrow.

The object in making hay from grass, as we have before observed, is to retain the maximum amount of sap, and this can only be done by allowing it to go through a state of partial fermentation in cocks whilst undergoing the process of drying.

This is best effected by first putting it into small cocks, then into larger ones, thus gradually curing in the shade; this also prevents all liability of a second fermentation in the stack or mow.

Clover is ready for cutting at a far earlier period than usually practised by farmers. To preserve all the saccharine juices it must be cut when in full bloom, when but a very few of the heads have begun to brown—it is common to wait until the majority of the heads are wilted and dead. The heads should wilt in the cock, and not on the stem.

Timothy, likewise, to secure a well-coloured and nutritious article, should be cut when the first joint above the root has turned yellow and become hard. If left to ripen its seed, the juices are turned into hard fibre, which is little better for feed than ground-up chips of wood.

"A farmer says he wants to let his timothy grow until it is ripe enough to haul into the barn the same day it is cut. This sounds very nice, and looks practical. But on the other side there is a horse that, if he could speak, would say he will not eat such hay at all if he can get hay that has been cut before the seed was filled, and has been well cured by the process of sweating in the cock. We think that in most cases it is the imperfect curing of early cut hay that brings it into disrepute with city buyers. Some cut it too early, and allow it to lie in the swathe and burn up in the sun. Finding it does not dry, they leave it all night exposed to the dew in the swathe, or even for a day or two under the sun and passing showers, till it gets wilted, not cured. Such hay has lost all its aroma and sweetness. Had it been tedded, or shaken out twice within six hours after cutting, and then put up in cocks to stay till it had gone through a slight degree of fermentation, it would have been quite a different article."

"The *Country Gentleman* hears of many farmers who could not get in any hay during the showery or 'catching' weather of this season; and is told of one man who is not supposed to be much of a farmer, but put from three to six tons of hay in good order into his barn every day for a week. There is no secret in the process. He put up the hay in cocks and put canvas caps over them, thus shedding the rain. Then when the weather was clear again, off went the caps and the hay opened to the air and sunshine. The caps he used were made out of old bags, and cost about fifteen cents each. But much higher priced bags would pay well on the investment when wet weather continues."

"It is held by some that clover, as soon as it begins to lodge, should, as a general thing, be cut. This irrespective of its age or size. Hence, clover by these men is cut early as a rule—in moist seasons always before it is in full blossom. When the crop is light (in a drought) it is cut later, but not much. The early cutting has convinced them of the superiority of the hay. Thus we have, Aug. 7th, the second cutting in process. There are a few heads, but half have not appeared. The crop has begun to lodge—of course it is of a good length to do this ordinarily; the stems are eighteen to twenty inches long. It is a heavy mass of green fodder, surpassing in weight the first cutting, on account of the more favourable weather.

"To cut thus early is to get all of the growth, as all can be cleanly cut off, not having lodged sufficiently to prevent this. There is a saving, therefore, in this respect, as well as in the better quality of the hay, no rotting of the lodged stalk taking place. This last, when much lodged, and a heavy growth, results in much loss."

Of late years caps have been brought into general requisition in the States for the protection of hay in cock.

For weighing hay in small lots, an American exchange describes a very simple contrivance, which saves the tying at least, and is very cheap and easy to make. It consists of an upright standard, five or six feet in length, of 4 × 4 scantling; a round pole will do as well. Near the bottom of this standard, two two-inch holes are bored at right angles to each other. Round straight poles are slipped through these holes, projecting some three or four feet on each side of the standard. On the ends of these poles are laid and fastened light narrow strips of boards or poles, forming a square, the sides of which are equally distant from the standard. A clevis is attached to the top end of the standard in which to hook the steelyard. The usual lever arrangement is used to raise the hay, which is simply pitched on to the platform. When not in use, the cross poles can be slipped out, and the whole stored in a small place.

Clover for Seed.—Clover seed is at best a troublesome crop, and rarely yields more than three bushels to the acre. Still, as from the farmer's own field he can obtain seed which he knows is fresh and unadulterated, it may be a safe plan to cut and thrash; but it must be borne in mind that the cutting of grass for seed is hard upon the land.

The period when it may be considered ready to cut is one requiring judgment. "As the crop approaches to maturity, it changes its verdant appearance to a light brown;" the leaves begin to harden and shrivel and drop off, leaving a bare stem, with the withered flower nodding at the top. The best plan is to pluck the flowers and rub in the hand. When the seed separates with some difficulty, but yet will come away from the flower, the crop should be cut; by the time it has dried it will thrash easily. Indeed, clover when ripe for seed is at all times a bad sheller, and should be secured with as little moving as possible. The reaping machine is the best implement for cutting clover for seed. The clover heads may be raked in windrows, and immediately pitched into a waggon rack which has been boarded up, so that as few shellings as possible may be lost in carrying.

It is better to cut clover for seed in the mornings and evenings, and on cloudy days, for it becomes very dry and brittle under a hot sun.

The crop must, however, be perfectly dry for thrashing, as if damp the seed is very hard to separate. But a wetting with rain, and subsequent drying, will have a good effect in making it thrash more easily.

Seed should be only taken from clover that has been grown on clean ground, or a plentiful crop of mulleins and other abominable weeds will be on hand for distribution over the farm.

The chief points to be considered in stowing away hay in the barn are :—Mowing away in such a manner that it may be easily moved again ; sprinkling with salt, the beneficial effects of which have been already shown.

In stacking hay, more care should be exercised than is usual in securing the bottom from wet. We believe that a regular stand upon some stone pillars or wooden posts would pay well, for such would not only keep the stack perfectly dry, but would also allow of a current of fresh air passing constantly below the hay.

When hay is very damp, a ventilator is most useful. This is simply made by keeping a bag filled with chaff, or some light but bulky substance, always standing in the centre, building round this bag, and then drawing it up each time that the layers of hay rise to the mouth of the bag.

This plan of ventilation need not, however, be resorted to unless the hay be very damp, for a moderate sweating of the hay renders it far more palatable to the cattle.

The grand principles of a well-built stack are that the centre be all the time kept higher than the sides, and that the whole be kept well trodden down.

Pasture Land.—The management of pasture land in Canada is more difficult than in the moister climate of England. Droughts are of such frequent occurrence during the summer, that grass, once eaten down, sometimes takes several weeks to put forth again the slightest growth, and thus at certain seasons through the summer we find that our cattle do no better when they have the run of twenty acres than at other seasons in a far smaller field.

It is the quickly renewed growth of grass after cropping that makes good pasturage, and this rapid revival will not take place if the land be allowed to get parched up.

Soiling vs. *Pasture.*—Our own experience in this matter has been that the less pasture land we have kept the better, and that for a climate almost tropical as is ours in the summer months, the soiling system is the correct one, if we would have our farms carry a heavy stock.

Indeed, by the growth of plenty of green fodder (notably corn), twenty acres may be made to feed forty head of stock equally as well—aye, better than eighty acres, while the remaining sixty acres may be reserved for winter feed in the shape of hay. The whole question of Soiling *vs.* Pasturing resolves itself into this: Will the extra expense of cutting and carrying food to the stock throughout the summer be more than counterbalanced by the acreage of land thus saved for other purposes? We submit as our opinion that it undoubtedly will, simply premising that a sufficiently heavy stock be kept to *pay for the* expense of one man's whole time. We shall enter more fully into reasons when we come to consider the principle of soiling cattle. At present our business is with pasturage.

Now, to keep a pasture field in heart, we must not only have a rich and deep soil, but we require any kind of grasses that will thoroughly shade the ground. Timothy is a valuable grass for hay, and is in first demand amongst city buyers; but it is a miserable species for a pasturage—not only itself a naturally dry plant, having few leaves by which to gather moisture at night, and partaking in this manner of the nature of a cereal, but it grows spindly, straight up, far apart, and permits the hot sun to strike down on to the very surface of the ground and to bake it for several inches in depth. It does not afford the same surface as other grasses from which to radiate the earth's heat at night, so that a maximum amount of dew may be condensed, and permits the hot scorching winds of summer to blow fairly through it, and dry and shrivel up its stalks. What we want upon our pasture ground is a luxuriant matted growth—one that will thoroughly shade the ground, and will condense the greatest amount of moisture at night during hot weather.

Dew.—And whilst upon the subject, we would explain the formation of dew. It is incorrect to say that "*the dew falls*," or even to speak of the *dew rising*. *Dew forms*—*i.e.*, it is simply a condensation of the atmosphere upon the surface of substances, varying in degree according to the amount of surface exposed to the atmosphere over a given area; for which reason dew is always heavier upon the grasses than upon the bare ground, and heavier upon thick matted, many-leaved grasses than upon those which, like timothy, spindle into one almost leafless stalk.

The action of the formation of dew may be seen every day. Go to the well or spring in hot weather and fill a glass with cold water; directly this glass, made cold by the water, is brought into contact with the warm atmosphere, moisture is formed on the outside of the glass. This is dew. The wet does not come through, for we know that water *cannot penetrate glass;* but the glass, being colder than the air, condenses the moisture of the atmosphere immediately round it into drops of water.

The same thing may be observed in winter, in frosty weather. When we rise from our beds in the morning, we find the window covered with frost or frozen water.

The pane of glass is made cold outside by low temperature of the air; our breath being moist, and coming into contact with the cold glass, is condensed into drops of water, and frozen. When we breathe upon a pane of glass at any time, moisture is formed by the condensation of our warm breath in contact with the colder pane.

In cold weather we can see our breath; because immediately the warm air exhaled by us comes into contact with the very much lower temperature of the external atmosphere, it is condensed into water or vapour, and as such is perceptible to the eye.

All these illustrations show—and the glass of cold water is the most palpable—that the effect of bringing air at a high temperature into contact with *cold* is to condense the air into water.

Now, after a warm day the atmosphere and surface of the earth have both been heated.

Immediately the sun goes down, the earth begins rapidly to lose its heat by radiation—that is, heat is passed away from every particle of the earth's surface, or of what grows on its surface, as grass, trees, &c., in radiating lines outwards towards the sky.

This radiation we will shortly explain. Heat is transmitted in three ways—by conduction, reflection, and radiation. By conduction, when you place one end of a piece of iron in the fire, and soon the other becomes too hot to hold; by reflection, when to preserve your wall you place a piece of bright tin between it and the stove, by which, as soon as the heat strikes the tin, it is thrown back towards the stove; and radiation is the process by which the heat leaves the stove and warms you as you stand some yards from it.

The heat, then, leaves the earth as it leaves the stove, by radiation upwards into space.

So that the earth *cools far more rapidly than the atmosphere immediately around it.*

The earth then takes the place of the glass of cold water, and the air condenses upon it.

We hear some reader say, "But why do we feel the evening air so cold if it is really warmer than the earth?" Because heat radiates also from your body, and the air condenses upon you and gives you a chilly and moist feeling.

Again, we hear, "Why is dew, then, never heavy under trees?" Because the tree above does the radiation of heat, and the rays of heat from the earth are stopped by the tree above, so that there the ground *does not cool as rapidly* as where unsheltered. If you climb the tree, you will see the dew heavy on the top.

Again, for the same reason, radiation is prevented by clouds, and, therefore, there is no dew in cloudy weather.

If you place a paper cover over a warm egg, but not in contact, the egg will not cool as rapidly as one that is not so covered, no matter how cool the surrounding atmosphere may be, because the paper prevents radiation of heat. The earth is the egg; if covered by a tree or by a cloud—aye, by a piece of paper, not in contact with it, radiation is prevented; it does not cool much more rapidly than the lower air, and consequently there is little or no dew, according to the closeness and thickness of the clouds.

We cannot afford space to enter more fully into the subject; we ask our readers to take notice that the greater the surface exposed over a given area, the greater the amount of radiation, the more rapid the cooling process, and the heavier the condensation of air into water or *dew.*

Thus a grass that throws out innumerable leaves will condense much air at night, and thus supply itself with much moisture to keep it damp through the coming hot hours.

The dew is also so heavy on clover and such leafy grasses that it soaks at last through them and drops to the soil beneath; it is then shaded from the hot sun by the dense growth of leaf, and the ground remains *moist.*

In timothy, the sun gets at the ground, and if it has become wet in the night, will cause rapid evaporation, and leave it drier in a few hours than if there had been no formation of dew at all.

We now give a list of grass seeds. In the first column will be found their prices as sold by Bliss & Co., seedsmen, of New York, and in the second column their prices as sold by Canadian seedsmen, the latter being taken from the catalogue of Messrs. Bruce, Hamilton.

The prices for 1873 of the several imported varieties of grass seeds already tried in the United States and Canada:—

	New York Prices.		Canada Prices.	
	Lb.	Bus.	Lb.	Bus.
CREEPING BENT GRASS, (*Agrostis Stolonifera.*)—A valuable variety for lawns, also highly suitable for permanent pasture on account of its growing earlier and later than most others, especially in moist situations......................	$0 45	$4 00	$0 00	$4 00
MEADOW FOXTAIL, (*Alopecurus Pratensis.*)—This is one of the best and earliest of pasture grasses; its root leaves are rather broad, and grows rapidly when cut or eaten down by live stock. It thrives best on meadow lands .	0 50	0 00	0 50	0 00
SWEET SCENTED VERNAL GRASS, (*Anthoxanthum Odoratum.*)—This variety yields but a moderate portion of herbage, yet permanent pastures				

	New York Prices.		Canada Prices.	
	Lb.	Bus.	Lb.	Bus.
should not be without it, as it is of good quality and very early. Its pleasant scent, not only when cut for hay, but also when the seeds become nearly ripe, is also a strong recommendation. It even deserves a place in the flower garden on account of its agreeable odour..	0 50	0 00	0 50	0 00
YELLOW OAT GRASS, (*Avena Flavescens.*)—Should be sown with other varieties, such as Crested Dogstail or Sweet Vernal, valuable for dry meadows and pastures...............................	0 75	0 00	0 00	0 00
RHODE ISLAND BENT, (*Agrostis var.*)—An excellent variety for lawns and pasturage............	0 00	4 00	0 00	0 00
SCHRAEDER'S BROME GRASS, (*Bromus Schraederi.*)—A new forage plant from Australia, particularly recommended for resisting the drought better than any other variety, and will thrive on any soil except where there is a superabundance of moisture ; yields two good crops in a season, and is much liked by cattle, who will walk over everything else to reach it, and will eat it down as close as they can bite..	0 50	0 00	0 00	0 00
CRESTED DOGSTAIL, (*Cynosurus Cristatus.*)—This grass, forming a close turf, and having rather fine foliage, may be advantageously sown on lawns and other places to be kept under by the scythe ; it is also useful in agriculture for very dry or gravelly soils. Cattle leave the seed stalk, but the foliage is always eaten down closely	0 60	0 00	0 50	0 00
ORCHARD GRASS, (*Syn, Round Cocksfoot*) (*Dactylis Glomerata.*)—A valuable grass on account of the quantity of nutritious feed which it yields, and the rapidity with which it grows after being cut or grazed. It is well adapted for growing under trees, or in orchards, etc., and is especially valuable for grazing bullocks, which fatten rapidly upon it. If allowed to stand for hay it has rather a coarse appearance, but if grazed it always has a fresh green hue..	0 30	3 50	0 00	4 00
HARD FESCUE GRASS, (*Festuca Duriuscula.*)—Will thrive in a great variety of soils, and resist the effect of drought in a remarkable degree. From the fineness of its foliage, it is well adapted for lawns or a sheep pasture, and its habit of reproduction after sowing is very great. It attains great perfection when combined with Festuca Pratensis and Poa Trivialis	0 30	0 00	0 00	4 00
MEADOW FESCUE, (*Festuca Pratensis.*)—This thrives in all soils, excellent for a permanent pasture, and is well liked by all kinds of stock. It makes excellent hay, the foliage being tender, succulent and highly nutritious..............	0 50	0 00	0 00	0 00
TALL FESCUE, (*Festuca Elatior.*)—A robust variety of the Meadow Fescue ; succeeds admirably in moist soils or where the meadows are subject to floods.....	0 50	0 00	0 00	0 00
SHEEP'S FESCUE, (*Festuca Ovina.*)—This grass forms a greater part of the sheep pastures of				

	New York Prices. Lb.	Bus.	Canada Prices. Lb.	Bus.
the English Southdowns. In quantity of grass it is not equal to other cultivated Fescues, but it should always enter into the composition of pastures in which sheep are to be pastured, as they are very fond of it, and mutton from such pasture is of the finest flavour....................	0 30	0 00	0 00	0 00
PURPLE FESCUE, (*Festuca Rubra.*)—A sub-variety of the *Festuca Duriuscula*, and especially suitable for dry, loose soils..........................	0 75	0 00	0 00	0 00
DARNEL-SPIKED FESCUE, (*Festuca Loliacea.*)—One of the most valuable grasses in cultivation either for permanent pasture or for lawns. It springs early, is very productive, very nutritious, and improves by age. It resembles the Rye Grass in its early growth, but excels it in the quality and abundance of its aftergrowth. It thrives on all good soils, and increases in bulk if pastured for many years.....................	0 80	0 00	0 00	0 00
MEADOW SOFT GRASS, (*Holcus Lanatus.*)—Grows from one and a half to two feet high ; thrives in almost any soil ; useful for orchards or pastures overhung with trees...........................	0 75	0 00	0 00	0 00
ENGLISH RYE GRASS, (*Lolium Perenne.*)—Very nutritious, and valuable for permanent pastures..	0 00	3 50	0 00	3 00
ITALIAN RYE GRASS, (*Lolium Italicum.*)—For alternate husbandry this is invaluable, especially for early sheep feeding and soiling...............	0 00	4 00	0 00	3 00
RED TOP GRASS, (*Agrostis Vulgaris.*)—Valuable for pasturage ; is well known and extensively cultivated in the Northern and Middle States and in Canada............................	0 25	2 25	0 00	2 25
ROUGH STALKED MEADOW GRASS, (*Poa Trivialis.*)—Produces a constant supply of highly nutritious herbage, particularly on damp soils ; and the marked preference which oxen, horses and sheep have for it distinguishes it as one of the most valuable for laying down pastures and meadows on soils either moist, or moderately dry..	0 50	0 00	0 00	0 00
WILD MEADOW GRASS, (*Poa Nemoralis.*)—Its habit of growth is delicate, upright, close and regular. There is no grass better adapted for pleasure grounds, particularly under trees, as it will not only grow in such places, but forms a fine sward where few other grasses can exist ; produces a good deal of foliage early in spring.	0 60	0 00	0 00	0 00
HUNGARIAN GRASS, (*Panicum Germanicum.*)—One of the most valuable varieties for soiling ; will thrive in almost any soil ; is not affected by drought ; may be sown as late as the 4th of July..	0 00	3 00	0 00	0 00
KENTUCKY BLUE GRASS OR SMOOTH MEADOW GRASS, (*Poa Pratensis.*)—This grass yields, at a very early period of the season, herbage of the most nutritious properties. Thrives in moderately dry soils ; extensively grown in many parts of the country..........................	0 25	3 00	0 00	3 00
KENTUCKY BLUE GRASS.—Extra clean...........	0 35	3 50	0 00	0 00
TIMOTHY OR HERD'S GRASS, (*Phleum Pratense.*)				

	New York Prices. Lb.	Bus.	Canada Prices. Lb.	Bus.
—Well known and extensively grown throughout the country ; very productive, and thrives on almost any soil. For laying down strong, tenacious and moist soils, it should form a considerable portion of the mixture required for husbandry or permanent pasture. It is also very profitable when grown alone. It has been found by careful analysis to contain a greater portion of nutritive matter than any other grass. Price according to market.				
REED CANARY GRASS, (*Phalaris Arundinacea.*)—Grows well by streams or marshes...............	0 75	0 00	0 00	0 00

There are also several varieties of clovers :—

	Canadian Prices.
COMMON RED, well known variety.. ..	Market price
LARGE RED GERMAN, *true*, very superior.................................	" "
YELLOW or TREFOIL, very valuable for pasture............	" "
WHITE DUTCH, highly esteemed for permanent purposes...............	per lb. 20 cts
LUCERNE or FRENCH CLOVER, very valuable, vigorous grower......	" 40 cts
RED PERENNIAL, (Cow Grass,) very valuable for pasture................	" 40 cts
BOKHARA, (*Melilotus Alba*,) a very vigorous growing variety ; may be cut three times during the season ; blooms early in August ; for green fodder or hay, cut when young—about two feet high ; average yield three to eight tons of hay per acre ; sow in spring ; the flowers are white and very sweet-scented, very valuable for bees................................	" 50 cts
ALSIKE, the most productive and without doubt the most hardy variety yet introduced.....................	Market Price

The Alsike Clover is valuable as a hay, and particularly of advantage to pasture land, and can be used on land too stiff or wet for the common and larger kinds of clover.

It is, indeed, by nature a triennial plant, but so readily seeds itself that it really becomes perennial in character. Having less tap-root than common clover, and more fibrous roots, it is not as liable to be thrown out by frost and thaw.

We should advise its use on low lands, especially such as are meant to be chiefly used for pasturage.

How to Stock Pastures.—Pastures require to be fully stocked, for if there are too few cattle, they will pick out food, taking the sweet fine grasses, and leaving all coarse tufts ; but the pasturage may be kept even by changing the stock upon it.

Let the cows have the first ; they require a large quantity, and rich pasture, to keep up a flow of milk. Let horses and young cattle follow—they will do well on it. When shorter and less succulent, then sheep, which are very close grazers, and whilst they will readily follow other stock, neither horses nor cattle care to eat after them. When the last have grazed pretty close, it will probably be time to use fall pasturage, when the summer pasture should be rested, so that enough top may be grown to protect the roots before the winter sets in.

Where but one kind of stock is kept, such as on a dairy farm, the pastures should be well divided up, so that no field may become at any one time bared.

Pasturing Meadows.—Great care should be exercised in turning stock on meadows at any time of the year.

For want of sufficient pasture, cattle and horses are often turned into the mown meadows, or stubbles that have been seeded with clover. This is, to say the least, injudicious. Generally, dry weather occurs after harvest, during which the clover and grass have a struggle to maintain their existence, the young clover plants especially suffering from the heat and drought. Possibly for some weeks the principal dependence of the meadows for moisture is the nightly dews. If the leaves are allowed to be eaten off, this mode of supply is arrested, by depriving the roots of the shade which they would have afforded. Only a weak growth can then be made; many plants will be totally destroyed; and when the fall rains occur, followed by nightly frosts, the unsheltered roots are thrown out by thousands. A promising piece of young clover may thus be completely ruined, and the next year's supply of hay be seriously curtailed. The small quantity of feed thus gained is dearly purchased. The life of the meadows is consumed and their existence threatened. We are aware of the great temptation there is to turn stock on to the aftermath and stubbles, but, unless in the very rare cases where the soil is rich and the growth is too heavy to be eaten nearly bare, it would be a great saving of money in the end to hire pasture, buy feed, or sell the surplus stock which cannot otherwise be fed at home.

Rye for Early Pasturage.—"The shortness and inferior quality of the hay crop often makes it probable that, by the time spring comes, many farmers find themselves with less of it than is desirable to carry through the stock in good condition till grass comes. The price also may rule so high as to be an inducement to sell hay, rather than consume it on the farm.

"In order to provide for this contingency, it will be well for those who breed stock largely, especially sheep, to grow some crop that will give them an extra early bite in spring, should the winter fodder not hold out.

"For this purpose, nothing better adapted to the climate, or more certain to succeed, than winter rye can be found. It will grow on almost any soil with very little preparation, and if sown early enough, will acquire such a growth before hard frosts stop it, that when the snow melts in spring the sheep will find a very good bite, and it will start again so early that much feed can be had from a field of it before there is a bite of grass in any of the meadows. The seed required will cost but little, as from a bushel to a bushel and a half per acre will be sufficient seeding. Stubbles, and land intended for fallows or roots next year, may as well be sown with this crop, if it is thought probable that there will be a deficiency of forage before grass comes again. But it is a very undesirable crop if allowed to go further and grow up to maturity, and those who sow it for the purpose of obtaining late fall or early spring feed must not be tempted by the fine appearance of the growth to neglect ploughing it up as soon as the stock can go to other pasturage. It is also better to be careful with stock when they are turned on such very early spring feed, and allow them to get gradually accustomed to it, otherwise the sudden change from dry fodder to green food will prove prejudicial by rendering them liable to scouring, and giving them a distaste to what dry fodder can still be spared to them. They should get out on the rye only for a short time each day, and in no case be allowed to live on it exclusively."—*Canada Farmer.*

Lucerne.—This grass we do not see mentioned in our Canadian seedsmen's list; but it has been fairly tried in the eastern States, under a climate very similar to that of our own Dominion, whilst there are recorded facts as to its cultivation here.

The editor of the *Canada Farmer*, in 1870, says, in answer to certain queries:—

"From a limited experience with lucerne, we believe it will endure the Canadian winter. Many years ago we saw this crop grown on sandy loam soil, and although neglected in its culture, there was an excellent yield the first year. It was sown about the 1st of May, and endured our winters, and yielded two cuttings each year for about five years. It was then destroyed to make room for a garden. The owner, a bricklayer, knew little of farming, and took no care of the young plants, even the first year. It was sown broadcast with barley. Many of the stalks were four feet high, and several horses were fed during the summer from it."

The following, upon this crop, is of great value, as coming from the pen of a farmer in New York State:—

"Respecting the cultivation of lucerne, I will give you my experience with great pleasure, as I feel convinced that it is a soiling crop which has only to be tried to be more generally grown. It is essentially a soiling crop, being ready to cut in the spring before red clover, and continuing to produce heavy cuttings all through the summer, no matter how hot or dry. Last season, though unusually dry, did not appear to check its growth, as we were able to mow over one portion of a field five times, and another, only seeded last spring, was cut four.

"There are crops that will yield a greater weight of feed per acre at one cutting—corn, for instance, and which is a crop that lucerne cannot supplant, as it yields a very heavy weight of green food at that season of the year when most of our dairy farmers are requiring such—but as a soiling crop proper, I know of none that can compare with lucerne, and one that few farmers can afford to be without. It yields a heavy weight of feed all the summer, of excellent quality, and one that does not require the expense of ploughing and re-seeding after each cutting, nor each year, as by proper management, and on suitable soils, it will remain profitable five years.

"Its relative value, as compared with corn, is decidedly superior, our sheep and cattle not only preferring, but 'doing' much better on it. In fact, corn with me has not proved a very satisfactory soiling crop—cattle fed on it generally losing flesh—until we have all but given over growing it for that purpose.

"The first hay we have this winter, that is the hay our calves and sheep prefer, is that with a little lucerne in it. Going on to the hay mow the other day, I saw a hole cut in it. Inquiring the reason, I ascertained that the shepherd had found where a load or two of hay, with a little lucerne sprinkled through it, had been mowed away, and that he had been getting it for his sheep, as they ate it better than good clover hay.

"A rich, dry soil, with an open, porous subsoil, is the most congenial to the growth of lucerne; but it will succeed well on any soil that will grow red clover to perfection.

"The seed may be sown broadcast, or in drills ten to twelve inches apart. In England we generally followed the latter course, so that after each cutting, or as often as might be necessary, we could run through the horse hoe, to loosen the soil and destroy weeds, &c., and by these means the crop could be grown successfully ten years. But here, I have generally adopted the former plan, sowing from twelve pounds to fifteen pounds of seed per acre, as early in the spring as the season will permit.

"The soil should be thoroughly prepared in the fall by deep ploughing, and manuring with rich, well-rotted dung, or what would be, perhaps, better, thirty to forty bushels of bone dust per acre, there being less liability of having foul seeds introduced, as this is a crop that is easily choked or run out by weeds, &c.

"In the spring the soil may be lightened with a two-horse cultivator, or scarifier, making a fine surface mould. The latter is essentially necessary to get a good plant. The seed being very small, will only require lightly brushing in.

"The after cultivation will consist yearly of a good top dressing of well-rotted dung in the fall, and harrowing and rolling in the spring.

"As I said before, weeds easily choke it; it will therefore be advisable to select a rich piece of soil free of weeds, and sow after some hoed crop, such as roots or potatoes.

"The first season will yield a fair crop, but the second, third and fourth will be the best."

The best grasses for butter purposes.—X. A. Willard, the first authority on the dairy in America, says upon this point:—

"'Fancy butter,' that will sell for a dollar per pound, cannot be made from bad material—from milk produced on weedy pastures, or upon the rank sour herbage of swamps, or upon land newly seeded with red clover. The experienced butter dairymen, therefore, pay much attention to the feed of their cows, and prefer old pastures.

"On the old pastures of the butter district there are several varieties of grasses that spring up spontaneously, and are much esteemed as affording sweet and nutritious feed, from which the best qualities of milk and butter are produced. These grasses form a dense solid turf, leaving no intervening spaces. They embrace the June, or blue grass (*Poa pratensis*), the fowl meadow-grass (*Poa serotina*), meadow fescue (*Festuca pratensis*), red top (*Agrostis vulgaris*), the wire grass (*Poa compressa*), the sweet-scented vernal and vanilla grass, together with timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), clover and other forage plants.

"The June grass (*Poa pratensis*) is regarded as very valuable; it throws out a dense mass of leaves, is highly relished by cattle, and produces milk from which a superior quality of butter is made. It is found growing throughout the butter districts of the country. The wire grass (*Poa compressa*) is deemed one of the most nutritive of the grasses; is very hardy, eagerly sought after by cattle, and is one of the best grasses for fattening. Cows feeding upon it yield milk of the richest quality, from which the nicest butter is made. It flourishes well upon gravelly knolls and in shaded places, and its stem is green after the seed has ripened. It is found growing in all parts of the country.

"The meadow fescue is common in old grass lands where the sod is thick, and grasses of different varieties are mingled together. It starts up early in the spring, is relished by stock, and furnishes good early feed. The milk farmers hold it in high estimation as a reliable grass, tenacious of life, and not running out like timothy (*Phleum pratense*) or clover. The white clover (*Trifolium repens*) springs up spontaneously in the old pastures, and is highly esteemed as giving flavour and quality to butter.

"The sweet-scented vernal grass grows best upon the moist soil of the old meadows. It starts very early, and gives off an agreeable odour.

"We have been particular in naming the grasses which are most esteemed for producing a high-priced butter, because a record of long and well-conducted experiments has proved their utility."

Permanent pastures can be kept up to a full growth only by careful attention.

After the pasturage has once become permanently established, it can be kept up for many years by an occasional dressing of well-composted barn-yard manure, superphosphate, or even a mixture of plaster and unleached ashes, giving at the same time a sprinkling of fresh seeds on those spots that show signs of having run out. Particular care must be taken all along to carefully cut out, root and branch, all noxious weeds that may make their appearance, and not to allow stock to pasture it down too closely in the autumn, so as to have the roots unprotected during the winter.

Hungarian Grass.—"The trouble about Hungarian grass is, that it is not generally cut at the proper time. I have raised it for several years, and consider it the very best hay for horses. They will keep fat on it, where on timothy they will grow poor. I sow half a bushel per acre. It then makes fine hay, and on good land should yield from two to three tons to the acre. Cut it when in the blow, before any seed is formed; wilt in the swarth the same as clover, and make in the cock. The stalk is nearly solid and the hay very heavy, and if made in this way will be as green as grass, and a horse will want little grain for ordinary farm work. I only feed grain in the spring when doing heavy ploughing. Give your horses all they will eat of it, and they will fat with decent usage. But if allowed to turn yellow and form seed it is the same as any other grain, and will, of course, injure a horse the same as if he were fed wheat in the bundle to excess. An over-feed of grain is bad. It is better to rake it by hand, but on a good soil you will tumble up a big cock in a small space.

"If cut at the time I mention, it will sometimes sprout up again and make good fall feed or a green crop to turn under. In one case I cut it the second time for seed, but it was short."—*Prairie Farmer.*

Millet.—"The Great or Indian millet (*Holcus Sorghum L.*, *Sorghum Vulgari*) * * * * [cultivated the length and breadth of the continent] has a stem that rises five or six feet high, is strong, reedy, and like those of the maize, but smaller. The leaves are strong and broad, having a deep furrow through the centre, where the midrib is depressed in the upper surface, and is very prominent below. The leaves are two feet and a half long, and two inches broad in the middle, embracing the stalks with their base. The flowers come out in large panicles at the top of the stalks, resembling at first appearance the male spikes of the Turkey wheat; these are succeeded by large, roundish seeds, which are wrapped round with the chaff. This grain is a native of India, where it is much used to feed poultry, and is frequently sent to Europe for the same purpose. It is much cultivated in Arabia and most parts of Asia Minor, and has been introduced into Italy, Spain, Switzerland and some parts of Germany; also into China, Cochin China and the West Indies, where it grows commonly five or six feet high or more, and, being esteemed a hearty food for labourers, is called Negro Guinea Corn. Its long awns or bristles defend it from the birds. In England the autumns are seldom dry and warm enough to ripen the seed well in the field. In Arabia it is called dora, or durra ; the flour is very white, and they make good bread of it, or rather cakes, about two inches in thickness. The bread which they make of it in some parts of Italy is dark and coarse. In Tuscany it is used chiefly for feeding poultry and pigeons—sometimes for swine, kine and horses. Cæsalpinus says that cattle fed on the green herb are apt to swell and die, but thrive on it when dried. They make brushes and brooms of its stalks in Italy, which Ray observed in the shops at Venice, and which are sent to this country. Of this species there are two distinct varieties, one distinguished by black and the other by red husked seeds, besides sub-varieties.

"The only sorts of millet which can be cultivated in this country are the German, cultivated, and the Polish sorts. According to Professor Thäer, the cultivated is to be preferred, as having the largest grain.

"The soil for the millet should be warm, sandy, rich and well pulverized to a good depth. The seed is sown in May, very thin, and not deeply covered. In the course of its growth, no plant, Professor Thaer observes, is more improved by stirring the soil, after which it grows astonishingly fast, and smothers all weeds.

"In harvesting the millet, great care is required not to shed the seed, and as it ripens rather unequally, it would be an advantage to cut off the spikes as they ripen, as in reaping maize. No grain is easier to thrash, or to free from its husk by the mill. It is used instead of rice, and in Germany bears about the same price. It produces a great bulk of straw, which is much esteemed as fodder." —*Loudon's* (*English*) *Encyclopædia.*

An American says that "curing millet is done in the same manner as timothy and other grasses. Weather favourable and properly handled, it will be sufficiently cured for harvesting two days after cutting. Harvest when the seed is about swelling. If cut at a later period the nutritious qualities will be seriously diminished. Product, two to four tons per acre. The land ought to be thoroughly ploughed and harrowed. Sow four or five pecks of seed per acre, broadcast, and cover with a harrow, followed by a roller; the land sandy or light loam, and made rich enough for corn. Millet for hay may be sown in the middle States as late as the 25th of July. The same mode of curing will apply as to the Hungarian grass. Our preference is the India or Grand millet, which produces a third more forage and seed than the common millet. Seed of the latter can be found at any prominent seed store. The India can scarcely be obtained till the new crop matures. Millet is very nutritious, and is eaten with avidity by horses and horned cattle."

Sorghum.—We have found no difficulty in curing sorghum, so as to be fed to cattle late in autumn and during early winter. It was placed as soon as cut in large shocks, carefully made, so as to stand even and erect, and was allowed to remain several weeks to dry. When green and fresh, cattle eat the whole stalk greedily; the only objection to it is that the animals, becoming accustomed to so sweet and delicious a food, neglect ordinary pasturage, and if they do not have enough sorghum will be apt to suffer. In early winter the stalks become too dry to be eaten in this way, and we therefore cut it short by horse-power, and feed it in boxes or mangers. When thus cut, the cattle eat it readily, and it increases the milk of the cows. It is important, in order to succeed well, that it be kept in good condition, and the work well performed. For fodder, it should be cut rather early—a little before the average time for cutting sorghum for manufacture, so that the stalks may not be too hard and horny when they dry. We would not recommend sowing broadcast; it does much better in hills or drills, where it can be cultivated and kept clean. A peck or so will do for an acre, varying with soil and culture; on a fine, rich soil, in perfect condition, and covering the seed at a uniform depth of about three-fourths of an inch, four quarts would be better than thrice that quantity on hard cloddy ground, or buried carelessly at various depths. It may be well to say that sorghum cannot be sown so thick as corn, to advantage, as the stronger plants crowd and shade the smaller ones, and obtain the entire ascendency; while corn, if sown thickly, is dwarfed all alike.

Vetches or *Tares* are very useful for soiling purposes. We have invariably made it a practice to grow a patch of tares near our stables for feeding horses when they come in from work. They are very nutritious, and agree well with all kinds of stock, while hogs will, in summer, eat them greedily. They should be allowed to wilt a little before feeding to horses. To do this, they may be cut in the morning and will be then ready for feed at noon. Like all such very succulent food, they should be given to cattle cautiously at first, or the animals may become "hoven," or bloated, by too greedy feeding.

It is a good plan to sow oats along with the seed; these help to support the vetch and keep them from becoming too tangled on the ground. We have usually succeeded in cutting two crops in the season—one through June, and again in the autumn.

WEEDS.

"If you've weeds in your garden, my good friend, I pray ;
  Do not stand looking over the fence ;
To your neighbour's domains—just over the way—
  Your weeds are the most consequence ;
Uproot them while yet there is daylight to work ;
  Tear them up seed and branch from the soil ;
They are sure to do mischief, so pray do not shirk ;
  You'll be amply repaid for your toil."

Yearly, millions of dollars are lost to the agricultural community in the war against weeds. Not only have we to engage in actual hand-to-hand fight to exterminate them in our hoed crops and upon our summer fallow, but every weed that grows takes away from the abundance of the harvest.

Nature does not distinguish between the weed and the farmer's crop—all are plants alike to her, and from her stores all gather food. Let us destroy the enemy, and we shall receive its share of natural provisions.

Attempts have been made by the State to curtail the spread of noxious weeds by legal enactments. Could such laws be practically carried out, they would indeed prove a boon to the agriculturist and to the country, but all such laws have failed, and in all probability will ever fail. The farmers must be educated up to the point at which they will plainly perceive money for their pockets in the eradication of noxious weeds.

A tidy farmer who attempts to keep all his land clean for his cereals, grasses and roots, is very often annoyed by a neighbour whose farm is the receptacle of every weed to be found in the category of botanists. These weeds allowed to seed are wafted on to his farm by every blast of wind, and through no fault of his own his land keeps foul, fight he ever so hard against it.

The travelling thrashing machines are prolific sources for the distribution of weeds. Indeed the farmer should see that separators are carefully cleaned of all small seeds before entering on his premises.

The roads are too often generous nurseries for the propagation of weeds; and so great was the nuisance in England, that grand jurors agitated the matter so strongly that it was forced upon public attention, and the Irish Royal Agricultural Society a few years ago resolved: "That as great injury arises to the farming classes from the growth of weeds along the sides of public roads, whose seeds being allowed to ripen and shed are spread over the adjoining lands, a circular be addressed to the grand jurors of the several counties soliciting them to give directions to the county surveyors to make it imperative upon road contractors to cut down and remove all weeds, more particularly thistles, docks and rag-weeds, before the 1st of June, and at such other periods in the year as may prevent their injurious effects to the farmer."

The object of such a course is obvious to any one who reflects for a moment on the fact that the seeds of weeds will lie in the ground for years without germinating, but as soon as the earth is ploughed for a crop spring into existence. No matter how clean our fields are kept, if the corners of the fences are allowed to be nurseries from which are scattered seeds for an annual supply of weeds. Every thistle top has seeds enough to stock acres, and every burr of dock can furnish seed for a township.

Our own Legislatures have passed Thistle Bills, but in practice they are but a dead letter.

The pathmaster is to see that all thistles, docks, &c., are cut on roads and in the fields in his section before they go to seed. In nine cases out of ten this person's farm is as well stocked as his neighbour's, and in many cases he is himself an untidy farmer, who "*lets things go.*" As far as the Canada thistle is concerned, we think that the law might step in and not only impose a fine on those that did not meet its requirements, but give to the Municipal Councils power to appoint an independent overseer to see to the enforcement of the law, and to be paid out of a public fine fund.

No man can be called a good farmer who does not keep his land clean. He may be a strenuous advocate of liberal manuring, but much profit is lost if he allow weeds to overrun, choke out his crops, and luxuriate on the feed that he has generously supplied for the use of his crops.

To ensure good crops, land must be cultivated in a superior manner, and when such is the case dirty land cannot be found.

"Prevention is better than cure" in all cases, and the labour of constantly going about and destroying thistles, burr-docks, rag-weed and other noxious plants, out of fence corners and neglected spots, before they can come to seed and multiply themselves into hundreds and thousands, is not, nor ever can be, looked upon as lost time. Indeed there is no time put in during a whole season's operations as profitable to the farmer as that of destroying *young weeds.*

In any badly neglected field, the botanist could probably point out to us over a hundred different kinds of weeds; annuals, biennials or perennials, deep-rooted weeds or flowering weeds, such as propagate by the buds in their roots, and such as are disseminated by seeds carried by every changing wind and by the birds of the air; but we shall speak only of the properties and methods of destruction of the most commonly known and most noxious weeds to the Canadian farmer. And first of the Canada thistle.

The Canada Thistle, for all that has been said, we believe to be indigenous to our soil and climate; but why it should be dubbed the thistle "of Canada" *par excellence* we are at a loss to see, for it was well known in the British islands ere a stick of our primeval forests had been touched.

The botanical name is *Cirsium arvensis*, and it is found in the cultivated fields and in the fence corners and highways of every part of Great Britain and the continent of Europe.

It has indeed obtained such a foothold upon Canadian farms, that we blush to think that outsiders may be readily excused for the assumption that it is a Canadian pet.

There is more than one way of effecting its destruction. We clip the following extracts from amongst the heap of writing, practical and theoretical, sense and bosh, that has from time to time appeared in the columns of our agricultural press; the two chief writers from whom we draw being those contributing over the signatures of "Vectis" and "C.," from time to time, in the columns of the *Canada Farmer.*

Destruction by Summer Fallow.—"This we believe to be the only thoroughly effectual mode by which to encompass the ultimate death of this pest, but the remedy must be searching, and carried on by no half measures.

"The Canada thistle has two kinds of existence—the annual and the perennial life. As an annual it is as easily killed as the most delicate foreign exotic. The least movement or stirring of the soil and exposure to the sun for ever so short a time is fatal to it; but the perennial requires a different course of treatment altogether; no half measures will do with it. If you plough only half enough, you have, by cutting up the roots covered with eyes, from long pieces into short ones, made thousands instead of tens of plants; each piece when severed and divided is ready to spring into a separate and individual existence. But if you plough (or move them in the soil) often enough, and the soil is dry, you make root and branch work with them, and (except on the deep, loose soil) you have got rid of them for the time altogether."

"C." says, and this we believe to be the only effectual plan:—

"Now, my plan is quite different. I never plough or disturb the fallow land infested with thistles until June, and then they are often three to four feet high in my rich clay land, and many of them forming seed; in fact, their growth is about done, and they only seek to mature their seed. Now is the time to go at them. The land is comparatively hard, and ploughs up very rough—and the rougher the better; and the larger the furrows turned, the rougher the land will lie. Much of the land so ploughed will lay up quite hollow, and expose a surface many times larger than the area of the land; the sun gets into and under these lumps, and being much exposed to the action of the air, the soil becomes completely dried, and every thistle that remains in a clod so exposed and dried will die, and in fact is dead in a week. As soon as ploughed once, do not go and harrow all down smooth again, for that course is the very worst you can follow. You can easily perceive that by these means you cover up all thistles exposed, and so prevent their death being entirely completed, where there are some remains of life left. But instead of harrowing, put in the plough again, and move all the under soil to the top, and enable it to obtain more ammonia and nitrogen from the air. While in this state of rough surface, so much is exposed that the land is absorbing at every pore from the atmosphere, and on a surface exposed to the action of the air a great deal larger than its flat area; whereas, if the land was well harrowed down, the surface exposed for such absorption would be but little larger than its absolute area. Weeds, also, vegetate more freely in this case, and in direct ratio with the surface so exposed. Three such movings, if the weather be dry, will entirely exterminate all thistles; they are dead, root and branch; they have for that year lost the natural and extreme tendency to surmount all difficulties and mature seed, as they had nearly done so before being disturbed, and hence are much weakened, and five times as easily killed. This course particularly applies to clay land, and is the mode of working fallows in England, so far as the rough surface is concerned, amongst the more intelligent farmers, especially where steam cultivation is practised. They do not absolutely plough, but do what they call 'smash up' the land with powerful cultivators, whose tines or teeth penetrate from twelve to fifteen inches, leaving the soil very rough, and the surface soil always on the top; and in many sections where the land is clean, this is considered the best mode of cultivating, unless where manure has to be buried, or weeds or sod killed. Let those who are sceptical try this plan alongside a piece worked in the old way of fall ploughing, and again in June or early in July, and again for seeding, with intermediate harrowings. My piece will be clean and free from thistles and weeds, whilst the other will be as foul as ever. My three ploughings are applied just when the heat is greatest, and will be found most efficient in their action.

"I entirely cleared twenty-seven acres of land, last summer but one, by this course, and as yet no thistles are to be seen, where, when I began, they could be counted by millions. Some were so high that I had to mow them before the horses could go into them."

By Clover.—Smothering with a heavy crop of clover will keep down thistles for a time, but roots will lie dormant, and when cultivation is again effected, they spring up and flourish with renewed energy.

On this point, "Vectis" practically remarks:—

"I do not for a moment mean to deny that clover, in a great degree, smothers and keeps down thistles, but I very much doubt whether it kills the roots. The thistle is a perennial, and can live and remain in a quiescent state with very small help from its leaves, provided it remains undisturbed in the ground. It hybernates, so to speak, until the favourable moment arrives for it to put forth new leaves and flowers, and then bursts into full vigour, and produces seed within four months from the time of making its appearance.

"The growth of the Canada thistle, when in a perennial state, is like that of the horse radish and other similar deep-rooted plants. It sends forth in the spring one of its long and rapidly growing underground branches; this pushes ahead until it finds sufficient light and air for the favourable growth of stem and flower. It comes to the surface, and if all is favourable there it at once developes the seed stem, but it does not finally push forth untii the favourable place is reached. These stems thus grow with the clover until the crop is ready for the scythe, and are then mown with the crop, thus cutting the thistle just when it has made its greatest exertion to live, and when it can actually least bear the check. The stems being thus cut off just down to the ground, the thistle has to form a new series of buds and headings, but it is generally too late for a second blooming; then the plant seems to husband itself for another year.

"A bunch of short-leaved stems and corresponding leaves grow amongst the second growth of clover, although they are not very observable, and the plant prepares itself for the next year's campaign against the farmer.

"Now, except in the loosest kinds of soils, the thistle does not grow as deeply in Canada as it does in England; for instead of going down to great depths, it simply grows to the extent of the plough gauge oı a little below, then runs out horizontally instead of vertically, and in some of the worst infested ground, roots may be traced in the bottom of the furrow for ten feet or more.

"All these roots are furnished with the regular complement of eyes for new shoots, all are within reach of the surface, and hence, when the circumstances are favourable, they all put forth at once, and form one of those mats of growth known as a 'patch of thistles.'

"These can only be destroyed by ploughing below the roots, and thus bringing them into the loose soil, then continually moving them to the surface before they have had time to grow or form new shoots; and in one season of summer fallow, if ploughed—or, what is equivalent to ploughing, moved by the cultivator or grubber often enough—they are killed and thoroughly destroyed."

American farmers also contend that the thorough summer fallow, commenced when the thistle is in blossom, is the most certain way of extermination. One of their most able writers says:—"On land not excessively stony, I can kill the thistles in four months, so that not one of them will ever peep again, for eight dollars an acre. The fine condition the soil will be left in will be worth about this sum additional. Let the thistles grow till flowering time; then turn them all under by means of a log chain attached in the usual manner to the plough, for ploughing under tall crops. Repeat the ploughing once a month until time to sow winter grain (or for any other crop), and the job will be completed. But remember—*the work must not be done by halves!* If you leave a thistle sticking up here and there, at any of the four ploughings, you will fail. Turn them under deeply—thoroughly; the roots will all die if they cannot breathe for a whole summer."

By Hoeing.—If this is done effectually, thistles may be greatly reduced in number; but it must be done very effectually. First *encourage the growth of the thistle* as much as possible, and then *destroy it as soon as it grows.* Every thistle root has upon its lateral roots a number of buds; these will lie in the ground for a long time without sprouting, and if not made to grow and the product destroyed, will take advantage of the fine culture of our land for some crop, as wheat, when we should be peculiarly glad if they did not put in an appearance.

One object, then, in effecting their destruction by the hoe, must be to cause first every one of these buds or eyes to sprout.

This can only be done by deep ploughing and deep cultivation. Say we would take off a crop of roots whilst we kill the thistle. Turnips will be found the best, because we may with impunity sow them late, say on the 10th of June.

Previous to that date we have time to plough and deeply cultivate the land, so as to get a fine deep mellow seed bed down to the very root of the thistle, and thus by culture give that root every chance to grow. Many of the roots will, by such cultivation, being thoroughly torn away from any hold upon the soil, and turned over and dried out, be destroyed before turnip-sowing time.

Such roots as remain under ground will lie in a mellow seed bed, and will all grow.

Now comes the work. Throughout the summer, whenever a plant from any eye of these roots appears on the surface, it must be immediately cut off. This can only be effected by a constant use of horse and hand hoe.

If all the eyes of the root have sprouted, it has been in point of fact turned from a perennial into an annual plant; and if all the annuals have been prevented from coming to maturity, the thistle crop is destroyed.

But if any of the deep roots have remained quiescent or dormant in the ground, there is yet left a perennial thistle root, and at some future time it will throw up its bunches, or "*Thistle patches.*" If, however, another root crop is grown on the same ground in the next year, and the same method of cultivation is adopted, the total destruction of all thistles in that field will be *un fait accompli.*

If we can get a good catch of clover on a field that is badly infested with "thistles," cut one crop, and turn down the aftermath, we shall have a preparation of the land which will grow two fair root crops in succession, upon the principle and for the purposes above mentioned.

We still, however, hold to the position that when very large fields are overrun with the thistle, the summer fallow, deep and thorough, commenced when the weed is in blossom, and carried on continually through the hot months, is the most effectual and practical means of destruction.

THE WILD OAT (*Avena fatua*)

Is a wild winter oat. It has been well known for a long time on the European continent and all over Great Britain, where it has been justly regarded as a dangerous pest, and has been pretty well kept under. If, however, it should ever get the same hold upon our Canadian farms as has the Canada thistle, it will be found even more difficult to eradicate.

It is a weed, the seeds of which are possessed of the most extraordinary vitality. It will grow anywhere and under any climate. It will be found in any crop, and, coming very rapidly to maturity, it will re-seed the ground ere our cereals are ready for the cradle.

A peculiar feature in the wild oat is that each seed has hooks upon it, like those found in the seed of a burr-dock, by which they attach themselves to any object passing in contact with the ripe stems, such as cattle. So readily is this accomplished, that some farmers have persisted that they fly forward of their own accord to cling to external objects.

The travelling separators and the habit of lending fanning mills are prevalent sources by which these weeds are spread from farm to farm.

If fed to horses, they will pass through into the manure pile, and unless such is very thoroughly heated, will grow again when carried to the fields.

The seeds will lie for a long time dormant in the soil, and even when buried to a great depth do not lose their germinating powers.

The stem will throw out flower and ripen its seed at any height from two inches to four feet, and if cut down close to the ground, will shoot out again and stool luxuriantly from the crown.

When once the wild oat has obtained thorough possession of a field, summer fallowing, such as we have above described for the thistle, becomes the surest means of eradication.

It has been asserted that the seeds of this noxious plant will lie for many years or for generations in the subsoil, and will spring into life on the first favourable opportunity. In support of this, "Vectis," to whose authority we have before alluded, records, that "his father owned a farm in England, on which wild oats were certainly known, for they are known all over England, but they were not plentiful, and from having been well kept under, were not even a nuisance, being duly weeded out of the growing grain with the docks, thistles, &c., every spring. Well, there was one field which it was supposed would be greatly benefited by the bringing up of an inch or two of subsoil, and this was done in the fall, so as to give it the benefit of the winter's frost. The field was well manured, and sown to peas. In due time the peas came up, but with them so plentiful a crop of wild oats, that they would have smothered the peas, but that peas like something to climb. The whole crop as green stuff amounted to more tons per acre than I should like to say; it was all cut green and fed to cattle in the way of soiling, and destroyed in the farm-yard, and every exertion was used to eradicate the wild oats by immediate ploughing, and fallow, or rather hoed crops; but that field was many years thoroughly infested with the wild oats, and they certainly had all been brought up by that two inches of subsoil, which by its appearance might have remained till that time undisturbed since the Deluge."

When not very bad, there is a simple mode of destruction which is practical to all forehanded farmers: it is fall ploughing. The spring crop, sown on second light ploughing, gang ploughing or cultivating, will so far obtain the start of the wild oats that when the crop is ready for harvesting the weed will not have gone to seed. But as this is only temporary, and only prevents the increase of the oat, the field must be ploughed each fall. A better plan is to cultivate or harrow thoroughly the stubbles immediately after harvest. This will start the weeds into growth, when fall ploughing will destroy them.

They will seldom come up through meadow or pasture land, but will lie dormant beneath the sod, ready to mature when cultivation shall have afforded them a satisfactory seed bed.

Even after harvest, when cut off with the crop, the stem that is left will throw up shoots, and seed before winter.

COUCH OR QUACK GRASS (*Triticum repens*).

This plant is not as prevalent in Canada as in the Old Country, but it is one, if well established, even more difficult to get rid of than either the thistle or wild oat.

Growing close to the ground, with a heavy broad blade, it will smother out almost any plant.

It is of a perennial character, and increases by spreading underground its white jointed roots, from each joint of which a stem is thrown up. Cut these roots up as much as possible, and if any joint be left attached to the soil by a single fibre it will grow and become the centre from which springs forth a new store of plants.

If the land is badly infested, nothing short of the expensive operation of *fallowing*, *raking*, and *burning* will be effectual.

Such a costly business may frighten the farmer, but it must be done.

We know of fields in our own neighbourhood so filled with couch that when ploughed and cross ploughed the soil cuts up into square chunks, which it is almost impossible to tear with the cultivator and harrow. A field never should be allowed to get into such a state ; but when, unhappily, it has become so overrun, the weeds must be torn to pieces, brought to the surface and burnt.

Plough deep and cultivate thoroughly after spring seeding is finished ; then by hand-rake gather the couch grass which is so brought up into wind rows and heaps, and set fire to it. Summer fallow the field thoroughly during the hot months, and each time that it is stirred, gather up the roots and burn. In the succeeding year put on a hoed crop, and keep it thoroughly hoed. This is the plan, and the only one, by which this pest can be eradicated from a field that has once become thoroughly overrun by it.

We would sooner own a field so covered with Canada thistles that there should not be enough bare soil on which to lay a sixpence, than one in which couch grass had held undisputed sway for any length of time.

In every agricultural paper or book, and from every farmer to whom we apply on this subject, we obtain the same invariable answer—nothing will destroy couch grass but bringing the roots to the surface, gathering them and burning. And such has been our own experience. Never let a patch increase. Like other weeds of a similar nature, it first shows itself by the appearance of one or two patches. Let these be destroyed by the above process, for if its spread be not immediately retarded, it will soon cover acres.

The weed will grow anywhere, and its root penetrate almost any substances ; it luxuriates on the heaviest of soils, and is yet at home in sand. Such is the forcing power of its root, that we have frequently found them growing completely through a potato ; and we once ploughed up an old boot sole, probably drawn out in manure, through the centre of which a root of couch grass had found its way.

SORREL (*Rumex Acetosa*).

When the season is unpropitious and meadows are thin, sorrel holds supreme sway, as in the season of 1871 and 1872. If clover is thin on the ground, some other plant will take its place—that plant in Canada is usually what is called Horse Sorrel—there is then commenced a struggle for growth between the artificial grass and the natural weed. One of two results must come to pass—either the clover smothers out the sorrel, or the latter so destroys the clover.

It is a common saying that land is sour when sorrel is prevalent, and that the application of lime, ashes and plaster will correct the acidity and make the soil *uncongenial* to the wants of sorrel; but this is far from being the case. Sorrel dearly loves a good warm soil, and will luxuriate in such like any other plant, be the same a weed or not.

But the application of these top dressings has the effect of pushing forward the growth of clover, which then gets the start and smothers the weed.

On light lands, the application of manure will destroy sorrel ultimately. The first year the sorrel will grow equally well with the grass, but in the second we have always found the clover make such rapid growth as effectually to destroy the weed.

That lime of itself will not destroy sorrel we know, for we have seen it flourishing on the very edge of a lime kiln.

But lime the land, harrow the grass, top dress it with ashes and plaster, and nurse it, and you will get rid of sorrel by pushing forward your own crop.

CHARLOCK, OR YELLOW MUSTARD (*Sinapis Arvensis*).

It is seldom that this weed, which is an annual, becomes so thick that it cannot be hand picked. As it ripens before any grain, forming seeds at the bottom, when the top is in flower it must be picked out of the growing grain fields.

Should it, however, have been allowed to overspread a large area thickly, a succession of hoed crops for at least two years will be found effectual, killing the plants before they have time to ripen and cast seeds. The two hoed crops are generally necessary, because in very few seasons will all the seeds be sprouted; some will lie dormant.

But if we succeed in destroying the greater part in one hoed crop, any that may be left, and grow in succeeding spring crop, may be readily picked by hand.

PIGEON WEED, OR RED ROOT,

When not very thick, may be destroyed by hand picking. Mr. John Johnston, according to the author of "Walks and Talks," has studied the habits of red root, or "pigeon weed," as he calls it, and thus ascertained how best to attack it. He sowed some red root seed in flower-pots each month, commencing in February, and kept them well watered. The seed sown in February, March, April, May and June did not germinate any earlier than that sown in July; that sown in August germinated more freely; while that sown in September came up at once, and in great quantity. Here he got an explanation of the fact that red root rarely proves of any damage to any crop except winter wheat. It shows, too, that a summer fallow for wheat will not kill it. The seed mainly lies dormant in the ground during the whole summer, and the thorough cultivation causes it to start up more freely in the wheat. But if you fallow the land and then do not sow it to wheat, the red root will spring up and can be easily killed. The red root seed gets into the manure from clover hay and wheat straw, and when the manure is applied to wheat it springs up, and there is no chance of killing the plants except by weeding and hand hoeing. It was for this reason that Mr. Johnston adopted the plan of spreading the manure on grass land in September. The red root seed then germinates, and when the land is ploughed over the following spring the plants are turned under and killed.

It appears, from the nature of the growth of this weed, that it cannot be destroyed by hoe crop or by summer fallow; the most effectual plan then is *"to prepare the land for fall wheat, and then not sow it to wheat."*

Docks (*Rumex Acutus*) do not seed until the second year. In the first year cut them off below the crown, or pull them up by the roots, and they will die. About the end of June is the best time. In the second year they form burrs, and thus become burr-docks. Then cut them after the seeds are partially formed, and when the stems are hollow. Don't pull them the second year, for there will be enough food stored up in the root to allow the seeds to ripen, even after they are out of the ground. It is better when the burr is fully formed to cut them off than to pull them up by the root.

Plantains.—Dig them out with a knife, and if on grass land, encourage the growth of the grass, which will kill out the weeds.

Smart Weed (*Polygonum Amphibium*) is not a noxious weed, but a valuable article of forage; horses and sheep eat it greedily, whether green or cured. Its effect upon the animal system is very good, and promotes health and vigour through the summer. It is, in fact, an excellent tonic, and is often used by man for giving a tone to the appetite and stomach.

Chickweed (*Alsine Media*).—Of this there are two kinds, one an annual and the other a biennial. Good culture and constant care in preventing the first from going to seed are the only necessaries required to keep it under. For the biennial, it must in some way be smothered out. Heavy growths of clover will generally effect its destruction.

Yarrow is a common perennial plant in Canada. It is very bitter in its nature, and so aromatic that it will impart a flavour to hay so strong that horses do not care to eat it. Good cultivation and heavy crops will soon smother it out.

FENCES.

Nothing contributes so much to the comfort, convenience, and successful prosecution of farming as neat and durable fences, dividing the fields into suitable sizes for a satisfactory rotation of crops, and keeping cattle secured in their proper pasture fields.

There is no index to the character of a farmer so suggestive as the state of his buildings and fences. Without good fences, no man who has engaged in a system of mixed husbandry, into which a certain amount of pasturage enters, can carry out his work successfully.

At one time, when timber was in great abundance, and the difficulties in the way of carrying to market made it of little cash value, rails were undoubtedly the cheapest and most practical for fence purposes. These are, at the best, most unsightly, and mar to a very great extent the beautiful landscapes of this our fair Dominion; whilst in their corners are to be found nurseries of weeds and insects.

Nowadays, timber has become a most valuable marketable produce, and it behoves us to use less wood in our fences, or to find a substitute altogether for such.

It is not many years ago that the farmer split *clear logs* for rails, because, forsooth, it was too great trouble to take such as were at all knotty or gnarled. To-day that same timber is worth twice as much per acre as cleared land standing by its side.

The wholesale destroyers of the forests, in the more civilized parts, have been brought face to face with the contingency of a future shortness in the supply of wood, and it has become necessary to economize in this direction.

We shall not, in this chapter, enter upon the innumerable patent fences that are being hawked about the country, a great number of which look very fine in a small model, but are, when brought into actual requisition, found to be miserable humbugs.

All the various kinds of fences that we shall here note have been tested and approved by practical farmers. Great diversity of opinion, as well as differences in access to various materials, exist amongst the farmers spread over such a vast extent of country as is covered by the agricultural population amongst whom this work is intended to circulate.

We shall then only indicate, by brief sketches, various forms of fencing now extant. Our readers may, according to the materials to which they have access, rest their individual judgment upon our sketches.

Rail Fences.—Splitting rails is best and most easily done in moderate weather, not on extremely cold days; they split best on thawy days, and especially in the spring, when the sap is rising in the tree.

The best wood for rails is cedar ; then come chesnut, white oak, elm (but very hard to split), white ash, black ash, red oak, bass wood, &c.

The large pine is too valuable for this use, and the small will not last at all well.

The tree should be split as soon as possible after it has been felled, for the more the tree has been allowed to dry out, the harder will it be to split. Moreover, if rails are split from a tree full of sap, they will last longer than from a dried tree. It is far better for rails to dry without getting full of water. Therefore, they should always be carefully piled in the bush, to shed all rain that falls.

In the older sections, we do not think that many more old-fashioned fences, wormed, ridered and staked, will be set up. They take up a great deal of ground, the plough cannot be got close to them without ripping out the stakes, and they take a great number of rails. This fence, with a two-feet six-inch at each corner, or five feet worm on the whole, and eight rails high, takes exactly a rail to a foot of straight measure from end to end.

Next to this kind comes the straight rail fence, held by upright stakes driven in the ground, and drawn together by a wire at the top—a good fence, but easily moved by the wind, as any force exerted horizontally on the upper part of a panel has an immense leverage upon the stakes, which are, in consequence, very apt to break off a few inches from the ground.

We would suggest an improvement; we do not know that it is patented; at any rate we have used it without the payment for a right.

Pass short slanting stakes across one another under the second rail, and resting upon the third, and sink them in the ground. These prevent the plough passing quite as close to the fence as it otherwise would, but they are beneficial in two ways: they brace the fence against lateral pressure, such as is exerted by the wind, and they relieve the wires of some of the weight of the riders.

We may observe a horse with his head through a fence, endeavouring to reach the cabbages. A boy throws a stone, the head is withdrawn rapidly, and only the providential fact that the rail was smooth prevented a large piece of skin being knocked off the animal's head. This is one of the great troubles in rail fences—' make the gaps at the top so small that animals cannot insert their heads.

It is said that if a man can insert his head, his whole body may be squeezed through any aperture ; and upon the strength of this statement (a statement we don't undertake to prove) may be founded another—that if an animal, from a pig to a bull, can put his head between the rails of a fence, he will find means to get the remainder of his body through.

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Moreover, if a horse or beast gets his head under the upper rider, he will soon learn to throw it off the fence. This may, however, be remedied by wooden caps, either bored and dropped on the stakes, or nailed across them, or wires bent round them above the top rail.

An American farmer writes of a fence that he made, and that will last until rust shall eat through inch iron rods :—

"Field boulders of about two feet deep were laid zigzag along the line of the fence, so as to occupy a space of about three feet wide; holes were drilled, and inch iron rods inserted, and fastened with melted brimstone. Then cedar rails (which had been in fence for fifty years without perceptible wear) were bored and dropped on to the rods; rails six inches through, three to a panel, making a fence five feet high. The fence was made crooked, that it might be stiffer than a straight fence.

"It is not a sheep-tight fence, but by filling under the bottom rail with stones or dirt it is a sheep fence. If a higher fence is wanted, a longer rod and an extra rail can be used. It is an excellent fence for land subject to overflows from freshets, where ice and logs do not run. The top of mine has been three feet under water often, but has always been undisturbed when the water subsides." A fence made of cedar rails, twelve feet in length, split as flat as possible, and about four inches by two or three thick, makes the most durable kind of fence; especially if, instead of the many kinds of straight fences we so often see, posts are mortised with five holes, $2\frac{1}{4}$ by $4\frac{1}{2}$ inches each, and cedar rails, tapered at each end to half their thickness, for about four or five inches in length, are inserted, passing each other in the mortise. They should be placed about four inches from the ground to the first rail, then allow four to five inches for the rail itself, and four inches of space for the following rails, and spaces of six inches alternately until six rails high are attained.

Board Fences.—The construction of these are more or less familiar to all our farmers. The chief points to be considered are deep setting, ramming the earth well in at the bottom, and not allowing too great a space between the posts. All board fences should be capped, to shed the rain. Cedar and chesnut are the best and most durable woods out of which to make fence posts.

There is an opinion very generally abroad, that charred timber will last longer in the ground than such as is not burned on the surface. We have never believed it, and are borne out in our opinion by the following excellent remarks in the *Manufacturer and Builder*:—

"As charcoal will endure for ages in places where timber would decay speedily, the practice of charring the surface of fence posts and other timber has been repeatedly recommended in books and ephemeral publications, as eminently worthy of universal adoption.

"The theory on which such a recommendation is based would seem to warrant a confident expectation of satisfactory results in practice, but repeated experiments with charred timber have furnished conclusive assurance that this process will not promote its durability. Indeed, numerous experiments have shown that charring promotes premature decay. Two posts split from the same log may be set side by side in the ground, the surface of one being charred and that of the other not, and it will be seen that the charred post will perish before the other.

"The same is true of railroad ties, and all such timber as may be exposed to the alternating influences of wet and heat. Could the entire timber be changed from its perishable condition to one solid piece of charcoal, the durability would be promoted to a surprising length of time, but the strength of the material would be destroyed. When fence posts or other sticks of timber are exposed to the rapid action of wet and heat, the surface will decay first. One might suppose, therefore, that when timber is enveloped by a layer of charcoal, the durability of the entire piece would be greatly promoted. And such would be the case, were it not for the fact that the charcoal is not impervious to water; and as water reaches the timber beneath the charred surface, decay will commence soon after the grain of the wood has been exposed to the influences of the weather.

"When the change has once begun beneath the charred surface, the durable covering of coal will be of no service whatever in preserving any portion of the wood. Taking this practical view of the subject, it will be perceived that if only half an inch of the outside of a post be charred, the post will not endure so long as if the same thickness of wood has been left uncharred, to waste away by slow decay."

To secure fence posts from sagging and heaving, nail a strip of board on each side of the post at the lower end, even with the bottom and projecting a few inches. When the post is set down, let these strips below run at right angles to the line of the fence.

The locust makes a very excellent wood for posts; they last long and hold nails well; if set out in a nursery, they would be fit for posts in about seven years.

There has always existed much difference of opinion as to the manner of setting posts, whether in the same way as the tree grew, or reversed with the head downwards. We give two opposite opinions upon this point:—

"Many years ago, by way of testing a certain principle, we set two gate posts, the one top and the other butt downwards. The latter was taken from the lower and what might be supposed the best end of the log, and all were entirely sound. We had, some years since, occasion to remove these posts; the latter was entirely rotted off, and the former would have lasted some six, eight or more years longer. We tried two pieces of post fence with similar results.

"It is such experiments as these that have got into our head, and most men's heads, the notion that a post set top downwards will last longest. Such practical tests are of more importance in deciding such questions than all the philosophical reasons that could be produced.

"Although we have heard of no philosophical reasons why a post set top downwards lasts longest, yet we have one of our own. It is moisture, for instance, that rots timber. Keep it dry, and it is exempt from decay. There are many kinds of vegetables that will propagate from the slip—for instance, the currant, grape, willow, &c. These, although separated from any connection with the root, continue to elevate the moisture from the earth, so as to cause their growth. Of course, the vessels of post timber, if placed in the ground according to the arrangements of nature, will elevate the moisture, and keep the timber damp; but if that order is reversed, it remains comparatively dry—hence the principal reason, no doubt, why a post lasts longest top downward."

And again: "Some twenty-three or four years since, I set a fence, enclosing house and door-yard—a rail and bannister fence. The posts were sawn from good-sized, first growth, red chesnut logs. To saw them tapering, one-half of them must be sawn to set in the ground top down, and the other half bottom down. The posts were set promiscuously, and to this day there has been no distinguishable difference in their lasting quality, unless it be where some of them had more sap on than others, and these gave out first, without regard to which end was set down."

When the doctors differ, who shall agree?

Comparative estimated cost of snake rail, straight rail, board and picket fences:—

Snake rail fence:

Twelve rails, at $25 per thousand	30 cents.
Ground covered by fence, with total worm from stake to stake, in alternate panels of six feet, at $50 per acre	78 "
Two stakes, at two cents apiece	4 "
	$1.12 per 12 ft.

Straight rail fence:

Eight rails, at $25 per thousand	20 cents.
Ground covered by fence, two feet wide	26 "
Two stakes	4 "
Wire	2 "
	$0.52 per 12 ft.

Board fence four feet six inches in height, cedar posts six feet apart, four boards, respectively six inches, six inches, nine inches, and twelve inches wide, with a coping board and vertical boards covering joints against the posts:

Two posts, at five cents	10 cents.
Fifty-four feet inch lumber, at $16.00 per thousand feet	86 "
Nails	5 "
Ground covered by fence, two feet wide	26 "
	$1.27 per 12 ft.

Picket fence four feet six inches in height, two scantlings two by three, pickets three inches wide, and spaces four inches wide, cedar posts six feet apart, and a bottom board a foot wide:

Two posts	10 cents.
Twenty pickets (three feet six inches by three inches) making seventeen feet, at $18 00 per thousand	30 "
Two scantlings (two in. by three in. by twelve feet), twelve feet of lumber, at $16·00 per thousand feet	18 "
Bottom board, one inch by twelve feet	16 "
Nails and spikes	7 "
Ground covered by fence	26 "
	$1.07 per 12 ft.

Comparative cost is, including land taken up:

Rail fence, with worm	$1.12 per 12 feet.
" straight	52 " "
Board fence	1.27 " "
Picket fence	1.07 " "

We have said nothing of cost of labour, because the posted fences, although requiring more work at first, do not require as much repairing from time to time as those made of rails.

Wire fences.—For use along a lane which is apt to drift up in winter, there is no fence so useful as wire. Indeed, in view of the high price of lumber, and the destruction of board fences by sagging, we think that the wire fence will, in time, come into very general use in Canada.

For a wire fence the posts should not be more than eight feet apart. Every other post may, however, be a stout stake, pointed and driven into the ground, the wires to be passed alternately on each side. This stake will keep the wires taut.

It is well where small stock are running to put one board on the bottom, and in the case of fencing a lane, this would allow sufficient snow to drift in to make constant sleighing. A scantling is also sometimes used on the top to make the fence more visible to cattle, especially young colts. The fence is, however, often made with no woodwork besides the posts. Nos. 6, 7 and 8 are used; we think, however, that 7 and 8 are rather light, and should advise the use of No. 6. Animals will not readily jump at a wire fence, or should they do so *once*, will generally learn such a lesson as will deter them from making a second attempt.

If we use a bottom board say from twelve inches to fifteen inches wide, the lowest wire should be three inches above it; then a space of four inches, then a space of five inches. This will raise the fence two feet from the ground; two more wires, at distances of twelve inches apart, would give us a four foot fence, which will be amply high enough should there be no scantling If a scantling is used, it may be put on six inches above the top wire, by which means we shall obtain a fence four feet six inches in height, requiring one board, five wires, and a scantling. Should the object be only to turn large stock, a less number of wires will be found ample.

The wires have to be attached to the posts and stretched.

Some bore small auger holes, and pass the wire through the posts; whilst others have used staples to keep the wire close to the post.

If staples are used on cedar posts, they may be made from the No. 6 wire, sharpened and driven in. If the posts are of hardwood, then stouter iron is required for staples. We prefer the passing of the wire through the posts.

Not more than fifty yards of wire should be used without stretching. The first post in the fence to which the wire is attached should be especially stout, and should be braced firmly, as the tension of the whole fifty yards of fence will come upon it. The wire must be coiled once round this post, and fastened tight by stout staples driven home.

There are several ways of stretching—one with a handspike, or with a roller worked like a capstan in grooves on the post, or by the use of a screw. The latter is the most powerful.

If staples are used, the wire should run in and out on alternate posts, so as to prevent the pushing out of the staples by stock rubbing against the fence.

As the cost of such fences will vary according to the number of wires used, the size of the wire, and the number of posts, &c., we give below a table showing the length of wire of each number that a given weight will make, from which may be exactly calculated the cost of a wire fence.

63 lbs. of No.	6	runs 223	yards,	and costs	$3 45 or 8½	cents per rod.
"	7	" 229	"	"	3.55 or 7¼	"
"	8	" 322	"	"	3.65 or 6¼	"

Cost of materials of a wire fence, posts eight feet apart, with a bottom board twelve inches wide, and a scantling three by four on top:

1½ posts, at 5 cents	7½	cents.
12 feet of inch board, at $16.00 per thousand feet	19	"
Scantling, 12 feet, at $16.00 per thousand feet	19	"
5 wires = 60 ft. of No. 6, at 8½ cents per rod	30	"
	75½	cents per 12 ft.

Summary of cost of material of various fences per twelve feet:

Rail fence (snaked)	$0.34 or	46⅔	cents per rod.
" (straight)	0.26 or	35¾	"
Board fence (horizontal)	1.01 or	$1.38	"
" (picket)	0.81 or	1.11	"
Wire fence, with scantling and board	0.75 or	1.03	"
" with 7 wires, alone	0.50 or	68¾	"

Stone Fences.—In some portions of Canada the farmer cannot find use for the piles of stones that he yearly picks off his fields, except in the erection of dry stone walls. The building of a dry stone wall requires no small amount of dexterity. We will describe the process.

The base should be at least 2 feet 6 inches wide; the line of the wall is marked out and made level the one way—that is, across the base.

In laying up the stones, the largest end should always be outside, so that any tendency of the small filling stones to roll will be inwards, and thus pressure upon the outside of the wall be avoided; the inside is carefully filled in with smaller stones, and the whole tapered until at the height of about three feet the wall is from 12 inches to 18 inches wide.

Coping stones are then laid on their edges all along the wall, and if lime can be handily obtained, it will pay to make some coarse mortar and lay between the coping stones.

If the wall be not considered high enough, long poles may be laid as riders, resting on crossed stakes at a height of a few inches above the top.

These walls must not be built where there is the slightest chance of spring freshets, and if on a side hill, a number of channels should be left in the bottom to admit surface water to flow through.

Hedges require capital and patience to grow successfully as stock proof fences. They must be protected from cattle when young, and take time to grow to maturity. Like all cultivated plants and crops, they must receive constant attention on the part of the cultivator.

But where a man has the means at his command, the sight of hedges upon his property will amply repay the outlay, and it must be borne in mind that a hedge once fairly established will last as long as a tree.

Many attempts have been made in Canada to introduce hedges. Near our cities we see them flourishing, but, as a rule, farmers will not give time and attention enough to render them a success, and in too many cases they have been allowed to struggle up neglected, when they are useless as stock fences, and for all practical purposes are but incumbrances upon the land.

ι neglected thorn may be utilized, by converting the osts upon which to form a board fence.

ỵ the following excellent articles upon Hedge Culture columns of the two first numbers for 1870 of the *Farmer* :—

e forests gradually disappear from the face of the country, it becomes a more and more difficult matter for the cultivator of the soil to provide the chief materials to keep up fences in the manner he and his fathers before him have been accustomed to, and it must soon come to the point that we must either adopt the long-tried and successful plan of older countries in forming permanent live fences, called hedges, or else abolish all right of stock to freedom on the highway, and confine them at all times within narrow limits, feeding them in summer on the soiling system. That hedges can be grown here successfully admits of no reasonable doubt; yet in the few cases where the ordinary farmer has attempted the work, he has often failed, and laid the blame of the failure on any and everything but the right one, which in nine cases out of ten is his own want of perseverance in well doing what cannot possibly succeed without being done well and thoroughly.

"There are three cardinal points absolutely necessary to be attended to in order to make hedging successful: 1st, Proper preparation and cultivation of the soil. 2nd, A proper selection of plants of the right sort. And 3rd, Proper care and pruning of the plants after the hedge is once established.

"*Preparation of the Soil.*—The first requisite is proper drainage, which can best be secured by first laying a tile drain at the depth of three or four feet from the surface along the centre of the line on which the hedge is to grow. At a distance on each side of this from 20 to 30 feet, according to the retentiveness of the subsoil, another tile drain should be laid. The soil over the drain on which the hedge is set is first to be trench-ploughed or subsoiled for a distance of at least four feet on each side, or to the width of 8 feet altogether. Then the surface is to be thoroughly broken, pulverized, and left ridged up slightly. To prevent surface water from being retained and soaking in amongst the roots, there should be a slight surface drain about five feet from each side of the hedge, just about the depth of an ordinary furrow drain, to draw off surface water from rains or melting snows and let it soak away to the tile drain without first getting among the main roots of the hedge.

"*Setting out the Plants.*—Whatever kind of plants are to be used to form the hedge, it is requisite that they be selected of as nearly equal size and quality as can be; as if strong and weak plants are intermixed, the strong ones will shoot ahead, while the weak ones will soon be outgrown and choked out, leaving the hedge full of small gaps that can never be successfully filled.

The plants are to be cut back before planting to within three or four buds or branches of the collar, which will leave them about three inches high when planted out. The distance apart at which the plants are to be set will vary with the kind of material used, but in any case must be uniform throughout. In assorting out plants as they come from the nursery or seed bed, it will generally be found that there are three sizes, which may be classed as large, medium, and small. One strip of hedge may be planted with the best and strongest plants ; another with those of medium size, and the small ones either set out again in the seed-bed till they get strong, or, if they are thrifty, though slim, set out in a strip by themselves. Every plant that has roots that are imperfect or deficient in fibres should be rejected, it being important that the roots, as well as the tops, should be equal in strength and quality. The planting out may be expeditiously done with a trowel or small garden spade. Insert the implement into the soil, press the handle forward, while another hand places the roots into the crevice, and on withdrawing the blade the earth will fall back on the roots, and can be compressed slightly by a pat of the implement, or by the hand.

After-culture.—Having planted out the hedge, the after-culture should consist in keeping the ground stirred with the hoe, and all weeds down, for a strip the full width between the water furrows on each side. Care should be taken to allow no animals to browse on the hedge at any time—a thing they are most apt to do when it is young, and full of succulent wood. Any plants that fail to grow must have their places filled from the seed bed, or from the end of the hedge, as soon afterwards as possible. When the hedge has fairly started growing, it should be left undisturbed by any pruning process for two seasons, at the end of which the plants are to be cut back to within four inches of the ground, and thereafter twice in each year, say in July and September, to within three or four inches of the previous cutting, the first time it is done, and as much higher with an inch more added at each time of cutting, till the hedge has reached a height of five or six feet.

" *Pruning into shape.*—The most common error in pruning hedges, and one that results in making them thin at the bottom, is that they are cut from the top downwards, instead of the bottom upwards, thus leaving a flat top. The hedge should be allowed to extend at the bottom to thicken it, and cut so as to form a triangle, the base of which rests on the ground, and the apex points upward to the sky.

" *Thickening neglected hedges.*—When a hedge, even at six or eight feet high, has become scraggy and thin at the bottom, it may be restored to usefulness by cutting each stem half-way through, near the ground, with an upward stroke of a sharp hatchet or chisel, and bending the plant down to an angle of about 30°, commencing with the first stem at one end and bending it, the next being bent to it, and so on to the other end. This operation must be performed very early in the spring, before the buds begin to break. A new growth will start upwards from near the cut, and at the end of a year the hedge can be pruned into proper shape, which consists mainly in throwing back the growth towards the bottom and side branches.

"*Deciduous Hedge Plants.*—Those plants that are of a thorny nature are usually best adapted for making a hedge, though good hedges can be made from some varieties of shrubby trees that produce no thorns. One of the most popular hedge plants of America, and one that is every way adapted to the purpose, where it can be successfully grown, is the Osage Orange. It is a rapid grower, makes a strong, thorny fence, and is easily propagated from seed. It does not, however, prove sufficiently hardy to withstand the severe cold of our Canadian winters, until the plants have become quite large and strong. In an experiment we tried with it some years ago, the plants were found very variable in their hardiness. Some of them were killed out entirely the first winter, some only partially so, while others were scarcely affected by the frost, and continued in after years to grow vigorously; but the seeming impossibility of filling up the gaps, after several trials, caused the attempts to make a hedge of Osage Orange to be abandoned. Three inches apart is the distance they find best to set the plants of Osage Orange in the western United States, where many hundred miles of hedges are made of it.

"*White Willow* suckers so badly, it is quite worthless for hedging.

"*Buckthorn* makes a capital hedge, and proves quite hardy here, but is of slow growth and difficult propagation, and has one serious drawback we have observed in those that have come under our notice, viz. it suffers greatly from summer drought when it has got well established, often to the extent of the destruction of so many plants as to leave large gaps in the hedge. It may be, however, that this can be prevented by mulching the ground on both sides of the hedge during summer time, with a layer of straw. Plants are set six to eight inches apart. They can be bought at most nurseries for six dollars per thousand.

"*Honey Locust* makes a thick, strong, rapid-growing hedge, perfectly impervious to any kind of stock. The plants can only be raised from seed. It is somewhat liable to winter-kill when young, but not nearly so much so as the Osage Orange. Plants may be set out nine to twelve inches apart; and it is absolutely necessary to keep it well cut back after the hedge is established, or it will get too strong and unmanageable.

"*Beech.*—Some varieties that are inclined to be shrubby, especially the purple beech, would make an excellent hedge, perfectly hardy, and capable, when once established, of turning any kind of stock. Such a hedge would, however, require to be protected from sheep and cattle in its early stages, as they are extremely fond of browsing on the young shoots of beech in the winter and spring. Plants set eight inches apart. Can be easily grown from seed or young plants a few inches high, grown in the woods, may be transplanted to a seed bed, and a year afterwards set out in a hedge.

"*Wild Plum.*—Some of the prickly varieties of our wild plum ought to yield a good material of which to make hedges, and plants could doubtless be easily obtained from seed. The wild crab would probably also make a good hedging plant under proper management, though as yet we do not think it has been tried.

"For merely ornamental hedges to the garden or lawn, or inside the fence in cities or towns, there is nothing equal to Privet, which is a quick-growing shrub, easily obtained at a cheap rate, in most nurseries, and quite hardy and reliable Set the plants four to six inches apart. Barberry also makes an excellent hedge for gardens, and is both useful and ornamental; the berries can be made into tarts and preserves by those who like their flavour.

"For a low hedge bordering a garden walk, there is nothing more beautiful than the Japan Quince (*Pyrus Japonica*), with its loads of bright scarlet blossoms in spring and early summer. Set the plants eighteen inches apart, and trim the sides in, so as to incline them to throw out branches towards the top and centre, till the hedge is about three feet high, at which elevation it is to be kept by regular pruning."

A correspondent of the *Prairie Farmer*, thus records a novel mode of trimming hedges, which appears to have the advantage of being exceedingly expeditious:—

"Having heard a great deal said about the mode of trimming hedges, I will give my mode of keeping hedges low trimmed, which for ease and expedition I think is the best I have yet tried. Take my waggon, with hayrack on, fill the space on off side of rack with an extra board, so as to make a good and soft platform to stand on, then I hitch my most steady team to the waggon, and armed with a good, sharp scythe, am ready for the work, drive with off horse next the hedge, tie the lines to the standards in the front of rack, with right line a little tight, to keep team close up to the hedge, then start the team as often as the length of the rack. I am now speaking of cutting the top of the hedge, which is much easier cut than timothy grass, being young and tender, and with a little care can be trimmed as level as a house floor.

"After trimming the top, I put out my team and walk backwards along the side of the hedge, with my scythe still sharp, trim with an upward stroke, and if there is any unevenness in the trimming you will immediately see it, having your face constantly towards the part trimmed. This is all very easily done, being much easier than mowing grass. A man can trim in this manner from one-half to a mile of hedge per day. It should be done twice during the season, in June and August. This manner of trimming gives the hedge a beautiful appearance, with a slope on each side and flat on the top, giving it the appearance of a well-laid stone wall."

Hedges and Mice.—These little pests are often found very destructive in hedges. The only practical plan to prevent their ravages is to be found in keeping the land at the bottom and along each side of the hedge clear of all grass. They will seldom move across bare land, nor take up their quarters except where grass is thick, in winter.

In the articles quoted above, no mention has been made of the English Hawthorn. We know of many hedges of this kind in Canada, but of none that have been kept properly cut down so as to be stock proof; but where they exist, although in a wild neglected state, they are hardy and thrifty.

The *Arbor Vitæ*, *Norway Spruce* and *Hemlock* make very handsome hedges, and though not stock proof, will be found very valuable as windbreaks, on the exposed sides of private grounds, barn yards and orchards.

Farm Gates.—Of these the number is legion, patented and unpatented—swing, slide, lift and self-acting gates.

Some gates cannot be opened except by a man's strength, whilst others are so delicately engineered, that on the approach of the horse and buggy, open sesame and presto!—the gate flies open of its own accord as if by magic. But as unfortunately, time and weather do not recognize the subtle mechanism of these patents, and lay upon them, equally with those of more humble pretensions, the heavy hand of inevitable decay, we prefer to leave them to be puffed by the patentees. As our work is devoted to the interest of the farmers themselves, we shall confine ourselves to a description of a few cheap gates that can be made by any handy man, with a few simple tools, and during the slack winter days.

For a simple swing gate :—

Take six pieces of stuff twelve feet long, four inches wide, and one inch thick; lay these down on a level piece of ground, leaving the first bottom space two and three-quarter inches wide, the next three inches, the next three-and-a-half inches, the next five-and-a-half inches, and the next or top space, nine-and-a-half inches wide; then take the same kind of material and nail across the ends with annealed nails; then nail on a cross brace from the upper to the lower corner, also with annealed nails, so that it will fit neatly inside of the end pieces. Now turn the gate over, and nail similar upright pieces across the ends, even with the ones on the opposite side, and one upright piece midway between the ends. This latter is far preferable to putting on a diagonal brace on that side In such a gate there is no mortising, and, for the weight of it, it is far stronger than any mortised gate that can be made.

Annealed nails are better than wrought nails.

Such gates look well, and are very quickly made. A good hand will make five of them in a day. In hanging, place the opening end at least one and a quarter inches above what you wish it to be, as any large gate, no matter on what kind of a hinge, will spring at least that much.

This may be varied by mortising the bars into scantlings for uprights.

A very good gate is made by forming a frame of scantlings, and letting pickets into the horizontals.

Referring to a good sliding gate, W. H. Smith, in the *Rural New Yorker*, says :—

"I have a gate which has been in use eight years, and works as well to-day as the first day it was put up. I now have nine of them on my farm. Not one of them has cost me a dollar since erected, nor any repairs, except two of them which have had new sills. They are constructed as follows:

"Four posts are set firmly in line, so that the fronts will be true. Measure fourteen feet, in line with those already set, and set the post the gate shuts against. Then place the sill for the gate to run on, fourteen or sixteen feet long, put down solid. The sill for the gate to run back on, can be made of any light material that will sustain the weight of the gate. The sill should have about one inch down grade toward the shutting post, and be spiked fast to the posts. The gate is made of any width lumber, and long enough to lap four inches on the shutting post, and about two feet on the groove post, to keep it steady. At the bottom the gate must have two boards to support the bolts that the rollers turn on. These rollers should be six inches in diameter, an inch thick, to run on half-round iron, placed at the proper distance from the bottom board of the fence, so to let the gate pass without rubbing. The iron rod should have holes punched, so as to let twelve-penny nails through to nail to the sill about two feet apart. Nail down the rod, and it is ready for the gate.

"The gate is put together with sixteen two and a-half inch bolts and eight three and a-half inch bolts ; the three and a-half inch bolts go through three boards at the bottom. The rollers go between the bottom boards close under the brace, so as to get the bearing ; the bolts should fit the rollers as tight as possible. These rollers in their place, put up the gate on the rod, and run it back on the fence ; mark the four posts one inch above the top of the gate ; saw them off square in line ; place on top of the posts a joist twelve inches wide, two inches thick; let it project over in front of the gate far enough to clear it; now nail a six-inch strip on the edge of the joist, so that the top edge will be even with the top side of the joist; the four inches projecting down will serve as a groove for the gate to run in, and keep it in its place, now spike the joist to the top of the post firmly; let the gate lap on the shutting post about four inches on half of the posts; then nail the ends of the boards to the post occupying the other half so that the gate will shut against the butts, which will help to sustain the post; now nail a board solid in line with the butts, and thick enough to project a quarter to a half inch from the gate; nail a stout board on the previous one, and let it project over about three inches toward the gate, and in line with the post, so as to make a groove for the gate to stand in. If it is properly shaped, the gate will jam in it, and remain solid until it is pushed back

"These gates are the cheapest and most durable of any I have ever used. I am now sixty years of age, and have used all kinds, but these are the cheapest and best."

The great difficulty encountered with swing gates, is the sagging and heaving of the posts, when the frost is coming out of the ground.

To overcome this, the following plan will be found effectual:—The posts are framed in a stout sill, about two feet above this a girt is framed in, this acts as a brace in such a manner that the posts are rigidly kept in place. A trench three feet deep is dug, the frame and posts are set up therein, and the earth is well stamped and compacted round the sill. The upper girt need not be sunk more than a few inches beneath the surface, but the earth should be well tamped and forced under it, that it may not suffer from loaded wagons being driven over it. These posts may be guaranteed to stay where they are placed until inevitable decay overtakes them.

It will not be out of place here to quote an excellent plan for lifting old posts that are firmly imbedded in the ground. A long logging chain is put around the post at the base and a stout prop put under it a few feet away and inclined towards the post, then let the oxen draw. There are very few posts so tight in the ground, that they cannot be easily removed by the strength of two stout oxen. In this way, a long line of fence may be removed in a single day. A span of horses may be used in place of the oxen.

MOVEABLE HURDLES.

At a meeting of the Elmira Farmers Club, Mr. George Maby said:

"Last fall I made a visit to Orange and Ulster counties, and there I saw a good deal of hurdle fence in use. It is made in sections eight feet long, and of the desired height, all of young chestnut, having regard to lightness and durability. Saplings four inches in diameter are suitable for posts, and these are cut about six and a half feet long, allowing eighteen inches to enter the ground. Each piece is split, making two posts, and sharpened as if for driving. At proper distances holes are bored in the posts; two holes with an inch augur as close as they can be bored together, to receive the slats. These are made of smaller chestnuts, those two inches in diameter being split to make two. Now the holes being bored and the slats fitted at the ends to enter them, they are driven together and light braces nailed across, and the panel is ready to carry out and set up. Holes are made with a crowbar and the posts dropped in, two panels to the rod, a quick job and a good fence. I saw fences of this character, which had been twelve years in use, and were yet serviceable. They are taken up at the close of the season and housed and piled in good order, and in the spring they are reset where needed. Low flats subject to overflow may be fenced in this way with entire security against loss by overflow, and it is a quick, easy job to put out or take up the fence. So patches of roots may be separated from the remainder of the field easily by this fence. Any common labourer may put it up if he has sense enough to punch a hole in the ground with a bar. The cost of the panels is 56 cents each, all ready to set up, and it is said the mountainous districts in those counties are inhabited by men who drive a profitable business in making this fence, and selling it to their wealthier neighbours on the low lands. Many farmers there deal largely in small fruits and these hurdle fences by their portability are just suited to their wants. Cattle have due respect for the fence, and on the whole I think it worth notice especially by those farmers whose lands are subject to overflow."

CATTLE.

When we advocate the keeping of well-bred cattle, we do not wish to be understood as advising the raising of thorough-breds by the generality of farmers. Such would not be remunerative nor practicable. What we require is good grade stock—cattle that have fineness of bone and at the same time a large frame. In order to keep up a good standard of grade, it becomes necessary that we look for sires to animals of the most symmetrical shape, the most perfectly developed form, and possessed in a pre-eminent degree of all those various points which go to make up a square well-built animal. We are not amongst the number of those who would disparage the common cow. Far from it ; we consider such to be of great value in their own particular way ; but we maintain also that they are capable of improvement. Their hardiness and freedom from disease are points in their favour. Let us retain those good inherent qualities, and by the use of a different class of bull, endeavour to break down such characteristics as may be found unprofitable in the common cow She is large in bone, and therefore is not profitable for beef; she is a greedy feeder, and takes far more food to put on a given weight of beef than one of her own size, that has finer bones in her frame. The preservation of pure blood, uncontaminated by mixture with different breeds is only required for breeding purposes, for the very best results have always been attained by crossing such thorough-breds with the common naturalized cow of the country.

In these days, when the farmer is looking to beef as a source of profit even greater than such as is realized by the exhaustive process of continual grain raising, and when every kind of fodder is scarce and dear, it behoves him to look well to the kind of cattle to which he devotes his attention and his feed.

The fine-boned, high-blooded animal will return a greater amount of beef, and that of a better quality, as the result of a given quantity of food, than will the coarse bred beast.

The questions that each farmer must set before him to be answered are: "What produce do I require from my cattle. dairy or beef, or dairy and beef ? What kind of animal will give me, in return for the care and food that I may devote, the greatest quantity of either or of both of these marketable products ?"

But we have often been asked which is the best breed of cattle for the ordinary farmer ? Shorthorns, Devons, Ayrshires or Jerseys? Now this matter depends entirely upon what sort of a common farmer the querist is. If he wishes to devote his stock to butter, the Jersey is undoubtedly the best, if to the raising of cattle for work, the Devon ; if a milkman near the city, Ayrshire ; and if a beefmaker ; the Durham

The Durham, though not giving a copious supply of milk, will be found a good butter cow, for her milk is exceedingly rich

Indeed, Mr. Allen, in his work on American cattle, affirms that they are as good milkers in quantity as any other breed ; and it should not be forgotten that the Teeswater cattle, from which our present improved Durham have sprung, were, one hundred years ago, noted in Great Britain for their feats at the pail.

For this reason the Durham strain or good Durham grades will readily commend themselves to those farmers who desire to obtain profit both from milk and beef; and in this latter particular these grades are very superior, for should our cow at any time go *barren* for a year, we can immediately dispose of her to advantage by a short preparation for and sale to the butcher.

The Devon and Hereford.—The latter have never taken well in America, and to our mind the reason has been, that though good beef cattle they are inferior as milkers.

The Devons are better milkers than usually supposed in Canada; the chief objection to them seems to have arisen from a prevalent idea that they were an ill-tempered breed. We believe there is some ground for the idea, at least when we compare them with the kind and gentle Durham or Ayrshire.

But in the southern parts of England, and especially in their native county, they are highly esteemed as generous milkers. There is no stock equal to them as oxen for work; and the best yokes that we have seen in Canada were invariably Devons.

The Ayrshires have from time immemorial been bred in the west of Scotland as milkers. In that rocky country, against whose heights the moisture-laden clouds from the Atlantic are constantly brought in contact and dispelled in rain, the natural pasture is superb, and in every way calculated to increase the milk producing qualities of any race of cattle. They are of undersize, hardy, kindly, and seem to do well under the Canadian climate. They require very little food to keep in good condition and generous flow; and for the farmer whose chief desideratum is milk or cheese, there is probably no better breed existing. But for beef-producing, not only is the frame small on which to lay meat, but the beef is inferior to that of the Devon or Shorthorn.

It is a common practice, and one highly recommended by many of our best breeders, to put a grade Shorthorn to a thorough-bred Ayrshire bull. They assert that the result is preferable in the dairy to a thorough-bred Ayrshire cow, while the beef-producing qualities are doubtless very much better than those found in pure Ayrshire.

The Alderney or Jersey come from the three little islands half-way between France and England, and situated in the English Channel. Again, the humidity of these islands has favoured the development of a good milking race of cattle.

These Alderneys are small in size, hardy and kindly—requiring but very little food to keep them in good flow. The richness of their milk is proverbial, being of a deep yellow creamy colour throughout; they are consequently very superior as butter cows, and we are surprised that they are not more sought after by private families, who require for their daily use rich milk, plenty of butter, and at the same time a gentle, kind and docile animal about the house. For such families, in town or village, the Alderney or Jersey will be found the very best breed.

The Dutch or Holstein Cattle, natives of Holland, have of late years attracted considerable attention at the hands of American dairymen, and we believe are yet destined to become an established breed on this continent. Holland is a purely dairy country, and the milking qualities of their native cattle are very excellent. They possess the great advantage of being largely built and capable of making fair sized beeves.

If nothing more would deter the ordinary farmer from going into thorough-breds, their high price forms a barrier ; and to our mind it is as well. Men of means and judgment have been found to take up breeding as a business. Let us be content with our grades, and look to them for thorough-bred males, by which to keep up the good qualities of our grades.

We go to the seedsman for new and improved varieties of seeds, and we pay him a high figure for them. We acknowledge the necessity of improvement in our cereals, and we are willing to pay those who have devoted time and money to starting such improvement. In like manner there are those who are devoting means, energy and education to the improvement of the several breeds of cattle ; before we partake of the benefits accruing from the devotion of these men, we must "pay our footing."

"To a man who deals in scrub cattle worth fifty dollars a head, it seems an enormous price to pay two hundred dollars for a herd book animal, and six hundred is deemed a clear case of extortion.

"But there is nothing in the breeding of choice animals to disturb the usual law of supply and demand. Like any other animal in the market, they are worth just what they will bring.

"The scrub cow is good for beef and milk, and it does not add a cent to her value that she can reproduce her kind. If she is a good milker she is worth sixty dollars as a new milch cow, if that is the market value of the article. If she will make five hundred pounds of beef, she is worth so many cents per pound, according to the market price. You can get as many as you like at that price ; but the thorough-bred is prized for different qualities altogether. If known to be a barren animal, she is worth no more than a scrub cow of the same weight. If she can reproduce her kind, every good quality in her is enhanced in value.

"We are ready to pay for her pedigree, her beauty of form, her capacity to make beef economically, to produce a large flow of milk or to make rich butter or cheese. These extra qualities are the result of care in breeding ; they represent capital lavishly spent and skill in the breeder, acquired by long years of experience. He has in the carcase of his thorough-bred animal a machine for the production of certain economical results which has cost him large sums of money. If he can show that he can produce these results with a fair share of uniformity, he is entitled to an extra price for his thorough-bred animal. There is no doubt that the skilful breeder can do this. A shorthorn bull at a large price is cheaper for a farmer who wants to raise beef than a scrub bull at any price. It is the confidence which farmers have that thorough-breds will transmit their good qualities that leads to the steady demand for them. *A.* breeds them, it may be to sell to *B.* at a fancy price. But *B.* would not want them unless he could sell to *C.* who is engaged in raising beef cattle ; and has found out that grade shorthorns will save a whole year of feeding, and one year's interest on the large capital he has invested in stock. He wants only a thorough-bred bull, and thinks he can afford to pay any price which is necessary to get him.

"The high prices for these animals will only continue as long as farmers find it to their own interest to buy them. The several breeds of cattle meet real wants among farmers who desire them for ordinary purposes. The demand will probably continue as long as beef, milk, butter and cheese are eaten; as long as oxen are used on the farm It is the most thrifty and skilful farmers that invest in thorough-bred animals.

"It is altogether probable *they understand their own interests.*"

Now, a stock of good grade cattle may be rapidly gathered up by any farmer at an expense of from one to two hundred dollars. Many breeders will dispose of a thorough-bred bull for a moderate sum because his colour does not suit them, whilst his pedigree may be perfect and he may possess every *useful* quality.

Co-operation in a neighbourhood where more than one farmer would purchase a thorough-bred bull, so that they might exchange and prevent too close breeding, would soon raise up a fine class of grades in a section.

Of one thing we may be certain, the use of a grade bull should never be permitted. It takes but four or five years to raise up a herd, with little expense, to three-quarter and seven-eighth bred animals, and then it is that the good qualities show and high figures begin to be realized. Could a common steer be made up to a live weight of 2,600 lbs. at three years old? We think not.

The old saying, "Blood will tell," true as it undoubtedly is, will be found no talisman against neglect, exposure and starvation. Many a man has tried improving his stock, but left them out in the weather and neglected them just as he used to do with his common stock; and the natural consequence of such treatment was made a ground of complaint against breeding.

If a man should buy some old worn-out watch for a dollar, and put it to steep in a basin of water, its functions would be, in all probability, somewhat retarded. Should he give a hundred dollars for a Waltham, and treat it in like manner, the fact of his article having been composed of the best material would not prevent its reduction to about the same state as the dollar watch when under the same course of treatment; but his loss would be the greater.

The reason why a grade bull is not a safe one to breed from is simply, we know nothing of his ancestry for any length of time back, and we cannot tell if those qualities which we particularly want to be developed in the progeny have been passed down to him through a sufficiently long ancestry to make it certain that they will also be stamped upon his calves.

Breeding.—" Whatever the class or character of the dams, the continued use of sires of a distinct breed, capable of transmitting a family likeness, should constantly be persisted in ; the man who does so finding his stock of various breeds of animals yearly increasing in value, the receipts correspondingly raised, and the occupants of his pastures, stables or stalls, wonderfully improved in appearance.

" Whether they attend to it or not, we find most men admitting the influence of a well-bred sire on the character and quality of the future offspring; but, strange to say, comparatively little stress is laid upon the influence for good which is exerted by the dam on her young, when she herself is of good quality and well descended. When both parents are good, progress is rapid ; and by holding over for breeders only the young of the best animals much time is saved, and the required amount of perfection is reached in a very limited number of years. Once looked to, this point will ever after be considered one of the most vital importance, and will on no account whatever be neglected or overlooked. To any one conversant with stock in large numbers, the influence of the mother is strikingly apparent in certain members of each class, their produce year after year exceeding in value that of every other animal of the same kind, and, when sold, brings proportionately more money. Thus, for instance, a cow will sometimes breed calves for a succession of years exactly the same colour, form and general character—no matter if the sire is changed each year ; and her progeny again will transmit to their own offspring the same characteristics, but in an improved degree, if the necessary measures have been attended to with this view. Families are thus founded, and men intelligent enough to profit by improving a good strain which has come in their way—it may be quite accidentally in the first instance—have gained for themselves a name and acquired fortunes. To breed from females which have proved themselves indifferent nurses, and whose progeny, however handsome they themselves may be, are always amongst the culls of the flock or herd, is very short-sighted policy, and detracts very materially from the prosperity of those who will not take the trouble of marking all such animals, and getting rid of them on the first favourable opportunity. Hardiness, by which general term a great deal of meaning is expressed, should never be lost sight of by the breeder, but, on the contrary, carefully attended to, as it is a quality of the utmost consequence, enabling them to withstand the vicissitudes of the weather, to keep up condition at periods when the greatest foresight cannot prevent a scarcity of food, to be always in good health, and to be able to breed animals of sound, healthy and hardy constitutions."—*Mark Lane Express.*

Animals should be selected for breeding purposes that have a character. If for the dairy, a character is wanted that they, and if possible their dams and grand-dams, &c., have been good milkers before them. And the same is applicable whatever be the qualities that the breeder desires to develop in his stock.

INDICATIONS OF QUALITY.

These, as generally observable to the eye, are:

For beef producing.—Moderate size, compactness and levelness of form, a straight broad back and fine tail, soft skin well covered with hair, short legs and well ribbed up.

For milking.—A broad forehead, small muzzle, kind and bright expression; the udders full, rounded and largely developed, but not fleshy; the milk-veins showing out large, thighs well kept apart.

For good constitution and early maturity.—Broad, deep chest, and ribs well rounded in the barrel behind the shoulder.

THE THEORY OF CATTLE FEEDING.

Mr. Fletcher says: "A farmer has three things to consider and three distinct objects to attain in feeding cattle—first, to make *bone;* second, to make *flesh;* and third, to make *fat.* Without bone he can have no flesh, and without flesh no fat. Thus they are dependent upon one another; they are all necessary to the support of animal life, and to the full development of the animal. This being so, it is absolutely necessary that in feeding an animal its food should contain all the elements of bone, flesh and fat; the two former being plentifully supplied to the growing animal, and the latter when it is being made up for the market. Now, bone has for its elements phosphoric acid and lime; those of flesh are gluten, fibrine, &c.; and of fat, carbon.

"These, therefore, it is necessary that food should contain in their proper proportions, in feeding the animal in its various stages. While young and in a growing state it requires the bone and flesh-forming constituents, and these are to be found in swedes, cabbages, potatoes, &c., all of which contain a large percentage of phosphoric acid, the principal constituent of bones, and also a considerable quantity of gluten, caseine, &c., the principal constituents of flesh; but if *flesh* is required to be laid on with a view to fattening, peas, lentils, and other leguminous food should be used; and for *fat* you must have recourse to linseed and other seeds containing a large proportion of oil, starch, gum, sugar, &c., all fat-forming constituents.

"The constituents the food ought to contain being known, the next question is the quantity required as best adapted to promote the growth and sustain the animal at different periods and under different conditions."

It is remarked by an eminent cattle feeder, Mr. Glyde, that "an ox requires two per cent. of his live weight of hay per day; if he works, 2½ per cent.; a milch cow, 3 per cent.; a fattening ox, 5 per cent. at first, and 4½ per cent. when half fat, and 4 per cent. when fat; grown sheep, 3½ per cent. to keep them in their store condition." An ox, to replace the daily loss of muscular fibre, requires from 20 to 24 ounces of dry gluten or vegetable albumen daily. This would be supplied by—

120 lbs.	of turnips,		or	17 lbs. clover hay.
115	"	wheat straw,	"	12 lbs. peas.
75	"	carrots,	"	12 lbs. barley.
67	"	potatoes,	"	10 lbs. oats.
20	"	meadow hay,	"	5 lbs. beans.

The closer the food approaches in its chemical constituency to the matter it is required to form, the sooner will the end be attained.

From the following table may be gathered the amount of each chemical constituent that dried beef (*i.e.* beef divested of its 77 per cent. of water) contains, and the proportion of those constituents found in hay, oats and peas:—

TABLE SHOWING CHEMICAL CONSTITUENTS OF DRIED BEEF, AND THE PROPORTION OF SAME CONSTITUENTS CONTAINED IN HAY, OATS, AND PEAS.

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Ashes.	Water.	Other Matter.	Total Parts.
Dried beef	51·82	7.57	21·37	1·501	4·23	......	......	100
Clover hay	33·47	4·20	32 51	1·26	7·56	17·05	3·95	100
Oats	41·57	5·25	30·10	1·80	3·28	18·00	......	100
Peas	38·24	5·84	33·10	5·00	3·71	14·11	......	100
Mutton fat	78·996	11·700	9·304	......				
Potato starch	44·250	6·674	49·076	......				
Gum	42·682	6·374	50·944	......				
Wool	50·653	7·029	24·608	17·710				
Horn	51 162	6·597	24·957	17·284				

Thus the best fat-producer here is found to be potatoes, and next to it comes clover hay. It will be observed the chemical constitution of these articles of food approaches very closely that of animal substances, and we may deduce from the fact how readily food acts on the system, and how essential to the well-being and the proper progress of bone, flesh and fat is a variety of food.

We give another table showing in a different form the relative nutritive properties of various common articles of food:—

RELATIVE NUTRITIVE VALUE OF VARIOUS ARTICLES OF FOOD.

Food.	Water.	Woody fibre, or husks.	Starch, Gum and Sugar.	Gluten, Albumen, &c	Fatty Matter.	Saline Matter.
Oats	16	20	45	11	6	2·5
Beans	14	8 to 11	40	26	2·5	3
Peas	14	9	50	24	2·1	3
Indian corn	14	6	70	12	5 to 9	1·5
Barley	15	14	52	13·5	2 to 3	3
Meadow hay	16	30	40	7·1	2 to 5	5 to 10
Clover hay	17	25	40	9·3	3 to 5	9
Pea straw	10 to 15	25	45	12·3	1·5	4 to 5
Oat straw	12	45	35	1·3	0·8	6
Carrots	85	3	10	1·5	0·4	1 to 2
Linseed	9·2	8 to 9	35·3	20·3	20·0	6·3
Bran	15·1	53·6	2	19·3	4·7	7·3

The most nutritious grasses are those which abound in sugar, starch and gluten. Sugar enters largely into the composition of milk. Hence it is that we find X. A. Willard, Esq., and our best authorities on the Dairy, recommending the sweet-scented grasses for permanent pastures.

The essential difference between cattle kept over and those that are intended for the shambles is, that in the former case a generous varied diet is required to perfect the whole animal organization, whilst in the other our efforts are directed to the supply of fatty flesh-forming food.

To reiterate, the *flesh-forming* constituents are albumen, gluten, &c., and those that go to form *fat* are gum, saccharine matter, starch, &c.

The next table shows how much for each of these purposes may be expected as an average yield for an acre of land.

An acre of land should produce, of—

	Flesh-forming food.	Fat-forming food.
Peas, (20 bushels)	285 lbs.	504 lbs.
Oats, (40 bushels)	232 lbs.	935 lbs.
Hay, (2 tons)	220 lbs.	1,660 lbs.
Potatoes, (150 bushels)	400 lbs.	2,220 lbs.
Carrots, (700 bushels)	840 lbs.	4,000 lbs.
Turnips, (560 bushels)	400 lbs.	3,350 lbs.
Wheat straw, (2,000 lbs.)	27 lbs.	626 lbs.
Oat straw, (1,800 lbs.)	24 lbs.	646 lbs.
Barley straw, (1,400 lbs.)	18 lbs.	430 lbs.

In the U. S. Agricultural Report for 1865 we find the following very exhaustive tables, prepared from the best English, German, and American authorities. From this may be deduced, when taken in connection with the analysis of the animal system, the comparative value for nutrition of nearly every crop in general or partial cultivation in Canada :—

TABLE OF COMPARATIVE EQUIVALENTS OF DIFFERENT FOODS.

FOODS.	Amount of flesh-forming constituents in one hundred pounds.	Amount of fat-forming constituents in one hundred pounds.	Total nutritive constituents in one hundred pounds.	Nutritive equivalents of one hundred pounds of superior English hay.
Irish potatoes'	1.4	18.9	20.3	245.3
Carrots	0.6	6.6	7.2	691.6
Parsnips	1.2	7.0	8.2	607.3
Jerusalem artichoke	1.0	18.8	19.8	251.5
Sugar beet	0.9	13.6	14.5	336.5
Turnips, (swede)	1.0	5.2	6.2	803.2
Common white turnip	0.9	3.3	4.2	1185.7
Mangold wurzel	1.0	12.6	13.6	367.6
Green pea straw	0.9	7.9	8.8	565.9
Spurrey, (green)	2.7	2.3	5.0	960.0
Green buckwheat stalks	0.2	4.7	4.9	1016.6
Common vetch, (green)	1.9	2·6	4.5	1106.6
French vetch, (green)	0.7	4.7	5.4	922.2
Green stalks of white lupin	1.8	2.3	4.1	1212.1
Green stalks of white bean	1.0	2.7	3.7	1345.9
Green oats, (fodder)	1.0	8.5	9.5	524.2
Timothy grass, (green)	4.0	9 7	13.7	363.4
Red top " "	3.3	8.7	12.0	415.0
Superior English hay	13.5	36.3	49.8	100.0
Red clover, (green)	2.0	3.6	5.6	907.1
White clover, (green)	1.5	2.7	4.2	1185.7
Lucerne, (green)	1.9	3.6	5.5	905.4
Red clover, (hay)	22.5	18.7	41.2	120.8
White clover, (hay)	18.7	40.0	58.7	84.6
Lucerne, (hay)	12.7	38.0	50.7	98.2
Wheat flour	14.7	66.4	81.1	61.4
Indian corn	11.0	66 7	77.7	64.2
Rye meal	14.3	55.8	70.1	71.0
Barley meal	13·0	52.0	65.0	76.0
Oatmeal	18·0	51.1	69.1	72.0
Buckwheat meal	9.0	52.1	61.1	81.5
Peas	23.1	41.9	65.0	76.0
Kidney beans	23.9	39.3	63.2	78.7
White field beans	24.0	39.7	63.7	78.2
Lentils	25.7	38.9	64.6	77.0
English linseed cake	22.1	51.0	73.1	68.0
American linseed cake	22.2	48.6	70.8	70.3

There is a variety in the various clovers. *Einhoff* and *Crome* give the following analyses :

	Red Clover.	White Clover.	Lucerne.
Water	76.0	80.0	75.0
Starch	1.4	1.0	2.2
Woody fibre	13.9	11.5	14.3
Sugar	2.1	1.5	0.8
Albumen	2.0	1.5	1.9
Extractive matter of gum	3.5	3.4	4.4
Fatty matter	0.1	0.2	0.6
Phosphate of lime	1.0	0.9	0.8
	100.0	100.0	100.0

Excellent analyses have been put on record by *Sir Humphry Davy* and *Mr. Herapath,* showing the relative value, as food, of the generally cultivated roots :—

QUANTITY OF NUTRITIOUS AND FAT-PRODUCING CONSTITUENTS IN A THOUSAND PARTS.

	Mucilage or Starch.	Sugar.	Gluten or Albumen.	Total.
Swede turnips	9	51	2	62
White turnips	7	34	1	52
Mangold wurzel (long red)	13	119	4	136
" " (orange globe	15¾	106¾	1½	134
Sugar beet	17¾	126¾	1¼	145¾

Treat all Animals Kindly.—It is a pity every one does not treat animals kindly, for much more can be done with them in all ways; they will do as you wish them readily, and you become completely master of them, without knowledge on their part that they are subservient to your desires. There is not a more interesting sight than to see a first-rate herdsman or a thoroughly good shepherd move a numerous lot of animals and draw them out into different yards, and then, perhaps, into pens—one here, two there, &c., but in every instance the right one going into the right place, and all this done without any bustle and in the most regularly quiet manner imaginable. Man too is an animal, and how very much better it would be if any one having that sort of animal around him would treat them kindly: he might, as stated with the lower animals, become complete master and have entire control of them, without their feeling how really subordinate they were. Overbearing manners beget dislike. Belittle a man by a foolish arrogance, and he is totally discouraged and becomes careless. In fact, there is generally a great want of sense in any one who tries to make others feel inferiority; and depend upon it, there is nothing better than kindly treatment towards *all* animals.

Store Cattle.—The two chief points to ever bear in view in the treatment of store and growing cattle is shelter and generous variety of food; and yet store cattle must be kept cheap, or they will "eat their heads off," as the saying is, ere they be ready to put up for the butcher or to come in as milkers. Well, comfort is half the battle, and costs very little. A warm shed in winter; a liberal supply of straw, varied with roots, and a very little grain in winter; shade and access to water in summer, and plenty of moderate exercise, are all that is wanted to keep young cattle growing. The object to be sought with stores is to keep the frame enlarging and the constitution sound and healthy, so that when the time of feeding arrives we may have a large and fully developed frame and a healthy machine by which to convert the crops into beef.

Depend upon it, for the ultimate benefit of the farm, the right and proper way of disposing of all straws, hays and coarse grains, is by making them "*walk off*" to market.

The common object sought in keeping cattle in the barn-yard through the winter is to keep the beasts at least in as good order as when they left the pasture, and to make manure.

If cattle be once stinted in their growth, they will never afterwards be able to acquire flesh either so rapidly or so fully as if better kept.

The different appearance of cattle kept well sheltered in winter and those that are allowed to run out in all sorts of weather, and unprotected, to grub their own food, is in the spring very apparent to the outsider; and if the owners could be persuaded to produce a fair and square account, we have no doubt that the feeder would show a better balance sheet ere June grass had left, than he who winter starves his cattle.

Fatting Cattle :—

"Oh ! rare rosbif ! loved by mankind,
If I were doomed to have thee,
All dressed and garnished to my mind,
And swimming in thy gravy,
Not all the country's force combined
Could from my fury save thee."

Buying Cattle to Fat in Winter.—The liberal and constant application of manure is the grand basis upon which rests successful farming. Of manure there are three kinds—the so-called artificial manures, green manures, and animal or barn-yard dung. Each in its place is necessary to a proper enrichment of the soil, and the obtaining of all is a matter of much importance. To make plenty of barn-yard manure, a number of stock must be kept, and such should be richly fed ; for as the fodder is rich, so will the manure be impregnated with a maximum amount of those rich elements which go to increase the growth of the plant.

While endeavouring to fat a great number of head of cattle, the question of a profitable return for the food supplied has to be considered as inseparably connected with the manufacture of rich manure. We have seen beasts put up to fatten who have eaten more than they have made. A thin beast, put up in the cold weather, takes a great amount of his food for the purpose of supplying the necessary heat to the body; while an animal in good order has a heat-producing store in his own fat, which allows all the extra food to be taken up in producing more meat. We may lay it down as an axiom that it will not pay to put up a thin beast to fatten upon stored or winter food.

After August, the fall pasturage will be ready for cattle; take them off this as soon as very cold nights set in, and stall feed. They will be the very best of beef by Christmas.

In this way alone, as a rule, can winter feeding of stock for the butcher be made profitable. The animal is growing from August to December without a day's check. We have bought steers in August for thirty-five dollars cash, and sold the same before

Christmas for sixty-five dollars, only stall feeding for about six weeks.

Money may be made in the current year by growing and selling a large breadth of grain, but it is made at the expense of our future income. Fattening of stock is the most profitable manner in which to apply our farm produce, for we have profit from the animals and manure to boot.

At the same time, there is such a thing as putting more feed into a beast than his increase in weight will pay for. If we adopt as an axiom, that an animal should always be *in good order* when put up for winter stall feeding, we cannot go far astray.

Choosing a Beast to Fatten.—British Husbandry says: "In choosing a breed more especially adapted for fatting purposes, there are some points which should be closely regarded. Attention should be paid to compactness and symmetry of form; deep fore quarters, wide carcases, fine small bones, moderately thin hides, a protuberance of fat under the root of the tail, and large full eyes. A well-shaped steer should thus have a small head, with a placid countenance, as indicative of docility and aptitude to get fat; a fine muzzle and open nostrils; the throat should be clean, long and thin in the neck, but wide and deep in the shoulders; the back should be broad and straight near the setting on of the tail, with the rump-points fat and coming well up to it; the barrel should be round, wide across the loins, and the girth deep behind the shoulders, with the space between the hip bone and the short rib very small (this latter is most important to all easily kept animals); the fore legs should be short and wide apart, so as to present a broad appearance to the chest, and the thighs of the hind legs should be shut well in the twist—the seam in the middle of which should be well filled; and the flanks should be heavy and full. A form such as this is not only the best for affording the greatest weight, but will be also generally found to lay the flesh upon the prime parts, to produce the least quantity of offal, with such a large quantity of tallow as, emphatically speaking, in the butchers' phrase, will cause the animal to 'die well.' These marks, however, are not the only indications of a propensity to fatten quickly. On the contrary, it has been found by experience that many coarse beasts, with large bones and gummy legs, have often proved superior in that respect to other animals of undoubted superiority in point of shape. The state of the hide and flesh is of the first importance, as the essential property of '*handling well.*'"

An eminent breeder considers that "it is the nice touch or mellow feel of the hand which constitutes, in a great measure, the judge of cattle."

"The knowledge and the value of *skill in touch* can only be acquired by long practice, but when once obtained, it may be relied on as the best criterion in judging of the feeding qualities of a beast, for it is generally found to be accompanied by the other good properties of gentleness, purity of blood and consequent disposition to fatten. A thin, papery skin, covered with light silky hair, denotes weakness, and is therefore as defective a test of superiority as that of a coarse tough hide, covered with hard, short hair, which always indicates a bad feeder."

This judgment of good feeders is most important to the cattle buyer, and we have the perfection of a skin indicative of disposition to fatten, thus briefly summed by an eminent cattle dealer, "as consisting in a thick, loose skin, floating as it were on a layer of soft fat, yielding to the least pressure, springing back towards the fingers like a piece of chamois leather, and covered with thick, glossy soft hair."

Early maturity can be gained in no other manner than by the increase of the superiority of *the breed*, best effected by the use of thorough-bred male stock.

Although it has been said that "a plain, coarse, ugly animal may pay more than a fine, well-made one, because the coarse one is bought at a much less price in proportion," yet our readers who have had experience in fatting extensively for the market will endorse us when we strongly recommend the propriety of the purchase of those cattle for the stall which have the finest points in their form; for these will not only carry beef of the best quality, but will consume less food in proportion, particularly as they attain age and fatness; and will thus, generally, realize the largest profits on their fattening.

Management in the Stalls.—The thrifty condition of a beast, and the saving of food from waste, are in a very great measure dependent upon their *management* when put up to stall feed.

The first point is comfort of accommodation; for on their easiness depends, in a great measure, the rapidity with which they will lay on fat. They should be *perfectly secured from the weather*, and a certain degree of warmth above and below—roofs rain-proof and floors dry. Neither should stalls be ill-ventilated or too warm; for the first fault may affect the healthy state of the respiratory and digestive organs, whilst the latter may cause perspiration, and every sweating is so much food lost to fat. A dry bed and plenty of litter inclines the beast to lie, and the oftener he is down, contentedly chewing the cud of perfect satisfaction, the more rapidly will he increase in size and weight.

Strict regularity in times and (if any) gradual variations in quantity and quality of food are most important.

Whatever periods for feeding are once adopted, they should be made a rule and acted up to within the minute. The beast soon, by instinct, will acquire a most accurate knowledge of his proper feeding time, and from that minute will be restless until he is supplied, and every minute of restlessness is again so much food lost to fat.

Stalls should be kept moderately dark, for by so doing the animal is induced to take more rest.

Cleanliness.—No point is of more importance, and probably there is none so generally neglected as this. Mangers should be cleaned out before every feed, that there may be no sourness found in the bottom.

Water.—It is not uncommon to say that cattle fatting require no water—that such as is contained in the turnips is ample. Try the beast with a pail of clean water immediately after he has eaten his turnips, and in nine cases out of ten he will take a drink. Turnips, no doubt, contain over ninety per cent. of water, but it is not in a form by means of which the animal *can wash down* his feed.

When to stop Feeding Cattle.—Nature has a law, that she will refuse to increase live weight of the animal world above a certain point. There is a period during the fatting of domestic animals beyond which feeding is no longer done at a profit. When the beast is well fattened, and loses his appetite for food, further fattening is only at a loss, and the sooner the animal is slaughtered the greater its profit to the feeder.

Feeding may be continued just as long as the beeve appears healthful, and will take his regular feeds with a keen relish.

Overfeeding.—There is such a thing as overfeeding, and the effect is that the appetite becomes cloyed, and it will take some time to bring back a healthful relish for food. To prevent this, careful watch must be set, and when a beast begins to *play* with his fodder, tossing it out of the box or rolling it into a ball, it should be immediately removed, and the amount of succeeding feeds be reduced.

Large quantities of grain should *never* be fed at one time. The error is not uncommonly committed of feeding the animal too little at one time, and then endeavouring to make up for lost time by cramming. This may have answered for the Irishman's pig, when he wanted to " put on a streak of lean and then a streak of fat—sure ;" but the effect upon beasts is to cloy the appetite, and the principle comes well under the old adage of " the more haste, the less speed."

LIVE AND DEAD WEIGHT.

The difficulty of judging correctly the difference between these weights has led to the adoption of calculations based on the measurement of the dimensions of the animal.

One plan is :—

The girth is taken by passing a tape-line round the body, just behind the shoulder blade and under the fore legs ; and *the length* is found by measurement along the back from the foremost corner of the shoulder blade-bone, in a straight line to the hindmost point of the rump, or to that bone of the tail which plumbs the line with the hinder part of the buttock.

This mode of measurement is *generally* acknowledged as the most simple and the best, as applicable to all breeds of cattle.

The weight is then found by any of the following rules:—

RULES FOR FINDING DEAD WEIGHT.

For example, we suppose a fat beast to be 5 feet in length and 7 feet in girth.

Rule 1. Multiply the square of girth in inches by length in inches, and divide the result by 525, and the quotient is the weight required:—

Ex.

Square the girth in inches	84
	84
	7056
Multiply by length in inches	60
Divide by 525.	525)423360(806
Ans..........	806 lbs.

Rule 2. Square the girth in feet, multiply the same by the length in feet, and multiply the double sum by 3·33, and the result is the weight required:—

Ex.

	7
Square girth in feet..............................	7
	49
Multiply by length in feet......	5
	245
Multiply by 3·33	3·33
Ans..........	815·85 lbs.

Rule 3. Multiply half the girth by itself in feet, and the product by fourteen times the length in feet. The result will give the desired weight.

N.B. This rule is more simple, but not quite as accurate as Rules Nos. 1 and 2.

	3·5
Multiply half girth by itself in feet	3·5
	12·25
Multiply by length in feet	5
	61·25
Multiply by 14	14
Ans..........	857½ lbs.

Rule 4. Multiply girth by itself in feet; multiply product by five times the length in feet; and multiply result by the fraction $\frac{2}{3}$.

	7
Multiply girth by itself........................	7
	49
Multiply by five times the length	25
	1225
Multiply by fraction $\frac{2}{3}$ .... Ans..........	816$\frac{2}{3}$ lbs.

Rule 5. Obtain the live weight of an animal by actual weighing, and divide this by 8, and multiply the quotient by 5. Thus, if the animal weighs 1288 lbs. on the scales:—

Divide by 8	8)1288
	161
Multiply by 5	5
Ans..........	805 lbs.

In other words, the live weight loses exactly three-eighths.

$$\text{For } 1288 - \tfrac{3}{8}(1288) = 1288 - 483$$
$$= 805 \text{ lbs. Ans.}$$

Or the mean amount of beef from a fat beast is about ·625 of the live weight :—

For, as above............ ·625 of 1288 lbs. = 805 lbs.

A number of experiments have been, within the last few years, made on this point at the public slaughter-houses of Paris and Brussels, and the result of these have been that—

An ox weighing 1322 lbs. yields :—

Meat		773·25
Skin	111·20	
Grease	88·00	
Blood	55·16	
Feet and hoofs	22·00	
Head	11·00	
Tongue	6·80	
Lungs and heart	15·33	
Liver and spleen	20·05	
Intestines	66·15	
Loss and evaporation	154·32	
		548·75
Total		1322·00 lbs.

In this experiment, the beef was only ·58 of the live weight, but we believe that our former figure of ·625, or $\frac{5}{8}$, is a better standard.

Rule 6.—As there is a difference in the proportion of meat to offal in animals of different condition, the following accurate rules have been struck :—

Multiply the girth into itself and multiply by the length ; if the beast is

"Just killable,"	multiply	product by	3·08
"Fair beef,"	"	"	3·22
"Fat,"	"	"	3·33
"Very fat,"	"	"	3·50
"Extra fat,"	"	"	3·64

Example:—

Take girth as before, 7 feet, and length 5 feet.

	7
Multiply girth by itself	7
	49
Multiply by length	5
	245

If "Just killable,"	multiplyby	3·08,	gives	754·70	lbs.
"Fair beef,"	"	3·22	"	788·90	"
"Fat,"	"	3·33	"	815·85	"
"Very fat,"	"	3·50	"	857·50	"
"Extra fat,"	"	3·64	"	891·80	"

In the *Quarterly Journal of Agriculture* we find also a statement of the live and dead weights; and proportion of offal of bullocks of different breeds, a summary of which is as follows:—

Breed.	Proportion of carcase to 700 lbs. of live weight.	Proportion of offal to 700 lbs. of carcase.
Durham	487½ lbs.	146½ lbs.
Devon	485 "	172½ "
Hereford	412½ "	220 "
Highland	380 "	282½ "
Cross-bred	366 "	282½ "

Thus establishing the Durham at the head of beef producers.

Again, we have another tabular statement of four animals, which, though individually of equal weight when alive, yet separately displayed an extraordinary difference when killed, in their production of beef and tallow, exclusive of hide and offal.

	Live Weight.	Dead Weight.	Tallow.
An Aberdeen ox	1859 lbs.	1182 lbs.	229 lbs.
A Shorthorn ox	1848 "	1261 "	196 "
A " heifer	1680 "	1087 "	210 "
A " steer	1681 "	945 "	208 "

It is instructive to observe the large proportion of tallow from the young stock as compared with that in the oxen.

CUTTING AND STEAMING CATTLE FEED.

We have been often asked what are the advantages to compensate for the trouble and expense of steaming our cattle food. Like all such farm operations, people have said it is all very fine for fancy stock, but it won't pay with our ordinary stock. The answer is ready. It will pay if only enough stock is kept. It will not pay to rig up apparatus at some expense, and then to expect the profits on two or three head of cattle to make it up to the farmer, but the aggregate saving of a few pounds per day, on a fair sized stock, will, in the course of a long Canadian winter, tell up to a very pretty sum total.

By steaming, twenty-five per cent., or one-quarter, is saved over the ordinary plan of feeding long fodder.

If 30 lbs. of hay be required per day to keep one cow in fair order, and, by means of steaming, it can be shown that 22 lbs., or three-quarters of the first amount, will answer the purpose equally well, we save 8 lbs. of hay per day, per cow. Supposing that we have twenty head, we thus save 160 lbs. of hay per day, equivalent to $1.60 cents per day when hay is worth $10 per ton, or for the five winter months we effect a saving in fodder to the amount of $150.

Albert J. Foster, a farmer having many years' experience, says before the Orleans County Farmers' Club :—

"Having been solicited to make a statement of my experience in cutting feed and feeding stock, I will say that I have cut feed, more or less, for the last fifteen years, and find it a great saving in feeding all kinds of stock, and particularly in feeding horses. I find that it does not require more than two-thirds as much in bulk when cut as when fed without cutting. I am feeding the present winter seventy horses and mules and eleven head of cattle entirely on cut feed. I do not steam my feed, for the reason that I have not the proper facilities for so doing, but I think a great saving might be made by steaming. I have a second-hand two-horse power that cost me $25, and a cutting box that cost $30, that I use for cutting feed for all my stock. Two men and a boy will cut enough in one day to last seven days. I mix this feed in a box as I want to use it, and always salt it well before feeding. In this way I have no sick horses, and they all appear to have good appetites. I usually water once a day, and while the stock are drinking, clean the stables. I find that one hand will take proper care of this stock, with the help of another hand one hour in the morning and at night. I have often heard it said that stock would not do well if compelled to eat cut feed up clean, and that this is particularly the case in regard to corn fodder; but I have nearly finished cutting 16 acres of heavy corn fodder, that, owing to bad weather, was not as well saved as some years, and as yet I have not thrown into my yard one bushel of this cut mixture. I intend to mix, as nearly as possible, two parts straw with one of hay and one of corn fodder. A sufficient quantity of this, with at least six quarts of ground feed (three parts shorts to one of meal) per head, will keep stock thriving and in good condition. I am not able to give any experiments in feeding cattle for beef, except in regard to one pair of six year old oxen, which I bought last spring, and worked through the summer, and fed on grain after they were turned to grass. They were weighed when put up to feed in the fall, again two weeks before selling, and when sold, and I found they had gained an average of 2½ pounds a head per day. They were fed, in addition to the regular cut feed, about six quarts of meal each per day. I am fully satisfied that it will pay any farmer to cut feed for his stock, and perhaps to buy more feed rather than to sell any off the farm.

"But this is not the only advantage gained by feeding cut feed ; there is a great saving in handling the manure, and it is always ready to use. I usually draw in the winter, and spread on the ground intended for corn, thus saving the time in the spring when I want to be at other work. Labour is also cheaper in the winter, and teams have not much to do. I consider one load of such manure worth at least two as usually drawn from barn-yards in the spring and summer. It is always ready for top-dressing meadows or orchards, or for manuring corn in the hill, or for mixing with other ingredients for any purpose."

For the very large farmer it would undoubtedly be advantageous to buy a regular apparatus, such as Prindle's Agricultural Steamer, but a very excellent substitute can be obtained by the use of the ordinary agricultural boiler.

Mr. A. Lurgan, of Bayfield, Ontario, thus communicates his simple plan in the columns of the *Canada Farmer* :—

"Invert and fit a strong tub, the staves eighteen inches or two feet long and two inches thick, into the top of an agricultural boiler. Slope the staves off from the outside, so that they will fit the top of the kettle tight, and plaster the joint round with a mixture of clay, sand, lime, and ashes, till it is perfectly steam-tight. Have a hole in the bottom of the tub, to pour in the water, and a hole in the side for the pipe to take away the steam; the hole in the bottom may be closed by a plug.

"Take your steam pipe into a box containing from 150 bushels to 200 bushels, and you will steam it in a short time as effectually as can be desired.

"Last winter I worked on this plan with a common large sugar kettle, set in a small stone arch, with a tub turned into it as described, and a pipe from the side of it leading into a common grain bin, holding 75 bushels, In filling the bin I first put in a layer of chaff or cut straw about a foot deep, and then a sprinkling of meal, and so on to the top of the box. I then filled the kettle with water to about a foot from the top, started the fire, and in a short time the steaming was complete. Instead of a common grain bin made of inch stuff, it would be better to have it made of two-inch plank with a false bottom. I have known two tanneries, in the early times of the settlement, to work for years with a similar contrivance."

Saving Effected by Steaming.—Augustus Whitman, in the *Country Gentleman*, says :—

"While 28 lbs. per day of good dry hay are required to keep dry cows (weighing from 1,150 lbs. to 1,450 lbs.) in an even condition of flesh, upon 20 lbs. of steamed feed a handsome gain is made.

"The trial that furnished the data for the statement was made a year since, when six dry cows, in condition as nearly alike as could be found, were divided into three pairs, and each pair fed differently from the others for three weeks; note was then made of the result, and the trial continued another three weeks, giving to each pair what another pair had previously been allowed. The result was, that upon 28 lbs. per day of good dry hay, two cows weighing 1,184 lbs. and 1,456 lbs. respectively, just about held their own; while another pair weighing 1,362 lbs. and 1,120 lbs. respectively, upon 20 lbs. per day of steamed feed, gained 54 lbs. and 36 lbs. Reversing the feed for the second three weeks, the last named barely held their own, while the first gained 40 lbs. and 30 lbs. respectively.

"I should say that the cattle on long hay had all they would eat at the three regular feeds, and the quantity consumed was found to be at the close of the trial equal to 28 lbs. per day, as above stated. You will very properly ask, what is the mixture made of?

"My steam box (in three divisions) holds enough to fill 200 feed boxes of about one bushel each, and requires to pack it well 900 lbs. of dry fodder. This is made up of 300 lbs. good hay and 600 lbs. of corn stover, dried fodder, corn or oat or barley straw. This is cut tolerably fine and well mixed, and when packed in layers for steaming is thoroughly wet and seasoned with 180 quarts wheat shorts, 60 quarts cotton seed meal, and 60 quarts corn meal

"The rule for feeding now observed, and that has been used for the past winter, is somewhat changed from previous years, and is a boxful of steamed feed morning and noon, and 5 lbs. dry hay at night. The two boxes of feed contain 3 lbs. good hay, 6 lbs. straw (or its equivalent), 1 lb. shorts, and $1\frac{3}{4}$ lbs. meal (half each cotton seed and corn), and upon this good gain is made, as the monthly record shows."

Before leaving the question of feed, we will return to summer feeding as performed under the system known as

Soiling.—Whether the adoption of entire soiling will pay or not depends in great part upon the nature and value of a farmer's land. Where there is rough land it is often only fit to be put into a state of permanent pasture. But where all the land can be used to advantage to raise meadow hay, it becomes a question whether it would not pay us better to get a full crop than to turn our cattle out upon land upon which our hot climate usually very materially reduces the amount of succulent food through the summer months. We are well aware that a given amount of land will feed far more head of cattle under the soiling system than when pastured. The question for the farmer to solve is, will the saving of land fo other purposes pay for the time and trouble tor be expended in cutting and carrying food all through the summer months?

There are six distinct advantages accruing from the practice of soiling:

1. It saves land.
2. It saves fencing.
3. It economizes food.
4. It keeps the cattle in better condition and greater comfort.
5. It produces a better flow of milk in milch cows.

6. It increases the quantity and quality of the manure made on the farm.

That it saves land there can be no doubt, for when there is a rank growth in the pasture cattle will leave all the coarse grasses unused; whilst by dunging, treading in wet weather, &c., cattle at pasture waste more feed than they consume.

X. A. Willard, the first authority on the dairy in America, is a strong advocate of the system, for he says that "stock provided regularly with an abundance of food and a supply of pure water, and otherwise cared for, are seldom essentially ill, seldom miscarry (in the case of cows), or meet with those accidents incident to herds that are roaming over pastures, often subjected to hunger and thirst, drinking muddy and impure water, driven and worried by dogs, breaking down and jumping over fences in quest of food, or otherwise gratifying their propensities for mischief. The soiling system does not necessarily confine the animals wholly to the stable. A yard is provided in which rubbing posts are set and shade is provided. Into this inclosure they are turned for several hours in the day, and where they can take all the exercise necessary for their health."

It has been estimated that *the amount of manure* thus saved for use upon the field crops of the farm alone pays for the time and trouble entailed under this practice.

The kinds of fodder grown for soiling purposes are chiefly clover, oats, Indian corn, cabbages and rye. The last makes an excellent early crop; then clover from the 1st of June; oats will be ready by July, and Indian corn may be made to come in by sowing at different intervals for all the hot month of August and the greater part of September; while the cabbages, helped out by the second crop of clover and other roots, will carry the soiled cattle into winter quarters.

The cattle require to be fed often, say five times a day, and to have access to plenty of pure water.

One boy, devoting his whole time to it, will feed a great number of cattle; but it is work that requires the constant supervision of the owner, for upon the regularity of feeding will entirely depend the thrift of the animals.

It is recorded by the Hon. Mr. Quincy, an American, and is corroborative of experiments made by Sir John Sinclair, that 17 acres of land under the soiling system will keep as many head of cattle as had previously required 50 acres of pasturage. Thus has been effected a saving of 33 acres, which at a very moderate rent would be equivalent to one hundred dollars a year, to say nothing of the crops that may be raised on the 33 acres, the increased amount of manure made, and the superior thrift of the cattle.

It has been urged that the abolition of pasturage on a farm would be hard on the land; but it must be remembered that none of the crops used for soiling are permitted to go to seed, and that a great amount of manure is made to return to the fields.

What it takes to Soil a Cow.—"Having an excellent piece of clover just coming into blossom, we measured forty square rods, and commenced feeding it to seven cows and four horses: it fed them liberally fifteen days. The two succeeding years we tried the same experiment, the animals differing somewhat, but with the same result. In each case we found forty square rods equal to the summer feeding of one cow. These crops of clover were very heavy, and could not always be equalled; yet, allowing for contingencies, we came to estimate one half acre of land in good condition in clover as adequate to the summering of a cow; thus making soiling equal to from four to six times the space in pasture. We tried afterwards much larger experiments—soiling thirty-five cattle and horses, and using some land in much poorer culture; but we found the saving comparatively quite as encouraging. We selected one hundred acres—barely sufficient to have pastured this number of animals—ten of it in clover, oats and sowed corn; we fed them from the 20th day of May to the 1st day of December. We had a surplus of sixty-five tons of hay, after feeding those animals six months and ten days, which sold in the barn for $972.00. It required six hours' labour per day to soil them, which amounted (in those cheap times) to $65.00. One hundred loads of manure were saved in fine condition, worth at least $50 more than the droppings of these animals at pasture. The expense of cutting and housing the sixty-five tons of hay was $1.50 per ton, or $97.50, which, added to the labour of soiling, makes $162.50, leaving $859.50 as the net gain of this soiling experiment."—*Live Stock Journal.*

MILCH COWS.

Selection.—We make no apology to the reader for quoting on this head somewhat lengthily from X. A. Willard's very excellent work, "Practical Dairy Husbandry." The work should be in the hands of every dairy farmer, and would, indeed, be found a valuable addition to any library in the country:—

"*Which is the best breed of Cows for the Dairy, and how is it to be obtained?*—This question has been before the dairy public for the last quarter of a century, and is to-day by no means settled among practical dairymen. If you go among the breeders of thorough-bred stock, you will get no end of argument, backed by a formidable pile of statistics, to show that this or that breed is the best. It is now Shorthorns, then Ayrshires, or Alderneys, or Devons, or Dutch cattle; just as you happen to meet those interested in one or other of these breeds.

"Now, it may be presumed that none of these men mean to mislead; for they may have strong convictions of the truth of what they advocate, and, under certain conditions, I think that it might be proved that either would be right. But that any one of these breeds is best adapted to all soils, all climates or all purposes, is quite another matter, and one which is not true in fact. The practical questions for dairymen to decide are—*first*, what breed of cattle is best adapted to the soil, the climate and the surface of the country, or farm, where the stock is to be kept? and, *secondly*, what breed is best adapted for the peculiar purpose for which it is wanted?

"It would, it seems to me, be exceedingly poor economy for the butter maker, located on a rough hilly surface, affording scanty herbage, to select Shorthorns; because they are not an active race, and demand a plentiful supply of nutritious food—food easy to be obtained. And to the cheese dairyman, located on a level or slightly undulating surface, yielding an abundance of rich food, who desired to get the greatest profit from making cheese *and beef*, it would be equally bad economy to select the Alderney. And yet, if one was to engage in butter dairying alone, where extra quality and high prices were looked after sharply, the Alderney might serve his purpose altogether best. It is from overlooking certain conditions, and hoping to realize every excellence, such as quality and quantity of milk, of butter, of cheese, of beef, with activity and endurance, all centred in one breed, that has caused so much dissatisfaction and difference of opinion among dairymen in regard to particular breeds."

In Allen's work on American Cattle we find the following excellent advice on the selection of good milkers:—

"Where the digestive organs are defective, good milch cows are rarely met with, since these organs have a powerful influence on the exercise of all the functions, and particularly on the secretions of the milky glands.

"Good milkers allow themselves to be milked easily; often while ruminating they look with pleased eye at the person who milks them, and like to be caressed, and caress in return. The udder is formed principally by the glands which secrete the milk, called the milky glands. These, four in number, two on each side, are designated by the name of 'quarters,' each constituting nearly one-fourth part of the udder. The udder is composed, moreover, of skin, cellular tissue, fat, lymphatic ganglions, vessels, &c. In almost all cows, the abundance of milk is in proportion to the size of the mamelles. The marks indicating that these glands are constituted so as to produce much milk are, a very large development of the hind quarters; a wide and strong lumbar region; a long rump; haunches and hind legs well apart; a large space for lodging the udder; milky glands well developed, and causing the udder to be of considerable size. In good cows the glands constitute a large part of the udder, and accordingly, after milking, it shrinks much, and becomes soft, flabby, and very wrinkled. The teats should be set apart from each other, as indicating that the milk vessels are large. Of all the marks for ascertaining good cows, the best are afforded by the blood vessels; if the veins which surround the udder are large, winding and varicose, they show that the glands receive much blood, and consequently that their functions are active, and that milk is abundant. The veins on the lateral part of the belly are easily observed. These veins issue from the udder in front, and at the outer angle, where they form in good cows a considerable varicose swelling. They proceed towards the front part of the body, forming angles more or less distinct, often divide towards their anterior extremity, and sink into the body by several openings."

Classification of milkers.—We may classify milkers in a general way as follows:—

Good milkers.—Veins large and of a varicose appearance, *i.e.*, knotty. Milk veins well developed. Udder large, pliable, and shrinking much after milking, covered with thin skin and fine hair. Hind legs wide apart and teats far from one another, with an outward slope. Broad chest, showing a good constitution, with a gentle and kindly disposition.

Moderate milkers.—Generally good shaped in udder and buttocks, but without a first-class development of the milk and blood veins.

Bad milkers.—Cows of bad constitution, or poor feeders. Fleshy thighs, so narrow that there is little room for the udder to hang, without being chafed; skin of udder hard, and coarsely haired; veins feebly developed.

MANAGEMENT OF MILK COWS.

Feeding in Spring and Summer.—We have already spoken at some length on pasturage and soiling in a former chapter; we now add a few remarks by *X. A. Willard.* He says:—

" There is a great difference of opinion amongst dairymen in reference to the kinds of grain best adapted to milch cows in spring.

" Dairymen generally suit their own convenience in the matter, without much regard to the opinion of others. . . . . So widely do people differ on this question, that many prefer to feed in spring nothing but hay, if of good quality, claiming that the cows will be healthier when turned to grass, and that the net profits from the dairy will be greater than when grain is used in spring feeding. In other words, that the value of the grain fed in spring more than balances receipts from the extra quantity of butter and of cream produced; and hence, that grain feeding in spring must be poor economy. Another class of dairymen, who claim to have looked pretty closely to profits to be realized from milch cows, and to have compared results one year with another, say that nothing is gained by having cows 'come in milk' as early as February or March. They prefer the months of April and May, as not only more agreeable, but actually resulting in greater profits.

"They argue that cows 'coming in milk' early in the season are more exposed to cold and storms, which must injure the health and weaken the constitution of the animal; that it sooner wears out the cow, and yields no more net profit than when a later date is had for commencing the business of dairying.

"Why, they say, should one do extra work in milking and nursing stock through the bad weather of February and March, when the result from stock calving thus early not only is no pecuniary gain, but brings positive injury to the herd? Others insist that greater profits are realized when cheese and butter making are commenced early in the season. But if we assume that cows are to come in milk as early as March, then some kind of food other than hay—at least hay as usually harvested—seems to be imperatively demanded, in order to keep stock in decent condition as to health and strength, until it comes to grass. . . . . .

"Now, the secretion of milk is in some respect a matter of habit or education, and should be promoted and kept up from its first flow. This cannot be accomplished upon hay alone, since the cow cannot be induced to consume the quantity necessary for her maintenance and a full yield of milk of good quality. This will be made evident by comparing the constituents of milk and those of ordinary meadow hay. Suppose the cow is yielding but eight quarts or twenty pounds of milk per day; this will contain a little over two and a-half pounds of dry materials, as follows:—

Of Casein	1·000 lbs.
" Butter	0·625 "
" Sugar	0·875 "
" Phosphate of lime	0·045 "
Other mineral ingredients	0·055 "
Total	2·600 lbs.

"Now, the same amount or twenty pounds of dry hay contain of albuminous matter, fibrine and casein, &c., say about 1·85; oil, butter, &c., say 5·36.

"So it will be seen that this quantity of hay (considering that a part of the nutritive matter is not assimilated and passes off in the excrement) will be mostly needed for the manufacture of the milk alone, while a like quantity, and more, must be used for her maintenance. Experience, as well as science, amply demonstrates the fact that late-cut hay, when used as an exclusve food for milch cows, is insufficient to produce milk rich in quality and large in quantity.

" The most natural and of course the healthiest food for cows in summer is green grass. When cows are giving an extra quantity of milk, and consequently are milking down thin and poor, it will be advisable to give concentrated food.

" When cows are first turned to grass in spring, if feed is abundant, they should not be allowed in the pasture but a few hours each day, for several days. The change of food should be gradual."

This is also to be guarded against when turning cattle in to aftergrass in the fall.

Salting Milch Cows.—They should have constant access to salt; they will take just enough to keep up their appetite and general health.

The common practice of salting at certain intervals is a bad one, for the cattle are themselves the best judges of when they require a lick at the salt, and if deprived of it at one time are apt to devour it too greedily when it is supplied.

Salt is necessary to milch cows: it is an important element in the constitution not only of blood, but furnishes the soda necessary to hold the cheesy portion of milk in solution.

Haidlin found, in the analysis of one thousand pounds of milk, nearly half a pound of free soda and over a third of a pound of chloride of sodium (common salt), and also one and three-quarter pounds of chloride of potassium. Pasture in the spring is deficient in saline matter. Salt should be certainly supplied at that season.

X. A. Willard tells us that, from actual experiments made, it has been found that in May and June, when milch cows have been deprived of salt for several days, the milk shrunk from *two to four per cent.* in quality.

Water for Cows.—No cow can keep up a good flow of milk without abundance of pure water. We have all observed the rapid decrease of milk when the weather has been hot or water scarce. Of milk no less than 87 parts in every 100 are water.

It is held by many that the quantity of drink taken by a cow is an excellent test of her worth as a milker. It must also be noticed in this connection, that as water enters so largely into the composition, any taint in the water will affect the quality of the milk to a very great extent.

M. Dancel, in his communications to the French Academy of Sciences, asserts that " by inciting cows to drink large quantities of water, the quantity of milk produced by them can be increased several quarts per day without materially injuring its quality."

Fall Feeding.—There is no season of the year when it is more essential that the feeding of milking cows be carefully attended to, especially of such as it is desired to continue in milk through the winter months.

Fall pastures are very apt to become stringy, bitter and unpleasant to the taste of cattle, and milk is sure to fall off if feed be not liberally given. Should the production of milk be allowed to fall off to any extent in the late autumn months, it will be found impossible to raise the flow again when once winter feeding has fairly commenced. A little bran or meal should be given daily to cows at this season, or even a small quantity of whole grain, such as corn, peas or oats. They should also be sheltered at night, or at least sheds should be at hand into which they may go in cold rain or early snow storms; and during the heavy white frosts that occur in the fall, or out of the cold north-easterly blasts which herald the approaching winter.

Milking cows are peculiarly susceptible to the bad effects of cold and wet, and such effects are invariably first perceived in the decrease of the flow of milk. The flow must be kept up if we would make our cows profitable machines. As well half feed a cow for no milk as run an engine with no paying freight behind it.

Moreover, fall frosts very materially injure the quality of grass.

COWS IN WINTER QUARTERS.

Cows should go into winter quarters in good thrifty condition. If poor in order and in milk at that season, they will remain so throughout the winter. When put up in good order, it is a simple matter to keep them well through the winter, and the supply of butter and milk will then come in at a time when its market value is invariably high.

Before leaving the subject of food we would say a word on

The use of Concentrated Foods.—Great care must be exercised in the feeding of meal and such strong food, which is not a natural diet to the animal; but, on the other hand, if hay and natural fodder is poor, the elements required must be made up by the use of strong materials.

Shelter is an important object to be ever kept in view in the management of animals, and of none more especially than in the case of such as are in milk. A certain amount of animal heat must be kept up in all living bodies. Any exposure to bleak winds or cold rain and snow storms has a tendency to destroy animal heat, and it must be restored by the application of extra feed. If by shelter we can save the animal heat from loss, then do we also save the use of so much food, and food has a distinct money value.

The usual estimation is that animals well and warmly housed in such a climate as ours will come out of winter in better condition and on two-thirds of the food consumed by cattle remaining without shelter. Thus by "housing" we save $33\frac{1}{3}$ per cent. of all the food stored in the barn—a very large amount where many head of stock are wintered.

Whilst attending to warmth, we must never neglect *good ventilation*, for a cow requires 956 cubic feet of fresh air daily.

Exercise.—Milk cows do not require much exercise, nor in the summer time will they voluntarily take more than is necessary to gather their daily feed, but a certain amount is necessary to the general health of the animal. For this reason we have invariably made a rule of turning our cattle out *every day* in winter (unless may be upon some that were exceptionally stormy) for some hours, according as the day has been bright and sunny or otherwise.

These are all matters of common sense, gained by a careful observation of the animal's own instinctive likings. That cows like to be let out on a winter's day, none can doubt who has ever loosed them from their fastenings; while no matter how short has been the time that they have exercised, they are ready to come back to their stalls immediately the door is again opened.

The Proper Age for Breeding.—This depends upon circumstances; but even with the Shorthorns, which mature very early, were they allowed to run until they were two and a-half to three years of age, they would become larger, finer, and more valuable, while their progeny would undoubtedly be larger and stronger. The custom, which at one time was very prevalent, and which we regret is not yet obsolete, of putting the heifer at one year old, is one fatal to the development of superior stock.

At an age when all the food is required for the formation and growth of the mother's frame, a sufficient nutrition cannot be afforded to the "fœtus," and the result is injury to the young and to the mother as well.

From two to two and a-half years old is the best age for putting to the bull. If the heifer is allowed to go over three years old, the animal gets in such high condition that there is often difficulty and uncertainty as to her becoming pregnant. If the first calf comes at too early an age, there will be danger from the mother not having attained her full growth; if at too late a period, there will be risk of fever to the heifer.

The same age applies to the use of the bull; he should never be used before he is two years old.

Treatment before Calving.—We must remember that the cow in calf has not only to yield milk for her master, but also to supply food to the "fœtus" within her. Her food must therefore be plentiful and generous; increasing in strength and quantity as she approaches her time of parturition. The chief point to be carefully kept in view in the treatment of cows in calf is, *never to allow them to become costive*, and this is best effected by liberal allowance of succulent food.

A moderately open state of the bowels is most important at the time of parturition in the cow. During the whole time of pregnancy her enormous stomachs sufficiently press upon and confine the womb; and that pressure may be productive of injurious or fatal consequences, if at this period the rumen is suffered to be distended by innutritious food, or the manyplus takes on that hardened state to which it is occasionally subject.

We shall speak more fully on the subject of Parturition in a future chapter devoted to Diseases, &c., of Stock.

Milking.—X. A. Willard says:—

"Farmers generally have the impression that when milch cows have wintered well, and are fairly out to grass, there need be little care or attention given to the animals, and that then in their herds they have a fountain that is to supply good pure milk simply by drawing it, not much matter how or when.

"It is true, people understand that when cows are milked with great irregularity, or are subject to any extraordinarily brutal treatment, such as sundry kicks in the udder with a heavy boot, they will yield unprofitable results, since the consequence of such management forces itself almost immediately upon the attention. But it is not those things that come so plainly under the eye of the observer, concerning which I propose to speak. If an angry man kicks his cow in the udder, probably some of the blood-vessels of the part will be ruptured, and the bloody milk which flows from the teats will speak more forcibly than any words of mine; but if he kicks her in the ribs or mauls her with the milking-stool upon the hips and back, the consequences may not be so immediately apparent, yet that damage has been done, and that loss will follow, are equally certain.

"I am speaking of no exceptional cases, but of such as are of common occurrence wherever any considerable herd is kept, and where the eye of the master is not sharp enough to detect and punish these offences.

"A rap upon the spine with the stool has ruined many a valuable beast; a stroke upon the udder has often produced unaccountable cases of garget.

"I wish it could be generally and thoroughly understood that nothing pays better in the dairy than kindness and gentleness to stock. Milch cows should be kept as quiet and comfortable as possible, and no person should be employed in milking that the animals fear. Any undue nervous excitement not only lessens the quantity but depreciates the quality of the milk.

"The hours of milking should be regular, and each cow should be milked in its regular order.

"The milk should be drawn rapidly, and to the last drop; and all loud talking, singing and wrangling avoided. These are little things in themselves, and may seem to many to be 'over nice,' but repeated and well-conducted experiments have convinced me that they are important points to be attended to, and must be observed to obtain the best results.

"In driving cattle from the pasture to the stable they should never be hurried faster than a walk.

"Good cows have well-filled udders, which make it painful to move over the ground faster than at a walk. Besides, in warm weather, by hurrying the animal there is always danger of overheating her blood and milk, and thus not only injuring it, but all the other milk with which it comes in contact.

"Dogs should never be allowed in a dairy. They are a source of infinite mischief. In all my observations I have never yet met with a first-class dairy of cheese where the cows were dogged from the pasture to the stable.

"Some people are in the habit, when first sitting down to milk, of drawing a little milk to wet their hands and the teat of the cow. It is not a cleanly habit, and should always be avoided.

"Some persons have the impression that milk in some way purifies itself, and that taints imparted to the milk cannot be carried into the butter and cheese. Such ideas are very erroneous.

"*Cows do not milk any easier with wet than with dry hands.* If the udder or teats are muddy or covered with filth, they should be washed with clean water and wiped dry. Then milk with dry hands, and it will be found easier and pleasanter, even with those who have been accustomed to wetting the hands and teats whilst milking."

On this subject, Professor Dick, of the Edinburgh Veterinary College, says:—

"The operation of milking is performed differently in various parts of the country. In some the dairy-maid dips her hand into a little milk, and by successively stripping the teat between her fingers and thumb, unloads the udder. This plan, however, is attended with the disadvantage of irritating more or less the teat, and rendering it liable to cracks and chops, which are followed by inflammation extending to the rest of the quarter. This accounts for the disease occurring more frequently among the cows under the charge of one milker than it does in those under the charge of another; and as this practice is more common in some parts of the country than in others, it also accounts for the disease being more common in these parts. This plan of milking, where the irritation is not sufficient to excite the extent of inflammation to which I have alluded, frequently produces a horny thickening of the teat, a consequence of the cracks and chops, which renders it more difficult to milk than when in its natural state, and at the same time predisposes to inflammation when any cause occurs to set it up.

"These effects may be, and are, almost entirely avoided by the more scientific plan of milking adopted in other parts of the country, where, instead of drawing down or stripping the teat between the thumb and fingers, as I have stated, the dairy-maid follows more closely the principles which instinct has taught the calf. She first takes a slight hold of the teat with her hand, by which she merely encircles it, then lifts her hand up so as to press the body of the udder upwards, by which the milk escapes into the teat; or if, as is generally the case when some hours have elapsed between milking times, the teat is full, she grasps the teat close to its origin, with her thumb and forefinger, so as to prevent the milk which is in the teat from escaping upwards; then, making the rest of the fingers to close from above downwards in succession, forces out what milk may be contained in the teat through the opening of it. The hand is again pressed up and closed as before, and the milk drawn easily and freely, without the tugging and wrenching inflicted by clumsy milkers."

The following instructions are the rules of a large dairy in Scotland. We recommend our readers to establish the same upon their own farms:—

1. Every cow must be in her stall at the appointed time of milking.

2. Milkers are expected to be on hand at 5.45 A. M. and 5.45 P. M., Sundays excepted, when milking will commence at 6.15 A. M. and 6.15 P. M.

3. Each milker will have charge of a definite number of stalls, and will be held responsible for the thorough milking of every cow occupying them.

4. Gentle words and kind treatment are enjoined. Striking cows with stools, clubs, heavy sticks, &c., will under no circumstances be allowed.

5. In driving the cows to and from pasture, great pains must be taken not to hurry nor run them.

6. When persons have any trouble with their cows, they are expected to report the same to the herdsman.

7. It will be the duty of the herdsman to occasionally inspect the milking of all the cows, and to report the result of his inspection to the superintendent.

Cows Withholding their Milk.—When cows withhold their milk, they are commonly in a dissatisfied state of mind, and therefore anything to draw their attention from this condition answers a good purpose. We have always succeeded by giving them a mess of food to amuse them while the milking is going on,—generally dry meal, so as to keep them long occupied. If they have sucking calves, let them suck at the time of milking. Driving them in a position so that their fore legs will stand on much higher ground than the hind legs, or on lower ground, counteracts the animal's attention, and generally succeeds. It is said that a weight on the small of the animal's back, as a bag of grain, will answer, but we know nothing of its efficacy, nor how heavy it must be.

Milking Kicking Cows.—Cows raised under gentle treatment, and well accustomed when young to handling, will seldom develop any propensity to kicking, *i.e.*, to systematic and vicious kicking, when being milked. The first drawing of the milk from the udder of a heifer is always accompanied by more or less pain to the animal, and usually results in a few lunges and timid kicks. Gentle handling is all that is required in such a case, with sufficient firmness on the part of the milker to show that he is determined to empty the bag. Time and gentle handling will rapidly accustom the heifer to being milked, when, far from showing an inclination to be obstreperous, she will find relief and pleasure in the operation. But as some heifers, perchance from careless handling on the part of the attendant, great soreness about the teats, or a habit formed, become bad kickers, it behoves us to use some strong remedy by which to master the animal. Whipping will never be of any avail. When kindness fails, one plan is to strap up the fore leg; this will often stop her, as she thinks that she cannot kick without falling when standing on two legs.

A more severe remedy, and one that we ourselves have always found effectual, is to pass a girth or rope round the body, just in front of the bag and over the hips, and draw it tight.

After a time the strap need not be tightened up, but only laid across her back, to make her cognizant of the fact that it is there.

The setting of the head firmly against the flank, close up to the hind leg, will often, with a steady pressure into the flank, stop a cow from kicking.

G. W. Jackson gives his experience with a kicking cow to the columns of the *Country Gentleman*. After trying all the ordinary plans with an inveterately vicious kicker, he says :—

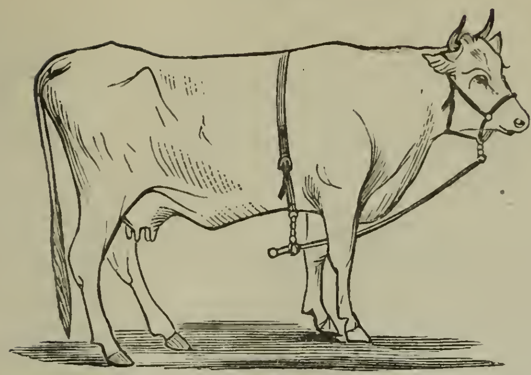
"Finally, I made a milking stall by putting up scantling two and a-half feet from the wall, the cellar wall answering for one side of the stall. I made the stall eight feet in length—if the cow is small, it should be shorter. Board up in front, so that the cow cannot get out; put up three scantlings, and leave a place on the right side of the cow to milk, so that a person can milk with ease. Board up the side, drive in the cow, and put up a bar behind to keep her from backing out. Then drive a stake in the ground about two feet behind the cow, buckle a strap around her right hind leg just above the hoof, pull her foot back about one foot, and tie it to the stake; then you can milk without being kicked or hooked. If this will keep any person from getting a broken nose, I shall think myself well paid for writing it."

Cows Sucking Themselves.—Some cows have a very awkward habit of reaching the head round and sucking themselves.

The following plans for prevention of this habit have been recommended :—

"Put on the cow a good leather head-halter with several links of chain in the tie ring; and a web surcingle with some links hang-

Fig. 26.



ing from the middle under the belly, ending with a ring. Make a smooth ash pole as thick as a hay-fork handle, having a little curve, with a snap at one end, which is secured to the bit of chain on the halter. The other end passes between her fore legs and through the ring which is suspended from the surcingle. The pole should be long enough to allow her to extend her neck and head without pulling it out of the ring; but as a further precaution, a strip of leather may be wound around the lower end, and nailed so as to form a slight knob too large to pass through the ring. The harness does not interfere with grazing, lying down or getting up, but *she cannot* suck herself.

"T. J. H."

Another farmer says:—

"Any one who has carefully noticed a calf while sucking has observed that the tongue is extended an inch more or less beyond the front teeth, to envelop the teat on the under side. Now, any device which will render it impossible for the cow thus to extend the tongue beyond the front teeth, it is obvious, will make it impossible for the cow to take her own milk; and this the bridle bit will do most effectually, if secured in the mouth by a small strap buckled over the head, back of the horns, as the back part of the tongue is so thick that the tongue cannot be extended under the bridle bit while the mouth is closed, which it must be nearly in the act of sucking. The bit does not in the least interfere with the operations of eating or chewing the cud, or of licking herself, as this act is performed with the mouth open sufficiently wide to allow the tongue to be extended out of the mouth under the bit."

A good, simple, and cheap arrangement to prevent cows from sucking themselves, or each other, may be made by making a halter as follows: Take two or three straps two inches wide, and long enough to reach around the cow's nose. Stitch the edges together, and the ends also, with sharp nails inserted every one and a-half inches, so that the points will stand outward. The heads of the nails should be very large, and should be between the two straps when sewed together. Now fasten two side straps, with a buckle on one end of one, so that when the part with the nails is around the nose, the side straps may be buckled together over the head, back of the horns; the part around the nose should be large enough to allow the animal to eat freely.

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MILK—ITS PROPERTIES, ETC.

Bossingault found on analysing the first milk that it contained in one hundred parts, for the first eight or ten days after calving, about four times as much caseine as in ordinary milk.

Voelcker's analyses of four samples of new milk show the proportionate constituents in one hundred parts to be—

Water		83·90 parts
Butter	from	7·62 to 1·99 parts.
Caseine	"	3·66 to 2·94 "
Milk sugar	"	4·46 to 5·12 "
Mineral matter	"	·64 to 1·13 "

Making dry matters to vary from 16·10 to 10·05 per one hundred parts.

All analyses show an immense variation in all the constituent parts of various samples of milk, dependent not only upon the different breeds, but also upon food.

The average quantities are stated to be, by X. A. Willard :—

Water	87·40
Butter	3·43
Caseine	3·12
Milk sugar	5·12
Mineral matter	·93
	100·00

Professor Voelcker, in papers prepared a few years ago for the Royal Agricultural Society, England, gives us the following compositions of milk drawn from cows, and we subjoin his remarks immediately following :—

"COMPOSITION OF NEW MILK.

	No. 1. Milk Analysed October 21, 1860.	No. 2. Milk Analysed Nov. 29, 1860.	No. 3. Milk Analysed Sept. 18, 1860.	No. 4. Milk Analysed August 7, 1860.	No. 5. Milk Analysed Sept. 6, 1860. (Morning's milk.)	No. 6. Milk Analysed Sept. 6, 1860. (Evening's milk.)
Water	83·90	85·20	86·65	87·40	89·95	90·70
Butter	7·62	4·96	3·99	3·43	1·99	1·79
Caseine	3·31	3·66	3·47	3·12	2·94	2·81
Milk sugar	4·46	5·05	5·11	5·12	4·48	4·04
Mineral matter (ash)	·71	1·13	·78	·93	·64	·66
	100·00	100·00	100·00	100·00	100·00	100·00
Percentage of dry matters	16·10	14·80	13·35	12·60	10·05	9·30

"I have selected these analyses from a considerable number made in my laboratory. They strikingly illustrate the great differences that exist in the quality of new milk. It might readily be imagined that milk such as that which I examined on the 6th September, containing 90½ per cent. of water, had either been diluted with water or at least produced by cows fed on mangold tops, distillery wash or similar food. Such, however, was not the case. The cows which yielded this poor milk were out at pasture, and every precaution was taken to get a fair average of the milkings from some eight or ten cows. The milk was received by me almost immediately after it had left the udder, and I can thus vouch for its being genuine, and, in its watery condition, natural. The pasture, however, was poor and overstocked, so that the daily growth of grass furnished hardly enough food to meet the daily waste to which the animal frame is subject, and was thus not calculated to meet an extra demand of materials for the formation of butter and curd. The milk consequently became not merely deficient in quantity, but also poor in quality.

"It is well, then, to bear in mind that an insufficient quantity of food in the case before us caused the supply of milk to be small and unusually poor. This analysis illustrates and confirms a principle generally recognized by good dairy farmers, that it is bad policy to keep more cows than can be liberally supplied with food. The evening's milk on the 6th of September, it will be noticed, contained about three-fourths per cent. more water and somewhat less caseine and butter than the morning's milk of the same cows on the same day. From this and other instances some may be disposed to infer that the morning's milk is generally richer than the evening's milk—a view which I myself was disposed to adopt until a larger range of experiments proved to me its inaccuracy.

"The mineral matters of which we have made mention in all the above analyses are composed chiefly of phosphates of lime and magnesia, chlorides of potassium and of sodium and free soda."

QUALITY OF MILK—HOW AFFECTED ?

In answer to this, Mr. Willard's statement is :—

"By the age of the animal, as well as by the distance from the time of calving.

"Now, as to the milk of aged cows, the general impression is that the milk of old cows is quite as good or even better than that of young cows.

"Hence the almost universal practice among dairymen is to retain old cows upon the farm, and if no accident occurs on account of which their milk fails, they are kept in the dairy until quite worn out with old age, and are then turned off—but little better than old skeletons of hides and bones—at from six to ten dollars a head. In England I found a very different practice prevailed. When milch cows have attained an age of from six to eight years, they are put in condition for the shambles and sold. A good profit is thus realized on the animals for meat, irrespective of what they may have made in the dairy. They hold that the milk of old cows is inferior in quality to that of young cows, and chemical analysis, it seems, confirms this opinion. Again, as old cows consume more food than young ones, and are therefore more expensive to feed, nothing appears so unprofitable as to keep cows until they grow old."

Voelcker affirms that "after the fourth or fifth calf, generally speaking, the milk becomes poorer. . . . . If turned into beef at seven or eight years old, there will be little or no loss; but if kept for four years longer and sold for ten dollars, the loss on first cost of the animal is some sixty dollars, or fifteen dollars per year."

What are the Strippings?— . . . . "Now, cream being lighter than milk, the denser or heavier portions of the milk is drawn first from the udder, while the lighter parts, rich in butter, remain back, and make up what is known among dairymen as 'strippings.' It will be seen, then, how important it is that the last drop of milk in the udder should be drawn while milking, and that when particular attention is not given to this point the loss is much more serious than a waste of the same quantity of first drawn milk, for the one is thin cream, while the other is nothing more than plain milk. There is another loss of course in not milking clean, as it has a tendency to dry up the cow, or lessen the secretion of milk from day to day."

MILK WILL BE TAINTED BY COWS INHALING BAD ODOURS.

It has been fairly established that the milk is affected by taint when cows are at pasture near where there is carrion or other decayed matter, and the taint will be carried right through into the milk pail, and from thence to both butter and cheese. Dozens of cases of this might be cited, but we content ourselves with again advising every farmer who keeps milch cows (and who does not?) to invest in Mr. X. A. Willard's excellent work on "Practical Dairy Husbandry."

We have already complete analyses of milk; we now set down the composition of *cheese* (American), by Voelcker :—

	No. 1.	No. 2.	No. 3.	No. 4.
Water	27·29	33·04	31·01	38·24
Butter	35·41	33·38	30·90	26·05
* Caseine	25·87	27·37	26·25	26·81
Milk sugar, lactic acid and extractive matters	6·21	2·82	7·43	3·64
† Mineral matters (ash)	5·22	3·39	4·41	5·26
	100·00	100·00	100·00	100·00
* Containing nitrogen	4.14	4·38	4·20	4·29
† Containing common salt	1·97	·47	1·59	1·94

COMPOSITION OF SKIM-MILK CHEESE.

(Voelcker.)

	No. 1.	No. 2.	No. 3.	No. 4.
Water	27·68	39·43	38·39	43·87
Butter	30·80	27·08	23·21	15·89
* Caseine	35·12	30·37	28·37	28·93
Milk sugar, lactic acid and extractive matters	1·46	·22	6·80	6·47
† Mineral matters (ash)	4·94	2·90	3·23	4·84
	100·00	100·00	100·00	100·00
* Containing nitrogen	5·62	4·86	4·54	4·63
† Containing common salt	1·27	·23	·33	1·66

So little cheese is made at home in Canada that we do not feel justified in devoting any of our pages to the manufacture of cheese. It is a subject to which justice cannot be done under very many pages, and we would rather, therefore, refer our readers to such works as that from which we have already made copious extracts, for fuller information upon the subject.

We conclude with an analysis of the composition of whey, from which our readers will perceive that its qualities as food are not by any means to be despised. The analysis is made in the same terms as that of butter and cheese—from samples.

	No. 1.	No. 2.	No. 3.	No. 4.
Water	92·95	92·65	92·60	92·75
Butter (pure fatty matters)	·65	·68	·55	·39
* Nitrogenous substances (caseine & albumen)	1 20	·81	·96	·87
† Milk sugar and lactic acid	4·55	5·28	5·08	5·13
Mineral matter (ash)	·65	·58	·81	·86
	100·00	100·00	100·00	100·00
* Containing nitrogen	·19	·13	·15	·14
† Containing free lactic acid	·48	·41	·36	·41

Raising Calves.—There are two distinct ways of raising a calf: we don't mean here, well or badly, but by hand or by the natural use of its mother's milk. There can be no doubt that the latter plan is the best for the calf, for it is nature's way, and in such matters nature can never stultify herself; but whether for the farmer looking to the question of profit this is the better plan, is open to strong doubt, and yet even doubtfulness on this point must be entirely governed by circumstances.

If the reader is one who is raising thorough-bred and high-priced fancy stock, the amount of butter or cheese lost in allowing the calf to suck its mother is as nothing in the balance with the value of any increase in the beauty, shape and size of the calf.

But for the ordinary stock, such as are generally raised by the farmer for general purposes, we, having tried both plans, are of opinion that the calf *should never see its mother*, and our reasons are briefly as follow :—

1st. Neither the calf nor its mother will fret much if they are separated immediately after birth. Science and nature tell us that the matter which the cow licks from the body of the calf is medicinal, and beneficial to her after parturition.

This is undoubtedly true, yet by giving the cow a good warm gruel, we have found that she is as certain to do well as after taking nature's medicine ; and if we permit the calf to remain for its mother to clean, or to obtain one draught from her teats, the worry and vexatious pining of the cow, when her young one is removed, is so much more keen as fully to compensate, in doing her harm, for the medicinal benefits gained by her in the licking of the calf.

Calves that have sucked at the mother for say eight or ten weeks, usually lose three or four weeks' growth in the process of weaning ; whilst the cow, in the worry and excitement of losing her calf after so long a knowledge of it, takes a very long time to become reconciled, loses much in flesh, while she is sure to go off very materially in her flow of milk.

The punching of the calf is very apt to make sore teats on a cow, so that breaking her in to milk becomes a far more difficult process.

Of course we must not be understood as laying down an universal rule, for there are cases when it becomes advisable to leave the calf a short time with its mother ; as, for instance, when the bag is very hard and baked after calving, nothing is so effectual for softening it and promoting the ready flow of milk as this very punching and chafing of the calf.

But to return. Calves brought up " by hand" are much more domesticated, less wild and timid, than those which have depended upon their mother for daily food. Rules that apply to domesticated animals undergo a change from such as rule in the case of wild beasts. Sucking is the natural and wild way in which calves are brought up, and applies well to all such cattle as those of Texas, which run almost wild in herds ; but for domesticated animals we must form new rules, for we have already broken through nature's laws in their civilization.

Heifers brought to milking without their calves, turn out more gentle—less given to wildness, kicking, holding up their milk and other bad tricks.

Oxen and cows that have been started " by hand " are more easily carried through the first winter than those that have been allowed to suck. They do not then require to be taught to eat corn meal, swill, &c., &c. These were all fed to them in their babyhood, and they "know the ropes." Indeed it has been urged that bringing up a calf in the way it should go is as important as bringing up a child in like manner—we do not mean important to the world, but to the animal.

With patience and determination a calf may be taught to drink out of the pail without the finger in two or three lessons.

Although the calf is not only foolish but naturally stubborn, yet it will soon succumb to gentle determination on the part of the feeder.

Indeed, it is about as easy in point of time and trouble to feed a calf by hand as to let him in to and remove him from his mother, at stated times, as is the proper custom under the other plan.

These customs, however, can never be regulated by rules ; each man will generally "gang his ain gait." Youatt is very averse to removing the calf at once, and puts it very strongly on a point of cruelty to animals when he says :

"It is a cruel thing to separate the mother from the young so soon. The cow will pine, and will be deprived of that medicine which nature designed for her, in the moisture which hangs about the calf, and the calf will lose that gentle friction and motion which helps to give it the immediate use of all its limbs, and which, in the language of Mr. Barry, increases the languid circulation of the blood, and produces a genial warmth in the half-exhausted and chilled little animal." He further says : "In whatever manner the calf is afterwards to be reared, it should remain with the mother a few days after it is dropped, and until the milk can be used in the dairy. The little animal will thus derive the benefit of the first milk, that to which nature has given an aperient property, in order that the black and glutinous fœces which had been accumulating in the intestines during the later months of the fœtal state might be carried off ; moreover, the cow's udder becomes more soft and pliant than it would otherwise be, by the calf being allowed to suck for a time. In the case of young cows especially, the udders of which are generally hard, it is often advisable to allow the calf to suck for a couple of weeks."

The calf should be fed for from ten days to four weeks (according as the farmer is willing to sacrifice butter to stock) on new milk, giving four quarts night and morning, or eight quarts a day.

At about five weeks old, the calf will take another four quarts at noon, or twelve quarts per day (skimmed milk). In changing from new milk to skimmed milk, care should be taken that the milk is at first warm, and it will pay well to add to it some fine-ground oat or pea meal. Cold skimmed milk, immediately on stopping new milk, will assuredly scour a calf badly, and this scouring is very injurious.

We should have mentioned, that calves are very apt to be costive at birth ; this must be carefully watched, and relieved with a dose of sweet oil. Calves are ready to eat grass at from six to eight weeks old; but the skimmed milk and meal should be continued for about three months, when they will thrive well on fodder and sour milk. A good calf should weigh four hundred pounds at ten months old. During the first winter, warmth and generous food, with plenty of succulents, are essentials.

A great mistake often made by farmers is the allowing of calves to run with larger cattle, especially those that are six or ten months (yearlings) older than themselves. Not only do the little fellows get mauled about, but rather than allow them to obtain any food, the older cattle will spoil such fodder as they cannot themselves eat. In this selfishness, yearlings and all cattle are not unlike many of their superiors of the genus *homo.*

The secret of raising stock is never to let them stop growing; crowd them on, gently at first, but more fully as they advance in age.

We have owned many two-year-old heifers which, fed cheaply but regularly, provided with warmth and shelter, tenderly handled at all times, and never interfered with by older stock, have been put to the bull, and before three years old have raised as fine calves and become as large and fully developed mothers as other cattle carelessly attended to have attained with a year's additional growth.

A good grade Durham steer should, under this system, with very little fatting at the last, be worth from sixty to seventy-five dollars as a three-year-old. That the superiority of thorough good beef cattle is recognised by our butchers, we were convinced on a visit to the stables of Mr. Rennie, near Fergus, Ontario. There stood a picture—a white three-year-old Shorthorn grade steer. He weighed twenty-six hundred pounds, was sold for ten cents a pound live weight, when common beef was worth only about five cents, and thus realized two hundred and sixty dollars to his proprietor. Unfortunately, we did not see Mr. Rennie himself, and were unable to get accurate particulars of the cost of raising, but are convinced, from what we learned from the young man who attended us, that the raising of that calf, from birth to maturity, did not cost one-half of what it will take to raise *four of the ordinary sixty dollar steers.*

Killing Heifer Calves.—We look upon this butchery as an abomination, and respectfully ask our farmers to "spare the innocents."

Indeed, why man cannot be content to live upon beef and mutton and pork and game, for meat, we know not. It seems a sinful waste of God's gifts to sacrifice the calf to suit the epicurean tastes of the diners of the world. We suppose it must, however, always be regulated by the knowledge on the part of farmer and butcher that under circumstances "there is money in it."

Our duty, however, calls us, in the design of this book, to touch lightly upon all subjects, to speak shortly on the best foods by which to *fatten a calf*, and we quote an excellent article on this point from the *Rural New Yorker*:—

"It has usually been thought impracticable to fatten a calf properly without giving it fresh milk from the cow. Milk is the best type of food for the young animal, because it possesses all the constituents necessary to build up every part of the system, and in the most soluble and digestible condition. Now, any food containing the requisite constituents, in a soluble condition, easily given in a liquid state, may be substituted for the new milk. Hay tea is sometimes used to bring up a calf. This is the soluble constituents of the hay, obtained by cooking. But the best food to fatten a calf, without whole milk, is oil meal, molasses, and skim milk for the first two weeks, after which a little oat or barley meal may be added. We have often made calves weigh one hundred and twenty to one hundred and forty pounds, at four weeks old, on this food. We have one now that weighs one hundred and twenty-five pounds at that age, never having had any new milk after the second day. Molasses may, perhaps, be considered a new food for this purpose, but, when fully understood, must be regarded as an important one. It is very soluble, and easily assimilated by the young animal. Liebig is of opinion that starchy food is first converted into sugar before being assimilated by the animal. We all know how rapidly sugar enters into the circulation of the system. Sugar is found to take the place of animal fats in cold climates in keeping up the heat of the body. It may be considered as a substitute for the oil of the milk used in making butter. Oil meal is rich in muscle-forming food, and phosphates with some remaining oil. Its constituents are mostly soluble, and easily assimilated as food. Oil meal should be scalded, and allowed to form a thick mucilage before being mixed with the skimmed milk. The molasses may be added directly to the milk, and the whole should be blood-warm when given. The proper quantity for a young calf is a table spoonful of oil meal and the same of molasses, divided into three parts, for one day's feed, added to the refuse milk. At the end of the first week each may be increased, and at ten days a spoonful of molasses and the same of oil meal may be given at each feed. At the commencement of the third week a spoonful of oat or barley meal may be added to each feed, but this should be cooked. This food, together with the skimmed milk of the mother, will make an excellent calf for the butcher at five weeks old. Now, the whole expense of this extra food is not more than one-tenth of the value of the butter made from the milk saved. At present prices it will cost less than one dollar for five weeks; and an early calf of the weight mentioned will bring from ten to fourteen dollars. The molasses may be of the cheapest sort, but there is none better than sorghum for this purpose." *Oil meal is better known as oil cake in Canada.*

How they raise Calves at Hohenheim.—This is in Germany; established in 1818; the father of agricultural colleges, and probably the best conducted in the world.

They raise calves entirely "by hand," and the daily allowance of food is as follows:—

	MILK. lbs.	OATMEAL. lbs.	FINE HAY. lbs.
1st week	12	0	0
2nd "	16	0	0
3rd "	20	0	0
4th "	22	0	0
5th, 6th, and 7th weeks	22	½	½
8th week	21	½	½
9th "	20	1	1
10th "	16	2	3
11th "	12	2	6
12th "	8	2	10
13th "	4	3	10

In the ninth week the milk is first mixed with water, and a little fine oatmeal is stirred in. The meal is afterwards mixed with the dry fodder.

After three months the milk is withheld, and then the young animals receive daily, till two and one-half years old, from twenty to twenty-two pounds of hay or its equivalent. But the calves never after receive, even in summer, any dry food till they are nine months old. The average feeding is so divided that the younger portion receives less, the older more, till two and one-half years, when they begin to receive the regular rations of the older cattle, including the grain fodder as indicated above. The growth with this treatment is such that these animals (not Shorthorns) attain the following weights at various ages:—

	HEIFERS.	BULLS.
Average weight of calves at three months.	233 lbs.	353 lbs.
" " " six months.	351 "	472 "
" " " twelve months	640 "	750 "
" " " two years.	1184 "	1300 "
Daily increase of calves	1·5 "	1·8 "
" " in second year	1·4 "	1·5 "

Oxen.—The method of training steers lies in a nutshell, and can be accomplished by any man who is gentle, without fear of the animals, and, above all, possessed of quiet determination sufficient to tire out the natural stubbornness of the ox:—

"First train them to lead by a rope attached to the horns. Then procure a light yoke and bows, and teach them to stand with them on for a few days until they get used to them. Then take them out and exercise them gently, and with great patience, teaching them the meaning of the terms used in going to the right or left and backing. If they get restive, quiet them with a little salt and some coaxing. Never unyoke them while they are excited; cool them down first. Let the lessons gradually increase in length until they understand their business; then attach a chain, and soon after a small log or other weight may be given them to draw. Working in this manner, they may soon be broken in to do light harrowing or other work not too heavy for them. It would be well if oxen were broken in to the use of a line attached to the horn, and the shouting commonly made use of were abandoned."

Our Shorthorns.—This favourite stock has obtained a strong foothold upon Canadian soil. It is the pride of the farm to show a beast with Durham in him, and the Canadian Shorthorns are becoming well known in Europe.

A residence and acclimation in Canada appears to give hardness and generally improve the constitution and form of the descendants of the Bates, the Booths, the Wallarbys and a dozen other tribes of celebrated English Shorthorns, and of late years we have been *selling thorough-bred Durhams to go to England.* In the present year one of our most celebrated breeders, Mr. Cochrane, of Compton, Quebec, has sold ten Duchess Shorthorns to Lord Dunmore, of Scotland, for no less a figure than *fifty-one thousand dollars, or five thousand one hundred dollars apiece.* We give below a list of some of our most celebrated Canadian breeders of thorough-breds :—

BREEDERS OF SHORTHORN DURHAMS.

Ashworth, Jno., Belmont............Ottawa.
Barker, W. B.. ....St. Thomas, O.
Beattie, Simon...... .. ..Bangor, O.
Bell, Jno. M...........................Atha, P. O., O.
Brown, Hon. Geo., Bow Park.......Brantford, O.
Craig, J. R.............................Edmonton, O.
Christie, Hon. David........ ....Paris, O.
Cochrane, Hon. M. H., Hillhurst....Compton, Q.
Dunkin, Hon. C.........................Ottawa.
Greig, Major............................Beachville, O.
Haskett, T. R . ...St. Thomas, O.
Isaac, Geo...............................Haldimand Plains, O.
Kirby, Jos................................Milton, O.
Miller, Geo., Riggfoot.................Markham, O.
Miller, Jno. (Jr.)....... ....Markham, O.
Miller, Jno...............................Brougham, O.
Mills, R. P...............................St. Thomas, O.
Snell, Messrs., Willow Lodge.........Edmonton, O.
Stone, F. W., Moreton Lodge.......Guelph, O.

Taylor, Col. J. B. ....London, O.
Thompson, W.... ....Markham, O.
Thompson, J. S.......... ....Whitby, O.
White, Jno., M.P........ ....Milton, O.
Whitson, Jas...............................Atha, P. O., O.
Wood, Geo.................................Stratford, O.

BREEDERS OF DEVONS.

Foley, R...................................Bowmanville, O.
Mann, Geo .... " "
Peters, W. J...............................London, O.
Pincombe, J.................. ....Bowmanville, O.
Rudd, Geo............ ....Guelph, O.
Whetter, R.................... .... London, O.

BREEDER OF HEREFORDS.

Stone, F. W., Moreton Lodge........Guelph, O.

BREEDERS OF AYRSHIRES.

Abbott, Hon J. J. C....................Montreal, Q.
Gibbs, Jno. L., Sunny Braes.........Compton, Q.
Lawrie, Jas...... . ...Malvern, O.
Logan, Jas.................................Montreal, Q.
Patton, J...................... ....Scarborough, O.
Wallbridge, A. H........................Belleville, O.
Wheeler, Messrs..........................Scarborough, O.
Whitney, N. S.............................Montreal, Q.

BREEDERS OF GALLOWAYS.

Hood, W....................................Guelph, O.
Kerr, Jno....... ....London, O.
McNeil, A..................................Vaughan, O.
McRae, T...................................Guelph, O.
Nichol, Jno.................................London, O.

Overfeeding for Exhibition.—The chief aim of breeders seems to be to outdo each other in so fatting up their thorough-breds as to hide the real points of breeding, by rendering the animals unshapely in the extreme by superabundance of fat, no matter what the cost, thus overlooking the most important and profitable argument advanced by the advocates of breed—the production of animals which give the maximum of meat at the smallest cost.

We would not reflect upon the judges; they have simply fallen in with a system, but this system has the most pernicious result.

In the words of a well-known breeder who resides near Guelph, "*Leicestriensis*"—"Does it not seem *senseless in the extreme* that after an experienced breeder has been to an enormous expense in importing first-class breeding animals, he should, by injudicious treatment of them, destroy their procreativeness, and thereby render them utterly useless for the very purpose for which they were imported?"

Many of our best breeders will not send their stock to our shows for this reason:—

Inferior animals are exhibited, many of whose bad points are hidden in fat; and again, our best men are determined not to destroy the constitution of their animals, and injure their power of procreation, by showing breeding stock dressed up in fat fit to become Christmas beef.

Surely it would be better that cattle of equal age, fed and stalled at the same time, should be brought before competent judges, to determine the *best frame* for putting meat and fat upon—the *frame* which would be most productive of profit to the producer and of eligible food for the consumer.

It is the *frame and constitution* that we wish to transmit to our herds when we pay fancy prices for thorough-bred animals. The *fat-producing qualities*—not the fat itself.

Prizes should be invariably awarded to the "best framed" animals; and good frames do not show to advantage under layers and rolls of fat.

We have been glad to see at our late large fairs, both at home and across the line, a step has been made towards discarding over-fed animals from the pens in which are shown breeding stock. May it prosper until judgment is given upon "frames" alone.

SHEEP.

The sheep is found in every part of the world. They are providers of clothing and meat, and in many parts also of milk.

The calling of the shepherd has from time immemorial been conspicuous, and not wanting in dignity and importance. Abel was a keeper of sheep; as were Abraham and his descendants, as well as most of the ancient patriarchs. Job possessed fourteen thousand sheep. Rachel, the favoured mother of the Jewish race, "came with her father's sheep, for she kept them." The seven daughters of the priest of Midian "came and drew water for their father's flocks."

Moses, the statesman and lawgiver, "learned in all the wisdom of the Egyptians," busied himself in attending the flocks of Jethro, his father-in-law.

David, that sweet singer of Israel, and its destined monarch—the Jewish hero, poet and divine—was a keeper of sheep.

To shepherds abiding in the field, keeping watch over their flocks by night, came the glad tidings of a Saviour's birth. The Hebrew term for sheep is significant of fruitfulness, abundance, plenty—indicative of the blessings which they were destined to confer upon the human family.

In the Holy Scriptures this animal is the chosen symbol of purity and of the gentler virtues—the victim of propitiatory sacrifices, and the type of redemption to fallen man.

Among profane writers, Homer and Hesiod, Virgil and Theocritus, introduce them in pastoral themes; whilst their heroes and demigods, Hercules and Ulysses, Æneas and Numa, carefully perpetuate them in their domains.

In North America we have a native breed from the Rocky Mountains, called by our hunters the *Bighorns.* They are great climbers, hardy and active, and in their habits more resemble the goat. In summer they are found single, but when travelling in lower and warmer parts for the winter months, they march in flocks.

The breeds cultivated on our Canadian homes are all imported European varieties.

Amongst the short-wools we have the Spanish and Saxon Merinos and the Southdown; and for long-wooled sheep we raise Leicesters, Cotswolds and Lincolns.

The Spanish Merino.—The wool lies thick, short, and close to the body, being abundant in yolk or oil; is matted closely together, and is covered with a dirty crust, often full of cracks. Legs long but small in bone, breast and back narrow, sides somewhat flat, fore-shoulders and bosoms are heavy, and the ugliness of the animal is caused by all the weight being carried on the coarser parts, and by the nature and appearance of the wool. Some are horned and some are not. They are small sheep, and, when fatted, make from twelve to sixteen pounds per quarter.

The advantages of the merino consist in the fineness and felting property of their wool; also, the closeness of their fleece and the large amount of yolk enables them to support extremes of cold and heat, and they will feed and thrive upon very coarse pastures.

Leicesters.—The old or unimproved Leicester was a large, heavy, coarse-wooled sheep, a habitant of the midland shires of England—a slow feeder, coarse in wool and in meat, but a heavy shearer. Its value in those days lay altogether in the quantity rather than the quality of its wool.

Robert Bakewell, of Dishley, in Leicestershire, and after him many eminent breeders, applied themselves to the improvement of this breed by reducing the size of the bone and fining down the texture of the wool. It is now at the head of the long-wooled breeds, is valuable for the quantity of meat that it produces, but far inferior to smaller breeds in the flavour and quality of its mutton.

The Southdown is a native of the chalky hills all along the south-western and west-southern coasts of England, extending northward to Norfolk and westward to Eastbourne.

It is probable that originally the Downs were horned sheep, as occasionally a horned ram crops up among them, but they are now usually polled.

Of black legs and medium size, the quality of the Southdown cannot be surpassed by any breed for mutton, and is only equalled by one, namely, the mountain sheep of Wales. Its wool, though ranked in the short, might, in point of length, well belong to a middle class. For mutton the Southdown is eminently adapted, maturing early, and possessing extreme aptitude to lay on fat; it is killed at two years of age, when, in England, it will run from twenty to twenty-five pounds to the quarter, whilst thirty to forty pounds to the quarter have been often on record.

It is a very hardy sheep, and loves high, dry and close pasturage, whilst it stands our Canadian climate better than any other kind of sheep.

The Cotswolds, natives of and named after a range of hills in Gloucestershire, in the west of England, differ from the Leicester in their superior hardiness and better adaptability to our soil, food and climate. They are also very prolific and splendid mothers, being supplied with a great flow of milk.

A cross of the old Cotswolds with the Leicesters has produced the present breed of improved Cotswolds.

The wethers may, in this climate, with ease be fatted to thirty and forty pounds to the quarter. The mutton is superior to that of the Leicester, having less tallow, and with a better development of muscle and flesh, but is far inferior to that of the Down.

The Lincolns are another phase of modern improvement upon an old breed.

The present Lincolns are robust in health, though somewhat coarse in wool and mutton; they are hardy, and yield a great amount of wool; they are prolific and good mothers, generally capable of supplying plenty of milk to two lambs.

Age of Sheep by their Teeth.—The age of sheep is commonly counted from the period of their first shearing, instead of the time at which the lamb was dropped, and may be known, like that of cattle, by the appearance of the teeth in the lower jaw, the upper jaw being without any in the front.

During the first year they are all of small size, but when from fourteen to sixteen months old, they renew the first two (or centre ones), and two more every year until the fourth shearing, at which time they have " a full mouth."

The *natural age* of a sheep is about nine or ten years, but their teeth begin to fail in the sixth and seventh years, and they become what is technically termed "broken-mouthed." As their power of mastication is from this date greatly impaired, it is usually poor economy to fit them for mutton later than six years of age.

Sheep were originally clothed with long hair, underneath which and next the skin was found, and is yet found in the sheep in those countries over which the Israelitish races wandered, a close mat of short, crisp wool. This is now the appearance of the covering of the Cape of Good Hope sheep and of the flocks of South America.

The change from hair to wool, influenced doubtless somewhat by peculiarities of climate, is yet chiefly due to civilization and cultivation.

If sheep be badly neglected, it will be observed that the tendency of their wool is to go *back* to a half-hairy condition.

The yolk, which is simply an insensible perspiration, keeps the wool soft, oily and strong. Where there is a deficiency of this substance the wool is dry and harsh and brittle. The quantity of this oily matter differs in various kinds of sheep, the Merino having in their wool the greatest proportion.

It is found in the greatest abundance about the neck and shoulders, and the texture and quality of the fleece is improved in proportion as this yolk soaks to a greater or less degree into other parts of the wool.

The chemical analysis of the yolk has established its composition as of carbonate of potash, acetate of potash, lime, muriate of potash, and animal oil—all forming a substance of a purely soapy nature, which accounts for the ease with which wool is washed white when upon the sheep's back.

Fine or coarse wools are regulated by the size of the fibre; but these terms, as commonly used, are vague, for all fine fleeces have some coarse wool, and all coarse fleeces some fine.

"The most accurate classification is to distinguish the various qualities of wool in the order in which they are esteemed and preferred by the manufacturer, as the following: first, fineness with close ground, that is, thick matted ground; second, pureness; third, straight-haired, when broken by drawing; fourth, elasticity, rising after compression in the hand; fifth, staple not too long; sixth, colour; seventh, what coarse exists to be very coarse; eighth, tenacity; and ninth, not much pitch-mark, though this is no disadvantage, except the loss of weight in scouring. The bad or disagreeable properties are: thin grounded, tossy, curly-haired, and, if in a sorted state, little in it that is fine; a tender staple, many dead white hairs, very yolky."

Breeding.—No one breed of sheep can combine all good qualities in itself. One is remarkable for its weight, early maturity or the excellent quality of the mutton, but deficient in quantity or texture of wool; while, on the other hand, a breed may produce heavy fleeces of superior wool, and be unfit to take a place in the market as first-class meat. Some varieties do well in one climate, whilst there no other sort will thrive.

Situation and nature of pasture lands are especially adapted to particular breeds of sheep. There are two essential considerations to be ever kept in view in determining upon any particular breed: *First*, situation of pastures, food and climate; and *second*, the market demand and facilities.

General Principles of Breeding.—The aim of every breeder of animals must ever be to retain by generation any and every variation for the better that may at any time be observed in his live stock. The same remarks apply to the very great advantage of using none but well-bred male stock for sheep, that we made in a former chapter when on the subject of cattle.

It may be observed that the influence of the ram having first fruitful intercourse with the female, is often distinctly marked through many generations. If that influence has been to improve, its effect will be felt through the flock for many years. *In crossing*, there are several objects to be obtained—to raise animals for the butcher or to establish a new breed. It is, however, nearly always advantageous to choose a large female of the breed which it is sought to improve; for instance, the Southdowns have greatly improved the Hampshires, and the Leicesters the ungainly Lincolns and large Cotswolds.

The Use of Rams.—Rams are used from one year old to ten and sometimes over. But a ram at from two to four years old may be considered in his prime. Much depends, however, upon whether rams have been overstocked. We have seen those that have not been allowed to run to too many sheep, sure lamb-getters even when quite aged.

A ram lamb should never be used; the effect upon him will be to stunt his growth, injure his form, and in the majority of cases to seriously impair his usefulness and damp his courage.

For a yearling ram thirty ewes are ample; a two-year-old may serve from forty to fifty; while a three-year-old will run satisfactorily with from fifty to sixty; and, in exceptional cases, rams have been found strong and mature enough to serve from seventy to eighty ewes.

An animal that is impoverished and overtasked cannot transmit faithfully those superior points for which he has been chosen as a sire.

A ram should be carefully selected, not only on his general excellence and blood, but with the distinct view of improving by transmission of some of his own characteristics to the progeny, and in which the ewes are generally deficient.

The general points of excellence in a good flock of sheep are, *strong bone* with a roomy frame, *heavy fleeces of good quality and texture, natural disposition to lay on fat early and quickly,* and *prolific nature.* Any of these characteristics deficient in a flock should be counteracted by the use of a ram with such very fully developed.

One ram and his flock of ewes should always be kept separate to themselves. Two or more rams in a flock incite one another to extra and unnecessary activity, and are sure to fight.

To Mark a Flock.—In order to show which individual ewe the ram has covered, smear his belly with a preparation of Venetian red and hog's lard.

To tell when the ram is ready for work, examine his skin upon the flanks ; if red, the natural desire is upon him. A good ram should serve all his ewes within three weeks. It is better, however, to leave him with them for a full month.

To make a ram serve from one hundred and fifty to two hundred ewes.—Robert Jennings, V.S., says:

" A couple of strong rams, of any quality, for about every hundred ewes, are aproned, their briskets rubbed with Venetian red and hog's lard, and let loose among the ewes.

" *Aproning* is performed by sewing a belt of coarse sacking, broad enough to extend from the fore legs to the hind legs, loosely but strongly round the body. To prevent its slipping forwards or backwards, straps are carried round the breast and back of the breech.

"It should be made perfectly secure, or all the labour of this method of coupling will be far worse than thrown away. The pigment on the brisket should be renewed every two or three days ; and it will be necessary to change the ' teasers,' as these aproned rams are called, about once a week, as they do not long retain their courage under such unnatural circumstances. Twice a day the ewes are brought to yard in front of the hut.

"Those marked on the rump by the teasers are brought into the hut. Each is admitted once to the ram, and then goes out at the opposite end from which she entered, into a field separate from that containing the flock from which she was taken.

" Thus a powerful, vigorous ram, from three to seven years old, may be made to serve from 150 to 200 ewes in a season."

Rams should be fed when on service with grain. The rutting season should be delayed until moderately cold weather in the fall, say November or December ; this will bring in the lambs in April and May.

The ewe goes pregnant about five months, or from 145 days to 165 days.

Lambing.—Pregnant ewes require a generous diet. Pea straw is even better than hay ; while the best division of fodder is pea straw (cut on the green side) twice a day, and good clover hay at one meal.

A few succulent roots and a little grain will increase the secretion of milk.

Too many turnips are injurious, as tending to sour the milk, to the injury of the lamb.

Ewes must not be allowed to become excessively fat, as in such condition abortion is readily brought on.

Abortion is likewise produced by frights from the appearance of dogs and strange objects, long and severe journeys, blows, &c., and more especially by the too prevalent practice of driving, with dogs not properly trained, ewes that are pregnant.

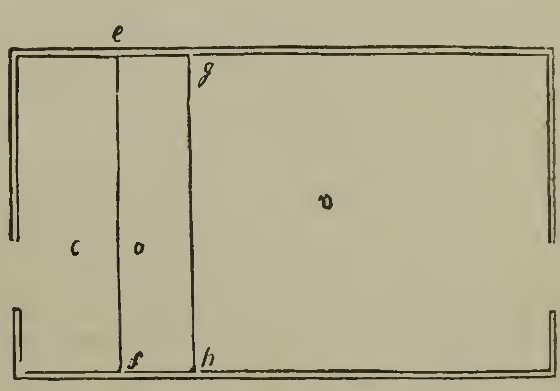
Lambs are usually dropped in Canada during the months of March and April; we think, however, that March is a very bad month in which to time the arrival of lambs.

Given good shelter and accommodation, and we have been more successful with February lambs than with such as came in March. In February there are usually plenty of fine sunny days, and in such weather, if the ewes can be kept in a warm place, well sheltered, lambs will do very well, and be large and fat for the Easter market. Even when lambs are dropped in May, the ewes should be always put in at night, and during rain, or when there is a prevalence of windy and blustering weather.

Should the weather be warm and bright, it is better that lambing should take place in the pastures, since sheep will there get away by themselves, and be disposed to own and take kindly to their own lambs more certainly than when confined in a crowded inclosure.

For ewes that are to lamb very early, or in winter quarters, the following is an excellent arrangement:—

FIG. 28.



In the pen shown, protected and yet well ventilated, *e f* and *g h* are moveable divisions across the pen, and dividing it into three divisions, *a, b, c.* These divisions are moveable, and *e f* and *g h* run on wheels, so that the size of *a, b, c* may be altered at will. In each of *e f* and *g h* there is a door. Now, before any ewes have lambed, the divisions *g h* and *e f* are pushed close to one end of the building, so that the pregnant ewes have the whole pen to run in.

As soon as lambing commences, the ewes are carefully watched, and as each ewe shows the usual signs of labour, the divisions are moved out, so as to make three pens—*a*, *b*, *c*. The ewe is placed in the middle pen, *b*, by herself, or with one or two others ready to lamb, as the case may be ; they are then by themselves when their lambs are dropped, and the lamb is neither separated from its mother, nor knocked about by the crowding of the flock. When the lamb is strong and able to suck fully, it and its mother are removed on to pen *c*. By this process the flocks are divided into three portions : pregnant ewes ; ewes having just lambed, or upon whom are the signs of labour ; and the ewes with their lambs. As the ewes continue to lamb, the pen *a* becomes smaller by the pushing up of the divisions *g h* and *e f*, and the pen *c* becomes larger, until, when all the flock have lambed, the pen is brought back to its original size by the pushing of the divisions over from one side to the other.

The jostling of sheep upon one another is very injurious to ewes in lamb, for which reason the shepherd must always teach his sheep docility, and by gentleness accustom them to his presence.

Enclosures for yeaning must be kept clean ; for when the lamb is dropped it is covered with moisture, and to this in a dirty enclosure so much filth will stick, that the ewe will refuse to lick the body of her lamb, which is nature's method of warming and strengthening the newly-dropped lamb. Neither should too much straw be used for litter, as such may embarrass the young lamb in attempting to rise for the purpose of sucking its mother.

The signs of lambing in the ewe are : enlargement and reddening of the parts under the tail, and a dropping of the flanks. The ewe, immediately before the pains of labour are fully upon her, stretches herself frequently, exhibits great restlessness, separates herself from her companions, constantly lies down and rises up again, as if dissatisfied with her bed ; paws the ground, and bleats as if the lamb were already born and she were looking for it ; and appears very fond of other lambs.

When these symptoms appear, if the sheep be yet in winter quarters, she should be isolated.

When the expulsion of a bag of water takes place from the *vagina*, the pains of labour are fully upon the ewe. While it is well to watch her narrowly now, interference should be carefully avoided. Nature may take some time to effect a birth, but to sheep that have not been frightened or subjected to rough treatment, and have been well kept, mechanical assistance is very rarely needed.

Uncalled-for interference with ewes when lambing, has destroyed more lambs than natural causes.

Interference, when not absolutely necessary, just frightens the ewe, and she ceases her efforts to expel the lamb.

Should it be apparent that the *fœtus* is presented wrong, that is, is not coming away in the natural position—the two fore legs with the head lying between them being presented at the mouth of the *vagina*—mechanical assistance becomes necessary. Let the shepherd oil well his finger and thumb, and whilst the ewe is gently caught and carefully held, push back the lamb and turn it very gently until the nose and fore feet appear.

Sometimes the ewe has not strength enough to expel the fœtus; in such a case aid may be given, *but very gently, and only to help the throes of the dam.* Never take away a lamb by main strength, or, as such work is sometimes called, by the exercise of brute force and stupidity."

The clearing, or *placenta*, which usually comes a few minutes after delivery, should always be taken from the lambing pen and not be allowed to lie there.

Cabbages or *kale* are better food for ewes, just previous to lambing, than turnips, for the latter are fibrous and astringent in the spring, and for this reason are not beneficial to the secretion of sweet milk. A little oil-cake, meal or whole oats will be found very beneficial to ewes before and during lambing.

Management of Lambs.—When the lamb is first dropped, it will be clumsy on its big unwieldy legs: be in no haste to help it to rise—it don't want milk immediately; what it requires is *nature's warmer*, the licking of the ewe. If the attendant interferes too soon, he angers the ewe, and she may even refuse to recognize her lamb, or, as we have often seen, even stamp upon it in her rage.

A lamb that gets at a teat and *sucks for itself*, will learn to take care of itself, and may generally be regarded as safe. If helped, it will continue to expect aid, and will not try for itself for several days.

Never feed with a spoon, but from a bottle with a quill or tube in the cork, because the latter is more like nature.

If a lamb is, however, so weak that assistance becomes necessary, don't throw the mother down, but make the lamb suck in the natural position of the ewe, because instinct teaches the lamb in search of food to point its nose *upwards.* If taught to suck from the bag of the prostrate ewe, the lamb, when strong enough, will be very awkward about finding the teat in its natural position.

If lambs have to be fed by hand, the mothers having no milk, the food should be invariably taken from a *new milch cow.* Don't feed this in its full strength, but mix it half and half with water, and put in enough molasses to give it the purgative effect of the mother's first milk; gently warm to a natural heat; when feeding be careful to make the lamb *suck* from the bottle. Many a lamb has been choked by *pouring milk* down the throat, and the consequent passage of the fluid into the lungs.

If a lamb becomes chilled, wrap it in a woollen or flannel blanket, and place it in a warm room, giving it a little milk, with a trifle of pepper, as soon as it can drink. Don't keep the lamb from its mother longer than possible—a little gentle friction, especially of the extremities, will be found very restorative.

Sometimes, a ewe having a good bag of milk loses her lamb, when it may be required that she should be taught to *suckle a strange lamb.* Skin her dead lamb immediately, and sew the skin on the lamb that she is required to raise. Put her in a moderately dark room; if she is suspicious of it, watch her carefully, and, if necessary, hold her for the lamb to suck. She will soon take to the young impostor, when the covering skin may be removed.

When a ewe has a full bag, and, losing her lamb, no other one is placed to her, the milk must be drawn off by hand once or twice, or the affection known as *garget* will ensue.

After milking, bathe with cold water, which has the effect of checking the secretions of milk, and gradually decrease her supply of succulent and milk-secreting food.

When a young ewe will not stand for her lamb to suck, it is the effect of soreness or hardness of the bag. Let the ewe be caught and held until the lamb has emptied the bag, and there will seldom be any trouble afterwards.

"*Pinning.*"—Young lambs are frequently subject to this trouble. Their first excrements are so adhesive and tenacious that the orifice of the anus becomes completely covered over, and subsequent evacuations prevented. Let the adhering matter be entirely removed, and the part rubbed with a little dry earth (*clay*). We have seen very many lambs perish from a neglect of this precaution.

Weaning should take place at from three and a-half to four months old. When first weaned, the lambs should be put in a field as far distant from the mothers as possible, that their respective bleatings may not be heard.

It is an excellent plan to turn one or two tame old ewes in with the lambs; these teach the young sheep to be docile, to come when called, to find salt when thrown out, and to eat from troughs, &c.

Lambs require *fresh and tender* pasture when first weaned; while the dams should be put for a week or so on short, dry, upland pasture, to stop the flow of milk. The latter should be carefully watched, as the bags of some may require emptying by hand. After once being thoroughly dried, they require to be well fed, to put them in condition for the rutting season.

Castration and Docking.—The object of docking is to keep the sheep, especially ewes, clean behind; since the animal, especially in Canada, being changed from dry fodder to pasture, and from grass to hay or straw, is very apt to purge.

It is usually done when the mothers are washed in the latter part of May, and that is about as good a time as any. It should, however, be carefully done, so that the skin may slip back over the wound. Let the skin be drawn tight back towards the body, while with a chisel and mallet the tail is cut quickly and cleanly off between the bone joints, leaving it from one and a-half to two inches long. By drawing the skin back in this manner, it will, when released from the hand, slip back over the end of the stump, and the healing will soon take place.

An ointment of lard and tar, mixed in the proportions of four pounds of lard to one quart of tar, should be smeared on the wound, in order to keep away flies, and thus prevent the formation of maggots.

Castration.—Some authorities advocate this operation in a day or two after birth, while the majority approve of the age of at least six weeks, when the creature has attained strength and the parts have not yet become too fully developed. We favour the latter plan.

Dry and cool weather should, if possible, be selected—a cool day if possible—and if warm, it should be performed early in the morning. It is a safe and simple operation. Let one man hold the lamb, with its back firmly pressed against his breast and stomach, and all four legs gathered in front and held closely in his hands. The operator then, with a sharp knife, cuts off the bottom of the pouch, frees the testicle from the inclosing membrane, and draws it *steadily* out, when, if the cord does not snap off at the proper distance, he cuts it with his knife. It is well to drop a little salt into the pouch. The end should be lightly smeared with an ointment for the same purpose, and as above recommended for docking.

Feeding.—Sheep purge very easily—for which reason they should not be turned suddenly from dry food to grass—which is best effected by housing them for the first few nights and feeding hay.

Water.—It is commonly thought that sheep require no water. They will, it is true, live without, but a free access to it is very advantageous, especially to ewes giving milk.

Salt is indispensable to the perfect health of sheep. Although it does well to feed it at intervals of, say, once a week, yet it is better that the flock should have constant access to it; they will not take too much; but, rather, will lick just the amount that nature requires, instead of eating it voraciously, as they do when it is served out at stated intervals.

Tar is supposed by breeders to be very healthful. Smeared on the nose it will be licked, and swallowed as the natural heat of the flesh or weather causes it to trickle down over the lips. There is no doubt that, applied to the nose, it will repel the fly, and, to a great extent, prevent what is known as "grub in the head."

Dry, sweet pastures are best adapted for sheep runs.

They will eat any kind of grass, pasturing on what has been rejected by horse and cow; they feed on many a weed that larger animals will not look at, as wild mustard, burrdock, thistles, milkweed, marshmallow, and many other similar plants.

Artificial Pasture.—Rye makes an excellent fall and early spring feed for sheep. Corn sown broadcast, or white mustard—both make an excellent feed for sheep, not only as pasturage, but when cut early for fodder and used in winter quarters.

That *shade* is very essential to sheep, none can doubt who have seen them panting in their heavy coats and crowding on to the smallest piece of shade possible to find. In the absence of trees, whose entire removal from many of our farms is to be deeply deplored, shade should be provided by means of any roughly constructed open shed. Want of shade is loss of flesh to the animal, and loss of flesh is a drainage to the farmer's pocket.

Fall Feed.—By the middle of November, grass has usually lost its nutrition in Canada, owing to the action of repeated frosts and thaws. It is time then that sheep should have some fodder in addition to their pasture. This may be provided in pens, by bringing them home at nights. Sheep that lose condition in the fall will seldom pick up again during winter. A few oats fed at this time, say a gill per head, will be well bestowed.

Winter Feed and Management are very shortly summed up. *Pea straw* is valuable for sheep feed. Corn stalks, Hungarian grass, and hay of all descriptions form good fodder. We prefer bright pea straw to any fodder for ewes in lamb; but as all animals like a variety, so an occasional change from one kind to another of fodder is highly relished by sheep. The straws of cereals, as wheat, barley and oats, being very dry, afford poor fodder to sheep. *Grain*, in small quantities, is the cheapest fodder we can give. Oats, at a gill a head per day, will go further in keeping sheep thriving and in good healthy order than an equal value of any other kind of food. *Indian corn* is bad feed for sheep; for pregnant ewes it is especially dangerous, as being very heating.

Roots should be fed in moderation to sheep.

Water in winter is very necessary, although very few farmers in Canada allow their sheep access to it.

Sheep should be kept separate from other stock. How often have we seen the cattle in a yard with their horns ornamented by lumps of wool taken from the fleeces of the farmer's sheep.

Cattle hook them and colts tease them, while neither cattle nor horses will touch what sheep have fed over.

Sheep do not require warmth—Nature has provided them with tremendous coats—but they must have *dryness* and shelter. Under a bank barn is the worst place to keep sheep; they should be confined in sheds open upon the south side, so that, on the one hand, neither rain nor snow can drive in; and on the other, there may be a plentiful circulation of fresh air. One evil effect of wintering sheep in too warm a place is, that the wool comes off them in spring long before shearing time.

The utmost regularity in feeding should be preserved—regularity as to the *times* of feeding. Sheep do not, like cattle and horses, feed well in the dark; they should therefore be provided with their evening meal early enough to allow them to consume it before night sets in. Regularity in *amount* is synonymous with a saving of fodder, and should therefore be carefully attended to.

The Effects of Food.—An analysis of wool shows us that it contains:—

Carbon.............. ..	50·65	100 parts.
Hydrogen	7·03	
Nitrogen	17·71	
Oxygen and sulphur	24·61	

The large quantity of nitrogen here contained shows that its production is dependent, in great part, upon food in which that element predominates; and all experiments have shown that amount of wool in every case depends upon amount of nitrogenous food. From this we may learn that the steady feeding of grain, such as peas and oats (especially the former), in such quantities as not to injure the health, will be most effectual in the production of an increased amount of wool.

Moreover, grain helps the increase of the tissue, and is, therefore, beneficial in putting *flesh* upon the stall-fed sheep, ; without it no fat could be produced.

Yards.—It is well that yards be attached to all winter sheds, as sheep, especially pregnant ewes, require daily exercise.

Washing.—The methods usually adopted for washing sheep depend upon the means at hand to the individual farmer. A thorough washing is, however, of great importance, for upon a proper performance of this operation depends greatly the value of our wool as a marketable commodity. It is often done in a very hasty and inefficient manner. We have seen a flock of sheep driven three or four miles along a dusty road, penned in on the banks of the Grand River, where the current is very strong, taken out one by one, shoved into the water, and after being turned over by a man standing in the river, and slightly rubbed, allowed to swim ashore and go off again along the dirty high road.

A roomy pond of clear stagnant water is far preferable to a running stream. The water is usually softer, and the yolk or oil which is supposed to be formed through the wool by insensible perspiration, being of a very soapy nature, causes the wash to act more effectually. In running streams this soap is carried away with each sheep, and the water remains hard from first to last.

The sheep, owing to the weight of fleece upon its back, is in its normal state hot at all times, and particularly so in the end of May. A sudden plunging into cold water is, therefore, a very severe shock. The water in a stagnant pond, or in one formed by draining a creek, has a chance of being well warmed before use, and this is another point in its favour.

Perhaps the most effectual plan is to combine these several ways. Let the sheep be seized by the fore legs, and passed to a man standing in the stagnant and warm water. He should turn the animal in every direction ; should squeeze out the wool well with his hand, and pass it on to one who is placed below, either in running water or under a shoot.

After two or three have been washed, we have good soapy water, which will far more effectually soften the wool and loosen all impurities than will clear hard water ; and these impurities will be entirely removed by a final immersion in the running stream. Moreover, the stagnant water, being warm, will prepare the animal's body gradually for the colder, and will do away with that shock to the system caused by a sudden immersion of the sheep, which has sweated under the combined influence of a May sun and its own struggles with its captor.

All burrs and tenacious impurities should be carefully and thoroughly removed, and the offensive matter collected round the anus may, when thus softened, be drawn from the wool, thus saving many pounds of wool in a flock from the process of tagging, at shearing time.

A clean pasture, and if possible a clean road to pasture, should be provided until after shearing. The former is most necessary ; for when the dews are heavy, if there be a patch of bare ground in the field, there will the sheep be found lying at night.

So important, indeed, has the subject of thorough cleansing of the fleece before shearing been considered by large breeders, that some years ago the Farming Society of Ireland recommended the use of a large tub of water warmed to blood heat, in which to place the sheep till the wool be well softened, and then to river wash, on the ground that " the keeping the animal in cold water a sufficiently long time to wash thoroughly, endangers its health ; that fleeces of a close pile cannot be cleansed by the usual mode of washing ; and that the extra labour required to wash sheep in tubs of warm water would be amply repaid were the washings in these tubs carried out and applied as manure, the quantity of rich animal soap which they contain making it one of the most fertilizing applications which can possibly be used."

It is better to allow a full week or ten days to elapse before shearing. The wool will then, if it has been fine, be thoroughly dried, and some time is necessary for the oil or yolk to ascend from the body into the wool, by which the weight of the fleece is increased, and by which a great deal of softness and elasticity is imparted to the marketable wool.

If the wool be got clean and white, it will always sell for more than enough extra to offset the increased labour and the diminution in weight.

Our wool (long) loses by washing about 36 per cent.; from this may be judged the relative prices that should be paid for washed and unwashed wool.

Shearing.—Between washing and shearing should be generally a week or ten days, but this must depend upon the weather; should the interval be cold or rainy, or even cloudy, more time must elapse. The wool should be thoroughly dried out, and the natural oil be allowed full time to rise in the fleece. Shearing should not commence until the dew has dried off sheep. Sheep are generally sheared upon the barn floor. It is well to raise a platform at one end a few inches, so that the shearing table may be kept perfectly clean; but if a nice clean sod is handy, it will be found that they will lie easier and more quietly on soft grass under the shears.

It is impossible to convey in writing intelligible practical instructions by which shearing can be taught. The operation requiring much sleight of hand, must, like the trade of a barber or haircutter, be learned by experience; there are, however, a few points that may here be with advantage indicated.

The wool should be cut off as close as conveniently practicable, and evenly. If the wool on the sheep's back is left uneven, or in very plainly marked ridges, it betrays a want of skilled workmanship on the part of the operator.

Care should be exercised that the wool is never cut twice in one place, as by so doing the length of staple is injured. The chief point to be attained is to place the sheep as easily in its different positions as possible, and to hold it firmly, that struggles may be avoided. It will be remarked, that clumsy shearers always grumble, because they say that they get the most troublesome sheep, when it is really but another application of the old adage, that "the bad workman complains of his tools."

Sheep-ticks.—These vermin, when very numerous, are apt to keep sheep very thin in winter, and at shearing time, being driven from the mothers, will go to the lambs.

A fortnight after shearing, when all the ticks have migrated from the back of the sheep to the fleece on the lamb, boil refuse tobacco leaves until the decoction is strong enough to destroy the vermin.

Five or six pounds of cheap plug tobacco will answer for a hundred lambs. The following plan of dressing lambs has been highly recommended: "The decoction is poured into a deep, narrow box, kept for the purpose, which has an inclined shelf on one side, covered with a wooden grate. One man holds the lamb by its hind legs, while another grasps the fore legs in one hand, and shuts the other about the nostrils, to prevent the liquid from entering them, and then the animal is entirely immersed. It is then immediately lifted out, laid on one side upon the grate, and the water squeezed out of the wool, when it is turned over and squeezed on the other side. The grate conducts the fluid back to the box. . . . . If the lambs are regularly dipped every year, ticks will never trouble the flock."

Miller's Tick Destroyer we have found to be an excellent and effectual preparation: full instructions for its use are conveyed with every box.

Marking Pigments.—Boil tar until, when cold, it has a glazed, hard consistency; stir in a little lampblack when boiling; apply when just cold enough not to burn the sheep's hide, and the mark will remain the whole year round.

Paint made of lampblack, to which a little spirits of turpentine is first added, and then diluted with linseed or lard oil, may be used.

The rump is the best place on which to mark sheep, as it is plainer seen when the flock are together or moving away. Moreover, the wool on the rump is less valuable than that on the flanks and shoulder. A distinction should be made in the mark between ewes and wethers.

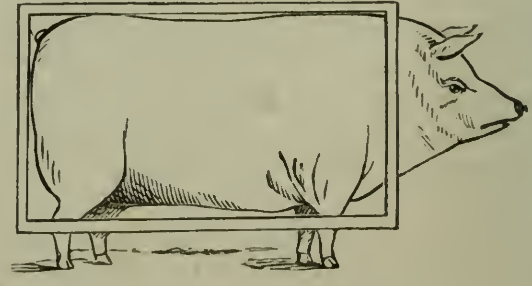
Maggots.—To destroy these, boiled tar is an effectual remedy.

The Diseases of Sheep will be noticed in a subsequent chapter.

PIGS.

"Pork, both in its fresh and salted state, is an article of such universal consumption (not only in Canada and the United States, but over the whole world), and the hog is such a profitable consumer of every eatable species of offal, that pigs are reared by not only every farmer, but every cottager who can find means to feed them; for there is no animal which yields so great a quantity of flesh in return for the kind of food which it consumes; and it has been not unjustly called 'the poor man's stock.' This, together with the fecundity of the sow, which gener-

Fig. 29.



ally produces from seven to ten young ones at a birth, and that not unfrequently twice within the year, tends, notwithstanding the demand, to keep down the price at market to a figure which would leave but little profit if reared upon purchased food. But as they will eat every refuse of animal and vegetable substance, from the kitchen or the stable, even if spoiled or trodden under foot by other animals, they are thus fed at comparatively little expense during their growth. They are also tended with little trouble; and this, combined with their leaving nothing to be lost, and producing large quantities of dung, of a quality only inferior to that of sheep, renders them so valuable to the farmer, that if the sale of the meat repays the cost of production, it is commonly thought sufficient.

"Although thus apparently careless of the quality, provided the quantity is sufficient to appease the appetite, and swallowing everything that comes in his way, yet, if allowed a choice of diet, the hog has the palate of a true gourmand, and always selects that which is the most nutritive; if turnips and potatoes be offered, he will be sure to choose the latter, and he infinitely prefers beans or peas to either oats or barley."

The animal, though unjustly considered filthy in his habits, is yet cleanly, if he be only allowed a proper chance, and his flesh is of a delicacy equal to that of any other meat; so that the pig is cultivated as a means of supplying food to the whole Christian world.

ON BREEDS.

The various breeds range through every size and shape, from the immense Yorkshire and modern Chester White to the small improved Berkshire and rough Highlander, the latter of which is described as an ugly brindled monster, the very epitome of the wild boar, yet scarcely bigger than an English terrier.

"His bristled back a trench impaled appears,
And stands erected like a field of spears."

We shall content ourselves with a succinct account of those now generally bred throughout Canada and the United States.

The pig is not a native of North America, and we owe the origin of all our present species to Europe and Asia.

Improved Berkshires.—These were first imported to America in 1832, and have steadily, since that period, risen until they have now attained the apex of popularity. Harris says, in his excellent work, "Harris on the Pig," that "although the Berkshires were fully as valuable as the breeders claimed, yet a widespread disappointment soon manifested itself. For a time the supply was not equal to the demand, and, doubtless, hundreds of pigs were sold as 'pure Berkshires' that were nothing but grades. But the general complaint was that the Berkshires *were not large enough.* The advocates of the breed met this complaint by statements of weights, giving many instances where Berkshires and their grades dressed four hundred pounds at a year old, and that at eighteen or twenty months old they could be made to weigh five hundred or five hundred and fifty pounds dressed. One of the prominent breeders stated that he had a thorough-bred Berkshire that gained four hundred and ninety-six pounds in one hundred and sixty-six days, and when killed, dressed six hundred and twenty-six pounds.

The fact is, that what the pork raiser requires is an animal that, having the least amount of offal, will mature rapidly and make a fine lump of pork at an early age. For the last few years there has been no demand for great coarse carcases, but buyers have preferred those that will dress from two hundred to two hundred and fifty pounds of pork.

The winter is long and severe in Canada, and it will not pay to feed pigs over the winter months. What we require is a class of pigs that have the qualifications to mature rapidly, and born in the spring will be ready for the knife, making one hundred and fifty pounds and upwards, by the first month of winter.

This tendency to early maturity is eminently characteristic of the fine improved Berkshires and Suffolks.

The value of these small breeds lies in their perfection of form, fineness of bone, and small proportion of offal; whilst they put the greatest proportionate amount of meat upon the ham and shoulder, the choice portions of the carcase. The essential points in a well-bred Berkshire are that the hair be long, thin and somewhat curly; ears fine, and fringed with long hair round the outer edges; the body thick, compact and well formed; legs short and sides broad; the back wide (showing a well-arched framework of ribs), on which to put fat; the head well set on; the snout short; the jowl thick; ears erect; skin fine in texture; flesh firm and well-flavoured. It is highly popular for pork feeding, on account of its smallness of bone, early maturity, aptitude to fatten on little food, hardihood and fecundity of the females, who are also good mothers.

Improved Suffolks.—The old Suffolks were white, long-legged, long-bodied, and, in general, a type of the *racers.* The present improved breed owes its existence to crossing with the Chinese, and a notable herd of such may be found on the late Prince Consort's farm near Windsor.

These improved Suffolks, many of which have been lately imported to Canada, and have deservedly become very popular, are well formed, compact, of medium size, with round, bulky bodies, short legs and small heads, and exceedingly fat cheeks.

They are rapid maturers; indeed, in this respect few breeders will agree as between them and the improved Berkshires. For our own part, we have always preferred the Suffolks to the Berkshires, although we allow a certain prejudice in favour of the colour of the former.

The Chinese.—The native *habitat* of this hog is in the south-eastern parts of Asia—Siam, China, Burmah, Malacca, Sumatra—and in many of the eastern islands; and there can be little doubt that the European stock was originated in the Asiatic breeds.

They are divided into two distinct varieties, the *white* and the *black;* they are all very small in size. Being exceedingly fine in bone, small in limb, of round bodies, and covered with fine silky bristles, they have been for many years largely used by English breeders to tone down the natural coarseness of the old British stocks of swine, and to the use of these Asiatic breeds we may trace most of the improvements now apparent in our own best stocks.

Yorkshires.—The old Yorkshires were coarse, ungainly animals, greedy feeders, and although consuming an immense amount of food, yet could show a very poor proportion of pork to bone and offal when slaughtered. Notwithstanding their great size, they seldom attained heavier weights than from three hundred and fifty to four hundred pounds, even when fat and full grown.

By crossing with the Leicesters, the Chinese, the Neapolitan and the Berkshires, the breed has been greatly improved, and has come down to us as the Improved Yorkshire.

Those from the Berkshires are hardy, but, though attaining considerable size, fatten very slowly.

The old breed, crossed with the Leicesters, has given us the *Improved Large Yorkshires*, and is in great request not only in Europe and Great Britain, but also in Canada. As we said above, if the present demand for small good pork continues in our market, the Yorkshires will never be a profitable breed to the Canadian farmer; for although they can be fed to an immense weight in time, yet they do not mature early enough. The prize boar at a Royal Agricultural Show of England, held at Chester, weighed no less than one thousand two hundred and thirty-two pounds alive.

Of the small Yorkshires, Mr. Mangles, a well-known pig breeder in Yorkshire, says:—"The small Yorkshire is peculiar to Yorkshire, and different from any other breed I have seen. It has a short head, small erect ears, broad back, deep chest, and short legs, with fine bone. It is always ready to fatten, and turn to account either in the way of roaster, small porker, bacon or medium. Three or four of the small breed might be fed well, and kept fresh and symmetrical, on the food which would barely keep one lean and gaunt large Yorkshire."

The Essex.—Sidney, one of the best English authorities on the pig, says:—"The improved Essex is one of the best pigs of the small black breeds, well calculated for producing pork and hams of the finest qualities for fashionable markets, but its greatest value is as a cross for giving quality and maturity for black pigs of a coarser, hardier kind. It occupies with respect to the black pigs the same position that the small Cumberland-Yorks do as to white breeds—that is to say, an improved Essex boar is sure to improve the produce of any large dark sow.

"The original Essex pig was a parti-coloured animal, with white shoulders, nose and legs; in fact, a sort of 'sheeted' pig, large, upright and coarse in bone. . . . .

"The improved Essex, with symmetry, have more size and constitution than the original Essex-Neapolitans, and this has been maintained, without any crosses, for more than twenty years, by judicious selections from the 'three distinct families' (Original Essex, Western Essex and Neapolitan-Essex)."

Chester Whites.—Harris says:—"The most popular and extensively known breed of pigs in the United States at this time is, unquestionably, the Chester County breed, or, as generally called, the 'Chester Whites.'

"The rearing and shipping of these pigs has become a very large and profitable business.

"One firm alone in Chester County, Penn., informs us that for the last three or four years they have shipped from two thousand five hundred to two thousand nine hundred of these pigs each year, and many other breeders have also distributed large numbers of them. There are several reasons why the Chester Whites are more popular than the English breeds. In the first place, they are a large, rather coarse, half-hardy breed, of good constitution, and well adapted to the system of management ordinarily adopted by the majority of our farmers. They are a capital sort of common swine, and it is certainly fortunate that they have been so extensively introduced into nearly all sections of the country. Wherever Chester Whites are introduced, there will be found sows admirably suited to cross with the refined English breeds. No cross could be better than a Chester White sow and an Essex, Berkshire, or small Yorkshire thorough-bred boar.

"We get the form, refinement, early maturity and fattening qualities of the latter, combined with the strong digestive powers, hardiness and vigorous growth of the Chester Whites.

"If the first cross does not give pigs possessing sufficient refinement and early maturity, a good, thrifty, well-formed sow should be selected from the litter and put to a thorough-bred boar, and this second cross will, so far as our experience goes, be as refined as is desirable for ordinary farm-yard pigs. . . . . The pigs from a third cross would have $87\frac{1}{2}$ per cent. of thorough-bred blood in them, and, so far as the production of pork is concerned, would be more profitable than thorough-breds."

The Cheshire, or Jefferson County Pigs.—This is a breed which, originating in Jefferson County, N.Y. State, has come into some notoriety in the States, though few have found their way into Canada. They are descended from the " Cheshires," one of the largest and coarsest breeds in England, of which Sidney says, " These unprofitable giants are almost extinct."

They are like the Chester Whites in form, but superior in beauty and fineness.

The Magie (Ohio) Pig is another large breed of pigs which has of late attained considerable celebrity, especially in the western States.

D. M. Magie is the largest breeder of them, and from him they have obtained a name.

They are large and coarse, and we doubt their ever finding favour, unless considerably refined, in the Canadian market.

Breeding.—The same remarks that have been applied to the advantages of breeding sheep and cattle from thorough-bred male stock, are of equal weight in the selection of sires for pigs.

There are distinct objects to be attained in breeding—improvement of shape, tendency to early maturity of progeny, and fecundity of sow and boar.

Under any circumstances, the points to be looked for in a good breeding sow, whatever may be her breed, are : a small, lively head ; a broad and deep chest ; round ribs ; capacious barrel ; a haunch falling almost to the hough ; deep and broad loins ; ample and wide hips, with considerable length of body. Smallness of bone is another property inevitably transmitted to progeny, and on the possession of which early maturity is dependent.

Twelve teats should be found on the belly of a good breeding sow ; for every pig selects a teat for itself, and keeps it.

Breeding sows or boars should never be raised from defective animals.

A good boar should possess a long body ; small bones ; well-developed muscles ; wide chest ; broad, straight back, not falling at the rump ; short head ; fine snout ; clear, bright eye ; a short, thick neck ; broad, well-developed shoulders ; a loose, mellow skin ; fine bright long hair and few bristles ; and small legs and hips.

In-and-in breeding has a very rapid deteriorating effect upon swine. When persisted in, the result is decrease in number, size and early maturity of every succeeding litter, until at length the progeny becomes puny, the sows barren, and the boars almost useless.

The practice is also very injurious in that it predisposes the progeny to all the diseases that the pig is "heir to," such as scrofula, epilepsy, rheumatism, &c. Pigs not only improve very rapidly by the use of superior breeding animals, but also degenerate very rapidly by injudicious management.

Raising Thorough-breds.—As in the kine or sheep, thorough-breds must be raised by some one to give us the benefit and use of blood-boars, but for the ordinary farm purposes a good grade pig will be found the most serviceable; in order, however, to keep up a good stock of *grades*, thorough-bred males must be used. As Harris puts it:—

" It cannot be denied that many farmers have purchased thorough-bred pigs, and after keeping them a few years have given them up in disgust. One cause of this result may be found in the erroneous ideas prevalent in regard to the object of keeping improved thorough-bred animals. No farmer could afford to keep a herd of high-bred Duchess Shorthorns simply for the purpose of raising beef for the butcher. Their value consists in their capacity to convert a large amount of highly nutritious food into a large amount of valuable beef, *and in the power they have of transmitting this quality to their offspring when crossed with ordinary cows.* It is in this last respect that pedigree is so important. But the former quality is due in a great degree to persistent high feeding for many generations. Were they submitted to ordinary food and treatment, especially when young, they would rapidly deteriorate. But put one of these splendid Shorthorn bulls to a carefully selected ordinary cow, and we get a grade Shorthorn that, with ordinary good feed and treatment, will prove highly profitable for the butcher.

" The same is true of improved thorough-bred pigs. Their valuable qualities have been produced by persistent high feeding. and by selecting from their offspring those best adapted for high feeding. Pigs that grew slowly were rejected, while those that grew rapidly and matured early were reserved to breed from. In this way these qualities became established in the breed; and these qualities cannot be maintained without good care and good feeding.

" In the case of pigs, we could well afford to give the necessary food to fatten thorough-bred pigs for the butcher. But we cannot afford to raise the young thorough-breds for this purpose. This would be true, even if we could buy thorough-bred boars and sows to breed from at the price of ordinary pigs. The reason we cannot afford to raise highly refined, thorough-bred pigs for ordinary purposes is, that if we feed them as they must be fed to maintain their qualities, they are apt to become too fat for breeding; and if we feed and treat them as ordinary slow-growing pigs are treated and fed, they lose the qualities which it is the object of the breeder to perpetuate. To raise highly improved thorough-bred pigs requires more care, skill, judgment and experience than we can afford to bestow on animals designed to be sold in a few months to the butcher.

"The object of raising thorough-bred pigs is simply to improve our common stock. They should be raised for this purpose, and for this purpose alone. The farmer should buy a thorough-bred boar from some reliable breeder, and select the largest and best sow he has to cross him with. A thorough-bred boar at six weeks or two months old can usually be bought for $20 to $25. Such a boar in a neighbourhood is capable of adding a thousand dollars a year to the *profits* of farmers who use him."

Fertility.—This is a quality that runs in families in sows, and one very important for the profits of the pig breeder. To keep up fertility in a stock, sows should be chosen for breeding whose ancestors have been noted for the same quality. Also, sows should be at all times plentifully but not highly fed. Plentifully, that they may never be suffering from hunger; and not too highly, that all danger of over-fatness and fever be avoided.

The influence of a first impregnation is very great upon the future breeding of a sow. We have many illustrations of this fact in daily experience, for we see the litter of a sow often taking for many years, even when a different boar has each time been used, after the first boar to which she had access.

Breeding and Rearing.—A strong, vigorous sow, of good size, should be chosen from which to breed. If a farmer desires to let his pigs run over the first winter, and to make heavy eighteen months old pork, a sow from a big-bred sow had better be selected to put to a small thorough-bred.

As we have said in a preceding page, we believe that for the farmers in Canada the most profitable kind of pig is one that will make from one hundred and fifty to two hundred pounds of pork in the first nine or ten months of its life; and for this purpose there are none equal to the well-bred small kinds—Black Berkshires and Essex and White Suffolks and small Yorkshires. We take the following full and yet concise instructions from the pages of "Harris on the Pig:"—

Store Pigs.—He begins by saying: "Better pay five dollars for the use of a thorough-bred than accept the services of a grade or common boar for nothing. . . . . . . If the sow has had pigs in, say, the middle of March, they may be weaned in six weeks; and if the sow has been properly fed, she will take the boar in a few days after the pigs are weaned. We should then get a litter of, say, grade Essex about the 1st of September. The sow, during the summer, should, if possible, have the run of a clover pasture; and if she is not in good thriving condition with this, and the wash or milk from the house, throw her two or three ears of corn a day. She should not be too fat, but there is not one farmer in a thousand who ever falls into this error. Let her have plenty of exercise; and if she is fully *half fat* by the time she comes in, all the better. If she is a good mother, nearly all her accumulated fat will find its way to the little ones before they are six weeks old.

"For two or three weeks before she is expected to farrow, let the sow be put in a pen by herself at nights, to accustom her to it. She may be allowed to run out during the day, but should always be fed separately in the pen, and in this way she will soon come to regard the pen as her own, and will go in as soon as the door is open. Let no harsh word be spoken, nor a kick nor a blow be on any provocation resorted to.

"The pen should have a rail round the side, about six inches from the floor, and eight or ten inches from the side of the pen, so that if she makes her bed near the side of the pen, as she almost invariably will, the rail will afford a space for the little ones to slip under, and thus prevent their being crushed against the sides of the pen.

"As at this season the weather is warm, she will need but little straw. The better plan is to put in two or three times as much straw as is needed two or three weeks before she is expected to pig. By lying on it she will make it soft, and this is very desirable. If any of it becomes wet or dirty, remove it from time to time when the sow is out. As the time approaches she will select a particular spot and 'make a bed.' When she is eating, or out of the pen, examine the bed and see that the sides are not too hard, or compacted together too closely, and that they are not more than four or five inches high; if so, remove a little of the straw. It is better to have too little than too much. After this, the sow should be left to herself. With gentle thorough-breds that are accustomed to being petted, we keep a close watch during such an interesting event, rendering assistance if necessary; but as a rule, and especially with common pigs, it is far better to trust to nature, and let things take their course.

"At this season of the year, and especially if the sow has had the run of a pasture, and is in a thrifty condition, there will seldom be any trouble. The little pigs will come strong, and commence to suck a few minutes after they are born. On no account disturb the sow until all is over. This may be two hours, and sometimes longer. Do not be in any hurry to feed her. But when she gets up let her have all the slop or milk that she will drink.

"It is better to watch her, and keep pouring it into the trough as fast as she will drink it up clean. Let her have all she can drink, but leave none in the trough. We are aware that these directions are not in accord with the general rules upon the subject. There are those who think that the sow should be kept on short allowance, so that she may be wide awake, and quick to hear the scream of any little one she may be lying on.

"This is all very well, but the chief danger occurs from the sow getting up and lying down again; and if she has a good meal, and eats it all up clean, she will be more likely to lie still during the night than if she is hungry.

"After she has eaten, and when she goes back to her bed, you will be there to hear if she lies on any of her pigs, and can go to the rescue. When she has once lain down, there is little danger until she gets up again. If all goes well for the first two nights, there will rarely be any loss or trouble afterwards.

"Give the sow all the milk or slops she will drink, but little or no grain for the first week or ten days. If the little pigs scour, change the food of the sow. There is nothing better for her than skimmed milk not too sour, and the next best thing is two quarts of fine middlings, scalded with two or three quarts of boiling water, and the pail afterwards filled up with water sufficient to cool it to the temperature of new milk.

"When the pigs are two weeks old, a little shallow trough may be made for them. Nothing is better for this purpose than two or three feet of a tin eave trough, turned up at the ends. Nail it to the floor so that the pigs will not upset it, and, if possible, put it where the sow cannot get at it. Then put in half a pint or so of sweet milk.

"Let them drink and waste what they will of it, but always clean it out before fresh is put in.

"Try to teach them early to eat their meals promptly and then lie down to sleep. Give them a small handful of oats, or, better still, three or four tablespoonfuls of oatmeal, increasing the quantity daily, but never giving more than they will eat up clean.

"If fed too much at one time, and too little at others, it will produce scours, and retard the growth of the pigs. At three weeks old a litter of eight or ten pigs will eat a quart of good oats four times a day. They seem particularly fond of cracking the oats and eating out the kernels.

"After the first week or ten days, the sow should have richer food, say two quarts of fine middlings and a quart of oat or corn meal three times a day. Let her have all she will eat, and in a week or ten days later give richer food. Boiled barley is excellent, but it is better to vary the food so as to induce the sow to eat more. We often throw our sows an ear or two of corn after they have eaten their regular meal. The more food the sow can be induced to eat, the richer will be the milk and the more rapidly will the little pigs grow.

"When about six weeks old, the pigs should be altered. Do not be tempted to reserve one of them for a boar. No matter how handsome and well-formed he may be, it is absolute folly to use him for breeding purposes. Select out one or two of the best sows, but alter all the boars.

"The sow pigs will grow and fatten more rapidly if spayed, but it is not often that we can find men in this country who are able to perform the operation with safety. Where there are such, all the sow pigs not intended for breeding should be spayed a week or ten days before weaning. There is nothing better to apply to the wound than petroleum—not kerosene, but the crude oil.

" The time of weaning will depend upon the time when it is required to have the next litter of pigs.

" If the sow is in good condition, she will take the boar in a week or two after the pigs are weaned. And if the sow and pigs are well fed, the pigs may be allowed to remain with the sow until ten weeks or three months old.

" It is better not to remove all the pigs at once; let them return to the sow for a few minutes at the expiration of twelve hours, and again at the expiration of twenty-four hours. We prefer, however, to let one or two of the weaker pigs remain with the sow for a week or so after the others have been removed.

" At the time of weaning, the pigs should have extra attention. Feed them five times a day, the first thing in the morning and the last at night. If they have all they can eat, they will not pine for the mother. Nothing is so good for them as milk. A little flaxseed tea, oatmeal gruel, or cornmeal gruel, mixed with the milk or given separately, will be good and acceptable. As the weather by this time is getting cold, it will be well to give warm food. But guard against giving it too hot: it should not be warmer than new milk.

" There is perhaps nothing better for the pigs than corn pudding and milk. Put two quarts of corn meal into a pail, and pour on two or three quarts of boiling water and stir it until all the meal is wet, then fill up the pail with milk.

" We need hardly add that all pigs should be allowed a constant supply of fresh water. There are few things more important in the management of pigs.

" Let the pens be warm, clean and well ventilated, but with no cracks for the wind to blow in on to the pigs. And, above all, let the bedding and pens be *dry*. There should always be litter enough for the pigs to bury themselves in. Warmth, to a certain extent, is equivalent to food, and, what is of more importance than the saving of food, it *saves digestion*. Let the pigs have all the exercise they wish, and then do not be afraid that warm, dry, and comfortable quarters, with abundance of wholesome food, will make them tender.

" We are aware that this is a common idea, but it is an erroneous one. A cold wind or storm, that will send a half-starved and neglected pig squealing round the barn-yard with hair on end, head down and back up, will have no effect on pigs treated as we have recommended. And there is nothing more important than to have young pigs in a healthy, vigorous, and almost *fat* condition before winter sets in.

"The pigs are now three months old, and should weigh 75 lbs. to 80 lbs. apiece.

"During the winter, the pigs may be allowed to run in the barn-yard, to pick up what they can find. If the cattle are fed with grain and oil-cake, a certain number of pigs will keep in good condition on the leavings of the cattle, and on food which would otherwise be wasted. Let the young pigs, however, have a separate pen from the old ones, and see to it that they have enough food to keep them in condition.

"By throwing them an ear or two of corn in the pen, they will soon learn to be ready at the appointed time to enter the pen for the night without trouble. On no account let them go to bed hungry.

"Let their stomachs be well filled, say at five o'clock in the evening, and they will sleep quietly until eight o'clock the next morning. In fact, a well-bred and well-fed pig will sleep three-fourths of his time during winter. If not disturbed, and tempted with fattening food, he will eat nothing and gain nothing. And sometimes, like other hibernating animals, he will live on his own fat.

"As spring approaches, the young pigs will need more food, and fortunate is that farmer who has a liberal supply of parsnips, sugar-beets or mangold-wurzels for them. These roots, pulped or rasped in a cider mill, mixed with a little corn meal, are a cheap and excellent food for pigs in the spring. But, whatever the feed, let the pigs have all they need to keep them in a good thriving condition.

"As soon as the clover is fairly growing, the pigs should have the run of the clover pasture. They will get three-fourths of their food in the pasture, and we need hardly say that where clover grows abundantly, it is the cheapest food that can be fed to a pig; with clover and the slops from the house and dairy, the pigs will keep in a thriving condition. But it is a waste of time and food to depend on this alone with pigs intended for the butcher. If fed from a pint to a quart of corn or corn meal a day, they will eat just as much clover, and will grow nearly as fast again. After harvest they will pick up considerable food on the grain stubbles; but if as fat as they should be by this time, stubble gleanings can be more profitably left to the breeding stock and spring pigs.

"By the 1st of November, such pigs as we have described, fed as here recommended, should be in prime order for the butcher, and can be sold at any time when the price is satisfactory.

"They should average 400 lbs. dressed weight. The pork is of the highest quality, and the lard keeps firm and hard during the hottest weather in summer, and makes excellent pastry."

Spring pigs, to be killed when nine or ten months old, should be brought in as early in spring as possible. As the weather in which they are born is apt to be cold and stormy, some care must be exercised in the protection of the mother and young. The pen must be warm and well sheltered. The treatment of the mother may be similar to that already explained in the foregoing extract. There should be plenty of straw, but let it be provided some days before pigging is expected to commence, so that the mother may bite it up short and make a compact bed.

In long straw, young pigs are apt, when first born, to become entangled, and so are easily laid upon and crushed by the mother.

It must be remembered that the pig when first born is very tender, is wet, and therefore very susceptible to cold. We have saved pigs born in February, when the thermometer was below zero, by careful attention to the exclusion of every possible draught of wind from the pen.

The same treatment of the mother, and sucking pigs the same time of weaning; castrating should be adopted as was recommended in the preceding extract from "Harris on the Pig."

Spring pigs, however, that are required to make choice pork before winter sets in, want careful attendance during the summer. They should have the run of a good clover field, and there, with all the milk and slops that can be spared them, and a very small but regular supply of grain, and constant access to water, they will thrive and grow during the hot months. As soon as ever the crops are off, let them be turned into the grain stubbles; there they will fill out and grow fat with amazing rapidity. *As soon as ever* the stubbles become pretty well gleaned, if the pigs be not taken up they will begin to lose fat by reason of the amount of exercise that they will take in wandering over the field in search of the shellings.

This must be avoided by immediately penning, and commencing to cram them with hard grain, corn or peas. The stubbles are generally cleared by the middle of October, when heavy pen feeding with sound grain, for about four or six weeks, will bring spring pigs into prime condition for the market, and of a quality for which there is and ever will be a large demand in Canada. Well-bred pigs of the improved breeds, such as Berkshire, Suffolk or small Yorkshires, will at ten months old, or by December, if well fed, in the manner above indicated, from the day of birth, dress from one hundred and fifty to three hundred pounds of prime pork.

Messrs. Lawes and Gilbert give the following table:—

TABLE SHOWING THE WEIGHT OF DIFFERENT PARTS OF A PIG WEIGHING ALIVE 212¾ LBS. (AVERAGE OF 59 PIGS.)

Parts.	Actual Weight.	Percentage.
Stomach and contents	2 lbs. 10·4 oz.	1·28
Caul fat	1 " 2·3 "	·54

Parts.	Actual Weight.				Percentage.
Small intestines and contents	4	lbs.	8·4	oz.	2·20.
Large " "	8	"	5·7	"	4·04.
Intestinal fat	2	"	5·6	"	1·06.
Heart and aorta	0	"	9·6	"	0·29.
Lungs and windpipe	1	"	9·1	"	0·76.
Blood	7	"	10·1	"	3·63.
Liver	3	"	4·5	"	1·57.
Gall bladder and contents	0	"	2·1	"	0·06.
Pancreas (sweet-bread)	0	"	6·6	"	0.19.
Milt or spleen	0	"	4·7	"	0·14.
Bladder	0	"	2·5	"	0·08.
Penis	0	"	7·1	"	0·21.
Tongue	1	"	0·2	"	0·48.
Toes	0	"	2·9	"	0·08.
Miscellaneous trimmings	0	"	8·8	"	0·26.
Total offal parts	35	"	4·6	"	16·87.
Carcase	176	"	5·3	"	82·57.
Loss by evaporation, &c	1	"	2·1	"	0·56.
Live weight after fasting	212	"	12·0		100·00.

From these and other experiments, Mr. Harris deduces the following: that

A moderately fat heifer or steer will dress	59⅓	per cent. meat.
" " mutton sheep " "	59¾	" " "
" " pig " "	82½	" " "

Showing that a pig turns out twenty-three per cent. more meat, in proportion to its actual live weight, than either the steer or sheep.

Pigs, if properly attended to, and treated well and generously, are the most profitable stock that the farmer can raise. They realize the great commercial principle of profit, namely, "quick returns," and, added to this, they have the qualities of rapid multiplication and early maturity.

Feeding Peas or Corn.—Peas contain in 1,000 parts—

	264 parts of gluten,	and 496	of starch, gum and sugar.
Corn	123 "	" 716	" " "
Barley	64 "	" 684	" " "

In our former chapter on the principles of feeding, we showed that food containing large amounts of gluten was flesh-forming, while that into the composition of which enters largely starch and sugar was fat-forming.

Hence, mixing peas and corn or peas and barley will be found better for the purpose of fattening pigs than the same weight or equivalent in money value of either of these grains fed separately.

Peas are the most valuable when the pig is first put up to fatten, by filling up the flesh on the bones; but when once the bones have become well covered with flesh, corn will be found most efficient in the formation of fat.

Sour Whey for Pigs.—It is calculated that about one pig can be reared from sour whey for every two cows in the dairy. Supposing a dairy to consist of fifty cows; three breeding sows, reckoning that each one would have eight young pigs, might be kept, giving them the run in any rough grass under orchard trees not much used for other purposes. These pigs, receiving as much of the sour whey as they will drink, will make strong growing pigs. The whey is much better for pig food when old, or at least some mixture of it should be so; and if it be used daily from the vat, which is as often getting replenished from the dairy, it makes a very wholesome drink for pigs, on which they will grow and do remarkably well. And as the pigs are small to begin upon it, and do not drink as much as afterwards, a stock collects for their large appetites; and this, with the wash which farm-houses must supply, with garden refuse thrown in it in the summer in addition, is found enough to keep the number of pigs mentioned, viz., about one of the age and description given, to every two dairy cows in milk.—" *Morton.*"

TABLE OF DENTITION OF PIGS.

	At Birth.	One month.	Three months.	Nine months.	Twelve months.	Eighteen months.
Fœtal { incisors	4	4	4			
Fœtal { dental	4	4	4			
Temporary incisors	..	4 central	8 central and lateral	8 central and lateral	4 lateral.	
Permanent incisors	..	..	..	4 corners.	8 central and corners.	12 central, lateral and corner.
Permanent tusks	..	..	..	4 (cutting)	4	4
Total in both jaws	8	12	16	16	16	16

SEVERAL MODES OF CURING BACON, HAM AND PORK.

Dry Salting.—Cut up into hams, shoulders and sides, and salt well; lay up for a time, and in about six weeks salt again. When the salt has worked well through the pork, it may be hung up in the kitchen to dry, and before the flies become troublesome in spring, pack the salt in sifted woodashes or in oats. It will keep sweet all summer.

In Brine.—Put a layer of salt at the bottom of the cask, at least one inch thick, and then pack tightly one layer of clear pork, each piece placed on its edge. Now put salt on again, to fill up the interstices between the pieces and to make another layer of salt over the layer of meat. Then add another layer of pork and another layer of salt successively, till the cask is nearly full, putting over the last layer two inches or so of salt. Now take cold water and make a brine as strong as salt will make it, and pour this brine over the meat, putting in enough to cover the upper layer of meat with the brine.

We have pork in our cellar now that was thus put away a year ago, and which is as hard and as perfectly sweet as any one could possibly desire. From the moment it is stowed and packed away it needs no more attention or watching.

The top of the barrel should be made small enough to be put over the meat, with a weight pressing it down. This gives easy access to the pickled pork, and keeps it under the brine. No one need fear using too much salt. Use it lavishly, and when the meat is all gone, take the brine and scatter it over the manure heap, just as it is being hauled out to the field. Used in this way it will be worth to the farmer all that it cost him; especially if applied where early corn or early potatoes are being planted. Land that has been dressed with salt manure has been put in grand preparation for a crop of turnips.

Sugar Curing.—Take fourteen pounds of good salt; one half pound of saltpetre; two quarts of molasses, or four pounds of brown sugar, with water enough to dissolve them. Bring the liquor to a scalding point, and skim off all the impurities which rise to the top.

When cold, pour it upon the hams, which should be perfectly cool, and not frozen, and closely packed in a barrel; if not sufficient to cover them make up with pure water. For a flavour, pepper, allspice, cinnamon, nutmeg, mace or cloves may be added.

Let the hams remain six or eight weeks in this pickle; then hang them up in the smoke-house, with the small end down, and smoke for from ten to twenty days, according to quantity of smoke made.

Keep the fire far enough away to escape all danger of heating the hams. The Westphalia hams, a noted article in the world's market, are smoked in a cool, dry chamber, into which the smoke is carried from a cellar below by a flue.

Green maple makes the best chips for smoking, after which come, in the following order, hickory, birch, corn-cobs, white ash or beech.

To Keep Flies out of Cured Pork.—Cover each piece with a canvas bag thoroughly saturated with lime whitewash, or pack in sifted ashes, dry oats or baked sawdust. Another plan is to dip them in meat paint. This is made by stirring very fine ashes into warm (not hot) water until the mixture is as thick as paint, then dip in the meat pieces and hang up *to dry.* The flies will not molest it.

ENGLISH MODES.

Westmoreland Hams, which are famous, are thus cured: They are rubbed hard with bay salt, after which they are left on a stone bench to drain off the brine. After four or five days the rubbing is repeated, with an addition of an ounce of finely-powdered saltpetre to each ham, mixed with the salt. Then they are suffered to lie about a week, and are then hung in the chimney to smoke. Some hang them so that they may be dried solely by the heat of the fire, without being exposed to the smoke; while others suspend them in the midst of the smoke, whether rising from wood or peat, and leave them there until the weather becomes warm, when they are packed up in oat chaff; though, to prevent them from being fly-blown, they ought to be covered with bags of coarse linen or paper.

In Hampshire, Berkshire, and some of the neighbouring districts, when the hog is killed the first process is to "swale" him or singe off his bristles, which is done by laying the carcase on one side and covering it thinly with straw, to be lighted on the windward side, and renewed as it burns away, taking care, however, not to scorch the skin; the other side is then turned, and when the process of singeing is completed, the bristles are scraped off dry. This is considered preferable to the usual plan of scalding and scraping, which softens the rind, and is then thought to injure the firmness of the fat. He is next cut into flitches, which are effectually rubbed with a mixture of saltpetre and common salt, and laid in a trough, where they continue for three weeks or a month, according to their size, and are during that time frequently turned, and when completely dried and cured on the same plan as that of Westmoreland, noticed above, are either packed in oat chaff or deposited on the kitchen racks for home consumption. They should be kept dry, and never be packed in cellars or damp places.

On the European Continent it is common to strip off the skin, the hide being sold for saddles, and the bristles for brushmaking. These parts afford some profit, and the flesh is said to take the salt better when skinned; but if cured, it is said that the bacon is subject to become rusty, and to waste in boiling.

Piggeries.—We have not room in the present work to go into the subject of piggeries, but we commend our readers to the excellent portions on this subject contained in "Harris on the Pig," a book written by a practical farmer and the son of a farmer, as he says in his preface, residing near Rochester, in the State of New York; and we have no hesitancy in saying that it is a work that should be on the shelves of every enterprising farmer.

Catching a Pig.—Of all the animals to catch, perhaps a pig is the most difficult, and the most provocative of constant loss of temper to the attendant.

However, as the more the temper is lost, the more perverse and obstinate the animal becomes, we should advise as the first essential "to keep cool."

Common method.—To drive him round till the attendant is out of breath and the pig has done himself a great amount of damage and lost a day's good food; knock him down with a stick; get bitten, and frighten the animal so that he will not willingly approach man for a month or so.

A better method is to fasten a double cord to the end of a stick, and beneath the stick let there be a running noose in the cord; tie a piece of bread to the cord (it may also be done without any bait), and when he opens his mouth to seize the bait, catch the upper jaw in the mouth, run it tight, and back of the tusk, and the animal is fast. Tie the other end to a post, and you may approach and do anything to the pig without fear, even to slaughtering. A pig tied by a cord, behind the tusks, and attached to a stout post, will do nothing but steadily pull back with his whole weight on the cord; he will never come forward.

Another method.—Catch one foot in a running noose and draw it off the ground, then throw a bag over the animal's head.

HORSES.

"The fiery courser, when he hears from far
The sprightly trumpets and the shouts of war,
Pricks up his ears, and, trembling with delight,
Shifts place, and paws, and hopes the promised fight;
On his right shoulder his thick mane reclined,
Ruffles at speed and dances in the wind.
Eager he stands—then starting with a bound,
He turns the turf, and shakes the solid ground;
Fire from his eyes, clouds from his nostrils flow;
He bears his rider headlong on the foe!"

POINTS OF A GOOD HORSE.

We extract from "The Horse in the Stable and the Field," by Stonehenge:—

"*The Head.*—Without a wide forehead (which marks the seat of the brain) you cannot expect a full development of those faculties known as courage, tractability, good temper, &c. The size of the muzzle is partly regarded as an element of beauty, and partly as a sign of good breeding.

"Hence, in the cart-horse a coarse jaw and thick muzzle are not regarded. A large and patent nostril cannot be dispensed with in horses intended for fast work, and should be desired even in the cart-horse, for in drawing heavy loads on a hot day his breathing may be rendered almost as laborious as that of the highly-tasked race-horse or hunter. So also with the jaw: if there is not ample width between the two sides for the development and play of the larynx and windpipe, the wind is sure to be affected, and, in addition, the head cannot be nicely placed on the neck. * * * The eye is to be examined with a twofold purpose—first, as an index of temper, the nature of which is marked by the expression of this organ; and second, of its continuing healthy. A full and clear eye, with soft, gazelle-like expression, is scarcely ever associated with a bad temper, and will most frequently continue sound if the management of the horse to which it belongs is proper in itself. The car should be of medium size, not too small nor too large; nor should it be lopped, though many good lop-eared horses have been known, and some very superior breeds, like that of the celebrated Melbourne, are notorious for this defect.

"*The neck* should be of moderate length, all beyond a certain dimension being waste, and even a moderate-sized head at the end of an extremely long lever being too much for the muscles to support. It should come out full and muscular, with a sweep between the bosom and the withers, and should gradually diminish till it runs into the head, with an elegant bend just behind the ear. A very narrow throat, suddenly bent at the upper part, known as the thropple, is apt to be connected with roaring, and on that account is objected to by horsemen.

"*In the fore quarters* there are several points to be attentively examined, and among these the shoulder is regarded as of most consequence when the horse under consideration is intended for the saddle. It is evident that unless there is length of the blade, and also of the true arm, there cannot be a full surface for the attachment and play of the muscles, nor can there be the same amount of spring to take off the jar which follows each footfall. The straighter the angle formed by the long axis of each of these bones, the less spring there will be. So also, if the angle is not sufficient, the muscles of the shoulder-blade will not thrust forward the true arm, nor will the latter be sufficiently clothed with muscles (without being loaded) to act on the fore arm, commonly known by horsemen as the arm. Hence it is found that, with an upright shoulder, not only is the stride in all the paces short and the action stumpy, but there is not that elastic movement which enables the horse to carry his body along rapidly and evenly, without rising alternately behind and before, and thereby jarring himself or his rider. On the other hand, the upright shoulder, loaded with a thick mass of muscles, is useful in the cart-horse, and to a certain extent also in the carriage-horse, in both of which the pressure of the collar requires a steady and comparatively motionless surface to bear it. * * * The point of the shoulder should be well developed, but not showing any rough protuberances, which are equally objectionable with a flat or ill-developed point. The length of the true arm is mainly dependent upon that of the blade; but sometimes, when this is oblique enough, the true arm is short and upright, and the elbow stands under, or only a little behind, the shoulder point. This is a very faulty conformation, and is seldom attended with good action. The chief defect in the elbow is seen when it turns inwards, and rubs so closely against the ribs that the finger can hardly be insinuated between them and it. Here the elbow is said to be tied or confined, and the horse is very apt to turn his toes out; while the opposite formation is indicated by turned-in or 'pigeon toes,' and turn-out elbows, frequently accompanying long-standing rheumatism of the shoulders. A long and muscular fore arm is a sure accompaniment of strong and sweeping action, and should be carefully prized; in other respects there is little to be noted here. Next cômes the knee, which should be broad, and, when looked at from the front, should be much wider than the limb above and below. It should taper off backwards to a comparatively thin edge, and should have a good development of the pisiform bone, which projects backwards at its upper part. The leg, immediately below the knee, should be as large as any other part, and not 'tied in' there, which indicates a weakness of this part. A bending of the knee backwards is called a 'calf-knee,' and is not objected to in cart-horses, in which it is by no means uncommon; but it is very apt to lead to strains of this joint in the race-horse or hunter. A knee naturally bending somewhat forward is much preferred by good judges, though when it is the result of overwork, it is almost equally to be avoided with the calf-knee. Flat, and at the same time large cannon bones, without gumminess, are of great importance; and if attended with a full-sized suspensory ligament, and with strong, clean, and free back sinews, the leg is to be considered faultless. The fetlock-joint should be of good size, and clean, whilst the pasterns should form an angle with the ground of between forty-five and sixty degrees. Lastly, the foot should be well formed; but the construction of this part being elsewhere more fully described, its consideration here is omitted.

"*In the middle-piece* the withers come first under notice. It is usual to desire them high and thin, but they are very commonly too much developed, and if the bony processes stand up like the edge of a razor, without muscles in them, they are to be regarded as objectionable rather than otherwise. * * * The volume of the chest is the measure not only of the capacity of the lungs, but of that of the large organs of digestion. Hence, unless there is a middle-piece of proper size, the wind is seldom good, and the stamina of the individual will scarcely ever be sufficient to bear hard work. * * * The capacity of the lungs is marked by the size of the chest at the girth; but the stamina will depend upon the depth of the back ribs, which should be especially attended to.

"*A short back*, with plenty of ground covered nevertheless, is the desideratum of every practical horseman. Unless the measurement from the shoulder point to the back of the quarters is somewhat greater than the height at the withers, the action is confined, especially in the gallop, for the hind legs cannot be brought sufficiently forward on account of the interference of the fore-quarter; and, indeed, from the want of play in the back, they are generally too much crippled in that respect. * * * Next to these points in the middle-piece it is important to pay attention to the upper line of the back, which should bend down a little behind the withers, and then swell out very gently to the junction with the loins, which can hardly be too wide and muscular.

"*In examining the hind-quarters,* so much depends upon the breed, and the purposes to which the animal is to be put, that only a few general remarks can be given. * * * Muscular quarters and gaskins are desirable in all breeds; for without strong propellers, no kind of work to which the horse is put can be duly performed. The judge of a horse generally likes to look at the quarters behind, so as to get a good view of their volume, and unless they come close together, and leave no hollow below the arms, he suspects that there is a want of constitution, and rejects the animal on that account. But not only are muscles of full size required, but there must be strong joints to bear the strain which these exert, and one of the most important of all the points of the horse is the hock. This should be of good size, but clean and flat, without any gumminess or thoroughpins, and with a good clean point standing clear of the rest of the joint; the 'curby place' and the situation of spavin should be free from enlargement; but to detect these diseases a considerable amount of practice is required. Lastly, the hocks should be well let down, which depends upon the length of the thigh, and ensures a short cannon-bone. The pasterns and feet should be formed in correspondence with those of the fore extremity, to which I have already alluded."

Breeds.—There are certain fixed types of horses which have the power to transmit their peculiar characteristics to their progeny when crossed to common mares.

These are the *thorough-bred Racer, Arab, Suffolk, Clydesdale,* and *Norman* or *Percheron.*

The Thorough-bred Racer.—We believe that a more liberal use of the genuine horses of this type would be productive of a great improvement in our present class of Canadian horses. The peculiar features and characteristics of these horses are splendid wind and great courage. We have them typified to a certain extent in the descendants of "*Lexington*" in Kentucky and in "*Scottish Chief.*"

For general purposes there can be no breed so useful as the cross between the stout, square-built and heavy farm mare and a thorough-bred blood horse. From the one we obtain size of frame, weight for the collar; while from the other are derived endurance, pluck and life.

The Arab has been used to advantage to produce the same qualities as the type above spoken of.

The Suffolk, usually called *Punch*, is a breed peculiarly adapted to farm purposes in Canada. They have strength, beauty, docility, are easily kept, and are fast walkers—good on the road or on the farm.

The Clydesdale is heavy and unwieldy, excellently adapted for heavy pulling at a slow pace, but it is not favourable for farm uses; a cross between a Clydesdale and a well-bred, fine-limbed horse, is productive of a superior farm and general beast.

The Norman or *Percheron* is being fast introduced into the States, and has made some foothold in Canada. The breed possess great strength with stoutness, and is of moderate size and good action.

Our French Canadian horse is from the pure Norman stock, crossed on the Indian ponies of the habitants of the Lower Province. For strength, toughness and sagacity, combined with smallness of size and easy feeding qualities, there is probably no superior breed in the world.

Trotting Horses.—The raising of trotting horses is in itself antagonistic to the development of a good breed of general purpose horses.

The trotter is of no breed, but owes his superiority in one particular part to the diligent training of himself and perhaps of his ancestors in that particular gait.

The Morgans and *Black Hawks*, *Tempest* and *Royal George*, are all mongrels, with an infusion of the blood of the racer, and in very few cases has a superior trotting horse been found capable of transmitting his qualities in that particular respect to his offspring.

When a common mare is put to a trotting stallion, the chance of the colt turning out well on the track depends not so much upon the trotting capabilities of its sire as upon the infusion of blood inherited from his ancestors.

On this point Stonehenge says:—" The pure blood stallion had no plebeian ancestors, and his colts, if not closely resembling himself, will still be good, inheriting the qualities of some ancestor, while the colts of a trotting stallion are likely to take after some dunghill grandmother."

A good trotting mare to a blood horse is almost certain to produce a fast colt; whilst a slow-gaited mare and a trotting stallion are equally certain (if the trotting stallion be not of good blood for several generations back) to produce an ordinary, and in many cases an inferior colt.

An undue encouragement has been given to these trotting stallions and trotting horses at our agricultural shows of late.

The ordinary farmer, who is the supporter of our agricultural societies, does not want weedy trotters for his uses, but good, serviceable, compact, easily fed and enduring horses.

Let the farmer, then, take a stand, and see to it that in our horse rings prizes are not awarded to some loose, weedy and leggy trotter, that can "knock spots" out of better built and more useful animals, when speeding round the puny ring, to the admiration of outsiders and the shouts and yells of appreciative boys.

Employ only stallions of pure blood, and beware of using any of the classes of ill-bred trotting stallions now so numerous. The fact of so many of these trotters having obtained premiums, and having thus been advertised before the public, is due to the unjust and harmful practice on the part of the judges at our agricultural societies' shows, of awarding prizes to animals for an excellence *in what they have been trained to do,* rather than *in those qualities which, inherent in the blood, they will without fail transmit to their progeny.*

Stallions should be obliged to show a pedigree at our exhibitions. This is just as important with reference to the horse, as it is to the bull that is entered as a thorough-bred. We are particular to know the exact descent of a bull, because we say blood is everything. Equally as rigid should be the rule as to the pedigree of the horse. An old writer has justly said :—

"The worst scrub of a hack of pure-blooded lineage will produce better colts than the handsomest mongrel that ever went on a shodden hoof can do."

The Farmer's Horse is an animal of *all work.* He is required occasionally to take the saddle or to draw the light buggy to town ; to be lively enough, that the driver be not required to "work his passage ;" and to be light enough, that an occasional trot along the hard high road will not use up his feet or legs. As steady pulling is required from the farmer's horse, a thicker and lower-set shoulder must be looked for than on the road or purely carriage horse. He wants weight enough to tell before the plough, and "go" enough to drive with spirit before the light rig. Were the operations of farming confined to heavy, steady ploughing and cultivating, the heavy-built, all-weight horse might suit the farmer. But in Canada the seasons are short, and we have in all our operations to "hurry up." We want a horse, then, that will walk up with the reaper and mower ; fetch the empty hay-rack and dung-waggon back from the barn at a rattling pace ; in fine, one who is capable of doing not only steady but fast work.

For these general purposes, a moderate-sized, strong, clean-limbed and active horse will be found best suited, and to attain such a class the half-bred horse with some blood in him will be found necessary.

Mares are, as a class, better suited for farm purposes than geldings. A mare, taking weight for weight and bulk for bulk, is usually stronger and more lasting than a gelding, and the farmer can at any time make her bring in a good income, not only from work but by breeding. There is a constantly increasing demand for stout, able horses, clean in limbs and with blood in them, in Canada; and we know of no kind of stock in the raising of which there is more profit at the present day, to the Canadian farmer, than that of a good class of agricultural horse. A good colt at three years old will fetch one hundred and fifty dollars, and will require little more attention and feed than a three-year-old steer, worth probably from sixty to eighty dollars.

If a farmer owns a good, sound farm mare, and can find a three-fourths or seven-eighths bred horse to which to put her, he need not fear but that he will raise a valuable and saleable colt.

By judicious management, the time taken from work for a breeding mare need be very short; for it has been proved over and over again, that the mare does best when moderately and steadily worked up to the very day of foaling. If a mare is put in May, the foal will be dropped at a comparatively leisure season of the working year.

The kind of mare from which to breed is very important; indeed we have observed that, as a matter of practical every-day observation, the value of a foal depends, no doubt, greatly upon the sire, but far more upon the mare.

So well aware are the Arabs of this fact, that it was for years a matter of very great difficulty, and is yet no easy task, to obtain a superior native Arab mare. They would part with their stallions, but nothing could induce them to permit a good mare to leave their country. The greatest evil has been done to the race of agricultural horses in Canada by the too common belief that "any mare will do to breed from," no matter how old, undersized, blemished, broken-winded or otherwise unsound. He says only that "a mare's a mare for a' that and a' that," and he looks to the stallion to counterbalance in the colt her inherited imperfections. It cannot be too often or too deeply impressed upon the farmer that from the dam comes the majority of points and beauties in the colt. In the days when Greece was at the head of civilization, an Athenian youth had entered his horse for a race in the Olympian games: "What chance have I of winning?" asked the youth. The answer made by an experienced Greek who stood near was, "Ask the dam of your horse."

We are too apt to think that the fact of a mare having curbs, spavins, contracted feet, roars, thick wind, heaves, blindness, &c., are purely the result of perhaps hard work, neglect or some local cause. In the great majority of cases, although these tokens of unsoundness may have been developed in the mare by hard usage or other temporary causes, they *are in her breed, and will be handed down as hereditary to her colts.* It is not safe to breed from unsound mares, unless such unsoundness be known as only resulting from purely accidental circumstances.

"It is possible that cases may exist where it is safe to breed from an old mare. Two of the finest horses that reins were ever drawn over were from a mare nearly thirty years of age, but she was perfect in limbs and spirits; had always been owned by the same person, and fed with as much regularity as the owner's meals were served; she was never raced at a 'military muster,' or overloaded in any way, and at thirty-three years of age she and her mate, of about the same age, were not only sound in wind and limb, but were a pair to be proud of when one held the reins over them. A pair of her colts, born after she was twenty-five, sold, under our eye, for twice as many hundred dollars as other fine horses about them brought! A moderate old age should not, therefore, absolutely exclude the mare from breeding, if she is right in other particulars.

"The common practice for many years past, and one which has become woven, as it were, into the habits of the people, so that it seems as natural as the breath of life, is to keep the old mare for breeding when she is unfitted for service on the road or on the farm. This is where the evil commences. She is a favourite animal, was handsome, spirited, and with a power of endurance almost beyond belief. But now she is seventeen years of age, has a spavin, a slight touch of the heaves, and one or two other trifling matters which are a little inconvenient for a working animal, but she will make a good breeder, and about pay her keeping besides! This is the conclusion arrived at, and thousands of such cases exist among us to-day.

"So the old mare, crippled by too early labour and disabled by disease, is to become the progenitor of a race which is to occupy a certain locality, perhaps for a hundred years! It is scarcely possible that her young will not be injured before they see the light; and the strong probability is that each of them will bear the marks of her imperfections; some with ringbone, perhaps, or asthma, or spavin, or some lurking disease that had not developed itself in the over-worked and disordered mother. We have seen a yearling colt with a ringbone upon every foot; well-formed otherwise, apparently healthy, eating and drinking well, but suffering and utterly worthless."—*New England Farmer.*

Proofs have been piled upon proofs, that blindness, roaring, heaves, thick wind, spavins, curbs, ringbones and founder, have been bequeathed from dam to colt, sometimes escaping one generation and being developed in the succeeding offspring. Hence the necessity of some knowledge of the ancestry of horses from which to breed.

In breeding, it is well to remember—

That peculiarities of form and constitution will be inherited from both parents; equally as much, aye, more, from the mare; and that out of a sorry mare, no matter how good the stallion may be, no perfect colt can come.

The parents, at the time of breeding, should be in full possession of their natural powers and strength.

Strict confinement to one breed, or a system of breeding in and in, too long persisted in, will result in deterioration.

Our stallions in Canada are not as good as they ought to be. There are not enough with good blood in them travelling the country. A few are owned by such men as Mr. Simon James, of Hamilton, and the late Mr. Sheddon, but they are so few that their service is placed at a figure far beyond the pocket of the ordinary farmer. We want more thorough-red sires. We have too many of these prancing stallions, with a fine-sounding name, who have not a drop of blue blood in their veins, and who, fed up and pampered, are full of life and *show*, but whose fat hides all their points, and about whose ancestors—many of whom were, doubtless, broken-winded, spavined, curbed and what not—we know nothing. They catch the eye by their fat, and prancing motions, but for the purpose of *improving* our stock few of them are at all efficient.

The brood mare is generally supposed to go with foal for eleven months, but there is a great irregularity.

Some have been known to foal in less than ten months, whilst others will run nearly, aye and over, the full year.

As we have before indicated, the end of May is the best time at which to put the farm mare in Canada; thus she comes in, in the early part of June, when the work is slack and pasture plentiful and tender.

It is better for the mare to work up to the day of foaling, though after the wax has appeared on her teats, which will be from one to two days before foaling, it may be as well to turn her into a nice quiet and dry paddock, and for the last two weeks of her pregnancy her work must be only steady draught,—no heavy driving nor working in deep soil, where she will have to strain in pulling out her feet.

Abortion or Slinking of the Foal usually occurs when the mare is about half through her time of pregnancy, or in the sixth and seventh months; they should in those months be carefully watched, well fed, the bowels kept open, and have regular exercise. Nothing is so apt to bring on abortion as standing idle in a stable; a mare is better at that time, if there be no work for her, to be running out in the yard or in a large loose box. This will be treated of more fully in our chapter on Diseases of the Horse.

Parturition in a mare is seldom accompanied with danger, if she has been well fed and cared for during winter and spring, and her bowels kept open (this is most important) at the expiration of her term of pregnancy. Where, however, great difficulty is manifest, or there is evidently a false presentation of the colt, a qualified veterinary practitioner should be called in, rather than risk the lives of mother and foal by interference on the part of those unskilled in such matters.

As soon as the mare has foaled, let her have the run of a paddock, with shelter at hand, and feed her plentifully, but not heavily. This is the most important time in the life of the colt If stinted in the first few weeks he will never recover lost ground The mare should then be kept in a good flow of milk. Remember that to suckle a colt without working, is quite as wearing, and more apt to pull the mare down in condition than to work a mare without a colt to suckle.

Let the colt learn to eat as soon as possible, by feeding the mare in a trough on the ground.

Three weeks, or, when the work only consists of drawing hay, or other light work, two weeks after foaling, the mare may be again harnessed. The colt should not, however, be at first allowed to follow the mare all day, or it will thoroughly tire itself out, but should be confined in a stable, and each day allowed to run a little longer with the mare. It will soon get used to it, and become wise enough not to follow its mother all round the field, but to wait and lie about.

We have seen colts not six weeks old allowed to run after their mothers along a hot, dusty, and perchance stone road, to town and back. Now, fourteen or twenty miles a day is rather too much for a colt whose legs are not one quarter formed.

Again, the farmer should bear in mind that the mare who works and suckles a colt at the same time is having the condition drawn down at double speed, and she must be fed grain and fodder in accordance.

Between the third and fourth week after foaling, the mare will come in heat again, and she is more certain to " hold" the horse at this season than at any subsequent one.

Weaning.—The colt should be weaned from five to six months old.

The colt should be kept away, as far as practicable, from the mother, that they may not pine for one another; she should be fed drier food, and her milk drawn from her, and so gradually dried off.

Management of Colts.—The following remarks, from a correspondent of the *Rural New Yorker*, are very pertinent:—

" We often, when travelling through the country in the fall, see colts with a rough, staring coat; eyes nearly closed, and a watery matter exuding therefrom; with a body shaped like a squash seed, which, but a few weeks before, while running with the mare, were possessed of a sleek, shining coat, eyes bright, and body as round as a barrel. Now the question arises, what is the cause of this? I answer, in nine cases out of ten it is improper weaning. Nearly every colt in a farming community is allowed to run with its mother until about four or five months old, when, to suit the convenience of the owner, it is turned into some distant field out of sight, and, if possible, out of hearing of its mother, there to run and whinney and worry, until it brings upon itself a fever, which weakens the constitution, closes the pores of its skin, and, in brief, the whole organs of digestion become more or less diseased. All of this can be avoided by a little care in weaning.

"My way of weaning is this : When my colt is four and a-half months old, I put a strong leather halter upon him and place him in a stall, and put his mother in an adjoining stall, with a partition between, so arranged that they can see each other, and, if possible, get their heads together. The first day I let the colt nurse twice ; the next day, once. I feed the mare upon dry hay and dry feed, and about half milk her two or three times a day until dry. The colt I feed upon new-mown grass or fine clover hay, and give him a pint of oats twice per day, and in about two weeks I have my colt weaned and my mare dry, with my colt looking as well as ever. When he is one year old, he has as much growth and development of muscle as one two years old weaned in the first described manner. When the mare becomes dry, colt and mare may be turned out together again in pasture."

And—"Colts are very apt to be left to shift for themselves after weaning. This is wrong. A year's gain in the usefulness of a horse may easily be made by care and attention during the first few months of its life. Then care should be exercised to keep it growing. During the fall months some of the best early-cut hay should be given to it ; and when the horses are stabled, let it have a loose box or stall adjoining them, where it can see and become used to the discipline of the stable. Everything around it should be well secured, lest in rubbing itself it might get something loose. A habit of breaking things and getting loose is easily and invariably formed at this time, and should be guarded against. During winter, feed your colts as you feed your horses. Give them a share of what is served out—oats, corn, or ground feed as it may be. They cannot grow or fare well otherwise. 'Stinginess' don't pay in rearing young animals. An addition of twenty-five or forty dollars to its value may result in the winter's feeding and care of one colt. Generosity here (of course exercised with judgment) is only wise foresight, and will pay good interest on the investment. Colts are better kept up than allowed to run around. They will become more docile and tractable, and will learn fewer tricks. Take them out only for exercise, except when at pasture, and then be sure to have a secure fence, or they will inevitably learn to rub it down or jump over it. Train your colt to walk, and keep it walking. Farmers don't want fast-trotting horses as yet ; we have need, so far, of fast-walking horses ; great need, we may say, for they are far too scarce. Therefore, train colts to walk at the rate of four miles an hour at least. The time will come when a horse that can walk his mile in twelve minutes will take a prize at an agricultural fair, equal in value to the best trotter. A team of such horses could plough an acre of ground, with a furrow six inches wide, in five hours, allowing time for turnings round. This is above the quantity ploughed on the average now in a day of ten hours. Horses of such capacity would be worth a large price, and it should be our endeavour to produce them. We have a breed that can transmit trotting capacity to its descendants; why could we not raise up a breed of walking horses? Some one might make a name and fortune in this."—*American Agriculturist.*

Breaking Colts.—We would only endorse the above remarks, and to the importance of teaching agricultural horses to *walk fast*, add the following summary:—

When first bitted, a bit should be selected that will not hurt his mouth, and one smaller than in common use.

Allow him to play with this bit, by champing it for a few days an hour at a time.

Before putting him in with another horse, accustom him to portions of the harness, and let the straps dangle round his legs, gently at first; and afterwards, let the tugs fall down and strike him about the heels; accustom him to stop at the sound "Whoa," without any bit in his mouth, and to understand and obey every word of command before he is put into harness at all.

If this custom of thorough training were more generally adopted before breaking to the waggon, we should have less "kicking scrapes" and fewer runaways.

Put him to a very light load at first, alongside of a steady but on no account a slow or lazy mate. Before he pulls an ounce, let him understand what "Get up," a chirp or a whistle means.

Directly he stops of his own accord, or when he is in the act of stopping, call "Whoa;" he will soon learn that that word means stand. Drivers very frequently stop the horse by a pull on the reins, and *then* call "Whoa." This is wrong; the word of command should be always given *before* the manœuvre is executed.

In teaching a colt to back—one of the hardest tricks, for it is a trick—don't call "Back" unless he is able and willing to do it. It is unnatural to him, and in this case the action of backing should be performed by gentle pressure, not severe force, upon the bit, and should be *simultaneous* with the cry of "*Back up.*"

How many horses do we find that if the reins should break will not run away; and yet it is as easy to train them to stop on the break of the line and the call of "Whoa," as to teach them to keep in the furrow or on the land when ploughing. Teach them when young to travel under a gentle strain of the line, and that the slacking of the line is meant to imply, equally with the word "Whoa," stop.

Horses are not generally deaf; on the contrary, they have an ear exceedingly susceptible to every wave of sound. There is, then, no necessity to *shout at a horse* as if he was "hard of hearing."

When a colt shies, he does it not generally from vice, but because he sees something that he never saw before. Don't beat him for that, as you simply increase his timidity. He associates the object, whatever it be, with a lash of the whip, and becomes still more frightened of it. Reader, did you ever take a child out for a walk, and meet some ugly animal, say an immense dog, at which your child was frightened? Did you beat the little one for its foolish timidity? We trust not. You rather coaxed it, soothed it, and led him up to pat the big ugly fellow, thereby allaying his childish fears by showing that there need be no cause of alarm. The child was frightened because he saw an object for the first time in his life, and couldn't realize what it was. You answer, "Of course I petted the child; do you think I'd be such an inhuman brute as to whip the poor little frightened thing?" And yet can you with a clear conscience say that you never drew the whip across a colt for exhibiting the very same fear as that which overcame your child? If you can answer this home question in the negative, then you have got the one great and practical lesson of horse-training—to teach the colt, by the influences of affection, salutary fear on his part, and steady determination, kindness and common sense, exercised in almost exactly the same manner as when brought to bear upon the early training of a little child on your part.

The whip is needed for the colt, as it is for the child, at times—administered rarely, but, when applied, used firmly—as a means of correction, but very seldom for the pure purpose of coercion.

Before we enter upon the question of food for horses, we would copy the following excellent summary, entitled—

"HINTS ON HUMANITY TO ANIMALS."

(*From a work on "The American Horse,' by Robert McClure M.D., V.S.*)

"1. Warm the bit in frosty weather, before putting it into the horse's mouth.

"2. Let the horse lick a little salt out of your hands whenever you offer to bit him.

"3. Never startle a horse by suddenly striking him.

"4. Uniformly gentle treatment will secure faithful and steady work. Anger, severity and sudden jerking endanger your harness, your vehicle and your life, besides permanently injuring your horse.

"5. Be well provided with horse-blankets, especially at night. If you are waiting for passengers, while you look for your own comfort by a warm fireside, or in thick wrappers, see that your faithful brute companion is also protected from the chilly air.

" 6. Wash the inside of the collar frequently with Castile soap suds, and when it has thoroughly dried, gently warm the leather and soak it with oil, so as to soften it; but do not allow any oil to remain on the surface of the leather unabsorbed.

" 7. If the shoulders are tender, feverish and disposed to chafe, they should be well rubbed, and afterwards washed with salt water. This should be done after unharnessing, so that the parts bathed may be dry before work is resumed.

" 8. Do not be tempted by over-pay to overload your team. Overloading occasions blindness, spavin, splints, glanders, farcy, and other painful and fatal disorders, and thus risks the loss of capital, besides injuring yourself by encouraging a cruel disposition.

" 9. See that the harness fits tight in every part, and that the shoes are tight and well put on.

" 10. Let your tones, when addressing the horse, be always gentle, soothing and pleasant. Pat him often, and encourage every sign of attachment that he gives.

" 11. Every vehicle should be so arranged that the weight on the neck is relieved when the team or horse is standing.

" 12. Curry, rub and clean *well* at least *once a day.* The effect is worth half the feed. A dirty coat and skin, when the animal is deprived of exercise in pasture and of rolling on the grass, cannot fail to produce disease.

" 13. Never use a check rein. It is false taste to think a horse more beautiful when his head is fastened in an unnatural position. The bearing rein keeps a horse in a constant fret, makes him restless and uneasy, and often prevents him from recovering himself in case of a stumble or a fall.

" 14. Your stable should be perfectly level, or *very* slightly inclined; well lighted, well drained, well ventilated, and well protected from draughts and from extremes of heat and cold. Keep the crib clean and free from dust, and keep the hay or other fodder as far from the stall as possible, so as to be away from the steam and breath of the animal.

" 15. If you use ground feed, remember that it is not unfrequently adulterated when bought.

" 16. If you suspect adulteration, usually done by the use of plaster of Paris or marble, or the sweepings of canal boats and barges, heat a portion of the feed to a red heat in an iron vessel. After the whole has been reduced to ashes, if they contain plaster, the ashes will soon set or harden, after being mixed with water to the consistency of paste.

" 17. Do not urge your beast beyond a walk when the heat is oppressive; furnish drinking water often, and sponge the legs and such parts as are liable to chafe by perspiration or otherwise; see the harness is not oppressive and cumbersome.

" 18. In icy weather keep your animal sharp shod, renewing the sharpening as often as the shoes become blunt. A few dollars expended in this way will undoubtedly save your horse from serious injury, and perhaps from loss of life.

"19. Standing on fermented manure softens the hoof, produces thrush and brings on lameness. Keep the litter dry and clean, and cleanse the stall thoroughly every morning.

"20. Sharp bits make the mouth tender at first and afterwards callous, so that the horse becomes unmanageable.

"21. If your horse kicks and plunges on mounting, look to the stuffing of the saddle, and see if it has become hard and knotty with use.

"22. Keep your wheels well greased.

"23. Keep the feet well brushed out, and examine every night to see if there is any stone or dirt between the hoof and the shoe. Change the shoes as often as once a month.

"24. Disease or wounds in the feet and legs soon become dangerous if neglected.

"25. When a horse is hot and fatigued from labour, walk him about till cool; groom him quite dry, first with a wisp of straw, and then with a brush; rub his legs well down with the hand to remove any strain, soothe the animal, and detect thorns and splinters; and give him his grain as soon as he is cool, dry and willing to eat.

"26. On the evening before a long journey give double feed; on the morning of starting give only half a feed of grain, or a little hay; on the road, feed in small quantities about every two hours.

"27. When horses are long out at work, provide them with nosebags and with proper food. The nose bag should be of leather at the bottom, and of basket work or open texture above. On coming home give a double feed of grain.

"28. Let the horse carefully into and out of a stable. Accustom him to stand quite still until you are seated. Start at a walk, and go slowly the first and the last mile.

"29. Never use the whip if you can help it. It will then be always available as a last resort.

"30. Be always on your guard, just feeling the mouth with the bit, lightly and steadily.

"31. If a horse shies, neither whip him nor pat him, and let him come slowly towards the object.

"32. If you value your own life, the lives of others, or your horse's, never drive fast in the dark, or in a town.

"33. Never add your own weight to a load that is already heavy enough. Get out and walk when you ascend a hill. If you stop on an incline, put a stone behind your wheel; and lock your wheels going down steep grades with a load.

"34. Never tease or tickle a horse, nor suffer it to be done by others.

"N.B.—The Ninth Avenue Car Line of New York, owning nearly eight hundred horses, and the City Commissioners of Boston, never allow a whip to be used with any of their teams."

Food for Horses.—If we would obtain full work from our horses, they must be well fed at all times.

The best hay and provender produced on the farm should be retained for the use of working horses, for such are in the end most economical.

However nutritious may be the food of horses, they must have bulk also ; for which reason, while we look to grain as a source from which to gather nitrogenous food, hay or straw has to be used to make up bulk.

Long fasting is very injurious to a horse. This is owing to the peculiar characteristics of his constitution.

The horse has a very small stomach, and requires to be kept at all times moderately full. "Little and often" is the safest rule of feeding for the horse.

When allowed to go too long without food, the stomach becomes empty, the intestines more or less filled with gas or wind ; and when, on reaching the stable, the animal is allowed to gorge himself with food or water, the consequence is an unnatural extension of the walls of the stomach, confinement of air in the intestines, incapability of digestion, and the consequent formation of yet more gas in the internal organs, and the result is an attack of gripes or colic, or, perhaps, staggers.

Oats are usually given whole, and in the case of young horses we think that the process of mastication is not only good for the teeth, but prevents "bolting," and consequent indigestion. In the old horse, whose teeth are level and worn smooth, it is wise to crush grain and to cut hay, for otherwise he will pass the oats through without mastication, and their benefit is lost to his system.

Feed.—Good hay stands first as general horse feed. Poor hay produces colic, and is bad for the wind, both of which are the sure followers of a diet of dusty hay or musty oats. Bad oats have a peculiarly diuretic action, increasing to a great extent the secretions of the kidneys, and consequently tending to weaken those organs.

Pea meal, barley meal, corn meal, and wheat meal, are all, in an uncooked state, bad feed for horses, as they are apt to cake in the stomach, and often bring on feverish diseases. Barley is undoubtedly more nutritious than oats, but there are required other qualities in food, besides a great proportion of nutritive matter, to render food for a horse wholesome, strengthening or fattening. Horses fed heavily on corn, peas, or barley are more subject to inflammatory affections than such as are kept chiefly upon oats.

This is in great measure shown by the practical observations of many men, and we have ourselves frequently observed that there are far more cases of colic amongst stabled horses, on Sunday night or Monday morning, than on any other day of the week.

Horses will do well on straw, if it has been cut on the green side ; but as it requires more digestion than hay, it should be only fed when horses are moderately worked, and have in consequence good appetites, or when turned out loose.

TABLE SHOWING AMOUNT OF VARIOUS FOODS GENERALLY SUFFICIENT FOR WORKING HORSES.

ARTICLES OF FOOD.	1st Class.	2nd Class.	3rd Class.	4th Class.
	lbs.	lbs.	lbs.	lbs.
1. Farinaceous substances, consisting of bruised or ground beans, peas, wheat, barley or oats	5	5	10	5
2. Bran, fine or coarse	—	—	—	5
3. Boiled or steamed potatoes, mashed	5	5	—	—
4. Fresh grains (boiled barley)	6	—	—	—
5. Hay (cut)	7	8	10	8
6. Straw (cut)	7	10	10	8
With two ounces of salt for each class, making	30	28	30	26

It will thus be seen that from twenty-six to thirty pounds of food will be required for each horse per day to keep him in good working order.

Of the four classes, we prefer, as conducive to the general health of the horses, Nos. 1 and 2.

We again quote the excellent advice of Dr. McClure, under the head of " Hints on Horse Food :"—

" 1. All horses must not be fed in the same proportions, without due regard to their ages, their constitutions and their work—*because* such action is the basis of disease of every kind.

" 2. Never use bad hay on account of its cheapness—*because* there is not proper nourishment in it.

" 3. Damaged grain is exceedingly injurious—*because* it brings on inflammation of the bowels and skin diseases.

" 4. Chaff is better for old horses than whole hay—*because* they can chew and digest it better.

" 5. Mix chaff with corn or oats, and do not give them alone—*because* it makes the horse chew his food more and digest it better.

" 6. Hay or grass alone will not support a horse under hard work—*because* there is not sufficient nutritive body in either.

" 7. When a horse is worked hard, the food should be chiefly oats and corn ; if not worked hard, his food should be chiefly hay—*because* oats and corn supply more nutriment and flesh-making material than any other kind of food ; hay, not so much.

" 8. For a saddle or coach horse, half a peck of sound oats and eighteen pounds of good hay per day are sufficient. If the hay is not good, add a quarter of a peck more oats.

"9. Rack feeding is wasteful. The better plan is to cut fodder and feed in manger—*because* the food is not then thrown about, and is more easily digested and chewed.

"10. Sprinkle the hay with water that has salt dissolved in it —*because* it is good for and pleasant to the animal's taste.

"11. Oats and corn should be bruised for an old horse, but not for a young one—*because* the former, through age and defective teeth, cannot chew them properly ; the young horse can do so, and they are thus properly mixed with the saliva, and turned into wholesome nutriment.

"12. Grass must always be cut for hay before the seed drops —*because* the juices that ripen the seed are the most valuable part of the hay. If they (the juices) are sucked out by its ripening and dropping, the grass will not turn into hay, but only wither and grow yellow.

"13. Vetches and cut grass should always be given in the spring to horses that cannot be turned out into the fields—*because* they are cooling and refreshing, and almost medicinal in their effects ; but they must be supplied in moderation, as they are liable to ferment in the stomach if given largely.

"14. Water your horses from a pond or stream rather than from a spring or well—*because* the latter is generally hard and cold, while the former is soft and comparatively warm. The horse prefers soft muddy water to hard water though ever so clear.

"15. A horse should have at least a pail of water morning and evening (we think three times a day), or (still better) four half pails-full several times a day—*because* this assuages his thirst without bloating him. But he should never be made to work directly after he has had a full draught of water, for digestion and exertion can never go on together.

"16. Do not allow your horse to have warm water to drink—*because* if he has to drink cold water after getting used to warm, it will give him colic.

"17. When your horse refuses his food after drinking, go no further that day—*because* the poor creature is thoroughly beaten."

Water for the Horse.—"This is a part of stable management little regarded by the farmer. He lets his horses loose night and morning, and they go to the nearest pond or brook to drink their fill, and no harm results ; for they obtain that kind of water which nature designed them to have, in a manner prepared for them by some unknown influence of the atmosphere, as well as by the deposition of many saline admixtures. The difference between *hard* and *soft* water is known to every one. In hard water soap will curdle, vegetables will not boil soft, and the saccharine matter of the malt cannot be fully obtained in the process of brewing. There is nothing in which the different effects of hard and soft water is so evident as in the stomach and digestive organs of the horse. Hard water, drawn fresh from the well, will assuredly make the coat of the horse unaccustomed to it stare, and it will not unfrequently gripe and otherwise injure him. Instinct or experience has made even the horse himself conscious of this, for he will never drink hard water if he has access to soft; he will leave the most transparent and pure well water for a river, although the water may be turbid, and even for the muddiest pool. He is injured, however, not so much by the hardness of the well water as by its coldness, particularly by its coldness in summer, and when it is many degrees lower than the temperature of the atmosphere. The water in the brook and the pond being warmed by long exposure to the air, as well as having become soft, the horse drinks freely of it without danger.

"There is a prejudice in the minds of many persons against the horse being fairly supplied with water. They think that it injures his wind, and disables him for quick hard work. If he is galloped immediately after drinking, his wind may be irreparably injured; but if he were oftener suffered to satiate his thirst, he would be happier and better.

"It is a fact unsuspected by those who have not carefully watched the horse, that if he has frequent access to water he will not drink so much in the course of the day as another who, to cool his parched mouth, swallows as fast as he can, and knows not when to stop."

We have already recorded our opinion in the agricultural press, that *the care of horses lies in a nutshell*; thus:—

"Handle the colt from the time it is foaled. By not working the dam too hard, and by generous food, keep her in good flow of milk. Feed well from the day of foaling; never let it stop growing. Halter-break the first winter.

"Begin to work him very lightly when two years old. Don't put him to heavy work until five years old. Feed him regularly, evenly and generously, whether at work or idle. Keep his stable *clean*, warm, well ventilated and light. Clean him every day, morning and night. Take off harness when brought to the stable sweated from work. Don't let working hours encroach five minutes on feeding times. Always put a lighter load than that which you think the horse could pull at his best. Never check his head up before a load. Keep your fences good, and your colt will not learn to breach. Don't let shoes go until they fall off. Go ten miles to a good horse-shoer rather than one mile to a botch. If your horse is sick, and you are sure of the nature of the ailment, attend to him at once; if the attack is beyond your knowledge, send to an experienced surgeon. Never let a quack into your stable. Ninety-nine out of every hundred colds, colics, heaves, blindnesses, strains, spavins, curbs, and other diseases and accidents to a horse, are caused by gross neglect."

A FEW COMMON VICES.

To Cure a Kicker.—The following plan has been found, though not always, yet in a majority of cases, to be effectual :—

" With a strong harness, hitch to a stout whiffletree, which has a rope attached to it long enough to allow a man to hold the rope with safety. Let one man hold a mare by the head, while another, holding the rope slack but firmly, moves the trace or whiffletree against the mare's legs, tempting her to kick. Allow the whiffletree to fly high when she kicks, but bring it back every time. Let her play with this arrangement until she is thoroughly tired of it and will not kick at it. Without harnessing her in any other way, try the same every day, until she will allow the whiffletree and traces, or anything, to brush and strike against her legs without showing any fright or dislike, even when fresh."

Or simply fasten a short trace chain about two feet long by a strap to each hind foot, and let him do his own whipping if he cannot stand still without it.

Give them a wider stall, or turn them loose in a box stall. If neither is convenient to do, or fails to cure, take a piece of trace chain about two feet long, and fasten one end of it with a strong strap to the foot with which they kick. Or put a surcingle loosely around the animal, and pass a cord from the kicking foot through the girth, around the head, in front of one ear and behind the other. Make the knots so that they will not slip tight, and give length for necessary motions.

Balky Horses.—Horses know nothing about balking until they are brought into it by improper management ; and when a horse balks it is generally from some mismanagement, excitement, confusion, or from not knowing how to pull, but seldom from any unwillingness to perform his duty. High-spirited, free-going horses are the most subject to balking, and only so because drivers do not properly understand how to manage. This kind of free horse in a team may be so anxious to go that when he hears the word he will start with a jump, which will not start the load, but give him such a severe jerk in the shoulders that he will fly back and stop the other horse ; the teamster will continue his driving without cessation, and by the time he has the slow horse started again, he will find the free horse has made another lunge and again flies back, and now he has them both badly balked, and so confused that neither of them knows what is the matter or how to start the load. Next will come the slashing and cracking of the driver's whip, till something is broken, or he is through with this course of treatment. It takes a steady pressure against the collar to move a load, and you cannot expect him to act with a steady, determined purpose while you are whipping him.

Almost any team, when first balked, will start kindly if you let them stand five or ten minutes, as though there was nothing the matter, and then speak kindly to them, and turn them a little to the right or left so as to get them both in motion before they feel the pinch of the load. But if you want to start a team that you are not driving yourself, that has been balked, fooled and whipped for some time, go to them and hang the lines on their hames, or fasten them to the waggon so that they will be perfectly loose; make driver and spectators stand off some distance, so as not to attract the attention of the horses, and unloose the check reins, so that they can get their heads down if they choose; let them stand a few minutes in this condition, till you can see they are a little composed. When you have them ready to start, stand before them, and as you seldom have but one balky horse in a team, get as near in front of him as you can, and if he is too fast for the other horse, let his nose come against your breast; this will keep him steady, for he will go slow rather than run on you. Turn them gently to the right, without letting them pull on their traces, as far as the tongue will let them go; stop them with a kind word, gentle them a little, and turn back to the left by the same process; as you turn them again to the right, steady them in the collar, and you can take them where you please.

If you want to break a horse that has long been in the habit of balking, you ought to set apart a half day for it. Put him by the side of a steady horse, have check lines on them, tie up all the traces and straps, so that there will be nothing to excite them. Do not rein them up, but let them have their heads loose; walk them about as slow as possible; stop often, and go to your balky horse and gentle him; do not take any whips about him, or do anything to excite him, but keep him just as quiet as you can; he will soon start off at the word, and stop whenever you tell him. As soon as he performs right, hitch him to an empty waggon and have it stand in a favourable place for starting. It would be well to shorten the stay chain behind the steady horse, so that if it is necessary he can take the weight of the waggon. The first time you start them do not drive more than two rods at first; watch your balky horse closely, and if you see he is getting a little excited, stop him before he stops of his own accord, caress him a little, and start again; drive them over a small hill a few times, and then over a larger one, all the while adding a light load. This process will make any horse pull true.

Pulling on the Halter.—A writer in the *Rural New Yorker* says that he breaks a horse from pulling by putting a rope or strap halter over the top of the manger, and back through a hole in or under the frame of the manger, and between the horse's fore legs, through a surcingle, and back to the hind leg. Buckle a strap with a ring on it around the ankle; tie the halter strap to this ring. Keep the horse tied in this way one week.

A correspondent of the *Cincinnati Gazette* says: "Tie the horse with an inch rope in a stall with a floor in it; have the floor about three inches lower behind than before, and make the floor wet, so that it will be slippery; after tying the horse around the neck with a knot that will not slip, get before the horse and take an old white hat and scare the horse by hitting him on the nose with the hat. When he pulls back from fright he will fall down, his feet slipping from under him. He will not try it more than two or three times before he will become afraid to pull, for fear of falling. Keep this up for a week or so, by making him pull until he will at last stand as quiet as a lamb. The writer says he broke two horses and two mules from pulling back in this way. He once tied a pulling-back horse with a running noose around the neck, and the horse pulled back and came very near choking to death. It broke him so, that he would stand if hitched with a string. Choking, in all cases, is not recommended, however."

Hard-mouthed Horse.—"Take a small rope, about three-eighths of an inch in size, very strong, and about nine or ten feet long. Tie a loop in one end, just large enough to admit a large hand. The loop should be tied by what is known as a "sailor's bowline knot," which cannot slip or tighten up. If you cannot tie the bowline knot, you must make a loop as best you can, and secure it from slipping by tying a cord around the knot to prevent any danger from the loop tightening. Now stand upon the near or right side of your horse, with the loop in your left hand; place it well up into the mouth; reach with your right hand over the neck, bringing the end over the neck towards you, passing it down through the loop which you have placed in the mouth, drawing up tightly upon the rope. Taking hold of the rope about three feet from the head, give your animal about one half dozen short pulls—first upon one side, then upon the other—in quick succession.

"Do not be afraid of hurting him; on the contrary, be very severe. Do not speak while you are using the rope, as your object is to make the mouth governable. After a few pulls, let the horse stand a few minutes. Then stepping off to the end of the rope to one side say, 'Come here,' and at the same time pull upon the rope quickly and decidedly; then go upon the other side and repeat. As soon as your horse shows signs of yielding to the slightest touch, step up and caress him by way of encouragement. In the same way teach him to yield to the slight touch of the rope, whether you step either to the right or left, in front or behind, at the moment you straighten upon the rope, accompanied by the words, 'Come here, sir.'

"After two of the above lessons, given in one day, you will proceed to another adjustment of the rope, viz.: make a loop just the size of the collar your horse works in; place it upon his neck, well back, putting the other part of the rope into his mouth, and down through the loop which you just placed upon the neck; draw up tightly, and proceed as described in the case of small loops. If the above directions are strictly followed, with determination and coolness, the worst and most unmanageable horse can be cured so that any woman or child can drive him with comfort and safety." —*Cor. Western Rural.*

To Drench a Horse.—An ox's horn, the larger end being cut slantingly, is the best instrument for administering drink.

The noose of a halter is introduced into the mouth, and then, by means of a stable fork passed through the noose, the head is raised up high. Introduce the horn (or bottle if used, though it is dangerous to put glass in the horse's mouth), and pour the liquid in *gently*, and over the tongue. In order to make the latter point sure, it will be as well always to draw out the tongue and hold it with the other hand; quickly take out the horn and let the patient have the use of his tongue; stroke the throat gently, and watch the gullet to see if he has gulped down what has been given. This may be repeated until the whole dose is taken. As the horse is sometimes very obstinate about swallowing, especially any bitter decoction like aloes, the head has often to be held up some time. A sharp slap on the muzzle with the open hand will often make him swallow.

Don't put too much into his mouth at a time, for it only makes him splutter, and perhaps cough it up again.

To make a twitch for the nose, take a piece of stout lath about three feet long; bore a hole one inch from the end; take a strong cord, put it through this hole, and tie the ends; put the lath in his mouth, with rope over the nose, well up above the nostrils, and this takes the place of the halter noose spoken of above. This is the principle of *The Twitch;* and by turning the stick round, the horse may be caused such pain in the squeezing of his nose and mouth as to have his attention fully taken up while any minor operation is being performed.

Biting.—This habit is usually taught to the horse by the foolish teasing of his attendants. It is a very dangerous habit, and the tickling and pinching of a horse, looked upon as sport by some idle and mischievous boy, has often in after years turned out a vicious biter. In this case prevention is the only remedy. A horse that has once acquired the habit can never be cured of it. He may be muzzled when in town, or where he is likely to do mischief to strangers.

Getting the Bit in the Cheek.—This is a habit resulting from sheer mischief on the part of the horse, and may be remedied by having very large bit rings, or putting a stiff round leather on each side of the bit inside the cheeks.

Rearing is often brought on by a too free use of the curb. A change from a severe to a more gentle bit will often cure this habit. As to *pulling a horse backwards*, Youatt says :—"The horsebreaker's remedy—that of pulling the horse backwards on a soft piece of ground—is worthy of him, and would be practised only by reckless and brutal men. Many horses have been injured in the spine, and others have broken their necks, by being thus suddenly brought over ; while even the horsebreaker, who fears no danger, is not always able to extricate himself from the falling horse. If rearing proceeds from a vice, and is unprovoked by the bruising and laceration of the mouth, it fully partakes of the inveteracy which attends the other divisions of restiveness."

Runaway.—If this proceeds purely and simply from vice, there is no cure. The horse has learned that he is stronger than the man, and he has learned "a stubborn fact." Very sharp, punishing bits will in many cases prevent their attaining a full knowledge of man's incapacity to hold them, if determined to bolt. We have cured a young horse of this habit by giving him all the running he desired, and a good deal more, by liberal use of whip and spur on a clean trail and over heavy ground.

Bad to shoe arises from careless handling and often rough treatment when first shod. Nothing but kind and encouraging treatment will overcome the difficulty ; it is seldom a vice, but in most cases is the result of timidity. It is a very awkward form of timidity, full of danger to the smith ; and we can hardly blame the mechanic if he sometimes pricks the foot of a horse that refuses to stand still. If the fear becomes confirmed, the horse has generally to be cast.

Pawing is a bad habit, for the cure of which shades will be found the best remedy.

Rolling in the stall.—The habit once acquired cannot be broken ; the only remedy is to tie him so short that he cannot lay his head on the floor, for a horse cannot roll without he gets his head quite down.

Shying.—In colts this proceeds from timidity ; as we have endeavoured to show above, gentle treatment and proving to the animal that the object at which he is frightened will not hurt him, are the proper methods to be adopted.

It may arise from defective sight, in which case, if the eyesight cannot be improved, the sooner the horse goes blind the better ; for a horse that is deprived of sight is a safer beast to ride behind than one who has only imperfect vision.

Where the habit arises from skittishness and a "good feeling" on the part of the horse, the best plan is to take as little notice as possible of him ; perhaps speaking a little sharply to him, but never using the whip. In most cases it is a mere affectation—a pretence of being frightened—on the part of the horse, and, like affectation in man or woman, the best cure is to take no notice at all of it.

John Lawrence, in his work on the Horse, gives the following instances of this phase of shying :

"I recollect," says he, "having, at different periods, three hacks, all very powerful; the one made choice of a windmill for an object or butt, the other a tilted waggon, and the last a pig led by a string.

"It so happened, however, that I rode the two former when they were amiss from a violent cold, and they then paid no more attention to either windmills or tilted waggons than to any other objects, convincing me that their shying when in health and spirits was pure affectation; an affectation, however, which may be speedily united with obstinacy and vice. Let it be treated with marked displeasure, mingled with gentle but decided firmness, and the habit will be of short endurance."

Slipping the Halter.—Some horses will get almost any halter off their heads at night. We once had a mare, upon whom, for the purpose of confining her to one stall at night, a halter was utterly useless. If you buckled the throat strap so tight that you could hardly get a finger between it and the windpipe, she would have that halter rubbed off before the middle of the night, and would go the rounds of the stable, sharing food with each horse in turn, and happy did she think herself if she could get at a bag or bin of oats. Being once at a strange house, and having put the halter, as we thought, very securely upon her, we found next morning that she had got at an oat-bin and devoured—we should be ashamed to put in print how many quarts of grain. Fortunately, we discovered the matter before any water was given her, and by a good dose and an injection, we managed to open a passage through her for the mass, which came away apparently as whole as when they lay in the grain-bin.

The only plan is to discard the use of a head-stall halter, and fasten with a stout strap, buckled close around the neck, and attached to a tie-strap by a ring sewed in.

Stumblers.—When this arises from inveterate laziness or ill-formed fore legs, it is useless to attempt to remedy the habit. Such a horse is only fit for slow work upon soft places.

Interfering.—The remedy for this lies in the skill of the shoeing smith; if he can make nothing of it, a leather sock must be worn.

Overreaching.—With horses having high hind quarters and being low in front, it is often a physical difficulty to raise the fore foot from the ground in time for the hind foot to come down in its place, without touching the fore as it is raised. It is sometimes attended with disagreeable consequences. The abrasion of the foot, the pulling off of the fore shoe, and in some cases the hind and front shoe, may lock and throw the animal when at speed. The remedy here again lies with the blacksmith, who should shorten and round the toe of the hind shoe as much as possible, while the fore shoe is made a *little* short in the heel. If it can be done altogether on the hind shoe it is better, for no fault is so injurious to the foot as any undue shortening of the heels of the fore shoe.

Crib-biting is one of the worst vices, or rather habits, that a horse can engage in. It consists of sucking wind into the stomach by placing the lips against a manger or any projecting woodwork. In some horses the habit has become so firmly implanted, that in lieu of a harder, better object, they will use their own forearm for this wind-sucking. The causes are standing too long in the stable without exercise, and, as many veterinarians also contend, indigestion.

A peculiarity of this habit is, that horses will learn it from one another; and if not checked in a horse, it will sometimes spread amongst the greater proportion of his stable mates.

The remedies are plenty of exercise and regular feed. Also feed his hay upon the ground, so that there are no projections in the stall over which he can place his lips. However, the habit becomes so deeply rooted in some horses, that they will crib-bite in the pasture field. A strap must then be buckled closely round the neck in the smallest part; this prevents the swelling of the windpipe large enough to admit of the passage of a large body of wind into the stomach.

THE COMMON DISEASES TO WHICH THE FARM HORSE IS LIABLE.

The information contained in this chapter has been obtained from the best authors on the Horse, and is confined to the more general and commonly occurring diseases.

Should our reader's horse be attacked by any of those complicated disorders not to be found in this work, he must call in the aid of a practitioner.

Indeed, we do not wish these pages to take the place of the veterinary, but in them the farmer will find many hints of use to him in the case of simple disorders in the stable, and by reference the right early treatment may often be adopted without delay.

Abscess.—A formation of matter just beneath the skin, generally from inflammation, acute or chronic.

Symptoms.—Pain, heat and swelling, from the head of which the hair falls off, showing a white, soft spot.

Remedy.—Apply poultices and hasten the formation of matter, then open it, and take—

Rain water	1 ounce.	Apply to wound twice a day.
Chloride of zinc...	6 grains.	

Accidents.—Rules for guidance of driver when his horse falls:

1. Hold the animal's head down with your knee.
2. Loosen the check rein and the parts of the harness attached to the vehicle.
3. Back the vehicle, so as to be clear from the prostrate animal
4. Steady his head and call to him to rise.
5. Treat him kindly when he is up, and don't brutally whip him for an accident.

Apoplexy, or *Megrims.*—*Symptoms.*—The horse falls without a moment's warning, or runs round once or twice and then falls, perfectly insensible, breathing heavy and low (or he may struggle violently for a time). In five or ten minutes he will rise and proceed on his journey as if nothing had happened, except that he will be duller than before. It will happen always without warning, and in severe cases the horse will die instantly. When a horse is bad enough for this last (or apoplexy proper), he will usually give warning in his general appearance. This warning will be—head low, supported on anything near, like a manger; staggers and appears unsafe on his legs; sight and hearing are affected. The horse will continue thus from one to twelve hours; he then falls; grinds his teeth; his eyes are open, protruded and fixed; pupils dilated; twitchings about the frame; muzzle cold; the vein of the neck swelled; cannot swallow; the drink is returned by the mouth or nostril, and dung voided involuntarily; twitchings increase to strong convulsions, and soon result in death.

Causes.—Undue pressure of blood on the brain, or even rupture of blood-vessels leading thereto; too small a collar on a thick-necked horse; or sunstroke.

Treatment.—Apply ice to the head, and warm the limbs by bandages and friction. Bleed, if it happens in the road, or where other remedies cannot be obtained. McClure recommends a blister of—

Spanish fly (Cantharides)	½ drachm.
Hog's lard..................................	2 drachms.

Mix them well together, and rub the salve well in by hand on the part just behind the ears.

If you want more medicine, get it from a qualified practitioner. Feed the horse generously.

Bite from a Mad Dog.—If the bite is in the body, syringe out the part immediately with a strong syringe—a hydrant flow if at hand—so that the very bottom of the wound may be cleaned. If on a limb, put on a tourniquet between the wound and the heart, so that the flow of blood is stopped. Then wash out the parts thoroughly; next, cut a portion of the flesh from the top, sides and *bottom* of the wound, and apply caustic—the best caustic is the "lunar caustic," or nitrate of silver; or a few drops of nitric, hydrochloric, or sulphuric acid may be dropped in the wound.

The reason that horses more seldom die from hydrophobia from bites, is simply that they know no danger. The imagination or thinking that one has been bitten by a mad dog, has alone brought on the disease in human beings in many authenticated cases. The fact of a dog going mad after biting a person need be no cause of fear. Unless the dog is rabid at the time, there is no danger; yet, precaution should always be taken.

Bleeding in the horse will never be entirely discarded. It is very well for veterinary surgeons to tell us that it is an exploded because erroneous system. Doubtless it is not necessary to have recourse to the lancet and fleam to as great an extent as was once the fashion; but the horse is a different patient to the man. We cannot lay our injunction on the horse, in certain cases where rest is necessary, to keep quiet, but we must make him quiet by physical means. When inflammation consists of increased flow of blood to and through certain parts, the only practicable way, in many cases, to abate the inflammation, is to lessen the quantity of blood. "If we take away the fuel, the fire will go out." Blood taken from the jugular, or bleeding at the neck, will lessen the general quantity; but where inflammation is local, more good will often arise from taking away blood at the part where inflammation is developed.

The medical practitioners, not only veterinarians, but those of man, appear to have run into the opposite extreme from the old-fashioned constant bleeding, and now set their faces steadily against the use of this remedy *at all.* No man can, however, deny that blood-letting is a rapid way in which to allay inflammation, and, what yet is of more importance, that medicines are more rapidly absorbed into the system and their action hastened after thorough bleeding.

One quart of blood taken from the foot in cases of acute founder, or an ounce of blood obtained by scarifying the swelled vessels of an inflamed eye, will give more relief than a copious withdrawal from the main vein.

A copious bleeding in the first stages of inflammation never yet did serious injury to a horse. The horse will bear, and with advantage, the loss of an incredible amount of blood.

The Operation.—The fleam is the safest instrument in inexperienced hands. A blood-stick, a piece of hardwood, is used to strike the fleam into the vein. This must not be done with too great violence, or the fleam may cut the opposite wall of the jugular vein.

Blindfold the horse on the side on which he is to be bled, and turn his head away. Smooth the hair along the course of the vein by wetting it with the finger; then with the third and little fingers of the left hand, which holds the fleam, press on the jugular so as to bring the vein well into view. Select a point about two inches below the union of the two portions of the jugular, at the angle of the jaw. Place the fleam *in a direct line with and exactly over the centre of the vein,* as close as possible, but its point not absolutely touching, and strike a quick blow on the back with the blood-stick. A fleam with a large blade is best, as the blood requires to be drawn speedily.

A slight pressure on the vein is all that is required to cause the blood to flow freely. Keeping the tongue in motion by introducing the fingers will also hasten the flow of blood.

When sufficient blood has been drawn, bring the lips of the wound together, pass a pin through them, wrapping round it some tow or a few hairs from the horse's mane or tail. When bleeding, as a test and relief for inflammation, let the blood flow into the centre of the pail, for if it be allowed to trickle down the sides it will not afterwards properly undergo those changes by which the experienced can tell the extent and nature of the inflammation.

The pin may be removed twenty-four hours after the bleeding.

Be careful to wipe fleams or lancets thoroughly immediately after use, so as to ensure their freedom from rust.

For general inflammation or fever, the *jugular* is the better vein from which to draw blood.

In affections of the shoulder, fore arm or foot, the *plate* vein, which comes from the inside of the arm, and runs upwards directly in front of it towards the jugular.

In affections of the hinder extremities, blood is sometimes taken from the *saphœna* or thigh vein, which runs across the inside of the thigh.

In foot cases, from the coronet, or much more safely from the toe of the frog; "not by cutting out, as the farrier does, a piece of the sole at the toe of the frog, which sometimes causes a wound difficult to heal, and followed by festering, and even by canker; but cutting down with a fine drawing-knife, called a searcher, at the union between the crust and the sole at the very toe, until the blood flows, and, if necessary, encouraging its discharge by dipping the toe in warm water. The meshwork of both arteries will be here divided, and blood is generally obtained in any quantity that may be needed. The bleeding may be stopped with the greatest ease by placing a bit of tow in the little groove that has been cut, and tacking the shoe over it."

Bowels, Inflammation of.—Symptoms.—Violent and *continuous* pain in the belly; *getting no intervals of rest from pain;* rolling, pawing, shifting about, sweating, and breathing fast, with *great fever* and excitement; *cold extremities.*

N.B.—The symptoms that are marked with italics are those that are not known in *colic,* and by which inflammation of the bowels and spasmodic colic may be distinguished the one from the other, and respectively properly treated. (Further, see Colic.)

Causes.—Sudden exposure to cold, severe exertion on the part of an over-fed horse, and colic neglected or wrongfully treated.

Remedies.—Bleed, taking away six quarts of blood; we don't like giving medicine by the mouth—if any, however, is given, let it be about twenty-five drops of tincture of aconite.

Blister the belly ; cantharides as hereafter given in list of medicines. Keep the extremities warm by bandaging and rubbing; keep the horse well clothed, but in a cool place. During the run of the disease, bran mashes and green food should be given, and all water warmed and made into a thin gruel with oatmeal.

Clysters or *injections* will be found very beneficial in allaying inflammation and making a passage—these are simplest made of warm soft water, soap and sweet oil, beaten up into a lather ; or where costiveness is known to exist, make a thin gruel, in which put half a pound of Epsom salts or half an ounce of dissolved aloes.

Broken Knees, caused by falling on hard substances and cutting the skin over the knees.

Treatment.—Carefully wash and clean out all gravel and dirt. Should the joint not have been opened, a linseed poultice must be applied. If the joint has been opened, the orifice must be closed or the oil will escape and a stiff joint result. Place a smooth piece of hot iron (heated in boiling water) over the wound—this will cause the lips to swell—and close it. If a repetition of this does not prevent the flow of joint oil, the animal will be rendered useless. Use the following wash as soon as oil has stopped, or if it be only a simple surface wound :—Sulphate of zinc, half an ounce ; rain-water, eight ounces. Do not bandage.

Back Sinews, Sprain of.—Causes.—Sudden and violent exertion acting on the tendons in the back part of the fore legs.

Symptoms.—Inflammation of the part, excessive lameness, and pain to the horse at every motion of the fore leg.

Remedy.—Foment the part well with warm water two or three times a day, and half an hour each time; between fomentations enclose the leg in a linseed poultice. Vinegar makes a good addition to the fomentation.

When the horse gets better, and can bear his weight, take away poultice, stop fomentations, and put on a thin flannel bandage, kept wet with vinegar and spirits of wine (one pint of vinegar to a quarter of a pint of spirits of wine). This bandage should be tightened up every day. If there remains, after pain has gone, any enlargement, a blister may be applied.

Blistering should never be applied to a part already inflamed. When the heat and tenderness have disappeared, by the use of cold lotions and fomentations, and the sprained part remains enlarged, or even bony matter threatens to be deposited, we may be justified in exciting inflammation of the skin by blistering, in order to rouse the deeper-seated absorbents to action, and enable them to take up this deposit.

Chill.—A shiver, usually a sure sign that some disease or fever is imminent. The disease is sometimes arrested by stopping the chill. Give twenty drops of aconite root in a wineglassful of water, blanket the patient, rub the legs, and generally promote the circulation.

Cold, or *Catarrh.—Symptoms.*—Discharge from nose and eyes, coat roughened, a loss of appetite, and cough.

Treatment.—Warmth, bran mashes, a few gentle doses of aconite—and let him alone. If he gets worse, then give, three times a day, in cold water, two ounces each of powdered gentian root, powdered pimenta, powdered carbonate of ammonia. Mix this lot and make twelve powders of it. Green cut food, when available, is one of the best things for a cold.

Colic.—Spasmodic Colic, or *Gripes,* or *Belly-ache.—Symptoms.*—Comes on very suddenly, and continues in spasms, each succeeding spasm being more severe until relief is obtained.

It is something like inflammation of the bowels, and in order to distinguish the two diseases, we give their respective symptoms below, and side by side:—

COLIC.	INFLAMMATION OF THE BOWELS.
Sudden in its attack.	Gradual in its approach, with previous indications of fever.
Pulse not much quickened in the early period of the disease, and during the intervals of ease, but fuller.	Pulse verymuch quickened, but small and scarcely to be felt.
Legs and ears of natural temperature.	Legs and ears cold.
Relief obtained from rubbing belly.	Belly exceedingly tender, and painful to touch.
Relief obtained from motion.	Motion evidently increasing pain.
Intervals of rest.	Constant pain.
Strength scarcely affected.	Rapid and great weakness.

Causes.—Drinking cold water, or feeding heavily with oats when overheated.

Treatment.—Warm the stomach. Give a bottle of warm ale, and mix in it three ounces of spirits of turpentine and an ounce of laudanum. If relief be not obtained in half an hour, and it is clearly a case of colic, repeat half the first dose with an ounce of Barbadoes aloes dissolved in warm water. Rub the belly well with a brush or warm cloth. Walk the horse about—and throw up an injection of warm water, soap and sweet oil with a solution of aloes. When relief is obtained, clothe him warmly, and give him a bran mash for the next few days.

Gin, pepper and such hot things may do good, but are dangerous in gripes, as tending to turn it to inflammation of the bowels. The attack generally gives way to the turpentine and laudanum.

Constipation, or the effect of continued costiveness.—Horses subject to such should be often supplied with mashes and soft food, and constantly watched.

Cough.—Chronic.—The presence of an obstinate cough may be traced to a hundred causes.

When the cause can be directly traced, as weakness of lungs, bronchial affections, worms, &c., a plan to get rid of the cough is to remove its cause (*causa sublata tulitur effectus*)—a good general *remedy* is :—

Digitalis...........	½ drachm,	1½ drachms to make two doses,
Nitre.........	½ drachm,	
Emetic tartar	½ drachm,	

and to be given once a day when very obstinate. A blister, extending from the root of one ear to that of the other, taking in the whole of the channel and reaching six or even eight inches down the windpipe, and even to the chest, will often prove effectual.

As prevention is better than cure, keep your horses from dusty hay and musty oats.

Crib-biting.—(See The Vices of Horses.)

Curb.—A swelling immediately below the point of the hock joint, the result of a strain of the straight posterior ligament. Cow-hocks very susceptible to curbs.

Treatment.—First foment with cooling lotions, equal parts spirits of wine, water and vinegar. If possible, keep a bandage soaked in this on the hock.

Absolute and long-continued rest. Cut the hair off and blister with an ointment of red iodide of mercury, applied once a week, and keep the skin well greased to prevent cracking.

Catarrh.—(See Cold.)

Cataract.—(See Eye.)

Chest founder.—Often confused with Feet founder, but is nothing more than rheumatism in that part.

Corded Veins, or *Farcy Buds.*—A sure sign that farcy is in the blood of the horse.—(See Farcy.)

Cow-hocks.—A bad shape for a horse's hind legs, always indicating a tendency, on any extra exertion, to throw out curbs ; and liability to windgalls, fetlock sprains, thoroughpin, spavins, cutting and knuckling.

Diarrhœa.—When it simply consists of a looseness of the bowels, unaccompanied by gripes or other pain, leave it alone ; but when the offensive passage continues, there will be some colic, and the discharge must be stopped.

Treatment.—If there be any pain, give twenty-five drops of tincture of aconite in cold water ; then the following powder, every two hours, until there is a change for the better :—Prepared chalk, half an ounce ; catechu in powder, one drachm ; opium in powder, ten grains. Allow plenty of water to drink. Give bran mashes for a few days, with cake meal or ground flax-seed.

DISTEMPER, EPIDEMIC CATARRH OR INFLUENZA.

Symptoms.—Shivering fits, to which succeed a hot mouth, greater heat of the skin than is natural, heaving of the flanks, and cough. The eyes are heavy and red, and the membrane of the nose red (but paler than in inflammation of the lungs).

Discharge from the nose ; at first watery, but soon thickening. This soon becomes offensive and full of matter. The glands of the throat and under jaw become enlarged, the membranes of the nostril and throat inflamed and tender, and there is difficulty in swallowing water, particularly if it be cold.

The horse coughs as he drinks ; the cough is painful, shown by the horse stamping his feet in the act ; soon he becomes very weak, staggers and almost falls, or supports himself by leaning against the side of his box or stall.

Legs swell, and enlargements appear on the chest and belly. The pulse is quickened. It rises to sixty or seventy, but the variation of the pulse depends entirely on the degree of fever that accompanies the disease.

Cause obscure; the consequence of a bad cold, or more frequently an epidemic in the district.

D. McClure, V.S., recommends for the distemper, as it appears in America, as follows :—

" Place the horse in a cool (not cold) and airy place, put a light covering on him, and give him twenty drops of the tincture of aconite root in a little cold water every four hours until five doses have been administered. Place plenty of cold water before the horse, so that he can drink as much as he wants. When the aconite has been all given, commence with fifteen-drop doses of the tincture of nux vomica, which repeat every four hours, continuing it for a few days, and if the animal improves, and the appetite returns, nothing more in the way of medicine need be given.

" Recovery being slow and the appetite poor, give the following powders morning, noon and night :—Powdered carbonate of ammonia, three ounces ; powdered gentian root, two ounces ; powdered pimenta berries, two ounces. Mix, and divide into twelve powders, and give them mixed in a little cold water ; and drench the horse out of a strong-mouthed bottle. The powders will have to be wrapped well, so as to keep them from the air and prevent the loss of their strength consequent on exposure. Twenty drops of commercial sulphuric acid may be given occasionally in half a bucket of cold water, which the horse will readily drink. Do not apply blisters or anything to the throat, as is too often done ; they can do no good, but positively much harm." (In our own experience we have seen the glands of the throat much relieved by blisters.—*The Author.*)

EYE—DISEASES OF.

Floating spots.—Bathe with cold water.

Warts on the eyelids may be cut off with a pair of scissors and the roots touched with caustic.

The thickening of the haw can only be relieved by cooling lotions, and physic to improve the general health.

Common Inflammation is generally sudden.

Symptoms.—The lid swells, eye partly closed, with some weeping. The inside of the lid will be red, some red streaks visible on the white of the eye, and the cornea slightly dimmed.

Treatment.—Look well to see that there is no object of irritation, such as hay seed, in the eye.

Apply cool lotions to the eye; give mash diet and gentle physic.

Ophthalmia, or *Moon Blindness.*—If the inflammation has not abated in several days, we may suspect periodical or specific blindness.

This is a disease which may be relieved for a time, but never cured ; in greater or less time, eyesight will become obscured.

For three or four weeks the inflammation will continue unabated, when suddenly, without warning, the eye will mend, and the sight be quite recovered. But before long the ophthalmia will come on again, and after a succession of intervals total blindness will ensue of one or both eyes.

Cool lotions and fomentations will give temporary relief.

In examining the eye of a horse, when about to purchase, care must be exercised that there are no traces of the existence of this disease. They are a slight thickening of the lids, or puckering towards the inner corner of the eye ; a difference in the apparent size of the eyes ; a cloudiness, although perhaps scarcely perceptible, of the surface of the cornea, or more deeply seated, or a hazy circle round its edge ; a gloominess of the eye generally, and dulness of the iris; or a minute, faint, dusky spot in the centre, with or without little fibres or lines diverging from it.

Causes.—Bad ventilation and darkness in stables are the chief predisposing causes to this disease.

Farcy is not *glanders,* but is very closely connected with it ; their symptoms often mingle together, or the one disease will run into the other. While *glanders* is incurable, farcy in its milder and earlier stages may be successfully combated. It is a "scrofula" acting on the blood vessels, especially upon those infinite smaller ones that open upon the skin—thus it is known—or appears outwardly as a skin disease. The valves of the blood vessels are affected and get out of order; hence the whole circulation being impaired, the blood must be cleansed.

Symptoms.—An unhealthy coat, loss of flesh, impaired appetite and general dulness, followed by, generally, the swelling of a leg, hind or fore. The swelled leg is hot and painful, and soon breaks out in "farcy buds;" these buds may be distinctly felt, like a lot of buttons on the leg, when the hand is passed down it; generally found on the inside of the limb. It assumes all sorts of forms. Sometimes these "buds" break into ulcers, spread round and are difficult to cure; or tumors are formed between the fore legs and about the groin, or upon the lips, which ulcerate and spread. When this stage is arrived at, watch carefully for glanders.

Causes.—Bad ventilation, inoculation or contagion from other affected animals.

Treatment.—Attack it in the first mild form, when it is only "button" farcy. Remove the horse to a place by itself, and keep him, his clothing, and everything used about him, from other animals. Provide for a plentiful supply of fresh air.

English treatment.—In the first stage administer a mild dose of physic; examine buds carefully, and if any have broken apply the budding iron, of a dull red heat.

Or if matter should be felt in them, showing that they are disposed to break, they should be penetrated with the iron. These wounds should be daily inspected, and if pale, foul, spongy, and discharging a thin matter, wash frequently with a lotion composed of *corrosive sublimate, one drachm dissolved in one ounce of rectified spirit.* When the wounds begin to look red, and the bottom of them is even and firm, and they discharge a thick white or yellow matter, *friar's balsam* will speedily heal them. Alteratives must also be used to attack the blood. The best will be the *corrosive sublimate, in doses of ten grains, gradually increased to a scruple*, with *two drachms of gentian and one of ginger*, repeated morning and night till the ulcers disappear—unless the horse be violently purged or the mouth get sore, when a drachm of blue vitriol may be substituted for corrosive sublimate.

Let the animal have plenty of carrots and green meat, with some grain, and let him be daily exercised.

American treatment (McClure).—Give twice a day, a tablespoonful at a dose, sulphite (not sulphate) of soda, continuing this till the horse is well; and for a few weeks after, two or three times a week, will be of good service. While the blood is thus being purified, ... give something to facilitate the removal of the effete matter from the body, without weakening the animal with debilitating diuretics.

For this purpose the following medicine:—

Powdered sulphate of copper, three ounces; Spanish fly (cantharides), one drachm; powdered gentian root, four ounces. Mix, and divide into twelve powders; and give one powder at night in some good feed, with no more cold water in it than will keep the particles of the feed together. These powders will do for two weeks; at the end of that time get more, and continue them till the horse is well.

In addition, give grass and generous feed.

The English practice also recommends moderate bleeding, when the farcy is attended at the outset by enormous swelling of any limb.

FEET.

Grease.—A disease of the heels and legs of horses; the result of suppurative inflammation, making the heels and legs dry, cracked, hot and swollen (more frequently behind than on the fore legs).

Causes.—Bad stable management; neglect to dry off the heels when the horse is brought in from muddy work, especially in the early spring; aided also by bad state of the blood.

Remedies (English).—Wash the heel well with carbolic soap and tepid soft water; then apply to the cracks, *white ointment* composed of *one drachm of sugar of lead, rubbed down with an ounce of lard;* or a lotion composed of a solution of *two drachms of blue vitriol*, or *four drachms of alum in a pint of water;* or *a poultice of linseed meal, with an ounce of finely powdered charcoal;* or *a poultice of carrots, boiled soft and mashed.*

Dressings.—An ointment composed of *one part resin and three parts lard*, melted together, and *one part calamine powder added* when the former begins to *cool.*

Remedies (American).—Keep heels dry and clean, and apply twice in the twenty-four hours—*water, one pint; sulphuric acid, two drachms; corrosive chloride of mercury, one drachm.* Mix, and shake up before using. Or for dressing, use glycérine, or *lard having no salt in it.* For obstinate cases—

Take one box of concentrated lye, and dissolve it in two quarts of water, and bottle up for use when wanted in the following way: Pour a wineglassful of the solution of lye into a small bucket of cold water, and wash and bathe the heels and legs for half an hour, morning and night.

N. B. by Author.—Don't wash farm horses' heels when they come in from work, but rub them dry; don't cut off the hair that nature has placed over the heels. Keep the horse's blood and water in good order; and on the first appearance of a crack in the heel, treat it just as common sense teaches you to treat *chaps* on your own hands.

An excellent and simple remedy for *scratches, cuts* with shoe corks, and most flesh wounds, is in use by the practical farmers of my own neighbourhood, and is one that we can personally highly recommend. Make a salve of gunpowder and lard and heat it over the stove, mashing it down so as to crush all the gritty particles of the gunpowder, and apply it with the hand to the parts affected. It is very healing and perfectly innocuous.

Founder.—Laminitis.—A hybrid word from the Latin *laminæ* or leaves, and the Greek affix *itis*. It is a fever of the leaves in the foot, and when left to itself will become chronic.

Causes.—Cold water when the animal has been overheated; inflammatory tendency of the feet; a sudden change of inflammation from some other organ to the feet.

Symptoms.—The horse refuses to move, stands upon his heels with fore feet spread forward to take the weight off the foot. Soon the horse, afraid at first to bring his feet under him to lie down, will flop down on his litter, and experience thereby relief. Feet hot.

In inflammation of the feet, the horse will lie down. In inflammation of the lungs, he perseveringly and obstinately remains standing.

Treatment (American).—Give good bedding, and the horse will lie down. Give *twenty drops* of the *tincture of aconite root* in a cupful of cold water, poured into the mouth from a bottle with a strong neck. Repeat the dose every four hours, till six or eight doses have been given. Apply ice-water cloths to the feet. Take off the shoes as soon as it can be done. Care should be taken in removing the shoes that every nail be drawn before attempting to pull off the shoe. Let the cold water be kept on constantly for the first day, or until active pain gives way. Pare the soles of the feet thin. Give plenty of cold water to drink. Feed on grass or soft mashes, but do not keep the horse too low. *Remember,* do not bleed, neither from the neck, nor foot, nor from any other place, in a disease of this kind.—*D. McClure.*

Canker in the Foot.—Causes.—Injuries to the sensitive sole by nails, bruises, and other accidents, as a piece of sole being torn off.

Treatment.—Removal of any diseased or dead sole or proud flesh. If not all removable, or removed, reduce caustic potash quickly to a coarse powder, as it soon dissolves on exposure to air. Lay it upon the raw surface. This apply next day, if first application has not removed sufficient or all of it. After proud flesh has been entirely taken off, dress every day with *Barbadoes tar, one pound; sulphuric acid, three drachms; powdered sulphate of copper, half an ounce.* Mix well, and spread a portion on the sore foot, and over this dressing a pad of tow or cotton, held firmly down on the padding, so as to produce pressure. This can be secured by thin splints from young wood placed across one another over the pad, and the ends pushed in beneath the shoe.—*McClure.*

Contracted Feet.—An unnatural contraction of the back part of the hoof. As the hoof draws in, the parts beneath, particularly the coffin bone and the heels of the coffin bone, diminish.

Causes.—Want of proper knowledge, on the part of the owner and horse-shoer, in injudiciously paring all feet alike; keeping shoes on too long; standing too long in dry places, and thus depriving the hoof of natural moisture (hence the benefit of stopping the shoe with cow dung in the stables); inflammation of the little plates covering the coffin-bone. Blood horses are particularly liable to contraction of the feet, whilst overfeeding and close confinement combine often to bring on many such local affections.

Treatment rests to a great extent with the shoer, and herein is the skill and knowledge of such a mechanic displayed. When contraction causes lameness, the case should be put in the hands of a vet.

Corns.—A red spot on the inner portion of the heel of the foot.

Cause.—Pressure and bruising by shoe, when badly put on or left on too long.

Treatment.—Let a skilful practitioner cut out the corns; then apply a few drops of commercial sulphuric acid to the part. Shoe the horse sufficiently often to ensure even bearing to the shoe upon the wall *only* of the foot.—*McClure.*

Pricks.—Treatment.—Pull the nail out and poultice the foot for twenty-four hours; then make an opening through the horn, over the place where the nail went in, so as to allow the pus to pass. After an opening has been made properly, drop *five drops of muriatic acid* into the hole, once a day for a day or two. Poultice every second night or day, and not oftener.—*McClure.*

Sandcrack.—A crack in the hoof, into which sand or other grit has got.

Causes.—Brittleness of hoof; want of natural moisture generally in the inner part of fore foot.

Prevention.—Apply to brittle feet equal portions of *oil of tar* and *cod liver oil, whale oil,* or any *fish oil,* well rubbed in with a brush on the hoofs a few times a week.

Treatment.—Considerably thin the edges of the crack; wash out well; and if any fungus shows through the crack, destroy it with *chloride of antimony.* Make a piece of iron red hot, and then pass it rapidly across the hair just above the crack, so as to make a scab; put a pledget of tow in the crack and bind it down.

Navicular Disease.—Behind and beneath the lower pastern bone, and behind and above the heel of the coffin bone, is a small bone called the *navicular* or shuttle bone. There is a great deal of weight thrown on this bone, and its surface sometimes becomes ulcerated.

Causes.—Constant work on hard roads, or inflammation neglected, and ending in ulceration.

Symptoms.—Hard to discover; when there is lameness and great heat, and none of the other diseases of the foot can be found, we may generally conclude that the navicular bone is affected.

Remedy.—The bone is so deep-seated that cure is impossible, though relief may be given by poultices and cooling applications. The old writers on the Horse recommend blisters on the coronet, setons run through the frog; but the farmer must here call in the surgeon. There is an operation called *neurotomy*, or the cutting out of a portion of the nerve, that has been found successful.

Thrush.—A discharge of offensive matter from the cleft of the frog, caused by inflammation.

Causes.—Dirtiness of the stable management, and sometimes the result or an accompaniment of navicular disease.

Remedy.—The application of an astringent, of not too caustic a nature. (English.)—The common Egyptiacum (vinegar boiled with honey and verdigris); or, a paste composed of *two ounces of blue and one of white vitriol powdered as fine as possible*, and rubbed down with *one pound of tar and two of lard.* A pledget of tow covered with it should be introduced as deep as possible, without force, into the cleft of the frog every night, and removed before the horse goes to work.

Treatment (McClure).—A few drops of muriatic acid forced into the centre of the frog once a day for a few days. Keep the stable and stalls dry and clean. A few doses of the sulphite of soda in half-ounce doses, once a day for a few days, will do good by its alterative and puritive effects upon the system.

Fever is generally increased arterial action, either without any local affection, or in consequence of the sympathy of the system with inflammation in some particular part.

Fever symptoms begin generally with a cold or shivering fit; the horse is dull, unwilling to move, with a staring coat, and cold legs and feet. This is succeeded by warmth of the body; unequal distribution of warmth to the legs—one hot and the other three cold, or some unnaturally warm and others *unusually cold, although not the deathly coldness* of inflammation of the lungs; the pulse quick, soft, and often indistinct; breathing somewhat laborious; but no cough or pawing, or looking at the flank. The animal will scarcely eat, and is very costive. Whilst pure fever lasts, the shivering fit returns at nearly the same hour every day, and is succeeded by a warm one, and that often by a slight sweating one; and this goes on for several days, until local inflammation appears or the fever gradually subsides. No horse ever died of fever; if he is not killed by inflammation of the lungs or bowels or feet, succeeding to the fever, he gradually recovers.

Fits, or *Epilepsy.*—Not common, but very awkward to the driver or attendant. The attack is sudden.

Symptoms.—The animal stops, trembles, looks round vacantly and falls. The convulsions following may be slight or terrible. In a few minutes convulsions cease, he gets up, looks around him partially stupified, shakes his ears, urines, and eats or drinks as if nothing had happened.

Remedy is to find the cause of the fits; but, as a rule, the epileptic fits become so frequent and violent, that the horse becomes unsafe to use.

GLEET (NASAL), OR DISCHARGE FROM THE NOSE.

The constant secretion of fluid which lubricates the membrane that lines the cavity of the nose, is under catarrh or cold increased in quantity and altered in appearance and consistency. We refer here to an obstinate and violent discharge of thickened mucus, even after all other trace of catarrh and fever has passed away.

If the discharge be not offensive to the smell, nor mixed with any matter, it will frequently yield to small doses of blue vitriol, from one to two drachms, and given twice a day. If fever or cough remain, the medicine recommended for cough may be used with the tonic. If the discharge be mingled with pus, and very offensive, the vegetable tonics, gentian and ginger, may be added to the blue vitriol, in doses of two drachms of the former and one of the latter; but there is then reason to apprehend that the discharge will not be controlled, and will turn into glanders.

Glanders.—This formidable disease has been known from all ages, and has been invariably considered incurable.

Symptoms.—In the majority of instances the horse will have been dull, off his feed, losing flesh, and with staring coat, and these preceding the actual and characteristic symptoms of glanders for several weeks.

First, an increased discharge of mucus from one or both nostrils; this is different from the discharge of catarrh, because it is usually lighter and clearer in colour, and more glutinous and sticky. When rubbed between the fingers, it has, even in an early stage, a peculiarly clammy, birdlimy feel.

It is not discharged occasionally, and in large quantities, like the mucus of catarrh, but it is constantly running from the nostril.

This discharge, in cases of infection, may continue (and in so slight a degree as to be scarcely perceptible) for many weeks or months before the health and capabilities of the horse seem to be injured.

It will remain for a long time almost transparent, yet gluey, and then it will begin to be mingled with pus, retaining, however, its sticky character, and being rarely offensive in the early stages. The *constant* flow of this secretion, with the absence of cough, either before or during the discharge, will be the early symptoms.

Soon, however, the pus mingled with the discharge becomes absorbed, and the glands beneath the jaw begin to swell. From this swelling the disease has been named.

The membrane of the nose will be either of a dark purplish hue, or almost of a leaden colour, or of any shade between the two; or, if there be some of the redness of inflammation, it will have a purple tinge; but there will never be the faint pink blush of health, or the intense and vivid red of usual inflammation.

Spots of ulceration will probably appear on the membrane covering the cartilage of the nose; not simple sore places, or streaks of abrasion, and quite superficial, but small ulcers, usually approaching to a circular form; deep, with the edges abrupt and prominent.

See that these ulcers, however, do actually exist, for spots of mucus adhering to the membrane have been often mistaken for them.

There is a form of chronic glanders which will continue for years, the horse constantly discharging from the nose, but able to work well. In this state, however, it is generally considered that the horse is capable of propagating the malady.

When these ulcers have fairly appeared, other symptoms showing an affected constitution will rapidly supervene: as loss of flesh, tucked-up belly, unthrifty coat, cough, impaired appetite, failing strength; the discharge from the nose daily becomes more purulent, discoloured, bloody and stinking; the ulcers will become larger and more numerous; and the air passages being obstructed, a grating, choking noise will be heard at every breath. The lungs are now diseased; they are filled with tubercles or ulcerations, and the horse soon dies, a worn-out loathsome object.

Glanders has been confounded with *Strangles* and with *Cold.*

IN GLANDERS,

No cough in early stages. The swelling below the jaws at first large, but surrounding enlargement soon goes off and one or two small distinct glands remain, and they are not in the centre of the channel, but *adhere closely to the jaw on the affected side.*

Ulceration of membrane.

The membrane a sickly hue—purple or lead colour.

The discharge, commencing thin, transparent, sticky, is *constant,* and increases to a purulent, bloody, stinking state.

IN STRANGLES,

Which are peculiar to young horses, and resemble common cold in early stages, there is from the first some fever and sore throat, a distressing cough, or wheezing.

The enlargement below the jaws is a swelling of the whole of the surface between the jaws, growing harder towards the middle; after a time appears to contain a fluid in a tumor, which bursts, and fever begins to abate.

The membrane of the nose is *extremely red.*

The discharge is profuse and thick from the first.

COMMON COLD

Is accompanied by fever, loss of appetite and sore throat from the first.

Glands of the jaw, if swelled, are moveable, with a thickening round them, and are hot and tender.

Discharge thick and purulent.

It is well, however, to bear in mind that *cold,* and every disease that has to a considerable and palpable degree undermined the constitution, *is very apt to run on to glanders;* and man should remember that inoculation by the *pus* of a glandered horse will bring the disease of glanders on to the human being.

The action of this disease is simple: commencing with ulceration of the membrane of the nostril, the *pus* formed sooner or later is taken up by the neighbouring glands; from them the whole system is inoculated and becomes vitiated.

Causes.—Hereditary, or brought on by starvation, debilitating diseases, &c.; but most frequently from starvation, added to filthiness in stable management. It may also be taken into a stable by contagion.

Treatment.—McClure says in his lecture before the Veterinary College:—

"To remove or neutralize the ferment or poison (absorption of pus), give one-half to one ounce doses of the sulphite of soda, at night, in cut feed, for several weeks, and five grains of powdered Spanish fly along with it, which will act not only as a powerful tonic, but as an agent whereby the product of the disease will be removed from the body of the animal by the kidneys."

This treatment will not interfere with the other medicine, which is powdered gentian root, three drachms; powdered sulphate of copper, two drachms. Mix these articles, and give the whole for a dose, and give one dose morning and mid-day. *Remember*, glanders is highly contagious to both man and beast.

Heaves.—Asthmatic in its nature.

Symptoms.—Either deep and incomplete respiration, or a double beat at each breath.

Causes.—Debility of a nerve.

Treatment.—To allay the peculiar beating, give of *powdered sulphate of iron*, one ounce; *gentian*, one ounce; *ginger*, one ounce. This is a temporary relief, but the large dose of iron is injurious to the horse. For a gradual and progressive improvement, five-grain doses of arsenic, given once in the twenty-four hours for two weeks; then, after a week's intermission, commencing as before, will soon cure many cases. Give the animal feed in small bulk. Use as little hay or rough feed, in large bulk, as possible. Improve the condition of the horse by every way or means, and you will relieve the animal.

Hidebound.—A symptom that the horse is "out of sorts," weak, &c. Where there is no apparent cause, such as cold, farcy, &c., the horse requires an alterative. *Saltpetre, nitre* and *sulphur*—two parts of the first, three of the second, and four of the last—a tablespoonful in feed every night; or, the following powder in feed every night:—

Powdered sulphate of iron	3 drachms.
Powdered gentian root	4 drachms.

Mix.

If the animal is fat, and yet hidebound, give—

Sulphuret of antimony	3 drachms.
Sulphur in flour	3 drachms.
Sulphite of soda	½ an ounce.

Mix, and give in one dose, repeating it every night for two weeks.

Feed generously with plenty of bran mash, and keep the bowels open.

If possible, do without medicine, and use bran mashes, carrots, boiled potatoes, and general change of diet.

Jugular Vein.—If, after bleeding, inflammation about the wound should set up badly, remove the pin, and apply a piece of bluestone to the sore for a day or two, and once each day. Hot fomentations or a small poultice may be applied to reduce inflammation. Cut feed, and thus save movements of the horse's jaws as much as possible.

Lampas.—Prick the bars and put in a little table salt. Don't burn the mouth.

LUNGS—AFFECTIONS OF.

Pneumonia.—An inflammation of the lung itself, sometimes called *Lung Fever.*

Symptoms.—Generally preceded by chills and fever; pulse oppressed and indistinct; ears and legs cold; the nostrils expanded; the head thrust out, and the flanks heave with a quick, hurried motion, expressive of pain. The membrane of the nose is intensely red. Countenance anxious, and indicative of suffering, with mournful looks directed at the flanks.

The horse stands stiff, with fore legs apart, and seems unwilling to move for fear of falling; he obstinately stands, day after day, and night after night; or if he lies down from absolute fatigue, it is but for a moment. (See Colic for comparison.)

Treatment.—Place him in a light, airy place; bandage the legs to keep them warm.

English: If bleeding is practised, a surgeon should stand by, with his finger on the pulse, to mark the effect.

Give twenty-five drops of tincture of aconite root in a cupful of cold water, and drench the horse. Repeat the dose every four hours, till six doses are given.

Pleurisy.—Inflammation of the covering of the lungs.

Symptoms.—The pulse hard and full; the extremities chilled slightly; nose red; pain expressed by a grunt on the part of the horse.

Treat as for inflammation of the lungs, but on second day follow the aconite with five grains of powdered Spanish fly in gruel, once in the twenty-four hours.

The services of a veterinary practitioner should be called in, as *pleurisy* may terminate unfavourably in *water on the chest*, or *adhesions.*

Maggots.—To remove, apply equal parts of creosote and olive oil, or a solution of corrosive sublimate.

Megrims.—A disease of the brain, occurring especially in hot weather; differs from *epilepsy* in the absence of spasms.

Causes.—Tumors in the choroid plexus, and enlargement of the pineal gland.

Treatment.—Palliative; use a Dutch collar.

Poll-Evil.—Causes.—Injury to the part, or disease of bone. Make the abscess large enough that it can be swabbed out with a piece of sponge or cloth on a stick, and the pus removed. Occasionally syringe or squirt cold water into the sore, and swab it out again until completely dry. Then apply the following, once in a day, with a swab :—

Creosote	1 ounce.
Oil of olives	2 ounces.
Oil of turpentine	1 ounce.
Mix.	

When the poll-evil is the result of diseased bone, ten drops of sulphuric acid poured in the fistulous opening of the swelling or sore will hasten recovery very much, and in many cases effect a good and speedy cure. Once a day will be often enough; and if there be more than one fistulous opening, drop the acid into one to-day and the other to-morrow, and continue from day to day until each opening ceases to discharge a whitish-grey matter, and a dry-looking opening is presented. Afterwards use a solution of the sulphate of zinc; one drachm of the zinc to four ounces of water will answer the purpose. The horse should be well fed and cared for.

Polypi.—If small, touch them with a stick of lunar caustic; if large, cut them off, and apply a weak solution of bluestone to the sore till healed.

Proud Flesh.—Sprinkle a little white sugar, powdered bluestone, or a little red precipitate on the surface of the sore or wound.

Ringbone.—Cause.—Hereditary predisposition.

Remedy.—If of recent date, and the horse be young, remove all heat and inflammation with cold-water cloths wrapped round the parts for three days, taking them off at night. At the end of that time get one drachm of the bin-iodide of mercury, mix with one ounce of lard, and apply one-half of the salve, rubbing it in well for ten minutes. Tie up the horse's head for a few hours, and the next day wash off with soap and warm water, daily anointing the parts with lard or oil for a week; then apply the remainder of the salve in the same way, and proceed as before.

Saddle Galls.—Use compound tincture of aloes. When sores become hard and firm, use the ointment of iodide of mercury.

Shoulder Lameness.—Usually produced by a slip or side fall, when the muscles of the shoulder are sprained.

Symptoms.—These muscles being deeply seated, we do not find tenderness, heat or swelling. We assume that the lameness is in the shoulder, in part, because we can find no hot or tender spot in the leg or foot. The horse steps longer with the lame leg and shorter with the sound one ; and, except in very severe cases, the horse will not only point the leg out from the body, but carry it along the side of the body. Now, in most sprains and diseases in the foot, the leg will be pointed straight out, without any side position. Take the leg which is lame by the pastern, and gently carry or pull it straight out from the body of the horse, in front, and gently also to the outside ; if it be shoulder lameness, the horse will not only show evidences of pain, but will in many cases, depending on the spirit or animation of the horse, get up from the ground with the sound leg and endeavour to wrest the lame one from you. Where the shoulder is bruised the horse will stand on his toe.

Treatment.—Absolute rest, warm-water cloths applied for two days, followed by cold-water cloths, in the same way and for as many days.

Then a slight blister of Spanish fly may be rubbed into the skin of the shoulder, taking care that none of it is put on at the situation of the collar.

Take Spanish fly powder, one drachm ; hog's lard, six drachms. Mix, and make an ointment or salve, and rub the better half of it into the skin. Next day wash off with warm water, and when dry from washing, anoint the blistered parts with oil or lard daily for a week.

Do not put the horse to work too soon after getting well from the lameness.

Shoulder-joint Lameness.—A serious form. This is to the fore leg what spavin is to the hock-joint.

Symptoms.—The horse drags his toe along the ground. He even stands with the toe resting on the ground, and in walking he throws his leg out at every movement of the limb.

Treatment is unsatisfactory, for the cartilages are likely to be destroyed and the bone beneath to become ulcerated. "In many cases," says McClure, "a cure can be effected by the ointment of red iodide of mercury, well rubbed in once a week for a few times."

Take bin-iodide of mercury, two drachms ; hog's lard, two ounces. Mix well on the bottom of a dinner plate, with a table knife. Of this ointment take one-fourth, and rub well into the joint, tying up the horse's head for a few hours. Allow bedding for the front feet, as the horse will stamp with his foot on the ground ; for the action of this ointment is said to be as painful as the hot iron, for about half an hour from the time it begins to act till the parts begin to swell from its effects.

Daily oil or grease the parts for a week, then apply as before; and remember, that to get all the benefits of this ointment, it must be well rubbed in.

Side Bones.—Cause and treatment the same as for ringbone.

Sitfasts, or *Warbles.*—Rub in about the size of a bean of the ointment of red iodide of mercury.

Baldness.—To make hair grow, use a weak ointment of iodine: Iodine, half a drachm; hog's lard, eight drachms. Mix, and apply by rubbing with the hand once every third day, till there are evidences of a growth of hair springing up.

Sores.—Healthy sores may be treated with the tincture of aloes, or myrrh, or simple ointment. Unhealthy sores should be treated, first by the application of some caustic, or powdered bluestone, nitrate of silver (lunar caustic), or caustic potassa; after which they may be dressed with myrrh or simple ointment.

Spavin.—There are several kinds of spavins, all affecting the hock.

(1.) *Bog Spavin* is situated in front of the hock-joint, and is a soft, fluctuating swelling, which rarely ever causes lameness. It is merely an enlargement or distension of the bursal cavity of the joint, and is filled with joint oil, but increased in quantity and not of natural quality.

(2.) *Blood Spavin* is a more extensive form of bog spavin, involving the hock-joint on the inside, outside, and front side.

Causes.—Hard work and fast driving, especially in young horses.

Treatment.—We should advise the application to a qualified man. The one method adopted is to let the fluid out, but there is always much danger of opening the cavity containing the regular joint oil. An old-fashioned plan was to strike the joint sharply with a wooden mallet; the stroke was supposed to break the skin confining the fluid, and by setting up adhesive inflammation, to close the opening.

(3.) *Bone Spavin* is the formation of irregular bony matter on the bones of the joint, which prevents their free action over one another. Sometimes only one or two bones are thus affected, while in other cases the whole of the bones of the joint are involved in the spavin. Bone spavin is seen on the inside and front of the joint.

(4.) *Occult Spavin.*—A disease similar to bone spavin, the bones of the joint being diseased and stiff, while there is no apparent enlargement. The cause, results and effects of this are the same as bone spavin, and the treatment should be alike.

Treatment for both *bone* and *occult* (hidden) *spavin* (McClure): In young horses, the red iodide of mercury, in ointment;

one drachm of bin-iodide of mercury; and one ounce of lard. Mix, and apply once a week, and lard the parts once a day till the next application.

Old horses should have a liniment applied once every second day to the parts: Oil of olives, two ounces; oil of turpentine, one ounce; creosote, one ounce. Mix.

This will relieve the pain, and to a great extent the lameness.

Uniform pressure will sometimes relieve bog and blood spavin, by promoting the absorption of the fluid contained in cysts or bags; though difficult to attain in a joint subject to such varied motion, yet it will be well to try a tight linen bandage to press upon the part affected.

Repeated blistering may sometimes effect a cure, or even firing may be tried.

Our only hope of cure in any of these diseases of the hock-joint, blood, bog, bone, or occult spavins, is to attack them at once and with vigour. Keep the horse up in good condition, and keep his general health in good tone.

Splint.—A small, bony enlargement between the leg and splint bones in young horses, and before the latter have attained to a union. Always found on the outside of small bone, and generally on inside of leg.

Causes.—Working horses at too early an age.

Treatment.—One or two applications of the ointment: Red iodide of mercury, or tincture of Spanish fly, one ounce; oil of croton, twenty drops. Mix, and apply with rubbing.

Sprains.—A twisting of a joint, with consequent injury to the articulations, ligaments, tendons and their sheaths. These usually occur to the pasterns, fetlock-joints, shoulder and its joint; hock, stifle, back, loins, flexor tendon, suspensory ligaments, &c.; and are caused by slipping, falling, overwork, &c.

Symptoms.—Pain, heat, swelling, and tenderness to touch.

Treatment.—Absolute rest. If there be any fever or irritation on the part of the horses, tincture of aconite root, fifteen drops, should be given three times in the day for two days.

For three days apply warm-water bandages or cloths, followed by cold-water cloths, for three days, taking them off at night. The bandages, whether warm or cold, should be re-wetted every hour or two—*i.e.*, before the warm cloths become cold, or the cold have become warm.

If the lameness and swelling have not ceased, apply for a few days, once a day, the liniment: Creosote, one ounce; oil of turpentine, one ounce; oil of olives, one ounce. Mix, and give plenty of rest.

STAGGERS.

Stomach Staggers.—An attack of acute indigestion, brought on by overloading the stomach, the consequence being what in man would be called a fearful headache.

Symptoms.—The horse stands, sleepy, dull and staggering; when roused, he looks vacantly around him, perhaps seizes a bite of hay, and dozes again ere he has begun to grind it; at length, he drops and dies; or the sleepiness passes off and delirium supervenes, when he falls, rises again, drops, beats himself about, and dies in convulsions.

Treatment.—Between stomach and mad staggers there is little difference in symptoms, and to distinguish between them we must know the history of the horse for some days previously.

Give injections of warm water, soap and oil, so as to clean out the bowels and obtain a free passage for the air.

To arrest the fermentation going on in the stomach, dissolve two ounces of sulphite of soda in a little water, and give the dose once every two hours. Also, drench with eight drachms of powdered aloes in a little water.

Mad Staggers.—Inflammation of the Brain, or *Phrenitis.—Symptoms.*—At first, very like stomach staggers, but after a while the horse suddenly begins to heave at the flanks; his nostrils expand; his eyes unclose; he has a wild and vacant stare, and delirium comes on rapidly; he dashes himself furiously about; and such is his strength and the unconscious mischievous actions of his delirium, that he becomes dangerous to all who may be near him, and destructive to his stall or anything within reach. This continues until either his first stupor has returned, or he dies exhausted.

This may be confounded with *Colic* and *Madness.*

IN COLIC,	IN MADNESS,
(*See also under head of Colic,*) The horse rises and falls, but not with much violence; he sometimes plunges, but more often rolls; he looks frequently at the flank with an expression of pain, and he is perfectly conscious. The spasms come on at intervals, between which he eats and appears quite well.	There may be more or less violence. There is always a set determination, easily observable, to do mischief, and there is also always consciousness.

Treatment of Mad Staggers.—Remove him from anything valuable or that can be broken, from all points or angles against which he may strike himself, and put a liberal allowance of litter under him. If practicable, put him in a loose box with a dirt floor.

He can seldom be saved. Let him be bled until he faints or drops; open both the neck veins at once. The quickness with which the blood is drawn is as important as the quantity. Afterwards, purge him with the croton nut, powdered *at the time* and given *in a drink,* in the dose of a half drachm, and followed by smaller doses of ten grains each, every six hours, with injections of warm water, soap and oil, until the bowels have been well opened.

Staked.—If the bowels are injured, or any portion have escaped through the opening and are torn, sew them with small, fine catgut, and pass them back into their proper place. If the skin only is wounded, it is but a simple sore.

If it is in a fleshy part, treat the wound with a weak solution of bluestone, chloride or sulphate of zinc.

Stings from Bees, Hornets, &c.—Take acetic acid No. 8, four ounces; powdered camphor, one ounce. Mix and dissolve; then rub a portion of the mixture in the parts most affected.

In about an hour, when the poison, swelling and irritation have been arrested, anoint with sweet oil or lard. Instead of acetic acid, strong table or white wine vinegar may be used without the camphor, but the acetic acid is more effectual, if on hand.

Stifled consists of the displacement of the stifle, or patella, which slides off the rounded heads of the bones.

The horse should be removed to a level pasture, and have him shod with a shoe having a projecting piece of iron attached to the toe, which will prevent the bones from sliding out of place and knuckling at every step.

Strangles is an abscess between the bones of the lower jaw, brought on by a poison of the blood which few horses escape; generally seen in horses at three or four years of age, and usually in the spring of the year.

Treatment.—Don't poultice but blister, if it is desired to hasten the process of the abscess.

It should be lanced as soon as the abscess has been brought well to head. If left to burst naturally, it is apt to form a bad, ragged ulcer, which is slow to cure.

Stringhalt.—Causes.—The loss of nervous influence in the leg, or the peculiar anatomical structure and articulation of the hock-joint of some horses.

Treatment.—There is no remedy, but occasionally, at a very early stage, the nervous influence may be restored by generous feed and, say, one grain of strychnia (nux vomica) given daily, for six weeks, in the horse's feed.

Sunstroke (*Coup de Soleil*).—*Symptoms.*— Exhaustion and stupidity; the animal falls, and can go no further.

Prevention.—In very hot weather, always use a sunshade for the horse.

Treatment.—At once remove the horse to a cool, shady place. Give two ounces of sulphuric ether; twenty drops of the tincture of aconite root, and a bottle of ale or porter as a drench.

Place chopped ice in a coarse towel or bag, and apply it between the ears and over the forehead, and secure it there. Warm the legs if they be cold.

Swelled Legs are usually the result of an impure state of the blood. Diuretics or alteratives should therefore be administered. (See Medicines.)

Thoroughpin.—An enlargement above the hock, between the tendons of the flexor of the foot and the extensor of the hock. Necessarily projecting on both sides of the hock, in the form of a round swelling, it is called a *thoroughpin.*

Cause.—Overwork.

Treatment.—The same as for *Windgalls,* which see.

Thrush.—(See Feet.)

ULCERS.

Healthy Ulcers.—Every sore that suppurates becomes a healthy ulcer. Generally they will heal themselves. To hasten the healing, if such is desired, apply a solution of bluestone, or chloride of zinc, as follows :—

Chloride of zinc	4 grains.
Rain water	1 ounce.
Mix.	

Or—

Powdered bluestone	2 drachms.
Rain water	8 ounces.
Mix.	

Apply either of these once a day, to moisten the lips of the sore and to arrest the formation of proud flesh.

Where proud flesh has grown up badly on neglected sores, caustic must be used.

Touch with the caustic potassa a few times, until the proud flesh blackens. Repeat if necessary.

N.B —Caustic potassa must be kept in a tight bottle when not in use; if not so preserved, it will become liquid.

Never use adhesive plasters if they can be avoided.

Indolent Ulcers.—These are such as are found on horses' legs and heels in such diseases as grease, farcy, &c.

Cause.—General debility, poor feed, or bad state of the blood.

Treatment.—Apply powdered bluestone to the ulcer, to eat off the unhealthy surface ; then apply a poultice for the night, made of boiled turnips, carrots, or any soft material. Cover the face of the poultice with brewers' yeast, or charcoal powdered.

Feed the animal well, and give half-ounce doses of sulphite of soda once a day, to purify and enrich the blood.

Irritable Ulcers, such as sores caused by flies, heat and sweat.—These are of the nature that they cannot be touched without bleeding; are red, angry-looking, and very painful; highly inflamed and extremely vascular.

Treatment.—Keep away flies. Dress the sore with oil of olives, one ounce; creosote, half an ounce. Mix, and apply to the sore with a piece of soft cloth once a day.

Warranty.—A certificate of warranty need not be a document of extreme and exact legal formality.

The law will see that if *A.* warrants to *B.* an animal to be sound wind and limb, quiet to ride and drive, and of a certain age, *B.* will receive his remedy should he be able afterwards to prove that at the time of the purchase the horse was not as *A.* had warranted it.

Such a form as the following is as binding in law as any of far greater formality :—

Received from A. B. one hundred and fifty dollars for a bay horse, warranted only five years old, sound, free from vice, and quiet to ride or drive.
$150. C. D.

Windgalls are soft, elastic swellings, oftener found on the hind than the fore leg, and near the fetlock.

Treatment.—Bandage tightly with a soft pad over each tumor; wet the bandages with vinegar, to each pint of which a quarter of a pint of spirits of wine has been added; or, more severely, blister the tumors. For these, the last process of "firing" has occasionally to be adopted.

Worms.—Stomach Worm.—These are the products of eggs laid by the bot fly in summer about the legs of the horse, and sucked in by him in the process of licking himself.

Symptoms of their presence are an unthrifty coat and loss of flesh.

Treatment.—Improve his condition by extra feed. In addition, give iron and gentian—thus: Powdered sulphate of iron and gentian root, each three drachms. Mix, and make one dose, to be repeated twice a week.

Fundament Bot.—These will be found sticking about the anus and under the tail.

Treatment.—Injections of linseed oil.

Warts.—Either cut them off with a knife, or take arsenic, one drachm; hog's lard, four drachms. Mix, and make into an ointment; rub a portion in and around the wart once a week. In a short time it will fall off.

Washy Horses.—Such as are not *well-ribbed home* (having too great a space between the last rib and the hip bone). These horses are subject to purging if more than usual exertion is required from them. They may be free and fast, but cannot have "stay."

Wolf Teeth.—Sometimes, at two years old, the second teeth do not rise immediately beneath the first or milk teeth, but somewhat to one side, and then, instead of the natural and gradual absorption of the latter, the whole tooth is pushed out of its place to the fore part of the first grinder, and remains for a considerable time under the name of a *wolf's tooth*, causing swelling and soreness of the gums, and frequently wounding the cheeks. As the very slow natural absorption of these displaced first teeth is often accompanied by pain to the horse, it is proper to get rid of these diminutive teeth, either by punching them out or by drawing them.

SOUNDNESS.

The following affections render a horse unsound:—

Broken Knees, if after healing the action of the knees is interfered with.

Capped Hocks.

Contraction of the feet does not necessarily entail unsoundness, but where present the feet should be closely examined.

Corns, and are seldom radically cured.

Cough.—As long as this disease hangs on a horse he is unsound.

Roaring, Wheezing, Whistling, High-blowing and Grunting, and *Broken Wind*—all being affections of the air passages, and interfering with perfect freedom in breathing.

Crib-biting, although not always so considered, yet is undoubtedly a form of unsoundness.

Curb, as long as the swelling remains, is partial unsoundness, for a horse that has once thrown out a curb is always liable to do so again on slight extra exertion.

Cutting can hardly be called unsoundness, but must be closely watched

Enlarged Glands.—If very large and tender, we should hesitate before we pronounced the horse sound, especially should the lining of the nose be red, and the gland at the root of the ear partake of the enlargement.

Enlarged Hock.—Will always be lamed by a few days of extra hard work.

The Eyes.—Proofs of unsoundness of the eyes are: a puckering of the lid towards the inner corner of the eye; a difference in the size of the eyes; a gloominess of the eye; a dulness of the iris; a little dulness of the transparent part of the eye generally; a minute, faint, dusky spot deep in the eye, and with little radiations of white light proceeding from it; starting at objects, if not proved to be a trick.

Lameness from any cause, as long as it remains.

Quidding.—If the mastication of food gives pain to the animal, he will drop it before it is perfectly chewed. This, an indication of disease, is a form of unsoundness.

Quittor is unsoundness.

Ringbone.—So far unsound as tending to the spread of inflammation and disease.

Sandcrack is unsoundness; but it must have occurred *before* or at the exact time of sale to entitle the purchaser to remedy, for it occurs very suddenly.

Spavins of all kinds constitute unsoundness.

Splint.—Only unsoundness if in the neighbourhood of and interfering with the action of any joint.

Stringhalt.—An ugly appearance, but not necessarily a principle of unsoundness.

Thickening of the Back Sinews.—If of any lengthened continuance, becomes a token of unsoundness. Must, however, be distinguished from *gumminess* or natural roundness of some legs.

Thoroughpin.—Only unsound if it is of great size. Where it is found, the hock should be carefully examined.

Thrush.—Veterinarians disagree on this point. We should consider its presence indicative of unsoundness.

Windgalls constitute unsoundness only when they cause lameness.

THE ORDINARY DISEASES OF CATTLE.

Abortion, or *Slinking.*—The period of abortion is usually from the fourth to the seventh or even eighth month of pregnancy.

Symptoms.—The cow is somewhat off her feed; rumination ceases; listless and dull; milk diminishes or dries up; the motions of the *fœtus* become more feeble, and at length cease; a slight but visible enlargement of the belly; a little staggering in her walk; when down she lies longer than usual, and when up she stands motionless. As the abortion approaches, a yellow or red glary fluid runs from the vagina (this is a certain symptom); her breathing becomes laborious and slightly convulsive.

The belly has for some days lost its natural roundness, and has been falling; she begins to moan; the pulse becomes small, wiry, and intermittent; at length labour comes on, and the abortion takes place.

Causes.—Sympathy with other cows that have aborted; extravagantly high condition, resulting in inflammation of the uterus; a constant repetition of the affection known as "hoove" or "bloat;" fright, blows, and brutal usage; running with the bull soon after conception. It is also epidemic, occurring in a greater or less degree in different seasons.

The Prevention of this disease may be readily inferred from a review of the above causes.

When it has occurred, treat the cow as after calving (reviewed in our chapter on Milch Cows), and be sure to remove the fœtus immediately, *and bury* it away from the cow pasture.

Let the parts of the cow be well washed with a solution of chloride of lime, and let this be also injected up the vagina.

To prevent, as far as possible, the spread of abortion by sympathy amongst the other cows, let the cow-house be well washed with some disinfectant, and every taint of smell from the fœtus and its accompaniments be thoroughly got rid of.

When abortion has once occurred to a cow, she should not be allowed again to breed, as it is almost sure to be repeated in her case.

Aptha, or *Thrush.*—An eruption in the mouth.

Cause.—Irritation caused by teething.

Treatment.—A wash made of a weak solution of vinegar and cold water, applied to the mouth twice a day.

Black Quarter, Joint Felon, or Quarter Evil.—Peculiar to young cattle, and occurring in the spring. A hind leg and thigh become congested and black with coagulated blood. It is sudden in attack and very fatal.

Causes.—A plethoric condition and fulness of blood.

Treatment.—The disease must be taken early. On its first appearance give the whole herd of young cattle a good brisk purge—say half a pound of Epsom salts in two bottles of water, sweetened with molasses, and add a teaspoonful of ginger.

Take the young cattle out of very rich pasture and put them in high, dry land.

Brain Diseases.—*Phrenitis.*—The same as mad staggers in the horse.

Causes.—Overfeeding in long, wet grass.

Symptoms.—The animal is dull; quickened breathing; excitement and delirium, with bloodshot eyes.

Treatment.—Give an active purge: one pound of Epsom salts and one pound of table salt, dissolved in four quarts of cold water, and sweetened with molasses. Apply ice to the forehead; warm the extremities and clothe the body.

Bronchitis.—An inflammation of the windpipe, sometimes extending to the lungs. Generally comes in epizootic form, attacking a whole herd.

Causes.—A peculiar state of the atmosphere, making it epidemic,

Symptoms.—A slight husky cough, with weeping from the eyes, and a watery discharge from the inner corner of the nose; a slight rough and grating sound will be heard in the windpipe. It is the forerunner of *pleuro-pneumonia.*

Treatment.—If the disease be discovered within forty-eight hours of the attack, take from four to five doses of the tincture of aconite root—twenty-five drops to a dose—and give one dose every four hours. If there be uncertainty as to whether the disease has existed longer or shorter, to save time the aconite may be given along with the following powders three times a day:—

Powdered sulphate of iron..........................	3 drachms.
Powdered gentian root	½ an ounce.

Powdered ginger root.....	½ an ounce.
Powdered sulphite of soda	½ an ounce.

Mix, and make a drench.

This medicine is to be continued (omitting the aconite after the fifth dose) until the animal is well, or looks brighter and eats all it gets.

In addition to the above medicines, give, once or twice daily, half an ounce of commercial sulphuric acid, largely diluted, or mixed in half a bucket of cold water.

In feeding, care should be taken not to give too much, so as to bring on dangerous indigestion. Give cold water and plenty of pure air.

Constipation.--Treatment.—When the costiveness is symptomatic of some derangement, purges are unnecessary, but the tone of the health must be generally improved. As for example: suppose the animal constipated, the whole of the eye tinged yellow, head drooping, and the animal drowsy and off his feed, then give the following:—

Powdered mandrake........	1 teaspoonful.
Castile soap (shaved)	¼ of an ounce.
Beef's gall	½ a wine glass.
Powdered capsicum	⅛ of a tablespoon.

Dissolve the soap in a small quantity of hot water, then mix the whole in three pints of thin gruel.

If the bowels be only torpid, say in the case of inflammation of the brain, we must combine relaxents with antispasmodics, thus:

Extract of butternut	½ an ounce.
Powdered skunk cabbage	½ an ounce.
Cream of tartar	½ an ounce.
Powdered lobelia................................	2 drachms.

Choking.—Many cattle have been lost by a potato or portion of some root lodging in the upper or middle third of the gullet.

Methods for dislodging it.—1st. Hold the mouth open with a balling iron, or some other contrivance; let a person with a small hand endeavour to pass a line with a loop round the obstruction and draw it up; at the same time assisting the process by manipulations on the outside of the throat. If this fails,—

2ndly. Pour small quantities of oil or melted lard down the throat. If this fails,—

3rdly. Use the probang, or in its stead a cane or rattan may be tried (never use a whip stock; many a cow has been killed by the use of the latter); but let the end of the cane be well wrapped with linen, thick, and in a ball shape. See that the linen is tied on tight, so that it cannot be left in the throat. Introduce the cane very gently, and if coughing is set up, remember it has touched the air passages, and remove it immediately, and see that it goes down the right channel. *Gently and steadily* work at the obstruction until it is pushed down.

There are cases when the gullet must be opened to get at the obstruction. This should be done by an experienced practitioner.

If choking lasts long, the throat is apt to swell and the gas accumulate in the first stomach. This will be treated of under the head of "Hoove," or "Bloated."

Colic will also be treated under the head of "Hoove."

Cow Pox.—This is a contagious eruption on the skin of the udder, which runs a fixed course and is attended by slight fever.

Symptoms.—Teats painful, slightly swollen; a faint blush upon the udder, and in a few days red, hard spots are seen, succeeded by red patches, which, in from a few days to a week, form bladders containing the vaccine lymph.

Treatment.—Warmth, nursing, and the drawing of the milk carefully from the udder.

Cud, Loss of the.—This is a sure symptom of disease. When apparent, look out for other diseases, such as bronchitis, pleuro-pneumonia, aptha, &c. On the other hand, after illness the renewal of the process of chewing the cud is a sure sign of permanent improvement.

Diarrhœa.—Simple diarrhœa seldom calls for treatment; it may, however, be well sometimes to give a few powders composed of prepared chalk, two ounces; ginger, half an ounce; opium, one drachm; mixed, and given as a drench in wheat flour gruel.

A change of pasture will often have the necessary effect.

Acute or Chronic Diarrhœa.—Causes.—The abuse of purgatives, by their being administered in too active a form; feeding on certain poisonous plants; sudden change of food from dry to green; excess of food; bad water; or an unhealthy state of the atmosphere.

Treatment.—Give generous diet, with linseed cake. McClure recommends commercial sulphuric acid, gentian, and sulphate of iron, as the medicines for this trouble. He also says: "I would advise weekly inhalations of sulphurous acid gas."

Diarrhœa in Calves.—Treatment.—Give three drachms of carbonate of soda in well-boiled wheat flour gruel once a day; or, give a tablespoonful of common rennet after each feed of milk.

Epizootic Aptha.—(See Murrain.)

Eye.—Cancer in the eye is incurable.

A pustular eruption on the edges of the eyelids must be dressed with the mild nitrated ointment of mercury, and the following alterative medicine may be given in a mash: One part of saltpetre, two of nitre, and four of sulphur.

Warts on the eyelids may be removed with the scissors, and the roots cauterized with lunar caustic.

General inflammation of the eye should be treated by bathing with diluted tincture of opium, or Goulard's wash. Or, if the haw of the eyelid swells and a fungous growth springs up, use a zinc lotion diligently, viz.: Two grains of white vitriol (sulphate of zinc) dissolved in one ounce of water, and the vitriol gradually increased to four grains, the liquid not being suffered to get into the sound part of the eye.

An obstruction in the eye, as gravel, straw, barley beards, &c., sometimes leaves a thickened eyelid.

Fomentations should be used to allay the enlargements, and an alterative given, for the swelling indicates a bad state of the blood.

Fever sometimes lasts only a day, and will yield to gentle physic and a mash. When fever does not yield to mild treatment, it is apt to terminate in hoove or murrain, or some other diseases. The symptoms for these must be carefully looked for, and as soon as they appear, be treated.

Flooding (from the womb), though rare, may follow natural parturition.

Treatment.—Apply cold cloths to the loins. Dissolve a pound of nitre in a gallon of water, and keep the cloths wetted with the solution; or, if in summer, use ice cloths. Let her drink all the cold water she will take, and give large doses of opium (two drachms every hour). Elevate the hinder parts of the cow; keep her perfectly quiet, and do not permit the calf to suck. Anything but absolute rupture of the womb will yield to this treatment.

Garget.—Mammitis, or Inflammation of the Udder.—Causes.—The bag allowed to become too full and hard after, or sometimes before, calving.

Symptoms.—A teat or quarter becomes enlarged, hot and tender, and begins soon to feel hard and knotty; and little distinct hardened tumors are felt inside the teat. This is apt to spread over the whole udder and to the other teats.

Treatment.—In the early stage, let the calf be allowed to suck and knock about and soften the udder. This will generally relieve her, by promoting a flow of milk.

If inflammation continues, or the udder is so sore that the mother will not allow her calf to suck, refuses to eat, or ceases to ruminate, becomes feverish, the milk is discoloured and mixed with matter and blood, the case is serious.

Then apply warm poultices to hasten suppuration. This may force the pus to evacuate itself. When properly discharged, use a healing ointment on the sores which will be left.

If the garget appears chronic, *i.e.*, the heat and redness be not followed by swellings containing pus, use cold applications, if possible; if that is not effected, bring on suppuration by poultices, and treat as above. Whatever treatment be adopted, be sure to milk the udder *severely*, and, if possible, put two strong calves to suck.

Hidebound.—An indication of a bad state of the digestive organs, and general " out of sorts."

Treatment.—A dose of physic, say: Epsom salts, one pound; ginger, half an ounce—in two bottles of cold water, and sweetened with molasses; or, sulphur, eight ounces; ginger, half an ounce—in a bran mash. After the physic has acted, give the following powders:—

Powdered ginger	1 ounce.
Fenugreek	1 ounce.
Carraway seeds	½ an ounce.

Mix, and give in one dose, daily, for a week.

Hoven.—Tympanitis, Bloated or Drum Belly.—This is simply a mechanical ailment, and is caused by the generation of a large amount of carbonic acid gas from a mass of partially decomposed food in the stomach, which has been allowed there to accumulate.

The paunch is distended or bloated; the skin drawn as tight as a drum; and if the gas be not evacuated, the internal organs are pressed upon and death ensues.

Treatment.—Must be rapid; time is everything. First, try mild methods. Give half a pound of table mustard and an ounce of chloride of lime, mixed in a little cold water; or, if handy, give freshly powdered carbonate of ammonia, in cold water; or, dash cold water over the loins, and move the animal gently about. The best of all the milder remedies will be found in an injection of raw linseed oil, soap and warm water.

If the gas is not soon evacuated by the anus, an operation must be performed. Every farmer should own a trochar and canula, the proper instruments to be here used. In default of these, and where the case is urgent, at once plunge a dinner knife, well sharpened, into the side, or at equal distance from the hip bone, short rib and spine, and on the left side of the animal.

Where the trouble has become chronic, *i.e.*, a return of this complaint is constantly taking place, it shows a debilitated condition of the walls of the rumen, and the following powder should be given for a few days, morning and night, in a mash:—

Powdered ginger	½ an ounce.
Gentian	½ an ounce.
Fenugreek	½ an ounce.

Inflammation is not common in cattle, but when it occurs may be treated as described before for the horse.

Jaundice, or the Yellows.—Cause.—An obstruction of the passage of bile from the gall bladder, and its absorption in the stomach, from which it spreads throughout the whole system.

Symptoms.—A yellow colour of the eyes, of the skin generally, and of the urine; seen plainly in the lining of the mouth and nose. In bad cases, the general health is seriously affected, causing general irritation and fever, quickness and hardness of the pulse, heaving of the flanks, excessive thirst, and suspension of rumination; costiveness, with the dung of a whitish or straw-coloured look. If it be not bad, give plenty of soft food, slops, &c. If it assumes an acute kind, a good dose of purgative medicine may be given:—

Epsom salts	1 pound.
Table salt	½ pound.
Ginger	½ an ounce.

Mix, and dissolve in four bottles of water, sweetened with molasses.

Lice.—(See chapter on Cow Stables.)

Milk Fever occurs from the first to the third day after calving. It is inflammation of the womb, which sometimes extends to the bowels.

Symptoms.—Loss of power over the hinder limbs, and consequent falling down of the animal; loss of appetite and suspension of rumination, resulting in the affection of the brain, and in a short time death.

Causes.—Too high condition at time of calving; overfeeding before or after calving.

Treatment.—To lessen the probability of this trouble, give, a week or so before calving, the same medicine recommended above for jaundice, and feed plentifully with slop mashes, giving no meal, grain, or heating food.

When the disease has set in, give, according to McClure, thirty drops of the tincture of aconite root, and half an ounce of the pure opium, in powder, in a bottle of thin gruel. The aconite must be repeated every four hours, without the opium, until four or five doses are given. Place chopped ice in a bag on the forehead, renewing it when wanted. At more leisure, give the Epsom salt purgative as above recommended. Keep the cow as quiet as possible; her legs and body warm. Give pure air, and as much cold water as the animal desires.

All writers insist that the *bowels must be opened;* clysters of warm water, soap and oil will help this greatly.

MURRAIN—THE MALIGNANT EPIDEMIC.

McClure is very hard upon the cow leeches for calling any disease *Murrain,* which name means *to die;* but although "by classical scholars, orators and poets, the use of the word murrain may be taken as an indication that they have read Virgil, Homer and Horace, yet when cow doctors talk about the murrain, it conveys the reverse idea to that entertained when used by the orator and poet." Yet we would remind Dr. McClure that a very well-known and revered classical scholar and poet has handed down for universal quotation the couplet:—

> "What's in a name?
> A rose by any other name would smell as sweet."

The disease may be the consequence of "Epidemic catarrh, epizootic aptha (*de la fievre aptheura*) in a malignant form, on account of the great vascularity of the system, and intensity of febrile action, and consequent vital exhaustion," &c., &c.; but of one thing we are well assured, that as *murrain* it was known to the old world, as recorded in the Book of Exodus (Chap. ix.); to Homer, 900 years before Christ; to Hippocrates, who flourished 500 years yet before Homer; to Plutarch, who speaks of it as occurring during the reign of Romulus; to Livy; to Virgil, in his pastoral "Georgics," about 50 years before the Christian era (see Georg. lib. iii. v. 478, &c.); to the historian, Cardinal Baronius, who refers to it as *murrain* in the year A.D. 376; to the Emperor Charlemagne, the whole of the cattle in whose army was destroyed by murrain in A.D. 810; to the Venetian States, which were ravaged in 1514 and 1599; to the *Journal des Savans*, in 1682; to Dalmatia and Italy, in 1711, whence it spread to Piedmont, thence to France, Germany and England.

In 1743, the disease, still known as the murrain, again broke out devastating France, Holland and Germany, when in Holland alone, more than 200,000 cattle perished with it: and again came over to Britain, and for twelve years laid waste the herds of the islands.

In the year 1747, *as murrain*, it destroyed 40,000 cattle in the two shires of Nottingham and Leicester; and in Cheshire alone 30,000 cattle died in six months.

As *the murrain* it is now known to farmers, veterinary practitioners, "intelligent persons" and "ignorant pretenders;" and for such, when once fairly afloat, there is no remedy but extreme measures to prevent its spread—total stamping out—and keeping herds carefully in good healthy condition. We trust we may never see the murrain in Canada.

Pleuro-Pneumonia.—Affection of the covering or pleura of the lungs and of the lungs themselves. At first,

The symptoms are scarcely observable. When, however, the constitution is no longer strong enough to resist the ravages of the disease, there appears diminution or irregularity of appetite. Soon afterwards, a frequent and dry cough, which becomes feeble and painful as the disease proceeds. The dorso-lumbar portions of the spine become tender, and the animal flinches when that part is pressed upon, and utters a peculiar groan or grunt, indicative, to experienced ears, of an affection of the *pleura*. Soon after, the movements of the flanks become irregular and accelerated, and the act of respiration seems to be sympathised in by a motion of the whole body. The sides of the chest and the loins become quite tender; the elbows are bent out from the chest; the pulse becomes feebler; the muzzle is hot and dry alternately; rumination is partially or entirely suspended. The fœces are harder than they should be; the mouth becomes dry. In most cases the disease pursues its course with little remission towards its fatal termination, every symptom gradually increasing in intensity. The respiration becomes more painful; the head more extended; the eyes are brilliant; every expiration is accompanied by a grunt and a kind of puckering of the angles of the lips; the cough becomes smaller, more suppressed, and yet more painful; the tongue protrudes from the mouth, and a frothy mucus is abundantly discharged; the breath becomes offensive; a purulent fluid of a bloody colour escapes from the nostrils; diarrhœa, profuse and fœtid, succeeds to constipation; the animal becomes weaker; it is a complete skeleton, and at length dies of utter prostration.

Causes.—Atmospheric influences cause this disease to assume the nature of an epidemic; sudden and severe changes of temperature, easterly winds, &c., and many other such uncontrollable conditions of the times. Also a predisposing cause which resides in the individual patient. A very fruitful source of predisposing causes may be found in the imperfect ventilation of cow-houses and stables; close contiguity to the smoking and fermenting dunghill; over-heated stables; too stimulating feed, and turning the cow suddenly from a heated temperature out into the cold.

Treatment.—The disease is far more fatal in cows heavy with calf, and in animals who are in low condition. McClure says:—"If the disease has been observed within forty-eight hours from the time of attack, give the following powders every four hours, between six o'clock in the morning and ten at night, or at six, ten, two, six, and ten o'clock:—

Tincture of aconite root	$2\frac{1}{2}$ drachms.
Powdered gentian root	3 ounces.
Powdered ginger root	3 ounces.
Sulphate of iron	2 ounces.

Mix well, and divide into five powders, to be given as above directed. After the five powders have been given, continue with the same powders, but *without* the aconite, and give them only *three* times a day. Half an ounce of the sulphite of soda may be added to each powder with advantage. The powders will have to be mixed in a large bottle of water and sweetened with molasses. Allow plenty of pure air, cold water and good strong feed, but not too much at a time. * * * In the early stages of the disease, the carbonate of ammonia given in three-drachm doses along with the other powders, will do much good. There are two points I have ever sought to obtain in the treatment of this disease :—

1st. To maintain the appetite ; 2nd., to restore and maintain it, if lost.

Red Water.—This disease usually occurs to cows a few days after calving.

Cause.—During the period of pregnancy there has been considerable determination of blood to the womb ; the condition of the blood is then, first locally, and soon after generally altered ; the red globules are broken up, and the colouring matter, or *hematosin*, escapes into and is passed out in the urine.

Symptoms.—General disorder, shown by suspension of rumination ; suffering ; diarrhœa followed by constipation ; and the urine, with difficulty discharged, is highly tinged with blood-red, and in the last stages is of a black colour.

Treatment.—First, a purgative : A pound of Epsom salts, a pound of common salt, half an ounce of ginger dissolved in water, and sweetened. Give plenty of mashes. The animal *must be purged* if constipation has set in. When the purging has been effected, give no astringents, but rather administer stimulants and medicines that act upon the blood and kidneys. Common turpentine or spirits of turpentine, guarded by a few drachms of laudanum, will be given with advantage. Or, by way of *precaution*, it has been well recommended that the bowels be carefully kept open before, during and after calving, by occasional doses of common salt dissolved in water ; and *as a cure*, give twenty ounces of Epsom salts in warm water, and half an hour afterwards two quarts of gruel with half a pound of butter dissolved in it ; half the quantity of gruel and butter to be repeated every two hours ; the purgative to be repeated, if necessary, at the end of twenty-four hours ; and should the constipation prove obstinate, injections composed as follows should be frequently administered : Boil an ounce of aniseed in a quart of water, strain the clear liquor, and dissolve in it four ounces of butter and a tablespoonful of salt.

Ringworm.—A parasitic disease, consisting in the growth of cellular tumours on the skin.

Treatment.—Use the oxide of zinc ointment.

Teats are subject to local affections, besides the inflammation of the udder, or garget (which see).

Milk Stones sometimes stop the channel. For their removal take a silver probe or a knitting needle, and if possible, by gentle pressure, force the obstruction up into the udder.

Strictures of the channel cause a small stream of milk to flow. Commence with a small silver probe or needle, and gradually use thicker ones till the channel is made of a proper size. The operation may take a week or fortnight, using the instrument once or twice a day.

Warts may be removed by sharp scissors and the roots touched with caustic.

Simple Sore Teats, in the form of excoriations or small cracks or chaps, are cured by fomentations and a dressing with the following ointment. Take an ounce of yellow wax and three ounces of hog's lard; melt them together, and when they begin to get cool, rub well in a quarter of an ounce of sugar of lead and a drachm of alum finely powdered.

Thrush.—(See Aptha.)

Warbles.—The larva of the ox-fly (*œstrus bovis*), which deposits its egg just beneath the skin, generally about the back, or where the beast cannot lick. Squeeze the tumour and force the larva out.

Yellows.—(See Jaundice.)

THE ORDINARY DISEASES OF SHEEP.

Sheep are difficult patients to deal with in sickness; but as many sheep are yearly lost from the effects of simple ailments, we shall refer shortly to the treatment of some of these.

Colic, or *Stretches—Causes.*—The same as induce bellyache or flatulent-colic in all animals, most frequently the result of costiveness.

Symptoms.—The sheep keeps rising and lying down, constantly stretches its fore and hind legs as far as possible apart, until the belly almost touches the ground, is in pain, and refuses all food.

Treatment.—Give a dose of linseed oil, or—

Epsom salts	½ an ounce.
Powdered ginger	1 drachm.
Peppermint essence	60 drops.

Costiveness.—For this give castor oil, two tablespoonsful every twelve hours until relieved; or Epsom salts, one ounce. It will be well also to give an injection of sweet oil, warm water and soap suds.

Chronic Cough is often noticeable in more or less of the sheep in a flock. This is nearly always cured by a complete change of pasture, accompanied by regular feeding with salt. If not so cured, it will generally be found symptomatic of some worse disease.

Eruptive Disease.—Sheep are subject to an eruption of the skin which gradually extends along the chine, and if permitted to become universal may prove dangerous.

Treatment.—Give daily drinks of half a drachm of cream of tartar, and one drachm of sulphur, in four ounces of camomile decoction. Anoint also with mercurial ointment.

Foot Rot.—Very prevalent amongst high-bred sheep. Sheep have a secretory outlet between the claws of the foot, which, when the hoof grows too fast, is apt to be obstructed, or may be closed up by sand, gravel, &c. Hence, inflammatory action is set up amongst the laminæ of the foot, and there is a secretion of fœtid matter.

When a sheep is observed to go lame, examine the foot, clean out from it all sand, gravel and filthy matter; cut off all loose and ragged portions of the horn of the hoof, and apply to the sore portions an ointment composed of two parts of tar and one of oil of turpentine, which having mixed, add one part of muriatic acid, and afterwards add four parts of blue vitriol. Or, the ointment may be made thus (McClure):—

Oil of turpentine..	2 ounces.
Sulphuric acid..................	½ ounce.
Olive oil	1 ounce.
Mix.	

Apply with a sponge or cloth; where sores occur on the divisions, touch them with nitric acid or a little of the butter of antimony (terchloride of antimony) by means of a feather,

Grub in the Head, or *Frontal Worms*.—*Cause*.—This is the larvæ of the *œstrus ovis*, or gad-fly of the sheep. It lays its eggs on the inner margin of the nose, which having become hatched, the larvæ or grubs creep up into the frontal and maxillary sinuses to the torment of the sheep, and at times to their destruction.

Symptoms.—The fly, laying its eggs in July, August and September, may be observed by the action of a flock of sheep, which collect in close clumps, with their heads inwards, and their noses thrust towards and often into the ground. During the ascent of the larvæ, the sheep suffers great torment; stamps, tosses his head, and often runs wildly off over the field. The larvæ, when once established, create no more trouble until in the succeeding spring, when they begin to crawl down again, causing more agony to the sheep than when they ascended.

Treatment.—As a preventive, smear the nose with tar, or take half a pound of Scotch snuff, and two quarts of boiling water; stir and let stand till cool, then squirt an injection of this up each nostril, two or three times between October and January.

N.B.—There is no actual danger from this grub, except in so far as the irritation makes the sheep liable to catarrh and other diseases of the head, and causes the poor animal considerable torment.

Inflammation of the Bowels, known as *Braxy*.—*Causes*.—Eating noxious vegetables; being turned too long or suddenly on turnip fields or turnip tops half rotten; exposure in cold weather.

Symptoms.—Uneasiness, loathing of food, frequent drinking; carrying the head down; drawing the back up; swollen belly; and avoidance of the flock.

Prevention.—Warm, dry shelter and nutritious food.

Treatment to be successful must be prompt. Give two ounces of Epsom salts dissolved in warm water, with a handful of common salt. If unsuccessful, give a clyster, made with a pipeful of tobacco boiled for a few minutes in a pint of water. Administer half, and if not effectual, follow with the rest. Assist the purgatives with warm gruels and laxative feed.

McClure says: "Give castor oil, two ounces; calomel, five grains; laudanum, two drachms; molasses, two ounces. Beat up with an egg, in warm water, and give it as a drench; repeating in half doses every six hours."

Rot.—A fearful disease.

Causes.—There have been no satisfactory causes given for this disease.

Symptoms.—Loss of flesh; what remains is flabby and pale; the animal loses all vivacity; the lips, tongue, and all mucous membranes are livid, and in the advanced stages are alternately hot and cold. The eyes look sad and glassy, the breath is fœtid, the urine small in quantity and highly coloured; the bowels are at one time costive, and at another affected with a black purging; the pelt will come off with the slightest pull.

Treatment, never successful unless commenced very early, or when the disease is of a mild nature.

1st. There must be a total change of food, and to that of a dry and nutritious character; all the farinæ are good, as wheat, barley, oat or pea meal. Give salt in water from the first.

In the more advanced stages, give every morning—

Watery tincture of aloes	½ ounce.
Decoction of willow bark	4 ounces.
Nitric acid	25 drops.

Scabs, or *Scabies,* or *Psora.*—This is not a common disease in Canada, but it occasionally runs through a flock. It is a cutaneous or skin disease similar to the mange of other beasts. Sometimes they appear in the form of erysipelatous eruptions, and at others as psoric or mangy ones. In the former instance they are universal and very red, and may be cured by nitre administered quickly, and a change of food. In the latter form, as scab, other remedies are required.

Symptoms.—The sheep is very restless, rubs against trees, stones fences, &c.; scratches itself with the feet, bites its sores, and tears off the wool with its teeth. The animal must be relieved, or under the torture it will pine away.

Treatment.—Separate the affected sheep. Cut off the wool in the neighbourhood of the scabs; wash them with soap suds, rubbed hard in with a brush; make a decoction of tobacco, to which is added one-third, by measure, of a strong lye from wood-ashes, hog's lard, and a little tar, and about one-eighth of the whole, by measure, of spirits of turpentine; rub this upon the scabs and around them, after they have been broken and cleansed with the soap suds.

Or, first wash with soap suds, and then dip in an infusion of arsenic, in the proportion of half a pound of arsenic to twelve gallons of water. See that this does not get into the nostrils.

Or, take common mercurial ointment and mix with from five to eight times its weight of lard; apply the ointment all along the back, and in a few lines along the sides of the sheep, first parting the wool carefully where the ointment is to be rubbed in.

A lamb requires one-third as much as a full-grown sheep; or, two pounds of lard oil, half a pound of oil of tar, and one pound of sulphur. Gradually mix the last two; then rub down the compound with the first. Apply ointment as before. Or, take of—

Corrosive sublimate	½ pound.
White hellebore (powdered)	¾ pound.
Whale or other oil	6 gallons.
Resin	2 pounds.
Tallow	2 pounds.

Mix, and melt together.

This is powerful, and must be used with caution.

Scouring, or Diarrhœa.—Causes.—Bad hay, or rapid transition from one kind of food to another; overloading the stomach; or a change of weather.

When not of long continuance, it is better left alone; it is simply nature's treatment for the removal of an overplus of bile from the system. When, however, the trouble continues so long as to very much weaken the sheep, and, consequently, make it subject to other and worse forms of sickness—

Treatment.—Change of pasture, or confinement to dry food. When medicine becomes requisite, give first a gentle cathartic, especially if any mucus or matter be observed in the fœces; either half a drachm of rhubarb, or an ounce of linseed oil, or half an ounce of Epsom salts—these to a lamb; give double quantity to a full-grown sheep. After this gentle cathartic, an astringent will be required. Give prepared chalk, a quarter of an ounce in half a pint of lukewarm milk, once a day for two or three days. Or, to combine both cathartic and astringent, give in the first place—

Powdered opium	2 grains.
Powdered gentian	1 drachm.
Powdered ginger	1 drachm.

Mix, and give in an infusion of linseed.

Also, it has been recommended in cases that do not yield to the simple chalk and milk, to take—

Prepared chalk	1 ounce.
Powdered catechu	½ ounce.
Powdered ginger	2 drachms.
Powdered opium	½ drachm.

Mix with half a pint of peppermint water. Give to a grown sheep two or three tablespoonfuls morning and night; to a lamb, half that quantity. This mixture is known as "Sheep's Cordial."

Staggers, Gid, Turnsick, Goggles, Sturdy, Watery Head, and *Pendro,* are all popular names for *hydatids* on the brain.

Cause.—An hydatid is formed upon the brain, being a parasite which in some unaccountable manner finds its way to the inside of the sheep's head.

Symptoms.—Stupidity; a disposition to sit on the rump, to turn to one side, and to incline the head to the same when at rest. The eyes glare and the pupils become rounded. A softness will now, by close examination, be found upon some part of the skull, generally on the opposite side to that on which the animal hangs the head. When no softness is found, the hydatid is in one of the ventricles, and death is near at hand. When a softness of the skull is in any spot apparent, death may be a long time coming.

Treatment.—This disease has been cured by practitioners by a removal of the hydatids; but as such is, at the best, but an experiment, the better plan is at once to make mutton of the subject.

THE ORDINARY DISEASES OF THE PIG.

Drenching.—Whenever possible, let all medicines be given in food; sometimes, however, the patient is off his feed, and drenching becomes necessary.

Let a man get the head of the pig firmly between his knees, while another secures the body; then take hold of the head, raise it a little, and incline it to one side. Separate the lips on the opposite side to form a hole, into which *gradually* pour the drench. Directly the pig snorts or chokes, release his head for a few seconds before pouring more into his mouth.

Remember, a pig has a small gullet and may easily be choked.

Do all kindly; no hitting, shouting and wrenching because the pig is obstinate. The man should show himself as obstinate, and he is but a poor man whose obstinacy takes the form of that of a pig rather than the quiet determination of a superior being endowed with reasoning faculties.

The weapon of the lower animals is brute stupidity; if we can only meet him with his own weapons—brutality and bad temper—then will he assuredly obtain the mastery.

Catarrh or Cold.—Causes.—Exposure in a stye full of draughts.

Symptoms.—An inflammation of the lining of the nose, and general dulness.

Treatment.—Opening medicines in warm bran mashes; give succulent food, and stop his allowance of rich meals, &c.

Cholera.—This disease has been very fatal in the United States, and we have had many cases of late years in Canada.

Causes.—The filthiness, not of the hog, but of his attendant, who persists in making the proverbial filth of a hog his excuse for possessing pig pens that, one mass of accumulated rottenness, are in themselves cesspools in which the most virulent diseases are generated. It has, so far, when once fairly established in a neighbourhood, proved fatal to all pigs attacked. We must look to its

Treatment by preventives.—Cleanliness in and about pens; a liberal use of whitewash, chloride of lime, carbolic acid, and such disinfectants. When one pig is struck down by cholera, kill him, remove him and thoroughly disinfect his stye. Give the rest the following; take an iron mortar and grind up together:—

Flour of sulphur	6 pounds.
Animal charcoal	1 pound.
Sulphate of iron	6 ounces.
Chincona (pulverized)	1 pound.

And feed at the rate of a tablespoonful to each animal, in food, three times a day for a week.

Diarrhœa.—A change of diet from succulent to more binding, will generally stop this trouble. Acorns, at the right season, will generally stop it.

If medicine is required, mix in their food chalk or powdered egg shells, with a little rhubarb.

Fever.—Symptoms.—Redness of eyes; dryness and heat of lips, nose and skin; loss of appetite and violent thirst.

Treatment—In this case it will often be well to bleed at once. See that the pen has plenty of fresh air, and allow all the cold water the pig requires. If he is costive, give castor oil or linseed oil, but not unless. These measures will usually break the fever. If not, little else can be done.

Inflammations (Internal) or Heavings.—Causes.—Cold caught in damp pens, dirtiness and impure air. It is infectious. "Harris on the Pig" recommends a mild blister; foment the body, under the fore legs, for an hour or so, with cloths wrung out of hot water, and rub on a little saleratus or soda occasionally during the operation, to soften the skin; then apply crude petroleum. This will act as a mild irritant, and heal at the same time.

When inflammation has once set in, the symptoms of which are the same as described for the horse or cow, success is very doubtful.

Jaundice.—Symptoms.—Yellowness of the white of the eye, the lips and skin generally.

Treatment.—Diminish the quantity of food and give aloes.

Mange or Itch is caused by the same *acarus* as the similar affection in other animals.

Use such applications as diluted carbolic acid, crude petroleum, &c., on the posts, sides of the pens, and in a weak form on the pig itself.

Give also sulphur in the food. Except as a last resort, have nothing to do with arsenic, corrosive sublimate, or mercurial ointments.

Measles.—A common disease amongst high bred and highly fed pigs.

Causes.—In-and-in breeding, dirty pens, &c. It is a parasitical disease, and measly pork is a fruitful source of tape-worms, and is utterly unfit for human food. Is often brought on by feeding raw flesh to pigs, and by the habit, not uncommon to sows, of eating their own offspring.

Symptoms.—Red eyes; foul skin and general dulness; loss of appetite; pustules about the throat, and a blotchy, red, eruptive appearance of the skin; cough, fever, running from the nose, and *a weakness of the hind legs.*

Not a fatal disease, unless neglected. Give nutritious and easily digested food, and mix in it sulphur, saltpetre, Epsom salts, and other gentle aperients. Thoroughly cleanse the pen.

Protrusion of the Rectum.—A very common affection of young pigs when highly fed, being a sort of *piles*, and generally the result of severe diarrhœa.

Treatment.—Wash the protruding gut with warm water; rub on a little laudanum, and gently force it back into its place.

Staggers.—A termination of blood to the head.

Treatment.—Bleed freely and give a strong purgative.

Surfeit or Indigestion.—*Cause.*—Indigestible food.

Symptoms.—Loss of appetite, panting, swelled stomach and vomiting.

Treatment.—If it does not naturally pass off by starving for some hours, give bran mashes in small quantities, and for several days give nothing but washy and easily digestible food.

Tumors, or hard swellings, which sometimes appear in various parts of the body.

Treatment.—Give sulphur, saltpetre and nitre in the food, as alterative medicines; and if the swellings become large and soft, open them with a knife or lancet and press out the contained pus or matter.

Rheumatism.—Common to thorough-bred pigs.

Cause.—Same as in the human subject: exposure to damp, or sudden changes of food, ill ventilation, &c.

Treatment.—Liberal feed and Rochelle salts. Give the salts for two or three days, in doses of one ounce a day for a moderate-sized pig, and more or less according to the weight of the animal; and then omit for a few days, and if necessary give again.

MEDICINES IN COMMON USE FOR HORSES, CATTLE AND SHEEP.

ASTRINGENTS.

For stopping discharges, as in diarrhœa.

It may be borne in mind that, with the exception of acrid substances, as mineral acids, &c., which no cattle bear with equal impunity with the horse, the remedies given require about the following proportions:—

A large ox will bear the proportions of a moderate-sized horse; a moderate-sized cow, somewhat less; a calf, about a third of the quantity; and a sheep, about a quarter, or at most one-third, of the proportions directed for a cow.

For more particular information, see our chapters on the Diseases of Horses, of Cattle, of Sheep, and of Pigs. The most of these remedies are compiled from the older veterinarians, such as Youatt, and from modern American writers.

The degrees of strength of the different recipes are usually regulated by their numbers, the mildest standing first.

ALTERATIVES.

(*Old.*)—1. Levigated antimony, two drachms; cream of tartar, half an ounce; flour of sulphur, half an ounce.

2. Cream of tartar, half an ounce; nitre, half an ounce.

3. Œthiops mineral, three drachms; levigated antimony, three drachms; powdered resin, three drachms. Give in a mash, or in oats and bran a little wetted, every night, or make into a ball with honey.

American.—(Sulphite of Soda.)—For horses and cattle, from half an ounce to an ounce, given daily.

Alteratives, Tonic.—1. Gentian, aloes, ginger, blue vitriol in powder, of each one drachm; oak bark (powdered), six drachms. Give every morning.

2. Powdered bark, three drachms; powdered green vitriol, one and a half drachms; powdered gentian, three drachms. Give every morning.

3. White vitriol, one drachm; ground ginger, two drachms; powdered quassia, half an ounce; ale, eight ounces. Mix, and give as a drink.

4. Arsenic, ten grains; oatmeal, one ounce. Mix, and give in mash nightly.

Astringent Mixtures for Diarrhœa, Scouring, &c. (*Old.*) 1. Powdered ipecacuanha, one drachm; powdered opium, half a drachm; prepared chalk, two ounces; boiled starch, one pint.

2. Suet, four ounces; boiled milk, eight ounces; boiled starch, six ounces; powdered alum, one drachm.

3. (For horses and cattle:) Glauber salts, two ounces; Epsom salts, one ounce; green vitriol, four grains; gruel, half a pint.

4. (When the scouring approaches the nature of dysentery): Castor oil, four ounces; Glauber salts (dissolved), two ounces; powdered rhubarb, half a drachm; powdered opium, four grains; gruel, one pint.

American.—Carbonate of lime or prepared chalk, one to two ounces for horses and cattle; and two to three drachms in wheaten gruel, with a drachm of ginger, for calves.

Or, for horses and cows: Catechu, two to five drachms; prepared chalk, one to two ounces; powdered opium, ten to thirty grains. Mix in wheat-flour gruel. Or, a tea made from the bark of slippery elm.

Or, nut galls, from four to six drachms in a dose.

Or, sulphate of iron (not when fever is present), in doses of two or three drachms, with an equal quantity of powdered gentian, twice or thrice a day, in plenty of cold water. Drench, or mix with cut feed.

Or, logwood chips, two ounces; boiling water, one pint, cooled and strained through a cloth, and given in doses of the whole for horses and cattle; from one to three ounces for calves.

Or, mercury with chalk (grey powder) given to calves in doses of from ten to fifteen grains, with a little ginger and in wheat-flour gruel.

Or, oak bark (boiled), half an ounce to a pint of water, and given in doses of four drachms to calves.

Or, starch with a few grains of opium and a little ground ginger.

Or, tannic acid, from a half to one drachm for cattle, and from ten to twenty grains for calves; and mixed in wheat-flour gruel.

Astringent Balls for Diabetes or Saccharine Urine.—Catechu, half an ounce; powdered alum, half a drachm; sugar of lead, ten grains.

Astringent Paste for Thrush, Foot-Rot, &c.—(*Old.*)—Prepared calamine, half an ounce; verdigris, half an ounce; white vitriol, half a drachm; alum, half a drachm; tar, three ounces. Mix.

Astringent Washes for cracks in the heels, wounds, sprains, &c., &c.

(Old:)

1. Sugar of lead, two drachms; white vitriol, one drachm; strong infusion of oak or elm bark, one pint. Mix.

(American :)

2. Green vitriol, one drachm ; infusion of galls, half a pint. Mix, and wash thrice a day.

LOTIONS, LINIMENTS EMBROCATIONS, &C.

General.—Alcohol or Spirits of Wine, is the foundation of many lotions and liniments.

For Sprains.—Acetic Acid.—Add one ounce of camphor to four ounces of the acid.

Or, *Tincture of Arnica,* one ounce ; water, two ounces.

For Wounds and Sores.—Muriatic Acid, or Spirit of Salt.—Pour a few drops into sores in the feet, nail holes, or poll-evil, &c.

Burnt Alum, with which to touch indolent sores.

Borax, dissolved in sixteen times as much water. Good for ringworm.

Lime Water and Calomel, the Yellow wash, and *lime water and corrosive sublimate,* the Black wash ; both good for unhealthy sores.

Sulphate of Copper.—Ten grains to an ounce of water.

Creosote.—Good for all wounds and sores.

Elm Bark (Slippery), scalded with hot water, makes a good poultice for wounds, ulcers and sores.

Glycerine.—Good for sores, especially scratches.

Tincture of Marigold.—Good for all sores; applied by wetting cloths. Good for burns and scalds.

Tincture of Myrrh.—For sores, sore mouth, &c.

Neats' Foot Oil.—To be used after blisters.

Oak Bark boiled in water, and applied to running sores, greasy heels, &c.

Sulphate of Zinc (White Vitriol).—For healing up wounds and sores. As a wash, one part of zinc to about twenty parts of soft water.

Tannin, mixed with water, is good for running sores.

Chloride of Zinc dissolved in water, also for healing wounds, prevents the formation of proud flesh.

For Bruises.—Tincture of Arnica as above.

Eye Lotions.—Plain cold water generally the best.

Sulphate of Copper, three grains ; rain water, one ounce. Apply with a feather or camel's-hair brush.

Acetate of lead (sugar of lead) in solution.

Chloride of Zinc, two grains ; rain water, one ounce.

For the Feet.—Terchloride of Antimony (Butter of Antimony)—Good for foul claw in cattle, or sores in feet of horses or sheep. Laid on by moistened rags.

Calomel.—Inserted in the cleft of the frog of a horse in thrush ; used for foul claw and sore feet in sheep.

Tar.—For stopping horses' feet; also to keep flies off any wound, sore or raw spot; and to keep out cold in winter.

OINTMENTS.

Collodion.—A solution of gun-cotton; for dressing wounds and cuts, in the place of plaster.

Friar's Balsam.—Applied to wounds and sores.

Iodine Ointment.—One part of iodine to eight parts of lard, good for soft swellings.

Iodide of Mercury.—Same proportions as above.

Nitrate of Mercury.—Good for ringworm; but spoils with long keeping.

Oxide of Mercury (Red Precipitate).—Used for unhealthy sores and ulcers.

Brewers' Yeast.—Good for unhealthy sores or ulcers.

Oxide of Zinc.—Good for scratches, and such shallow sores.

Carbonate of Zinc (Calamine).—One part to four parts of lard; good for healing sores.

BLISTERS.

(Old :)

1. A general one: Powdered Spanish fly, two ounces; Venice turpentine, two ounces; resin, two ounces; lard, two pounds. Melt the latter together, and when warm stir in the cantharides.

2. A strong, cheap blister, but not to be used in fever or inflammations of bowels, lungs &c.: Euphorbium powdered, one ounce; oil of vitriol, two scruples; Spanish fly, six ounces; resin, one pound; lard, one pound; oil of turpentine, three ounces. Melt the resin with the lard. Having previously mixed the oil of vitriol with an ounce of water gradually, as gradually add this mixture to the melting mass, which again set on a very slow fire for ten minutes longer; afterwards remove the whole, and when beginning to cool, add the powders, previously mixed, together.

3. A mercurial blister for splints, spavins, ringbones, &c.

Add to four ounces of either of the above blisters, half a drachm of finely powdered corrosive sublimate.

4. A strong liquid blister: Powdered Spanish fly, one ounce; oil of origanum, two drachms; oil of turpentine, four ounces; oli e oil, two ounces. Steep the cantharides in the turpentine for three weeks, strain off and add the oil.

5. A mild liquid or sweating blister: Of the above No. 4, one ounce, with an addition of one and a-half ounces of olive oil or goose grease.

(American :)

Tartarized Antimony (Tartar Emetic).—As an ointment, to be used about the kidneys where Spanish fly blister must not be used.

Iodide of Mercury.—For swelling of the neck glands, for tumors, for splints, ringbones, spavins, windgalls, shoulder-joint lameness, thoroughpin, &c., &c., and is a good general ordinary blister.

The horse must be prevented from getting at it with his lips.

Mustard Seed.—A good blister on the belly and over the loins; for lumbago, sprains of the back and bowels, &c., a mustard plaster is highly recommended.

Savin, or *Oil of Juniper.*—One part to sixteen parts of lard; good for keeping up the action of blisters.

Spanish Fly, or *Cantharides.*—Ground up and mixed with oil or lard, thus: Spanish fly powdered, one drachm; lard, six drachms. Also used for application to splints or soft tumors of the legs, thus:—Tincture of Spanish fly, one ounce; croton oil, twenty drops.

CLYSTERS OR INJECTIONS.

(Old:)

1. Thin gruel, five quarts; Epsom or common salt, six ounces.
2. For Gripes or Colic.—Mash two onions; pour over them oil of turpentine, two ounces; pepper, half an ounce; thin gruel, four quarts.
3. Nutritious Clyster.—Thick gruel, three quarts; strong sound ale, one quart.
4. Strong broth, two quarts; thickened milk, two quarts.
5. Astringent Clyster, in Diarrhœa, &c.)—Tripe liquor, or suet, boiled in milk, three pints; thick starch, two pints; laudanum, half an ounce.
6. Alum whey, one quart; boiled starch, two quarts. A simple injection, useful in nearly all cases of colic or costiveness, is composed of warm water, soap and sweet oil, beaten up into a lather.

CORDIAL BALLS.

(Old:)

1. Powdered gentian, four ounces; powdered ginger, two ounces; coriander seeds powdered, four ounces; powdered carraway seeds, four ounces; oil of aniseed, a quarter of an ounce; make in a mass with honey, molasses or lard, into balls of from one ounce to one and a-half ounce weight.

STIMULANTS.

Ammonia.—Two drachms to half an ounce in water, as an antispasmodic in cases of flatulent colic.

Carbonate of Ammonia.—Two drachms, given three times a day in thickish gruel; good in cases of weakness and general prostration.

Chloroform.—Good for chills or in case of colic. From one to two drachms in weak whiskey every two or three hours until colic is relieved.

Fenugreek.—In one ounce doses, good for loss of appetite, &c.

Juniper Berries.—Good also in loss of appetite.

Magnesia.—Also in loss of appetite in young animals. Give about four drachms with a little ginger, to prevent the magnesia griping.

Spirits of Wine (Alcohol).—A good stimulant; far better to give in colic than bad whiskey.

Oil of Turpentine.—Very excellent to relieve spasms in colic.

COUGHS AND COLDS.

(Old :)

Chronic Cough Balls.—1. Calomel, one scruple; gum ammoniacum, two drachms; horse radish, two drachms; balsam of tolu, one drachm; squills, one drachm. Beat all together and make into a ball with honey, and give every morning, fasting

Drink for Chronic Cough.—2. Tar water, half a pint; lime water, half a pint; tincture of squills, half an ounce.

Powder for Chronic Cough.—3. Tartar emetic, two drachms; powdered foxglove, half a drachm; powdered squills, half a drachm; calomel, one scruple; nitre, three drachms. Give every night in a mash.

(American :)

Elecampane.—Make a tea of this, and give it as a drink.

Henbane.—A relief for cough or irritation of the throat or windpipe. One or two drachms of the extract of henbane forms a dose.

CAUSTICS.

(American :)

Sulphate of Copper.—To destroy proud flesh—used in crystals or in solution.

Caustic Potash.—Very quick reducer of proud flesh.

Lunar Caustic (or Nitrate of Silver).—A common caustic for unhealthy sores or ulcers. Also *Verdigris,* or subacetate of copper —a mild caustic.

COLIC REMEDIES OR ANTISPASMODICS.

Ammonia.—(See under the head of Stimulants.)

Calcium, or *Quicklime.*—For flatulent colic, where there is bloat present: For horses and cattle, from one to two drachms. When used in the form of lime-water, give five ounces.

Chloroform.—(See Stimulants.)

Ginger should enter every dose for gripes or colic. From one to two ounces for horses and cattle; for sheep, two drachms; for calves, one drachm and under.

Laudanum given in conjunction with turpentine, and in quantities not exceeding one ounce.

Pepper given in combination with ammonia from three to five drachms; and of cayenne pepper, from twenty to thirty grains.

Spirits of Wine.—(See Stimulants.)

Turpentine.—(See Stimulants.)

DIURETICS.

Medicines which increase the flow of urine, by action upon the kidneys.

(Old:)

1. *Diuretic Ball.*—Resin, one pound; nitre, half a pound; horse turpentine, half a pound; yellow soap, a quarter of a pound.

2. *Diuretic Powder.*—Resin powdered, four ounces; nitre powdered, eight ounces; cream of tartar, four ounces. Given in six, eight or ten-drachm doses, nightly, in mash.

3. *Drink for action on the urine.*—Glauber salts, two ounces; nitre, six drachms. Dissolve in a pint of warm water.

(American:)

Oil of turpentine, from one to two ounces, mixed in an equal amount of any oil.

DISINFECTANTS, OR PURIFIERS.

For Fumigation.—Manganese, two ounces; common salt, two ounces; oil of vitriol, three ounces; water, one ounce. Put the mixed manganese and salt into a basin; then, having before mixed the vitriol and water very gradually, pour them by means of a tongs, or anything that will enable you to stand at some distance, on the articles in the basin, gradually. As soon as the fumes rise, retire, and shut up all doors and windows tightly. Or, set fire to sulphur and let fumes rise.

Quicklime is, in whitewash, or thrown about in a powdered state, an excellent disinfectant.

Carbolic Acid.—Add a tablespoonful of the greatest strength solution to a bucketful of whitewash, and thoroughly wash every part of stables or pens.

Chlorine Gas.—Pour hydrochloric acid on an ounce or so of black oxide of manganese; put a spirit lamp under them, and shut the fumes in.

Chloride of Lime.—Sprinkle about.

FEBRIFUGES, OR MEDICINES FOR FEVER.

(Old:)

1. *A Powder.*—Tartar emetic, two drachms; nitre, five drachms.

2. Antimonial powder, two drachms; cream of tartar, four drachms; nitre, four drachms.

3. *A Drink.*—Sweet spirits of nitre, one ounce; mindererus spirit, six ounces; tartar emetic, three drachms.

4. *Epidemic Fever Drink.*—Sweet spirits of nitre, one ounce; simple oxymel, six ounces; tartar emetic, three drachms.

5. *Malignant Epidemic Fever Drink.*—Simple oxymel, four ounces; mindererus spirit, four ounces; beer yeast, four ounces; sweet spirits of nitre, one ounce.

(American :)

Sulphuric Acid.—Forty to sixty drops very largely diluted with water. In mixing, add acid to water, not water to acid.

Aconite.—Never carry this medicine, which is a powerful poison, being a sedative, too far. Never give more than eight doses of twenty drops, or six doses of twenty-five drops.

Aniseed.—One or two ounces daily, in conjunction with fenugreek or cardamons.

Cardamons.—One or two ounces.

Caraway.— Do. do.

Fenugreek.—Given in one-ounce doses.

PURGING MEDICINES.

(Old :)

Balls.—(Very mild:)

1. Powdered aloes, six drachms; oil of turpentine, one drachm.

2. (Moderate.)—Powdered aloes, three drachms; oil of turpentine, one drachm.

3. (Strong.)—Powdered aloes, ten drachms; oil of turpentine, one drachm—made into a ball.

(Liquid.)—Epsom salts (dissolved), eight ounces; castor oil, four ounces; watery tincture of aloes, eight ounces.

(American :)

Aloes.—Six drachms, made with powdered ginger and molasses, two drachms, into a ball.

Castor Oil is decried by American writers, as tending to bring on inflammation.

Croton Oil.—A dangerous medicine, but very rapid to open the bowels; only to be used in extreme cases. For the cow (only), ten to fifteen drops, given along with Epsom or Glauber salts.

Epsom Salts.—Valuable and safe, especially for cows—one to two pounds, largely diluted with water. For calves, from one to four ounces; for sheep, from four to six ounces.

Glauber Salts, or Sulphate of Soda.—Good for cattle and sheep.

Linseed Oil.—The safest oil as a base in which to give purges, and as a lubricator of the throat in cases of choking—from one to two pints at a dose.

Salts.—Chloride of Sodium or Common Table Salt is a laxative or gentle purge.

POULTICES.

Bran and Goulard water.

Boiled and mashed turnips, carrots or parsnips.

Hemlock.—For cancerous sores.

Linseed.—The very best poultice.

Hops or Yeast from the brewer.

N.B.—Never bind a poultice on tightly, so as to stop the circulation of blood.

RHEUMATIC APPLICATIONS.

Colchicum (*Meadow Saffron*).—The seeds and root can be bought as a tincture. Given internally, from one to two drachms for horses and cattle.

Tincture of Guaicum.—A resin ; give half an ounce twice a day in cut feed, or as a drench in cold water.

SEDATIVES (*to allay excitement*).

Tincture of Aconite Root.—(See Febrifuges.)

Belladonna.—Used as a substitute for opium in many cases, as a milder medicine. Used in doses of half a drachm, in half an ounce of sweet spirits of nitre, two or three times a day.

Chloroform.—(See Colic.)

Digitalis.—A dangerous drug, not often now used. Acts too suddenly on the heart.

Gum Tragacanth.—A resin. From one to two ounces for horses and cattle ; four drachms for calves or sheep, dissolved in warm water as a drench.

N.B.—In the use of sedatives, care should be exercised that they are not carried too far.

STYPTICS (*or applications to arrest bleeding*).

Cobwebs.—Gathered in a mass and applied.

Perchloride of Iron, applied with a soft brush, or pledget of soft cloth or cotton saturated and bandaged over the wound.

Tannin.—*The hot Iron* and *Bandages.*

N.B.—When an artery or large blood vessel is severed, the surgeon must be brought.

Should an artery on any of the limbs of man or beast be cut, bind tightly round the limb between the wound and the heart ; put on a tourniquet, or twisting stick, and draw the bandage so tight that the flow of blood is arrested.

Difference between the flow of blood from a cut vein and a cut artery :

The blood flows *steadily* from a cut vein.

The blood flows *in jets* with every pulsation from a cut artery.

SKIN DISEASES—APPLICATIONS.

(Old :)

For Mange.—Sulphur vivum, eight ounces ; arsenic in powder, two drachms ; mercurial ointment, two ounces ; turpentine, two ounces ; lard, eight ounces. Mix and dress.

Note.—We think this must be effectual, but a very dangerous and poisonous application.

(American :)

Benzole.

Iodide of Sulphur.—In all applications of sulphur keep the patient from getting cold or wet.

Bichloride of Mercury (Corrosive Sublimate) should only be used in ringworm and very bad mange, being a dangerous poison.

Peach Leaves, infused like tea in water, are good for itch and ordinary skin diseases.

Petroleum (Crude).—Good to destroy lice. Is apt to bring the hair away ; for which reason should be mixed with other oil, say linseed.

Sulphuret of Potash (Liver of Sulphur).—Dissolve an ounce in a pint of water, and after having rubbed the affected parts well with a hard brush to expose the *acarus,* apply the solution.

Sulphur.—The safest article to use, in all shapes ; only as it opens the pores, it leaves the patient subject to take cold, which must be guarded against.

TONICS.

To increase the general tone of the system.

Muriatic Acid (Spirit of Salt).—Forty to sixty drops given, largely diluted, three or four times a day.

Nitric Acid (Aquafortis).—Also very largely diluted.

Arsenic.—A poison, but a splendid tonic ; two and a-half grains per day are ample ; given *well mixed,* in a *very large bulk* of cut feed.

Camomile.—A mild tonic.

Coriander Seeds.—Especially good for calves ; two drachms in their milk feed.

Iodide of Iron.—One or two drachms in cut feed, twice a day.

Sulphate of Iron.—Always combined with some vegetable tonic, as gentian or ginger root ; two or three drachms to the horse and cow, mixed with feed.

Strychnine.—Very dangerous poison. For horses, *one grain* once a day is ample, given in cut feed or in a gruel drench ; the dose may be gradually increased to three grains.

☞ Remember, *twelve grains* will kill a horse.

Pariera Brava.—A root; one ounce to be sliced and boiled in a pint of water; let cool and strain, and give on cut feed, half a pint at a time.

Sassafras.—Given as a tea; very excellent in the spring of the year.

Snake Root.—Given in the same manner.

Willow Bark.—Dried, boiled down in water, and given in feed in the spring of the year.

VERMIFUGES (*for the Expulsion of Worms*).

Assafœtida.—A gum resin. About two drachms.

As-arabacca.—For worms in the nasal air passages. Blow a drachm up each nostril; take care that the operator does not inhale it. For sheep, put them in a close pen and scatter it in the air, to make them sneeze.

Fern.—For horses and cattle, one pound of the root in powder; for sheep, from three to five ounces.

Pumpkin Seeds.

Savin.—For horses and cattle, three to four drachms.

FARM IMPLEMENTS.

It is impossible in a work of the present size to enter into a full description of the various implements and tools made use of in Canadian agriculture.

Suffice it to say, that good tools and implements are necessary adjuncts of good farming. The carpenter cannot make neat and fast work with blunt chisel or ill-set saw; neither can the husbandman till his fields neatly and thoroughly, nor perform his farm operations with speed, unless he has provided the best of implements.

The power of the horse can only be used in one uniform direction, viz., by draught in a nearly horizontal position.

Our implements must be so adapted to this uniform "pull," as to perform themselves, under such influence, the varying operations which go to make up cultivation, harvesting and carrying.

Man is endowed with but a very small amount of strength, and can adapt his physical exertion but in a very few directions. The head must be used to utilize forms and shapes, material, and the fundamental laws of nature, for the performance of the greatest amount of actual work with the minimum exertion and expenditure of his physical force.

By the subjugation of natural laws to the use of man, he is enabled to produce excessive motion and multiplied strength with an expenditure of but little original force.

The grand principles to be ever kept in view by the farmer and the manufacturer, the user and the maker, must be to produce such implements as will, with the least exertion on the part of man or beast, produce the most perfect results in the shortest possible space of time.

We shall therefore, in this chapter, rest content with a passing indication of those principles which should be especially developed in the several tools and implements necessary to the use of the farmer in the pursuit of a course of mixed husbandry.

The invention of agricultural implements must have been coeval with the early days of the world, and as far as history leads us back, their origination was due to the ancient Egyptians. Antiquarians agree that the primeval instruments used in cultivating the soil must have been of the pick kind, and medals of great antiquity dug up at Syracuse, in Sicily, in Egypt and Arabia, all point to this fact. From the days when the Israelites were under Egyptian bondage, an improvement in implements of tillage has been gradually progressing, and yet in the present age—the vaunted nineteenth century—we are in this department, after so many centuries of invention and improvement, yet in our infancy.

There is no field which affords so wide a scope for the genius of the mechanic of the present date as the improvement of agricultural implements and machinery. Every new tool for the use of the farm that can fairly stand the test of practical trial, and in that trial prove itself worthy of public confidence, is readily adopted by the farmer.

D. G. F. Macdonald, an able English agricultural writer, calls attention to the ingenuity shown in America in the invention of agricultural machinery. "See," says he, "how the Yankee ingenuity of the farmer of the Western States devises implements for the more economical and rapid prosecution of labour." We are driven to exercise our ingenuity by the want of hand labour. We have horses in abundance, and we must make them do all the labour possible, and thus are we driven to the use of horse machines even where the cost of such shows no great advantage over the old-fashioned plans of manual work.

In the old countries, the economy of general agricultural machinery is very generally recognised ; how much more necessary does it appear to us in a land where seasons are short, farm hands scarce, and wages very high.

Let us for a moment illustrate this point by one implement, seldom seen a few years ago, but now coming into very general use in Canada—the hay and straw cutter. The author had occasion to notice this point a few years ago in the volumes of the *Canada Farmer*, thus :—

"On this subject the following pertinent remark was made to me a few days since by a farmer who generally feeds from twenty to thirty head of cattle every winter : 'I might as well have no barn in which to house my fodder as no machine to cut it up with. In the one case I should lose, perhaps, twenty per cent. by exposure to the weather ; and in the other case I should lose the same or more by the wastefulness of my men and the daintiness of my well-bred and highly-fed cattle.'

"In Canada, owing to the length of the season in which we are compelled to supply dry food to our cattle, it is of the greatest importance that we utilize every particle of both hay and straw. Moreover, cattle feeding is now fast becoming the most profitable part of husbandry to the Canadian farmer, and an increase in this branch of farming certainly exercises a great improving influence upon the heart of our lands, in that we thus return a greater proportion of the produce of the farm to the soil in the shape of manure.

"Without going into the advantages of steaming cattle food, I propose to review the great saving of fodder effected by the use of the chaff-cutter.

"When straw alone is not considered rich enough fodder for stock, it is often advantageous to mix it with hay. This mixture cannot be fed in its long state, for the cattle will pick out the hay and throw aside the straw; but when the two are cut and thoroughly mixed, they will be consumed together, and will thus answer the required purpose. Moreover, the beasts will digest the same proportion of fodder in less time, and thus cattle will be able more thoroughly to perform that process of chewing the cud so necessary to their perfect digestion. Again, when hay has been kept long in the barn, or has been cured in rainy weather, there is always a certain proportion of dried up and inferior stems; these when cut into chaff may be thoroughly mixed with the more juicy part of the hay, and will not then be set apart and wasted by the animal when feeding.

"The saving in fodder thus effected has been variously estimated. My own experience leads me to consider that 15 cwt., when it has passed through the chaff-cutter, will fodder cattle thoroughly, where it would require a ton of long hay. Allowing the standard price of clover hay to be ten dollars per ton, we should thus effect a saving of ten dollars in every four tons fed. The expense of cutting is very slight, for enough chaff can be worked up in one day by two teams and three hands to serve fifteen or twenty head of cattle for a full month. The cost of a good serviceable chaff-cutter, which can be worked by hand or horse-power, such as are made by Messrs. Maxwell & Whitelaw, of Paris, Ont., is about forty-five dollars.

"Ten head of fatting cattle will consume about four tons of clover hay in a month. If these cattle are put up for two months, we shall have saved twenty dollars directly by economy in feeding, and more in that better fitness for the butcher which is the result of allowing them plenty of time to lie in their boxes."

Canadian Tools, Implements, and Agricultural Machinery are many and varied, and show an immense amount of enterprise on the part of our manufacturers. The show of implements at our agricultural exhibitions would not disgrace a far more populous and richer country, but there is one want sadly felt by the farmer —a want of solidity and durability. Competition is keen, and the desire of manufacturing numbers, and the rapid demand upon new inventions, as soon as their practical merit is proved, have led too many of our makers to neglect the staple of their material, and turn out work from inferior iron and badly selected wood. This is more especially the case with Canadian reapers and mowers. As soon as the name of any particular patent has made itself felt, there is a rush of demand. The reaper or mower is called upon to do very heavy work. Put into rough fields and subjected to careless handling, to stand for any length of time it must be of the very best material, both iron and wood. And yet we regret to say that too many of our manufacturers are not particular about the quality of wood, and in too many cases use old stoves and burnt up irons for the purposes of castings for their machines. Is it then any wonder that every season we see farmer after farmer flocking into towns, wasting the precious hours of harvest, to obtain new castings for their machinery ?

The reaper and mower for which we pay one hundred and fifty dollars ought to be a first-class article, and should have no flaw in it, for at that price, allowing a generous commission to the agent, the manufacturer makes an immense profit.

We want greater durability in our tools and implements. It is useless to disguise the fact, that too many of the farmers use their implements shamefully, exposing them to rain and sun; but there is altogether too much inferior material in their construction, and too little care exercised in the several departments of manufacture.

The drawback to a greater expenditure on the part of the farmer in improved implements arises not only from their first cost, but the subsequent expense entailed by wear and tear.

If a farmer buys eight hundred dollars worth of agricultural implements and machinery, and they give out in eight years, it will readily be perceived that one hundred dollars per annum on eight hundred dollars is a very severe interest actually lost to the farmer's pocket.

At the same time, a high-priced article, if really good, is cheaper at almost any price than one of inferior quality; and we should be glad if the judges at shows would look more closely to the durability of the articles shown when awarding prizes, which are afterwards used as a widely circulated medium of advertisement, and by which the choice of the buyer is in no small degree influenced.

A farm waggon, three-fourths worn out, at a cost of fifty dollars, is money almost thrown away, when one new from the shop can be obtained for one hundred dollars; and so is it with many machines. There are many farmers who seem to suppose that if they can buy a machine cheap they have done a good thing. Now, it is very true that one may easily lay out too much money on his mower or reaper, or rake or cultivator, or thresher, or any other implement he has to buy. The best of these may be dearly bought. But we speak of the purchase of cheap articles simply because they are cheap. Nearly always these are the dearest in the end. They seldom work well, get out of order easily, are of poor material, and soon break up or wear out. The best way is to work along and shift as you can until you are able to purchase a first-class and reliable article, and when you have bought, use carefully, and house it when not in use.

By such a course as this, a farmer will in a few years provide himself with excellent machinery and tools. With these he can do his work well and rapidly, and easily and with comfort. A poor tool with which one has much to do had better be thrown away than continued in use. How a poor scythe or a poor axe worries the one who wields it; and how it acts like a brake upon the wheels of labour! So it is with every other implement of labour that is inferior or imperfect. Many a farmer is behindhand and feels his labours to be drudgery who might see a chief cause of this in his failure to provide himself and his help with suitable tools.

Let him carefully calculate the difference of ability to execute between good tools and poor ones, and he will no longer doubt that economy demands the use of the former. The loss of time and muscle, and the failure to do rapidly and well, charged to the account of poor tools, will show him that he who would thrive must secure implements of the best quality with which to do his work.

We are happy to have hailed some years ago the establishment of an agricultural warehouse, in Canada, devoted entirely to the importation of and agency for the best and newest agricultural implements.

This establishment, in the hands of Mr. Rennie, of Toronto, and under his able management, has, we believe, proved a pecuniary success to the proprietor, and is of value to the farmer.

We object to no such middleman as he; unlike the perambulating agents who make a commission by hawking some particular invention, or puffing his own employer's machinery, Mr. Rennie admits all implements of an improved kind into his warehouse; gives all a fair and honest description in his catalogues; and will give a straightforward explanation of the peculiar advantages, and will not fear to point out any of the disadvantages, of the various implements under his charge.

There is also, under the management of Mr. Weld, of London, Ontario (a practical farmer, and an enthusiast in all matters appertaining to the farmer's calling), established an emporium which has already done good work in the dissemination of seeds and of agricultural implements and machinery.

We have also heard of several depots of a similar character which have lately or are about to be established; and we would beg our farmers, in their own interest, to extend their patronage in a free and liberal manner to all such as may be founded in the several parts of the Dominion.

PLOUGHS.

Of ploughs there are two distinct kinds—those that are mounted on a wheel or wheels and are called *wheel ploughs*, and *swing ploughs*.

With the ordinary class of ploughmen, and considering that we in Canada, in choosing our workmen, cannot be very particular as regards their qualifications as ploughmen, we may look upon the wheeled plough as an instrument by which a comparatively inexperienced ploughman can make good work; while the performance of the operation with the swing plough, except in the hands of a man of some experience, will prove a bungling job.

On the other hand, the swing plough is *capable* of doing actually better work than that mounted on wheels, and the friction and draught are undoubtedly proportionately lighter.

There is no wheeled plough in the world, not even excepting the "Howard," that can compete in the essential qualifications of neat furrow slices, control and easy draught, with the Improved Scotch swing plough in the hands of a good lowlander; but we have ourselves seen better work done by means of the "Howard" in the hands of a greenhorn, than that by a superior Improved Scotch held by a man of mediocre ability as a ploughman.

On the whole, take ploughmen as they are, and ploughs as they are generally constructed, it will be found in Canada that the work is generally neater in those districts where the wheel ploughs are in use; whilst, on the contrary, in townships where the swing plough is common, the workmen will be found superior handlers of the plough.

In the construction of a plough there are certain general principles that must be carefully regarded.

These have reference to the laws of formation of the various parts as adapted to their special uses.

First, the throat or breast, or that part which enters and perforates the soil. In this portion lie the greatest points of resistance, and the form must, in order to reduce such resistance to a minimum, be of a long, narrow, tapering, sharpened nature, while friction is greatly reduced by the amount of polish or smoothness of the material employed.

The mould board, being that portion which regulates the position of the furrow slice, must be of that hollowed-out and twisted form which not only tends to lessen resistance, but gives form and shape to the turned-up soil.

The beam and muzzle require to be of that length, substance and shape which allows of the moving power being attached in the most advantageous line of draught.

The stilts or handles are but levers; and the mechanical principles of leverage must be brought into action, in order to place the power under full control of the driver, that he may, by the slightest exertion of force, alter the direction, and that such force used by the holder may be applied to the instrument without unduly affecting the draught.

The land side is of no less importance than the mould board, for here in many ploughs is to be found a useless friction. This portion is the fulcrum on which the leverage of the stilts is exerted, and all that is required is that it should, when necessary, afford a steady purchase on which to bear the handles in shifting the direction of the moving plough.

Line of draught must be at right angles, in the case of horse-power, to the slant of the animal's shoulders. When the horse is pulling, the collar, pressing tightly upon the shoulder, is of a slightly circular form. The point of draught is then where the trace is attached by the hames to the collar.

The direction of draught, starting from this point and at right angles with the slant of the shoulder (shown by a line drawn from top to bottom of collar), should pass directly through the plough-bridle, and cut a point in the coulter at half the depth of the furrow.

Now, ploughs are to be seen any day in the right season in Canada, in which such a line of draught from the collar would pass almost over the beam and to some part of the stilts; such a variation must cause the plough to dip, and thus give a very great extra amount of friction. In other cases the line of draught will be found to strike the earth before the coulter reaches the spot, and such entails a form of share which not only keeps the plough in the ground, but affords extra and useless resistance to the draught, which exerts a constant force to lift the plough out of the soil.

The beam serves as a line of connection to which is attached the various parts of the plough—hence it is the basis of the whole construction, and its shape is of the utmost importance—and of whatever material it is made, it must be stoutly built.

If we take the angle which the horse's shoulder makes with a perpendicular from the horizon, and continue another line at right angles to it, or in the line of draught, the length of the line from the horse's shoulder to where it meets the coulter at half the depth of the furrow will be about twelve feet for ordinary-sized horses.

If the plough be properly made, this line of draught will pass through the middle of the lowering and heightening holes of the muzzle; and *the length of the beam,* in accordance with these principles, should be from six feet six inches to seven feet, in order to give it a proper height for the bridle.

Land side should be a perfect plane, and run exactly parallel to the line of draught. How often are ploughs made with a land side turned off two or three inches at the hind end and outwards.

Such a form is worse than useless, for it entails a considerable amount of unnecessary friction. The effect of such a shape is, that the plough is thrown off towards the furrow, and the mould board pressing with undue force upon the slice breaks and crumbles it, besides giving extra exertion to the horses or cattle.

The coulter should be as nearly as possible at an angle of 45° with the surface of the ground—for if it is more oblique, it picks up stubble and grass roots which choke under the beam; and if less oblique, it will be apt to drive stones and sods and other obstacles before it, causing an increase to the amount of draught.

The Mould Board.—This part of the plough must vary in shape according to the nature of the soil and the various kinds of ploughing.

For working fallows and light lands, a slightly convex surface is most effectual.

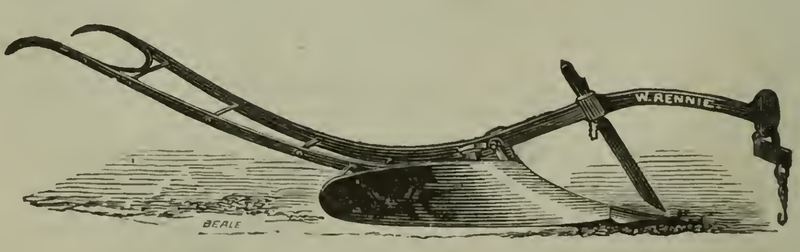
For clover leys, sods, pasture fields and clayey land, an almost even plane is better; and for stiff clays, a concave form is necessary in order that the surface may clear itself.

A land side, if too short, renders the plough unsteady, being easily disturbed by any obstacles in the soil; whilst too long a land plate affords a great friction when the leverage of the handles to turn the plough is put in force.

The Handles.—Long handles are necessary to give power over his implement to the ploughman. They should at the end be of such a height that an average-sized man has neither to bend the arm when holding them, nor to stoop in order to lift upon them.

The Share varies in form with the different sorts or styles of ploughing generally required; but it should be of steel, that it may be always bright; and it is as important to the horse that a share be sharp, as to the mower that his scythe blade be well whetted.

Swing Ploughs.—Of these in Canada there is an endless variety, and every township or section appears to take to its own special favourite. We shall here merely indicate a few of the newer kinds.



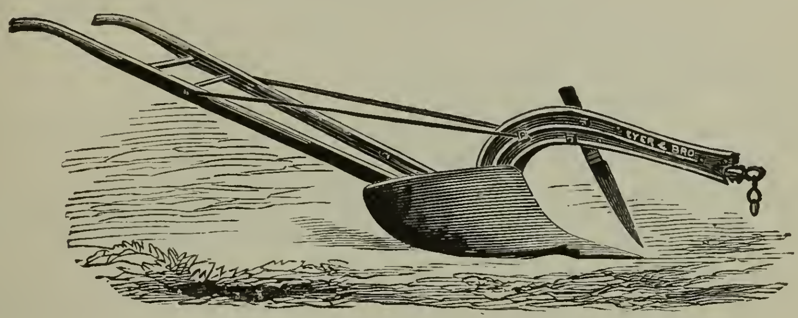
GRAY'S CHAMPION SINGLE FURROW PLOUGH.

This plough is made of wrought iron throughout with the exception of mould boards, which are of steel or cast iron.

In the trial of ploughs at Paris, in 1871, under the auspices of the Provincial Agricultural Association of Ontario, it was awarded the first prize. Under the dynamometer, this plough, itself weighing 180 lbs., showed an average draught of 500 lbs., and it was observed that on ascending a hill this draught was only increased by about 25 lbs.

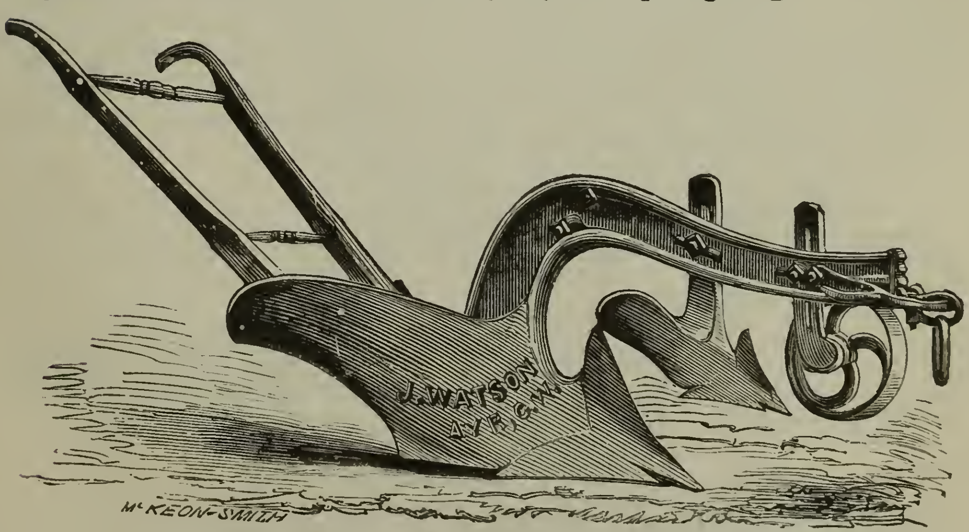
The same maker has also put out what he calls

"*Gray's Light Canada Plough,*" of the same form as the above, but of lighter make. It is made of wrought iron, with a cast iron head, steel mould board and steel shares.



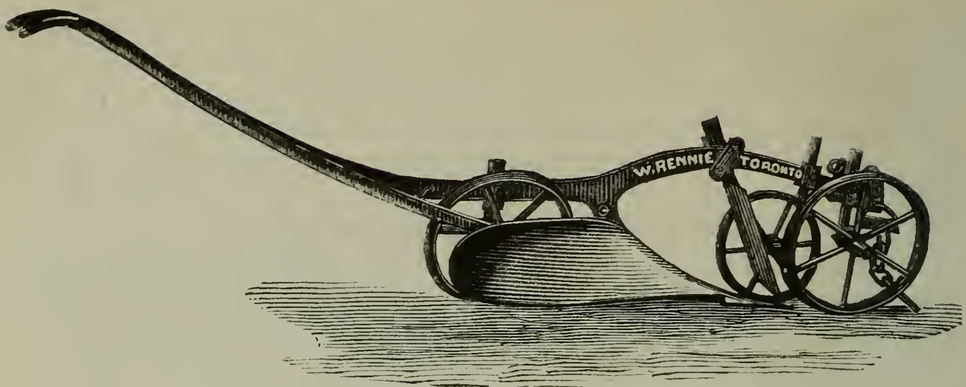
THE COMBINED CAST BEAM PLOUGH

Does not make the work that such ploughs as above described are capable of, but is adapted to every style of ploughing.



YANKEE NO. 22 JOINTER (TWO OR THREE HORSE).

Of the Jointers, for deep ploughing, cross ploughing and breaking up old tough sods, we select one manufactured by Mr. Watson, of Ayr, Ont., adapted for two or three horses, according to the depth required to be turned up and the nature of the soil.



THE ANTI-FRICTION WHEEL PLOUGH.

A new plough has lately been introduced by Mr. Rennie, known as the Anti-friction Wheel Plough. He says :

"The superiority of a rolling to a sliding motion in the construction of ploughs is easily understood, as securing lightness of draught and ease of management.

"The Anti-friction Wheel Plough is fully a third less draught than the ordinary single-furrow plough.

"It can be worked in any soil with two horses the same depth as can be done with three horses, besides making more regular work.

"This plough is easily adjusted to any required size of furrow or style of ploughing, and when so adjusted is self-acting, following the horses without the guidance of the ploughman.

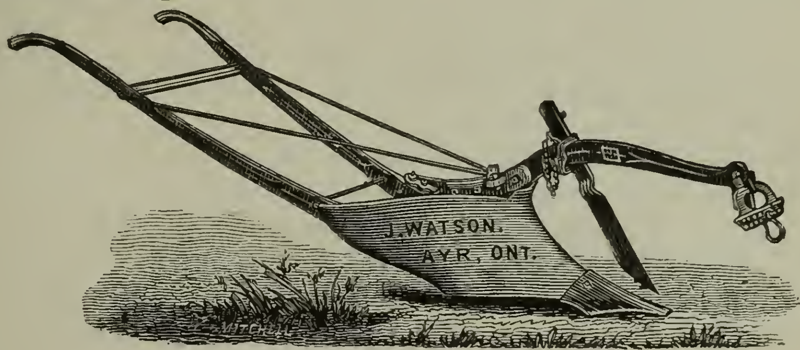
"When the ridges are struck out by a competent ploughman, the work can be carried on by a boy, the stilts or handles being used merely for turning at the ends and for passing obstructions in the soil."

THE SWIVEL OR SIDE-HILL PLOUGH.

Is built in a series of several sizes, from a light one-horse to a heavy or four-horse plough.

They are so constructed that the mould board can be instantly changed from one side to the other, enabling the operator to perform the work horizontally upon side-hills, going back and forth on the same side, and turning all the furrows downward.

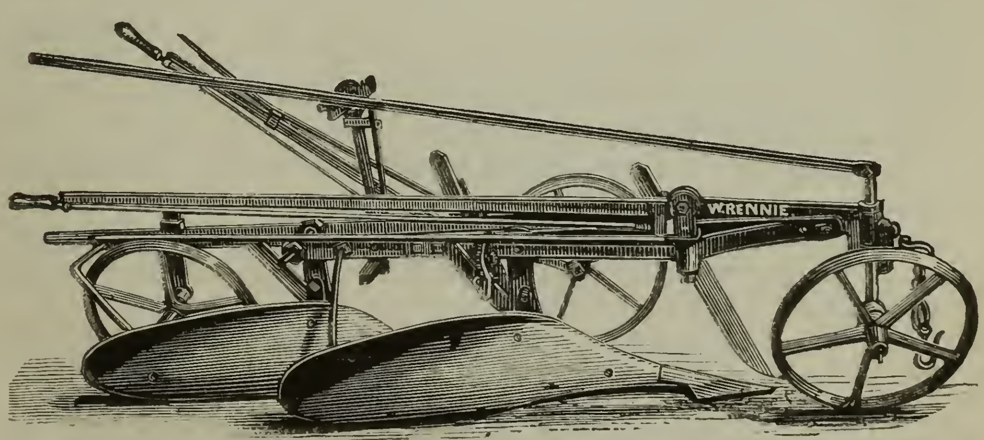
They are employed by many for level ploughing, as this leaves the field without any centre, dead or finishing furrows; thereby allowing the mowing machine, horse rake and hay tedder to work to best advantage.



HILL'S PATENT PLOUGH

ls one of the very best swing ploughs made in Canada, and we give it as such a place in this chapter.

The advantage which it specially possesses is, that it is equally serviceable as a sod plough or as a jointer when the skim coulter is attached.



GRAY'S DOUBLE FURROW PLOUGH.

As economizers of labour, both manual and horse, these ploughs have for several years been widely used in the old countries, and for the last two years a great number have been sold in Canada.

Every farmer who has bought one has been well satisfied with his investment.

They have become deservedly popular, owing to the saving effected in draught, manual labour, and wear and tear.

This plough is imported from Mr. Gray, Scotland, but we trust before long our Canadian manufacturers will turn out a similar implement.

They are wholly carried on large angular rimmed wheels, which not only carry their weight, but also resist the pressure exerted in lifting and turning the furrow. They have neither side nor sole plates, and hence are free from all friction caused by the rubbing action of the same; the cutting part of the coulters and shares are so constructed and arranged that they make room for the rest of the plough, and no part of it touches the soil or mould board. By this arrangement the power required to work the plough is reduced fully a third.

The double-furrow plough can be drawn on heavy soil with ease by three horses. and on light soil by two.

Among the advantages these ploughs possess are the following :—

The work can be accomplished by fewer horses. On moderately heavy land the double-furrow plough drawn by three horses, will plough three acres per day of nine hours, thus securing to the farmer a saving of not less than 30 per cent., or affording him the opportunity of having his ploughing done quicker when a suitable season occurs.

With one of these double-furrow ploughs one man can do the work of two, if using the ordinary plough, and with far more ease, as they guide themselves, and only require attention in case of anything unusual in the soil.

The shares are made of steel, and are so cheaply constructed, and keep sharp so long, that the whole cost of keeping them up does not exceed the cost of sharpening the old iron share.

These ploughs raise and loosen the land more thoroughly; from their construction they turn a deeper and broader furrow, and press it more closely than the ordinary ploughs. There being no sole plate, the subsoil is not glazed and hardened as by the common plough, the advantage thus gained being great in all cases, but especially in damp soils.

It is suitable for all kinds of ploughing, and will also rib up to 18 inches in width.

The two lifting levers afford additional facilities for throwing the plough over fast stones or other obstructions in the soil, and the adjusting screws on both right and left hand levers make it easily adjustable to any inequalities of the surface.

On light land, or for ribbing, it can be worked by two horses, and on heavy and rocky land three horses can be used with safety.

It is easily adjusted to plough any required width of furrow.

This plough, when once adjusted, is self-acting, following the horses without any attention from the ploughman, and works well in any kind of land.

GRAY'S TRIPLE-FURROW PLOUGH.—(See Appendix.)

This extraordinary economizer of labour is similar in construction to the double-furrow plough, having the new governing steerage, and is made so that in heavy work it can be readily changed in a few minutes to a double-furrow plough.

At a time when facility for getting through work is of such urgent necessity, farmers will readily observe and appreciate the importance of this triple-furrow plough.

In ploughing loose land for wheat, and in cross ploughing for root crops, it does the work of three common ploughs in superior style, and saving two men and three horses.

It has also been successfully used in making two drills at a time for root crops, by merely withdrawing the centre plough.

The lightness of draught is, in the case of this triple-furrow plough, exhibited in a most marked manner, the dynamometrical tests having shown an average draught of one horse power *per furrow*, at the usual depths ; so that, except in stiff heavy lands, this plough can be worked by three horses.

Amongst our other ploughs we have "*Barrowman*," "*Wilkie*,' "*Murray*," "*McSherry*," "*Britannia*," "*Morley*," "*Model*," "*Gem of Ayr*" (*Watson*), "*Scotch Canadian*," "*Highland Mary*," and very many others, varying in forms and prices.

HARROWS.

An instrument of nearly as much importance as the plough, and of quite equal value in cultivation.

" Any man can make a set of harrows," is an expression not uncommonly heard. It is, however, very far from correct ; for, as a matter of fact, very many who professionally are engaged in their manufacture do not construct them properly. The shape of a harrow and the relative position of its teeth are governed by arbitrary mathematical laws, the slightest variation from which will result in an imperfect implement.

The shape of the harrows commonly in use is either a V or rhomboidal, and the best angles for the rhomboid are a smaller angle of 75° and a larger angle of 105°.

The object in making a harrow of this shape—*i.e.*, on these angles—is to bring the furthest point of the rear as near as possible to the horses.

The rectangular frame can only be brought not to track by allowing one corner to fall far behind the opposite angle, and thus so much of the harrow is at a great distance from the horses, and draught is increased ; for the nearer a horse is to his work, the easier the draught. (For Diagrams see Appendix.)

It will thus be seen that there is a rhomboid, having the two angles at one side respectively 75° and 105°, which will theoretically cause the resistance of the earth to allow of the harrows riding parallel to the double tree, or at right angles to the line of draught ; whilst practically, the more closely the framework and the setting of the teeth approach this shape, the easier and lighter will the draught be upon the horses.

In the before mentioned diagrams the one being a set of harrows in the form that we have recommended, and which ride squarely forward ; and the other being square-framed, and consequently having to be drawn as it were "askew"—it will be plainly perceived that whilst each harrow covers the same amount of ground, and the distances between the tracks of each tooth are the same, the main portion of the square harrows is very much further from the horses, and consequently that the draught is proportionately greater than that of the first or rhomboid-shaped implement.

In order to enable harrows to ride squarely forward, it then becomes necessary to build wooden frames on the above principle. The square body has, however, been adapted in the iron frame, to draw parallel to the double and whiffletrees of the team, as shown in the plate.—(See Appendix.)

The Chain Harrow is a form which will be found excessively useful; being composed altogether of iron links, working loosely into each other, they clear themselves well.

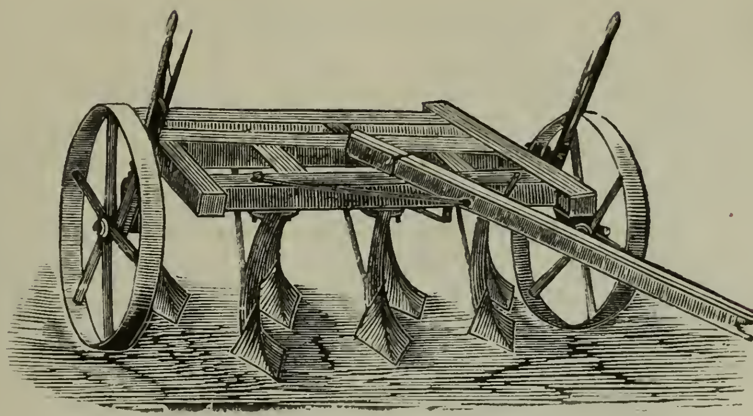
They will be found excellent tools for harrowing in grass seeds, following the grain drill to smooth off the surface of a seed bed, and for spreading top dressings of any kind, whether barn-yard manure or other rough deposits; and above all, they are very light on the horses.

The Rotating or Revolving Harrow is an ingenious contrivance. They are to be had, we believe, from some American manufacturers; the best that we have ever seen are two of English make, being *Crosskill's* harrow and *Ashby's* harrow.

By the use of this tool we obtain a rotary as well as forward motion. They have been found excellent devices for cleaning out couch grass and such weeds, and leaving them free of adhering soil when exposed to the hot summer suns.

The Brush Harrow is also a good, simple and cheap contrivance for dispersing top dressings and covering grass seeds. Small branches (beech are the best) are interwoven in a rough frame, made of scantlings, using three or more cross pieces, into which the brush is twined in such a manner as to leave the lower part rough and bushy. This drawn over pulverized land will cover grass seeds better than any other kind of harrow ; and it has this advantage, that any farmer can go to his woods and make one in a very short time.

Our practical experience in the use of this ready home-made harrow, especially for covering grass seeds, has been always entirely satisfactory.



GRUBBER OR CULTIVATOR.

These implements, though known under very many names, as *scufflers, scarifiers, extirpators*, &c., &c., have but one object, and may therefore be considered conjointly under the above caption.

The introduction of cultivators as substitutes for the plough is of comparatively recent date. Previous to the nineteenth century they were little known, and by no means generally used. Their adoption has, however, brought about a revolution in the system of cultivation, and in the present day we probably do very much more work with the cultivator in the season than with the plough.

The principles to be secured in the construction of these implements are: *play* to secure an even grubbing of knolls and hollows, *a thorough uprooting* of every particle of soil in their passage, the *minimum amount of draught* to the horses, and the formation which shall ensure a *rooting up* of weeds and grasses and sods without choking up the machine.

To ensure play for hollows and knolls, and to allow of collected sods, weeds, &c., escaping from under the machine after being rooted up, the frame must be *hung* on the axle, that it may have swing.

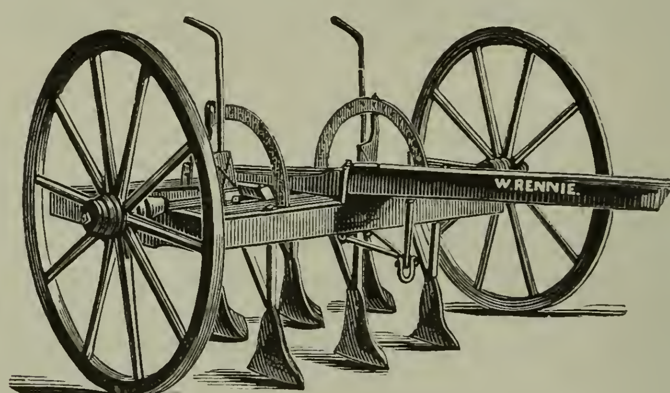
To ensure easy *draught* on the horses, the centre of resistance when at work must be known by the maker, and that point brought as near as possible to and in the natural line of the trace and collar.

We have seen such grubbers as take too firm a grip on the soil, and entail extra exertion on the part of the team to keep them *out of* the land, whilst others again are so badly constructed that an extra hold must be taken of the soil to prevent the horses drawing them to the surface. These are two very important points which have been often overlooked by judges. It is a comparatively easy matter to make an instrument that will clear itself well and grub thoroughly; the skill of the inventor and mechanic is more severely tested in reducing the draught to a minimum, and in obtaining the proper direction of draught from the centre of resistance to the motive power.

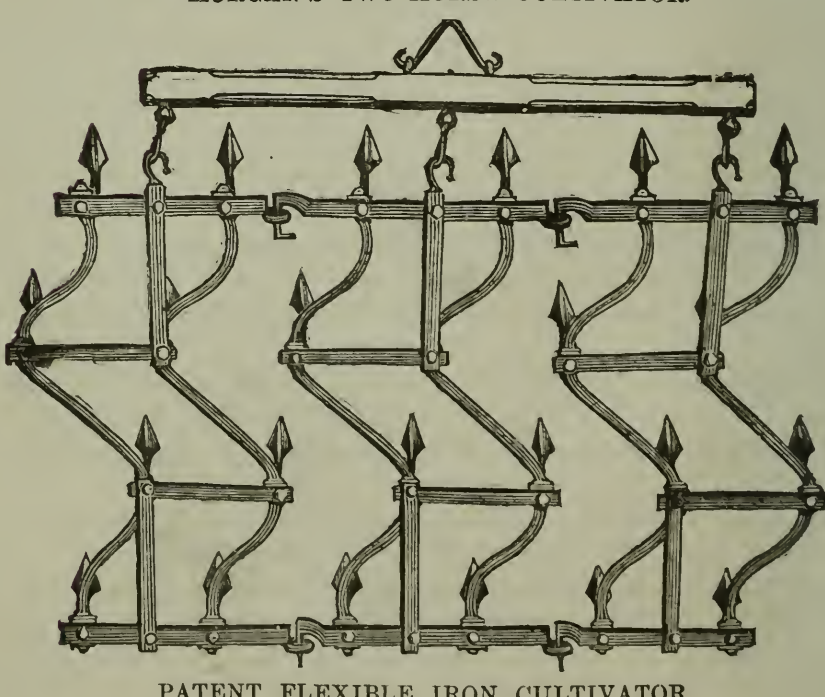
The old country cultivators are very effective, but are nearly all horse-killers.

We choose for illustration the Scotch Grubber and a Canadian two-horse cultivator.

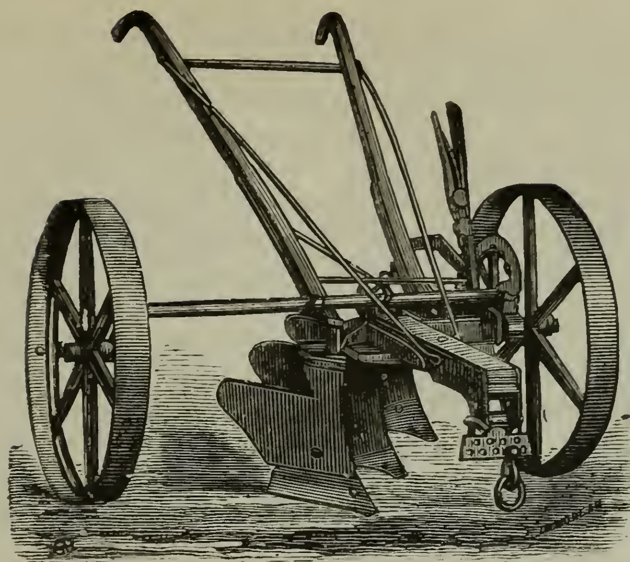
The Grubber is a heavy draught implement, but will be found none too strong in land badly infested with *couch grass;* while the other cultivator is better for summer fallow stirring and general cultivation.



MORGAN'S TWO-HORSE CULTIVATOR.



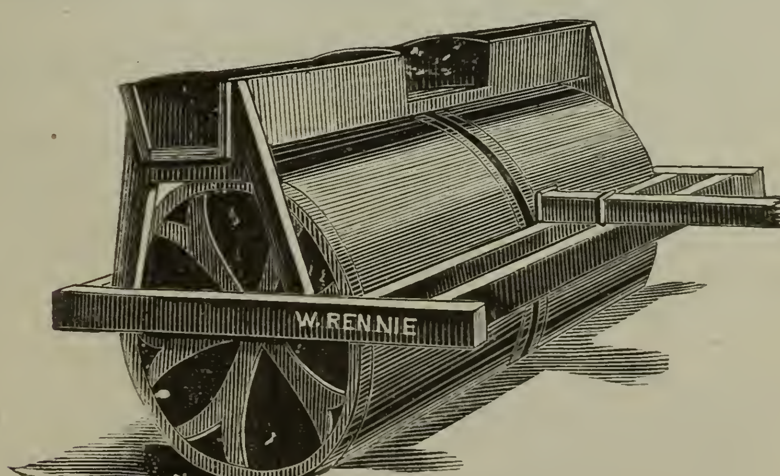
PATENT FLEXIBLE IRON CULTIVATOR.



GANG PLOUGH.

The Gang Plough is the double or treble-furrow plough in miniature; that is, it ploughs again perfectly to a depth of a few inches in loose soil, already ploughed, two or three furrows at a time. This implement is specially adapted for preparing fall-ploughed land for spring grain, or for covering peas or wheat that are to be sown on such land broadcast.

With this, on any but very stiff clay, an ordinary team can turn over from four to six acres a day. It has wooden handles and a short beam, but a tongue may be put in instead of beam and handles; it is with a tongue better under command, especially where the land is rolling. With steel mould boards and chilled shares this implement is easily worked by an ordinary team for the purposes of second ploughing.



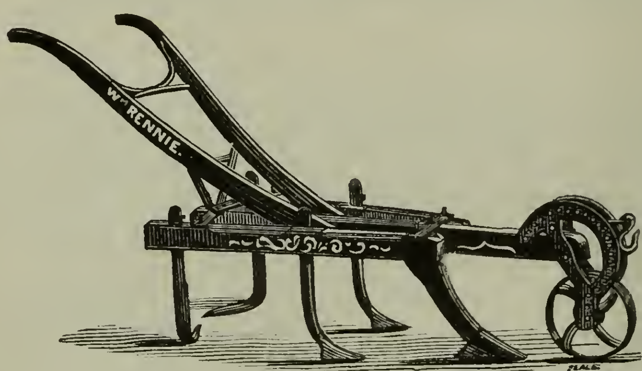
FIELD ROLLER.

The roller has been a much-neglected implement in Canada.

It is indispensable to good cultivation. Dry land will mellow quicker under the roller than by the action of the harrows. Finely pulverized seed beds will retain their moisture longer after rolling than when left by the harrows.

All grass land ought to be rolled in spring, to level meadows for the future passage of the mowing machine and to press into the ground such roots as have been "heaved" by spring frosts and thaws.

Barley and spring grains, a week or so after coming up, frequently suffer from hot air obtaining access through a loose surface soil to their roots. The pressure of the roller is for this an effectual remedy. In fact, a farmer may as well discard his harrows as his roller, and no cultivation can be thoroughly and properly completed without the aid of this implement of tillage.



EXPANDING HORSE HOE.

In these implements there has been for several years past an ever-increasing improvement.

Every section has now scattered through it many styles and patents, amongst which it would be invidious and indeed impossible to distinguish.

We give one illustration of the expanding horse hoe, which may be used for cleaning between rows of roots, earthing up potatoes, or simply stirring the soil. Expanding hoes of this nature are often supplied with a double mould board better suited to the earthing up of potatoes and corn.

MACHINES FOR SOWING.

Grain Drills.—In a former chapter the question of the respective advantages of broadcast and drill sowing has been considered.

The points to be secured in the construction of a perfect grain drill are—

That every seed shall be distributed at the exact depth required, or that depth the most favourable to its germination and growth.

That the seeds be evenly and regularly deposited, and that none be left on the surface.

That the delivery of the seeds be uniform, and that the grain be not cut in passing through the feeding apparatus. (N.B.—These two points can be fully tested on a barn floor.)

That the gearing apparatus be so constructed that the delivery may be immediately arrested, and that the delivery be *instantly* again started on motion of the driving wheels.

IMPROVED GRAIN DRILL.—(See Appendix.)

Broadcast Sower of Plaster, Guano and General Fertilizers. (See Appendix.)

Drills for sowing Turnips, Carrots, &c.

There are but few important principles to be regarded in the turnip drill. These are, that the drill shall not flatten down too much the ridge of earth; that the delivery be uniform and constant, and plainly visible to the operator; that the delivery be instantly stopped when required, as at the headland in turning, and as instantly commenced again; and that the covering of the seed be perfect.

Amongst the many excellent machines now turned out by our Canadian implement manufacturers, the undermentioned from the shops of Mr. John Watson, of Ayr, Ont., is very perfect in all these qualifications.

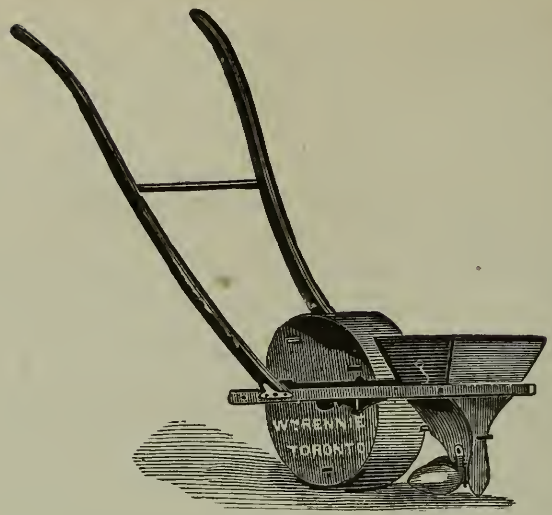
The concave rollers in front shape the drill, and are moveable upon a rod, so that they readily adjust themselves to various widths; they carry the sowing tooth along with them in such adjustment, so that seed is always dropped in the centre of the drill. The two iron rollers that follow cover the seed and press the soil.

The sowing apparatus consists of two tin canisters mounted on a shaft, and by regulating holes will deliver seed of various kinds and at different rates.

IMPROVED TURNIP AND SEED SOWER.—(See Appendix.)

Hand Drills for Root Seeds.—There are also several hand drills, which, being cheaper, commend themselves to the use of those who work small areas.

Amongst them are the Wethersfield Seed Drill, which marks its own row, drops, covers and lightly rolls the earth upon the seed.

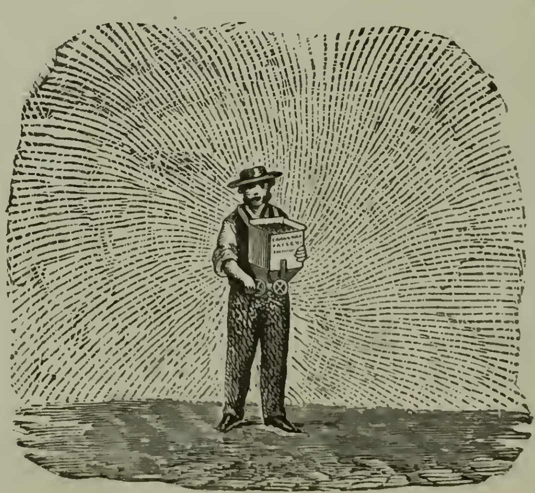


WETHERSFIELD SEED DRILL.

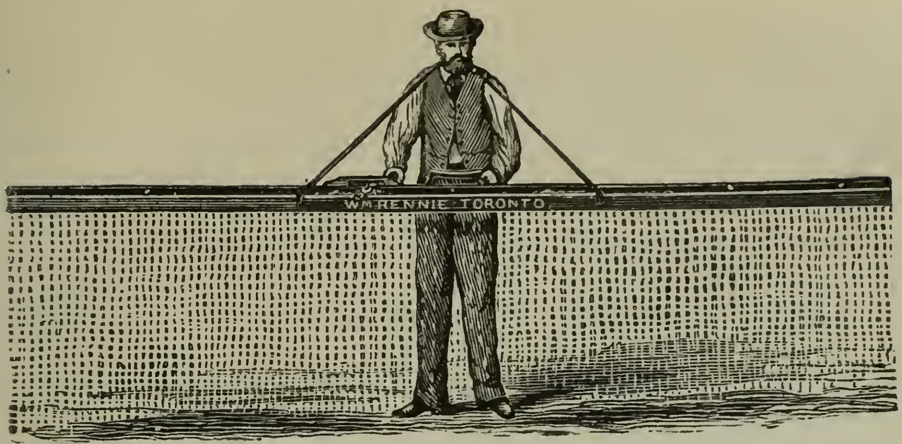
A BROADCAST SOWER OF AMERICAN INVENTION.

This ingenious implement, known as Cahoon's Broadcast Sower, the author has himself used and, whilst unwilling to condemn it for practical use, cannot take upon himself to recommend it.

It is capable of sowing, in the hands of a stout man, a very large average per day. Our experience with it has been varied. One field we sowed came up with beautiful regularity, while another, sown in a wind, was a failure as far as even distribution was concerned. It doubtless requires some experience upon the part of the sower; and while some farmers have entirely discarded it, others have been well pleased. It has taken a firmer foothold in the States than in Canada.



CAHOON'S BROADCAST SOWER.



GRASS SEED SOWER.

This long box is worked on a simple principle, and is attached to all the improved grain drills, by which the grass seed is sown with the grain and by the same power.

A small lever handle works it: when used by itself, it is so regulated that by opening wider or closing the distributing holes, any desired quantity per acre may be sown.

WAGGONS.

There is no implement in more common use than the farm waggon. It is an indispensable part of the farm stock.

The waggon as used in America is a superior vehicle, from the fact that it can be adapted to a great variety of objects.

The chief points of variation in the waggon are in the several axles used. Of these there are the *iron*, the *arm*, and the *wooden* axles.

The wooden axle is the lightest runner, and when the waggon is kept entirely for farm use is probably more generally serviceable than any other kind. It will not, however, stand much road work, and for this or for use upon the road and in the fields we must choose between the arm and the iron axle.

The iron axle is solid iron throughout; on the outer ends is a thread, on which a " burr" secures the wheel in its place.

This undoubtedly makes the strongest waggon, but is very heavy. It is only adapted for constant use under heavy loads and on metalled or other hard but smooth roads.

It is also very liable to break under the effect of frost in winter.

For general purposes the " arm" " patent skein" axle is the best. This being wooden with iron extremities, on which the wheel runs and on which the skein for the nut to secure the wheel is made, is an easy runner, giving to the ground and not shaking itself to pieces, whilst the draught is light upon the horses.

It is capable of carrying as heavy loads as the ordinary farmer requires to market, and, except for constant travel upon the hard high road, is in every way better adapted for general purposes than either of the other forms spoken of.

Good material, well seasoned, and true workmanship about the wheels and running gear, will ensure very many years' last to such a waggon if fair usage is accorded it by the farmer.

Such a waggon, not overloaded or too often "run," kept well painted and protected when not in use, will last from ten to twenty years.

The Size of Wheels.—As to the relative size of wheels, the American waggon is practically perfect.

An authority says :—

"If the load be placed in the body of a waggon, on the fore and hind wheels, in the proportion that their diameters bear to one another, nearly all the advantages of having wheels of *equal* diameter (as in a trotting skeleton waggon) will be obtained.

"This proportioning of the load cannot at all times be obtained in waggons of the ordinary description, even if wished ; because the body of the waggon must be equally filled with goods, or a great loss of room would occur."

As the load is usually distributed, the greater part is, especially in the case of a load of hay, on the hind axle.

Should we distribute our load equally, the fore and hind axles would require to be far apart, and hence the point of resistance of the hind wheel being far removed from the horse, the draught would be increased.

To overcome this, we increase the diameter of the hind wheel and thus admit of the heaviest of our load being placed aft of the centre of the waggon,

"The ease with which logs, &c., may be removed on a pair of wheels of large dimensions has been long a well-established fact. In passing over a rough and uneven road, a small wheel sinks into every little hollow, and the axle, if noticed, will be found to describe a line almost as curved and irregular as the surface of the road. A large wheel on the same road partakes but slightly of its inequalities, and the line described by the axle will be found to deviate but little from a straight line ; indeed, with a wheel sufficiently large, the axle will describe a perfectly straight line. In the latter case the friction, and consequently the draught, will be little more than if the carriage should run upon a railroad ; the larger, therefore, we use the wheels, the nearer we approach this point of effect."

In practical use, a certain limit of size has to be applied to the wheels of a waggon, on account of the difficulty which, in one mounted on very high wheels, would result to the process of loading.

Dishing of Wheels.—This absurd process is pretty well exhausted now, and the only excuse given at the present day—and it looks decidedly lame—is, that a certain " dish" outwards from axle to rim is necessary to prevent the tightening of the tire from dishing the wheel inwards.

The use of wheels is to lessen the resistance to the draught by reducing the friction, or changing that friction from the nature of a grind or rub to that of a rolling motion, thus admitting of the smallest-sized point of resistance to be pressing on the ground at one time.

That resistance is naturally least when the ground is hard and smooth, as on an iron rail or a board floor; it increases when the ground is soft and rough, and still more in an ascent, because the power of draught is partly exhausted in an effort to lift the waggon in an opposite direction to the force that pulls downward —that of gravity.

When the wheels are dished, they plough the soft ground and grind the hard ground, and thereby they increase the power of resistance, and require more power of draught to overcome the resistance afforded simply by the absurdity of their own form.

Narrow wheels are drawn more easily through loose stones, but upon every other kind of ground the broader wheel is drawn with less power, and acting as a roller benefits the roads.

If a system of broader wheels were adopted in Canada for farm waggons, our roads would not be so terribly cut up as they are at times.

High broad wheels do not sink as deeply into soft ground as do low wheels (it is nearly always the fore wheel of the Canadian waggon that sticks the team in a mudhole) but if the low wheels be made broader, the benefit obtained will be in proportion to the additional breadth.

High wheels turn seldomer round in a given distance than do small ones, which is an advantage. High wheels are heavier than low wheels which is a disadvantage. The happy practical medium will be found between extra height and too small diameter.

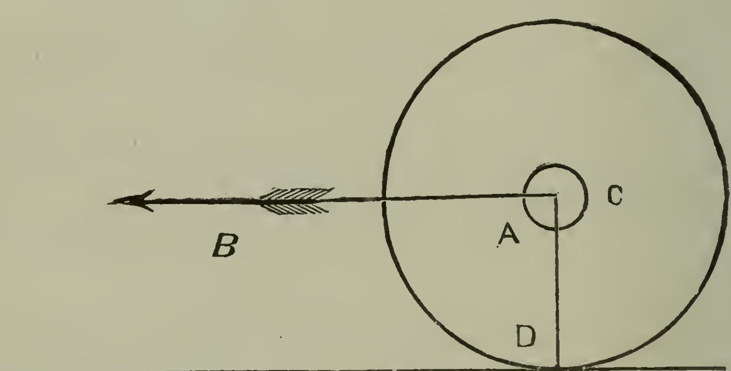
High wheels are useful to carry great stones, or great logs slung under the axles, while loads of every kind ought to be hung as low as possible.

The placing of loads upon springs (as in the city "lorries,") allows the carriage of them to be lighter; and the lower the weight be hung, so much the less chance that the line of gravity will fall outside the base and the load tip over.

Now, the principle upon which the force of resistance of the wheel works is very simple, and yet mathematically exact.

Let us examine the theory:—Assuming the road to be level, the wheel being a circle, the centre will always remain at one height, and consequently will move parallel to the plane surface in a perfectly regular line. If any weight be attached to or suspended from the centre, this will also move in a continued straight line without rising or falling, and consequently, when once put in motion, there is nothing to check its progress (neglecting for a moment the slight resistance of the air) and it will require no force to keep up the movement so long as the wheels continue to turn.

We have, therefore, in this case only to examine into the force necessary to turn the wheels. The wheels, if left to themselves, would roll on with perfect freedom whatever might be their weight or whatever weight might be attached to them, provided nothing, in the mode of attaching that weight, impeded their revolutions; but, in practice, we cannot admit of the load revolving with the wheel, and we have no means of suspending it to the wheel, except by means of an axle fixed to the load, and passing through the centre of the wheel. The axle presses upon the lower surface of the hole; and consequently, when the wheel revolves, causes a friction proportionate to the load upon the wheels, under the circumstances here supposed; and it is the action of this friction, the degree in which it affects the draft, and by what means this effect is increased and diminished that we must consider.



Let C be the centre of the wheel, of which CD is the radius; and CA that of the axle passing through the wheel, and which being fixed to the load does not revolve with the wheel.

If the force CB be applied to the centre of the wheel tending to advance it in the direction of B, the point D being in contact with the ground, the wheel is compelled to roll over, and the force CB in turning the wheel acts with a leverage equal to CD, but the friction between the axle and the wheel is at the point A, and in preventing the turning of the wheel it acts only at the extremity of the lever CA; consequently, if CD be ten times as great as CA, the force CB, need only be equal to one-tenth of the amount of the friction; and, as a general rule, the radius of the axle, and the friction remaining the same, the force necessary to overcome the resistance arising from this friction will be *inversely as the radius or the diameter of the wheel*; or, in other words, the draught will in this case diminish exactly in proportion as the size or diameter of the wheel is increased.

The *exact* amount of friction at the axle depends somewhat upon the nature of the substances in contact.

Thus the friction between metals is less than that between woods; and where the parts are in proper order, greased, &c., the friction becomes practically very much less.

It has been laid down as a general rule, that in the case of an iron axle in contact with an iron box in the hub and well greased, the friction amounts to about one-eighth, or at the most one-fifth of the pressure or weight.

Example.—Suppose it one-sixth; and if the diameter of the wheel is to that of the axle as 18 or 20 to 1, the whole resistance arising from friction at the axle will be $\frac{1}{6}$ of $\frac{1}{20}$, which is equal to $\frac{1}{120}$ So that to move one ton would require a force of traction of about 17 lbs.

So much for the resistance offered by the axle and hub. In practice, however, this friction is by no means the most considerable power of resistance to the draught.

We have hitherto, for the purpose of considering friction alone, supposed the road perfectly level. It is needless to say that this is only a bare supposition, seldom or never found in practice.

But on an uneven road the friction remains about the same.

There is yet another impediment to the movement of the wheel—obstacles in the road, or yielding materials.

It was found in England by practical experiment that the force required to move a four-wheeled vehicle weighing 1,000 lbs. shewed, after repeated trials, the following results:—

Description of Road.	Force of traction required to move the vehicle (1,000 lbs.).	
1. Turnpike road, hard and dry	$30\frac{1}{3}$	"
2. Ditto muddy	39	"
3. Hard compact loam	53	"
4. Ordinary by-road	106	"
5. Road newly gravelled	143	"
6. Loose sandy road	204	"

The wheels were upon wooden axles, and being nearly constant, probably absorbed at least 1-80th of the weight, or $12\frac{1}{2}$ lbs. of the force of traction, leaving therefore for resistance caused by road on half a ton on wheels—

Turnpike road, hard, dry, about	18	lbs.
" dirty	$26\frac{1}{2}$	"
" newly gravelled	$130\frac{1}{2}$	"
Loose sandy road	$191\frac{1}{2}$	"

In passing, let us not neglect to take particular notice of the fact that the sandy road offered ten times the resistance of the turnpike road, and from such a fact deduce a lesson of the vast importance to the farming community of good high roads to market.

MOWING AND REAPING MACHINES.

Mowing Machines.—The combination of mowing and reaping machines is fatal to the perfection of either operation, or at any rate to that of cutting grass.

The operation of cutting grass and that of reaping grain are very different, and it is impossible to combine the necessary qualifications for each class of work in any one machine without we have more extra and unnecessary friction and weight than is absolutely necessary for either operation.

A mower should be specially adapted to the cutting of heavy grass in a wet or dry state. To effect this is required great rapidity of motion and light draught. The reaper does not require as rapid a motion of the cutting parts, and therefore the use of the same pinion wheel for reaping and mowing either necessitates extra speed on the part of the horses in the one case, or entails useless rapidity of revolution, and therefore waste of power, in the other.

A mower requires to be light, compact and strong, for it is subject at all times to a very great resistance, cutting in wet grass and close to the ground, entailing also a rapid multiplication of motion between the driving wheels and the pitman shaft. A reaper meets with little resistance from the grain, cuts high off the ground, and therefore entails in itself but little extra draught, were it not for the softness of the ground. Nowadays, the addition of the heavy platform and the solid self-raking apparatus increases the draught immensely, and hence the necessity of reducing as much as possible all useless multiplication of motion.

The first invented machines were reapers, and, as is generally the case with *new-fangled notions*, they were received with disdain by the farmer, who would cut his grain "as his father did before him;" and yet in the present day there is not a farm of 100 acres in Canada, a new country, on which the occupant feels secure of his harvest without the use of a reaping machine.

We pride ourselves upon our ingenuity in the invention of machines, yet the principles of the reaper have undergone no radical changes since the days when, at the commencement of the present century, the Rev. Patrick Bell put his new invention into practice. Our skill has been shown rather in modification or simplification.

To Mr. Smith, of Deanston, who, in response to an offered premium by the Dalkeith Farmers' Club, brought out a reaping machine in 1812; to Mr. Scott, of Ormiston, who made an attempt in 1815; to Mr. Mann, of Raby, in Cumberland, England; to Mr. Ogle, of Rennington, near Alnwick, England; but especially to the Rev. Mr. Bell, whose machine, invented in 1828, has been in use ever since, we owe the first introduction of the horse reaper.

The principles of this early and very complete machine are the same as those of the present day, though the form has been materially altered. We find the driving wheels attached to the axle, and motion communicated thereby to the reel for knocking down the grain, the cutter bar, knife and triangular sections; but the horses walked behind the machine, and so propelled it in front of them.

An estimate of the probable value of this early machine may be formed from the reports signed by numerous practical farmers, who were spectators to different trials made in 1829 and 1830. In 1829, the machine was tried at Powrie, in Forfarshire, Scotland, before about fifty landed proprietors and practical agriculturists, who signed a declaration declaring that "the machine cut down a breadth of five feet at once, was moved by a single horse, and attended by from six to eight persons to bind up the corn; and that the field was reaped by this force at the rate of an acre per hour."

In September, 1830, the machine was again publicly tried at Monckie, in Forfarshire, in the presence of a still greater number of persons, who attested that it cut in half an hour nearly half an acre of a very heavy crop of oats, which were lodged, thrown about by the wind, and exceedingly difficult to harvest. The price of the machine was from £30 to £35. It may be seen that, with the exception of the self-rake and self-binder, the present inventive age has neither improved upon capacity of cutting, nor upon price.

Indeed, even our new inventions are not so very original, for in 1822 a machine for reaping and sheaving (laying in sheaves) corn was invented, but, owing to the apathy of the farmers, could not be put into general use. This machine operated satisfactorily, and would cut fourteen acres a day.

The essential qualifications of these machines are—

Speed of motion, communicated with the least extra exertion on the part of the motive power.

We know of only one machine in Canada—viz., that of the Messrs. Noxon, of Ingersoll, Ontario—in which the speed of the cutting knife can be changed without increasing or diminishing that of the horses. This is very necessary. In all fields we shall find spots where grain is badly lodged, or green, or where there is a rank growth of grass or even weeds; in such places we require an extra amount of speed to the knife, and unless we can obtain such by the multiplication of the revolutions of the pinion on the machine itself, we must secure it by urging forward the team. Now, the ordinary farm team naturally gets into a certain gait whilst performing such an operation as that of reaping, and it is not always an easy matter to increase the speed of their walk at the proper time and place; whilst, if we keep them at full speed all the time, we waste much power upon the higher parts of the field, where probably the resistance to the cutter is very much less.

In cutting down hill, all steady teams exhibit a tendency, in holding back, to pick their steps very slowly, and I have myself frequently had the motion entirely stopped by this tendency on the part of my team to crawl down hill. Hence the advisability of control over the speed of the cutter, independent of the horses.

It is well known that the wear and tear is greater on a machine cutting at extra speed in light grain or grass, than where the resistance and the cutting power are about equally balanced.

This is well illustrated by the case of a man who should hit out from the shoulder and his blow meet no resistance; such an effort will hurt or strain the arm more than if he should meet with some soft object at the extremity of his stroke.

Hence the importance of a power to change the rapidity of the cutting motion.

Changing the Height of Cut.—This is a very important command to be secured.

In all fields there will be found lodged spots of grain; it is very advisable that the cutting bar can be so lowered that it may pick such up.

Again, the relative position of the horses to the machine, and the consequent altered direction of draught, will, in a hilly field, cause the machine at one time to plough the ground, and at another, in light grain, especially oats, to bend the crop before it and to pass it over uncut.

Obstacles also occur on the surface of the land which would very greatly retard a day's work had the operator to remove each one.

The raising of the heel of the reaper and mower has been brought well under control, but a better arrangement to raise the extreme point of the bar, without stopping the team or leaving the seat, has yet to be secured.

The best we have seen is upon the "Kirby" as a mower. The same principle was applied to the reaper put out by Mr. Forsyth, of Dundas, in his reaper, on the Buckeye principle, but not proving satisfactory in practice, it has been for the present withdrawn.

The correct position for the cutting apparatus has been a subject of hot discussion amongst manufacturers. We incline to side with those who claim the rear as the proper position. The advocates of other positions rest their claim chiefly on the advantage that "when" the driver is thrown from his seat he runs less danger.

This we think a weak argument. They admit the liability of persons being thrown off in a forward cutting machine, and we think that there is more chance of being so pitched out in such on the same principle as that which throws the handle of the plough *up* and the person *forward* on to the stilts, when a stone or root is suddenly struck.

For our own part, we would sooner be thrown *in front of the knives* than on top of them, the latter being to our mind the probable position into which the driver would be thrown in the forward cutting machine, by a very sudden and severe jar.

We have worked a machine with the cutting apparatus to the rear, and also one where the bar was forward, and the above is our own practical opinion upon this subject.

Again, obstacles may, in the rear position of the bar, be seen before the knife is upon them, and so avoided. It is, however, claimed that there is less side draught where the bar is in front. This is, doubtless, to some extent true, but by a judicious placing of the pole to the opposite side of the machine this side draught is reduced to a minimum.

Now, we believe that, as a matter of fact, it requires less power to work a machine with the cutting apparatus to the rear, and that the application of a given amount of draught power exerts a greater force to drive the knives. Where this portion is in front, and resistance is met with, the effect of that resistance as against draught is to force the face of the bar downwards, and, if set very low (an important object in mowing), into the ground, and thus the traction of the wheels is weakened just when most needed, and the whole action reversed from that which is sought.

Levers.—The machine requires two levers—one to raise the whole bar over obstacles, and another to simply change its angle, and, by depressing the points of the guards, allow them to pick up and press to the knife lodged hay or straw.

The driving wheels of most of our machines are too small, and in reaping sink deeply into soft ground. Why manufacturers should heretofore have found it impracticable to make their driving wheels larger, we have been at a loss to conceive. We are aware that the relative proportions of the several gearings require to be changed with any heightening of the axle, but no alteration of principles is involved.

The materials used by too many of our makers are very inferior. We call upon the mower and reaper to sustain very severe shocks and strains, and none but the best material can give satisfaction to the farmer.

Many a manufacturer has lost custom, in spite of the excellence of the principles upon which his machine works, by the use of inferior castings and bad steel.

The farmer does not look much to mechanical principles. Give him a machine which will stand his work, and he does not care much for any other qualification.

The harvest time is short in Canada. Let the report once be fairly credited in a section, that a certain manufacturer's implements are always "breaking," and he may withdraw his agents.

Give us castings, not made from old stoves, but from such material as that of the railroad car wheels ; give us good steel, well-seasoned wood, and firm at that, and we will excuse high painting, aye, and will not look too closely at the quality of the harvesting. What we desire—and the manufacturer who in this accords with our wishes, will find it to his advantage—is a machine that will stick to its work day in and day out.

We do not like the six-acre per day cradlers, but steady men who stick to their work day by day ; neither do we care whether a machine does ten or twelve acres a day ; but we want one that will last to do its average *every* day.

It is not necessary to mention name or locality, but we know of a locality in which one machine, in one year, entirely cut another out, not for any superior qualities in principle or work—indeed, it could not harvest as large an acreage per day, nor did it lay the gavels as well—but it was made of the best of materials, thoroughly tested before sent out, and the farmers recognized the advantages of a machine that was not in the weekly or daily habit of "breaking a casting."

Simplicity we also require. Farmers are not mechanics, and must have a machine the principles and working of which are not difficult to comprehend.

There are various machines in the field of competition in Canada. The following is a brief *resume* of the great trial held at Paris, Ont., in 1871, under the auspices of the Provincial Agricultural Association.

Of twenty mowers that were entered, only eight came out for competition. The ground was hilly and rolling ; the crop, mixed clover and timothy, was light and over ripe.

The competitors were :

"*The Cayuga Chief*,"	Brown & Patterson	Whitby, O.
"*Wood's Patent*,"	Massey	Newcastle.
"*Ohio Buckeye*,"	Noxon Bros.	Ingersoll.
"*The Humming Bird*,"	J. Watson	Ayr.
"*The Clipper*,"	Do.	Do.
"*The Sprague*,"	Maxwell & Whitelaw	Paris.
"*Buckeye*,"	Bell & Son.	St. George.
"*Wood's Patent*,"	L. D. Sawyer	Hamilton.

The first half acre was cut by Mr. Noxon's "*Ohio Buckeye*" in eighteen minutes, but the others were not far behind in speed. This, however, depends in great part upon the horses and driver.

SINGLE MOWER WITH FORWARD CUTTING BAR. (See Appendix.)

SINGLE MOWER WITH CUTTING BAR IN REAR. (See Appendix.)

THE CAYUGA CHIEF. (See Appendix.)

The test of draught which was very carefully performed resulted as follows :—

Name of Machine.	Width of Cut.	Draught.
"*Cayuga Chief*"	4 ft.	180 lbs.
"*Wood's Patent*" (Massey)	4 ft. 2 inches	190 "
"*Do. do.*" (Sawyer)	3 ft. 10 inches	233⅓ "
"*Ohio Buckeye*"	4 ft.	193½ "
"*Humming Bird*"	4 ft.	165 "
"*Clipper*"	4 ft 6 inches	175 "
"*The Sprague*"	4 ft.	145 "
"*Buckeye*"	4 ft 2 inches	200 "

The prizes in this class were awarded thus :—

1st, to "*The Cayuga Chief*;" 2nd, to "*Buckeye*;" 3rd, to "*The Clipper.*"

Combined Mowers and Reapers turned out in stronger force, there being 14 in the competition, and the test showed as follows :—

AYR CLIPPER (MOWING),—(See Appendix.)

AYR CLIPPER (REAPING),—(See Appendix.)

TEST IN MOWING.

		Width of Cut.	Draught.	Draught per inco of Cut.
Oswald & Patterson	Ohio Buckeye	4 ft. 3 in.	275 lbs.	5½ lbs.
J. Bingham	Ohio Buckeye No. 1	4 " 3 "	250 "	4 9-10 "
J. Bingham	Ohio Buckeye No. 2	4 " 3 "	251 "	4 9-10 "
J. H. Grout	Ohio	4 " 3 "	240 "	4 7-1 0 "
Noxon Bros	Noxon's Standard	4 " 6 "	230 "	4¼ "
Noxon Bros	Ohio Buckeye	4 " 3 "	220 "	4⅓ "
J. Watson	Ayr Clipper	4 " 8 "	205 "	3½ "
Harris & Son	Kirby	4 " 3 "	280 "	5½ "
L. D. Sawyer	Ball's Ohio	4 " 3 "	225 "	4 3-7 "
J. Forsyth	Ohio Buckeye	4 " 4 "	225 "	4⅓ "
J. Forsyth	Ball's Ohio	4 " 3 "	240 "	4¾ "
H. A. Massey	Hubbard	4 " 6 "	275 "	5 1-11 "
Eastwood & Co	Ohio Buckeye No. 1	4 " 3 "	250 "	4 9-10 "
Eastwood & Co	Ohio Buckeye No. 2	4 " 2 "	250 "	4 9-10 "

The following is the result of the test in reaping:

		Width of Cut.	Draught.	Draught per inch of Cut.
H. A. Massey	Hubbard	5 ft. 6 in.	225 lbs.	3 3-7 lbs
J. Bingham	Ohio Buckeye, Dodge R.,	5 ft. 6 in.	241 "	3 7-11 "
J. Bingham	Ohio Buckeye No. 2, Dodge R.	5 "	225 "	3¾ "
J. Forsyth	Ohio Buckeye, Johnson Rake	5 "	233 "	3 9-10 "
J. Forsyth	Ball's Ohio, Johnson Rake	5 "	225 "	3¾ "
Harris & Son	Kirby, Dodge R., sing. dr. whl.	5 "	208 "	4 6-10 "
L. D. Sawyer	Ball's Ohio, Dodge Rake	4 " 6 in.	250 "	4 6-10 "
J. Watson	Ayr Clipper, Johnson Rake,	5 "	233 "	3 9-10 "
Noxon Bros	Ohio Buckeye, Johnson Rake	5 " 6 in.	225 "	3 3-7 "
Noxon Bros	Noxon's Standard, Johnson R.	5 " 6 in.	233 "	3½ "
J. H. Grout	Ohio, Dodge Rake	5 "	150 "	4 1-6 "
Eastwood & Co	Ohio Buckeye No. 1, Dodge R.	5 "	222 "	3½ "
Eastwood & Co	Ohio Buckeye No. 2, Dodge R.	5 "	225 "	3¾ "
Oswald & Patterson	Ohlo Buckeye, Dodge Rake	5 "	236 "	4 "

The prizes were awarded thus :—

IN MOWING.

First prize............J. Forsyth............Ohio Buckeye.
Second prize ....Noxon Bros..........Noxon's Standard.
Third prize.............Harris & Son.........The Kirby.

IN REAPING.

First prize.........J. Forsyth.........Buckeye, (Johnson rake).
Second prize.......Noxon Bros......." Standard " (Johnson rake).
Third prize.........J. H. Grout.......Ohio (Dodge rake).

It is observable that the Buckeye gearing and Johnson rake, received first favours.

THE JOHNSON SELF-RAKE.—(See Appendix.)

THE KIRBY COMBINED AS A SELF-RAKING REAPER.—" *Dodge Rake.*" (See Appendix.)

Thrashing Machines.—The origin of the threshing machine is due to Scotland, where a century ago the first attempt was made to construct one driven by a water-wheel, which put in motion a number of flails of a similar kind with those used in threshing by hand. It soon fell into disuse, and it is now about sixty years since the invention was brought nearly to its present perfection by an ingenious mechanic named Andrew Meikle.

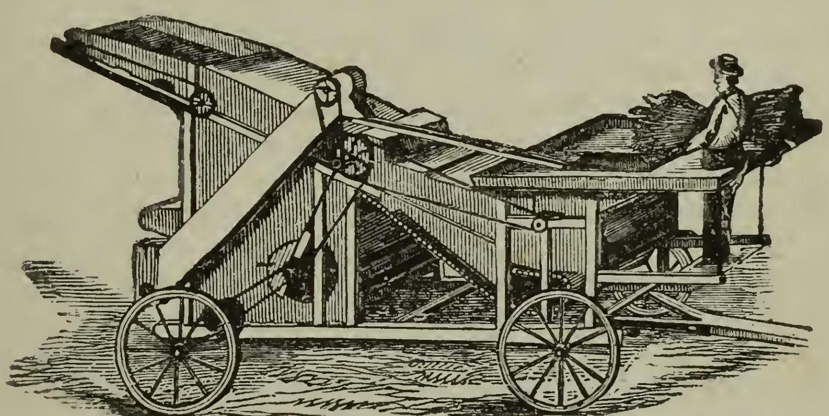
There are but two kinds of threshing machines now in general use in Canada ; they are the " *Separator*" and the "*Vibrator*."

The several qualifications of the first are :—

The frame is solid and well braced, the very best iron or steel being used in the shafting.

That it threshes cleanly, quickly and thoroughly—*i.e.*, that the light grains and weed seeds are entirely sifted from amongst the plump grain ; that it will thresh at least 250 bushels of wheat per day, and that no grain goes over in the straw ; and that it responds easily to the revolution of the cylinder.

The cylinder is no unimportant portion of a " Separator ; " the best material should be in the teeth and the cylinder itself should in all cases be bound with a centre head.



IMPROVED THRESHER AND SEPARATOR.

The only difference of any moment between the several machines of this class, is found between those that are run chiefly by belting and such as are geared all through.

IMPROVED TEN-HORSE PITT'S SEPARATOR. (See Appendix.)

We are indebted to Mr. Watson, of Ayr, for the following plate of his "Improved Ten-horse Pitt's Separator," which, as will be seen, is geared all through.—See Appendix.

The Little Giant Thresher and Separator, which has now been before the Canadian public for four or five years, is a very useful implement.

It will thresh over two hundred bushels of wheat, of a good fair crop, in a day, and we have seen it do its work as cleanly as any of the large ten-horse power separators. The straw and chaff are taken from the cylinders by rakers; the straw is then carried out of the machine by an ingenious contrivance worked by cranks, which serves to give the straw an additional shake, so that no grain is carried out. The chaff and wheat are shaken down on the grooved and slatted shoe, by a rock roller, which also riddles through a comb when the blast from the fan strikes, the same as in other machines.

The cylinder measures 2 feet 4 inches longitudinally, with a 13½-inch diameter ordinary open cylinder, with eight bars, teeth in every bar, and two centre heads.

The length of the machine over all is, without tongue, 12 feet. It is made for a six-horse power, but two teams can drive it without distress.

For this machine there is in use a new style of power, to which allusion will be made under the head of Motive Power.

The Little Giant is a very handy machine for a farmer's private use. His own teams can run it. It is very compact, does excellent work, is very simple to manipulate, and is stowed away in small space. It is a great advantage to have a machine at hand at all times through the winter. When no other work presses we can thresh. Straw is better for feeding purposes when freshly threshed. There need not be a single pound of straw wasted through the winter.

Its cost is one hundred dollars—little more than the price of a lumber waggon—and if the farmer will allow a sinking fund of the percentage per bushel that he pays to the hired thresher, he will in two or three years save enough to purchase this very useful little machine.

We have no hesitancy in recommending this machine to any farmer growing on an average over fifty acres of grain a year. Being easily portable, two neighbours could very well buy one together and share its work. It is a great favourite already in some sections of the country.

THE LITTLE GIANT THRESHER AND SEPARATOR. (See Appendix.)

The Agitator.—For this machine the manufacturer claims the following advantages :—

That it has facilities for separating and saving grain which it is impossible to apply to other styles of separators; that while its capacity for threshing is equal to that of any other machine, it is simpler in its construction, more durable, easier managed, and lighter on the horses.

The teeth of the cylinder are distributed equally over all the bars, causing it to run steadily, feed regularly, and retain its balance equally. It is 31 inches longitudinally, 16½ inches in diameter, and weighs 270 lbs., mounted and balanced on a steel shaft.

There is also what is called an improved concave regulator. This consists of two concave ends, with a disc working in each; a square iron rod passes through these two discs, and is operated by means of a handle at the feeder's hand, retained in place by a ratchet and pawl; the iron being turned operates the discs and causes the concave to rise and fall as may be desired, both ends rising and falling together, keeping the concave always parallel to the cylinder. By this arrangement the feeder has complete control over the concave; so that should the grain be throwing over in the straw, he can set it closer to the cylinder, or in very dry sheaves can set it wider and feed faster, both which operations can be accomplished without stopping the machine, removing the feed board, or unscrewing nuts, as is the case in the ordinary machine.

THE AGITATOR. (See Appendix.)

Immediately on leaving the cylinder, the straw is received on a long box or trough, about six inches deep, with the bottom formed of slats set edgeways, in the manner of Venetian blinds, through which the grain passes. It is furnished with a succession of agitating finger bars, with long projecting fingers in each. The box or trough is moved with a vertical motion by means of a crank shaft; and by a simple arrangement on the ends of the finger bars, the vertical motion of the box communicates to them a motion very like that of a pitchfork in the hands of a person pitching straw after the old open cylinder, in order to separate the contained grain.

Having passed over one set of these fingers, the straw is immediately received upon a second set, where it undergoes a similar process, and so on over the whole series of sets; so that when it reaches the stacker every kernel of grain has been shaken out.

The grain falls through the slatted bottom of the upper trough or section into a second one, with a close smooth bottom, reaching from under the concave to about the middle of the shoe, and with sufficient of a decline to carry the grain freely to the shoe. This second or lower section has likewise a vertical motion, and that part of it which overhangs the shoe is perforated with holes, through which the grain is delivered evenly and regularly over the riddles.

The two sections move in opposite directions—one going forward while the other goes backwards. They thus counterbalance each other, so that no jar is caused to the machine.

The shoe is much larger and more capacious than in the ordinary separator, and the grain is evenly distributed over it. There is plenty of blast and sufficient sieve room to take care of all the grain that can be got through the machine, and the maker claims that there need be no "poking" or "scraping" to clear the shoe.

There are but four belts on this machine, and only one of special moment—*i.e.*, the main or cylinder belt, leading from the cylinder to the crank shaft and fan. This, in the machine that we have seen, is supplied with a tightening pulley, operated by a lever at the feeder's side, by means of which he can tighten it without stopping to unlace. He can likewise stop the whole machine back from the cylinder.

It is very much cleaner than the common separator in one way, for it leaves but little litter on the ground beneath and around it.

It is likewise claimed that no dust is thrown out from the cylinder, but is all carried through with the straw to the back end.

Having a less number of pulleys, shafts and other working parts, the friction is naturally reduced, and therefore the "Agitator" requires a less amount of motive power than the older-fashioned separator.

"In the older kind (alluding to the ordinary style of separator) there are four shafts, one canvas belt, one picker, one slatted belt, twenty-six pulleys, and four belts required for merely separating the grain, apart from the fan, elevator and shoe; while in the 'Agitator' the separation is much more effectively performed by means of the oscillating trough or box and fingers, driven by one crank, thus dispensing with all those shafts, pulleys, &c."

The "Agitator" is also so arranged that the carriers may be attached either above or below the shoe, and either save the chaff or carry it along with the straw.

Clover Threshers.—The following is a simple plan, in the absence of a clover huller, to thresh clover by means of a threshing machine:—Elevate the concave, or depress the cylinder so that there remains barely room for the ends of the cylinder teeth to pass clear of the concave; then attach a board in front, on the left side of the cylinder, and half the width of the cylinder.

Back of the cylinder, and opposite where the clover enters, a similar board. The clover passes through the opening in front, strikes the back board, and rebounds back over the cylinder, striking the front board and passing out; thus each feed is struck or threshed twice, and thoroughly.

When winnowing, if the screen is too coarse, cover it with wrapping paper, secured to the sides of the screen with tacks. In the fan shoe attach an oats and a four or six mesh riddle. The seed will pass down the heads amongst the tailings, and the loose chaff will fly off. If not satisfactorily threshed, pass the heads through the threshing machine a second time.

Threshing Grasses.—If the straw is long, remove the fenders; if short, on the contrary thresh and winnow as directed for clover, but the blast of wind will require to be reduced.

MOTIVE POWERS.

Horse Power.—The subject of motive powers has given rise to endless discussions amongst scientists, but to the farmer the real question at issue is, what form of power will do his work best and most economically; and this question can only be answered by each individual for himself, according to his own special circumstances.

It will, then, be of more value if this portion of the chapter be rather devoted to pointing out the horse powers, steam powers, and wind powers to be obtained, and the special advantages of such as are now upon the market.

For heavy work, such as driving the threshing machine, there is no power in the Canadian market equal to the Improved Pitt's Horse Power. In some cases they have failed, but this has been simply owing to carelessness in their construction; and on the other hand, where the principles of their operation have been carried out with mechanical precision, and good material has been employed, this patent has given universal satisfaction.

In buying a horse-power, the purchaser should look closely to the following points :—That the castings are true, and that there is ample provision for overcoming any tendency to mash cogs which may appear in running : that the material employed is of the best, the castings not made from old stove plates, and the pins and journals of the best steel. Look well to the bevel wheels ; on them there is great strain.

Whilst on the subject, no farmer should allow in his barn any tumbling rods that are not furnished with slip-knuckles and rings with riveted bolts, or some similar contrivance, to prevent the protuberance of bolt ends and keys that have been so often the cause of fatal or serious accidents. (See Act of Parliament passed in 1874.)

See that all boxing is lined with a good thick layer of Babbitt metal, and covered with dust covers ; that the frame is well braced, to prevent any chance of straining. The transverse and friction rollers should be faced. The newer kind of rollers are made much larger than formerly, and in consequence, revolving more slowly, they wear less.

TEN-HORSE POWER.—(See Appendix.)

A little power has been lately constructed which is invaluable to the farmer. It can be used with two, four or six horses. It is light, compact and substantial, and being accompanied by a jack, plenty of motion can be obtained from four horses to run straw-cutter, grinder, drag saw, &c., &c.

FARMER'S HORSE-POWER.—(See Appendix.)

The Totman Horse-power is also another form, of very great general use to the farmer. It is calculated for one or two horse and can be easily covered in or readily removed from place to

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place at any season of the year. By means of a shaft and pulley in place of the pitman, this power, which was originally designed only for application to a drag saw, can be applied to a chaff-cutter, grain crusher or any light machinery. There is also another pattern made on the same principle, to which four horses may be attached.—(See Appendix.)

TOTMAN POWER APPLIED TO A STRAW CUTTER.—(See Appendix.)

TOTMAN DRAG CROSS-CUT SAWING MACHINE.—(See Appendix.)

The old Tread Power we hope is now discarded, as fit to be classed only amongst those works which are brought within the scope of the Act for the Prevention of Cruelty to Animals. (See Appendix.)

Fanning Mills.—The principles of a good fanning mill are, easy change of the shake, thorough control of the draft or blast, and a careful sizing of sieves.

The sieves and screen should be made, if possible, to shake independent of one another, and there should be a contrivance to regulate the angle at which the sieves dip.

The less gearing the lighter will be the run. There should also be an ample area for screening.

We hope the day is not far distant when our threshing machines will be so improved as to dispense with the necessity for a second operation in the hand mill.

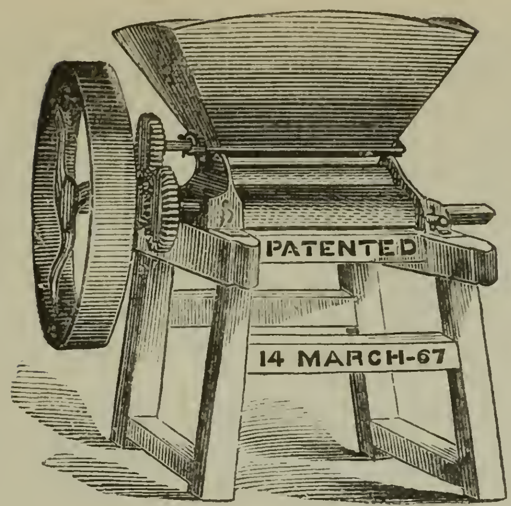
Corn Shellers.—Of these there are several patents, American and Canadian.

The *Canadian Chief Corn Sheller*, it is claimed, will shell a bushel in two minutes, and can be run by hand or horse power. This machine in competition with American machines obtained the first prize at the Buffalo International Exhibition.

Grain Crushers.—In these days when our coarse grains are readily sold for cash, and when economy of feed is the only way in which to make the fatting of stock profitable, every man, who winters cattle, should be possessed of one of these useful implements.

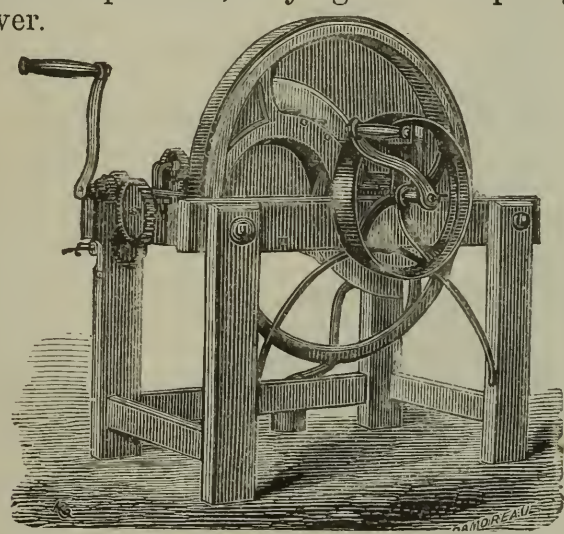
The amount paid in toll to the miller will pay on most farms in one season the first cost, and the farmer is assured that his feed is the pure article, which, made under his own eye, cannot be adulterated without his knowledge.

By the one item of bruising oats for horses there is a great saving. Even with young horses a saving of 25 per cent. is effected by feeding them crushed oats, while in the case of old horses, whose powers of mastication are reduced, it becomes necessary that their feed be softened.



PATENT WOOD FRAME GRAIN CRUSHER.

These implements are made in various forms, some on wooden frames and others upon iron, varying also in capacity of work and crushing power.



STRAW-CUTTER—FOR TWO MEN OR HORSE-POWER.

The hay and straw cutter is an indispensable article in the list of farmer's stock.

We, ourselves, bought one of the improved kind last year, and know that we saved thereby at least five tons of hay, which ruling at about $15 per ton in the barn was a gross saving of $75 in the one winter. We gave $40 for the implement and, adding 25 per cent. for wear and tear, we effected a net profit of $25 by our investment.

Of late years, fodder has been scarce, and farmers have generally become convinced of the utility of the straw cutter, which prepares coarse food in such a manner that all animals will readily eat it, thus saving much waste. Nearly all our agricultural implement makers are now engaged in their manufacture, and yearly many hundreds are sold throughout the Dominion.

Some are made for hand power, and others to be run with horse power. The former are fit only for the use of private gentlemen who keep perhaps a single horse and cow, but to any farmer with a reasonable live stock, the straw-cutter will be found as profitable an implement as he can have in his shed.

Root Pulpers.—Of root cutters there are a vast number, but the principle of cutting roots is, in practical benefit, far behind that of pulping.

It is well known that the best form of feed to fatting cattle, is that in which it has been reduced to a certain stage of fermentation. To effect this, the most rapid and economical process is, to reduce the roots to a pulp and mix with cut fodder.

The only root pulper we have at present in Canada is the Benthall, an English patent, and they are imported.

AGRICULTURAL STEAMER AND BOILER.

Whilst on this subject, we pass to the *Agricultural Steamer.*—An opinion on the advantages to be derived from steaming food will be found in a preceding chapter on Cattle Feeding.

The accompanying Figure represents a steamer well adapted for the purpose, sold by Mr. Rennie, of Toronto:

This is used for cooking food, heating water, &c., by steam, though useful on the farm and elsewhere for many other purposes.

It is made in two sections, the lower one being the cauldron, and the upper one the steam attachment, which has a pipe that leads into a large barrel that stands near it. Both sections are designed to be used separately from or conjointly with the stove, or on an arch, as may be preferred. For indoor work this steamer will be found very valuable, as it is perfectly secured from all danger of communicating fire, and, by an improved combined vacuum and pressure safety-valve, from danger of explosion. The furnace is made of wrought and cast-iron. The stove is of heavy boiler iron, and the base, flues, &c., of cast iron. The cauldrons stand from three and a-half to four and a-half feet high, with a diameter somewhat less than the height.

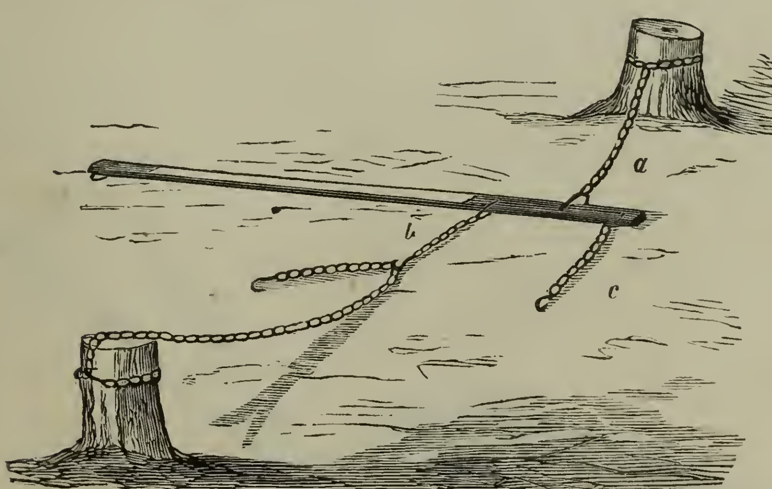
Three sizes are made, to steam from twenty to one hundred bushels of cut feed per day, and to hold from one to two and a-half barrels of water.

There are also various implements of less common use, but all labour-savers.

The Stump-Puller.—Of these, the most powerful and probably the best for general use is that made upon the screw principle. The screw and the screw-box is the only part of the machine that cannot be made by any farmer.

SCREW STUMP MACHINE. (See Appendix.)

We find the following simple stump machine in the columns of the *American Agriculturist*:—



A SIMPLE STUMP-PULLER.

It is worked by a lever, moved preferably by a stout yoke of oxen. The end of the lever is supplied with a strong clevis, sufficiently long to pass around so as to be used on either side. The fulcrum of the lever consists of a chain which is to be fastened to the largest stump near (a); on each side of this is a clevis, with a short chain and hook attached. To work the machine, fix a chain to the stump to be pulled, hook on to one of the short chains of the machine (*b*), draw up the oxen until that chain is tight; hook on the other chain (*c*), turn the team, and draw up as far as they can go; hook the chain (*b*), turn and draw again, and so repeat until the stump is drawn out. Then fasten on to another, and repeat the process until all the stumps are out within reach of the one the machine is anchored to. The machine will then have to be moved to another anchoring place, and so on until the field is cleared. The last stump left must be grubbed out. It will be necessary to remember that the power of this lever is very great, and stump pulling requires stout implements and chains. A breakage may not only cause delay, but a blow from a snapping chain may very easily be fatal; it is therefore absolutely necessary for safety that the chains be made of the best iron, with the best workmanship, and strong enough to hold against all the resistance they may meet. The lever should be strengthened with iron plates in those parts where the holes are bored for the clevis bolts.

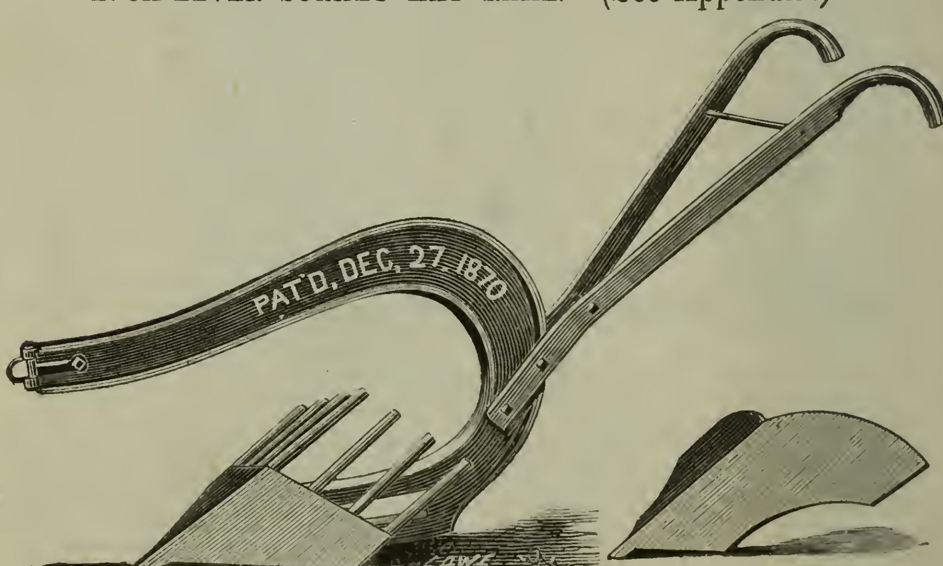
Horse Rakes and Tedders.—For horse rakes, there is none equal in perfectness of execution to the American Revolving Rake, now in common use; but it is a man-killer.

The Sulkey steel-toothed rakes are coming into use, and are very generally liked in the older portions of Canada, or where the fields are well cleared of stumps, and are moderately smooth.

We have seen an application of the Revolving rake to the Sulkey principle. It is manufactured by Mr. Forsyth, of Dundas. Accompanying is an illustration.

SULKEY REVOLVING HORSE RAKE.—(See Appendix.)

LOCK-LEVER SULKEY HAY RAKE.—(See Appendix.)



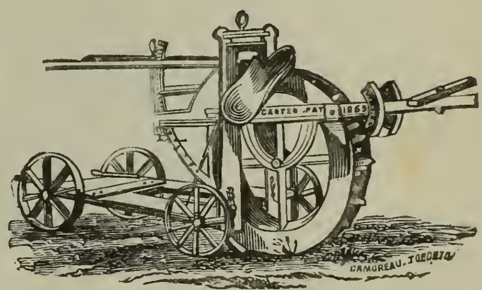
DICK'S PATENT POTATO DIGGER.

DRAINING TOOLS.

Draining Spade.—This is the proper shape for finishing off the bottoms of drains in which tiles are to be laid.

ENGLISH DRAINING SPADE.

This ditching machine was first introduced to the public in the summer of 1869. It has been awarded the highest premiums wherever exhibited, both in Canada and the United States. Indeed it has in every instance, when brought into competition with others, proved itself to be far superior to any other machine of the kind yet invented.



CARTER'S IMPROVED DITCHING MACHINE.

Its principal parts are an iron wheel four feet in diameter and eight inches wide, with two flanges of five inches projecting from its edges. Between the flanges, on the circumference of the wheel, are cogs five inches long, arranged in rows of two at points twelve inches apart around the wheel. Immediately in the rear, and in close proximity to the bottom of the wheel, is a steel plough-shaped cutter, arranged in such a manner that the earth continues its upward progress to the top of the wheel, where the cogs pass through a comb, and the earth is discharged into a polished steel spout, and falls at a convenient distance from the trench. The whole is connected with a car upon which the operator stands, who has the power of regulating the cutter for the purpose of levelling the bottom of the ditch—quite a *desideratum.*

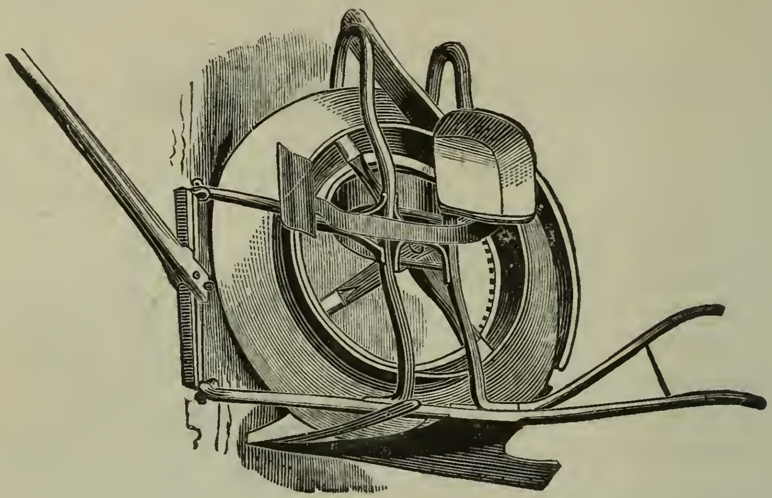
The machine is drawn to and fro in the same track, cutting from two to five inches each time (at the will of the operator) until the ditch is the depth required.

The machine is simple in construction, very strong, and not liable to get out of order.

It will work satisfactorily in the hardest as well as the toughest and most adhesive clay soils; will also work admirably in sandy or light soils.

Two men and from two to four horses are required to work it, cutting from one hundred to two hundred rods (according to soil) of ditch, three feet deep, eleven inches wide at the top, and eight inches at the bottom, per day.

Official authorities certify that it does the work of from twenty-five to thirty men per day, and saves fifty per cent. of the former cost of draining.



CARTER'S OPEN DITCHER, ROAD GRADER AND SUBSOILER.

This machine is quite simple. The main fixture is that of a plough driven and used in the ordinary manner. Attached to this is a large wheel, which lies on its side, and revolves as the plough cuts a furrow, takes the earth from the plough, and, carrying it round the flange of the wheel, drops it in the middle of the road, a distance of seven feet from where it originally lay.

Thus the machine cuts a ditch on each side of the road to any required depth, and throws the earth into the middle, not in large quantities, but equally distributed across and along the road. In this operation the two machines, which are usually employed on such work, are combined in one, and the work done in the same time as an ordinary plough would take to cut a ditch.

It is an excellent machine upon the farm for making open ditches, and may, indeed, be used in some cases for subsoiling. It is supposed to effectually grade from three-quarters to one mile of road per day, and the same amount of open ditch.

TABLES, &c.

Measures of Length (Gunter's Chain) used in land surveying.

7·92, or nearly 8 inches	=	1 link.
25 links, or 198 inches	=	1 pole.
4 poles	=	1 chain.
10 chains, or 7,920 inches	=	1 furlong.
8 furlongs, or 63,360 inches	=	1 mile.

A chain is equal to 100 *links,* or 702 inches, or 22 yards, or 66 feet.

Measures of Surfaces, or Square Measure.

144 square inches	=	1 square foot.
9 square feet	=	1 square yard.
$40\frac{1}{4}$ square yards	=	1 sq. pole or rod.
40 square poles	=	1 rood.
4 roods..	=	1 acre.

Note.—An error is often made which should be guarded against in supposing the terms "square inches" and "inches square" to be synonymous—denoting, in fact, the same thing; but there is a great difference between them. "Twelve square inches" is only the twelfth part of a square foot, but "twelve inches square" is 144 square inches.

Land—Square (or Gunter's Chain) Measure.

62·726 square inches	=	1 square link.
2·295 square links	=	1 square foot.
20·661 " "	=	1 square yard.
625 " "	=	1 square pole.
10,000 " "	=	1 square chain.
2·5 square chains	=	1 square rood.
10 " "	=	1 square acre.
640 square acres	=	1 square mile.

Cubic Measures of Solid Bodies.

1,728 cubic inches............................	=	1 cubic foot.
46,656 " or 27 cubic feet	=	1 solid yard.

☞ *Note.*—While square measure is based upon the square of numbers, which is found by multiplying any number into itself, as $4 \times 4 = 16$, which is the square of 4; cubic measure is based by multiplying any number twice into itself, as $4 \times 4 \times 4 = 64$, which is the cube of 4. Surface has only length and breadth; a solid body has length, breadth and thickness.

Avoirdupois Weight.

27·343 grains	=	1 drachm.
16 drachms	=	1 ounce.
16 ounces	=	1 pound.
28 pounds	=	1 quarter.
4 quarters	=	1 cwt.
20 hundredweight	=	1 ton.
14 lbs. (English measure)	=	1 stone.

Bread Weight.

4 pounds is the full-sized .... 4 lb. loaf.

Dry Measure, or Measures of Capacity.

4 gills	=	1 pint.
2 pints	=	1 quart.
4 quarts	=	1 gallon.
2 gallons	=	1 peck.
4 pecks		1 bushel.
8 bushels (English)	=	1 quarter.

Measures of Time and Motion.

A mean solar day is the mean apparent time of one revolution of the earth on its axis; and it is divided into 24 hours, an hour into 60 minutes, and a minute into 60 seconds, &c.; hence the mean daily apparent motion of the sun is 15 degrees per hour, or 1 degree in 4 minutes of time. A sidereal is the real and invariable period of the diurnal rotation, and contains 23 h. 56 m. and 4 1-10th seconds of mean solar time. A tropical year is the period of one revolution of the earth in its orbit, and contains 365 d. 5 h. 48 m. 49·19 seconds of mean solar time. The seconds' pendulum makes 86,400 vibrations in a mean solar day, at the same place on the earth's surface. A lunar day is 24 h. 48 m. The sidereal is 3 m. 56 sec. less than the solar day.

Commercial Numbers.

12 articles	1 dozen.
12 dozen	1 gross.
20 articles	1 score.
5 score	1 common hundred.
4 quarters	1 hundred.
24 sheets paper	1 quire.
25 "	1 printer's quire.
20 quires	1 ream.
21½ "	1 printer's ream.
2 reams	1 bundle.
10 reams	1 bale.
5 dozen skins parchment ...	1 roll.
100 words in law make ...	1 folio.

Capacity of Cisterns.

Supposing the annual rainfall to average about three feet, it will furnish to each square foot of surface 22·44 gallons; so that in calculating the capacity of a cistern to hold the water shed from any sized roof, find the number of square feet of surface that the roof covers, and multiply by 22·44; the result will be the number of gallons that will, on an average, be supplied in a year.

Example.—The roofing covers a building of the size of 30×40 feet, or 1,200 square feet; multiply this area by 22·44, and you have 26,928 gallons. As you are constantly drawing this water, cistern room to hold one-half, or 13,464 gallons, will be ample. Now to find the requisite sized cistern.

If circular, take the diameter in feet, square that, and multiply by ·785398; that gives the area in feet: multiply this by 1,728 and divide by 231, and you will have the number of gallons capacity of one foot in depth of the cistern; from this calculate the depth.

If square or rectangular, multiply length by breadth, and proceed to multiply result by 1,728 and to divide by 231, as before.

In this way we find that each foot of depth of a

CIRCULAR CISTERN,		SQUARE CISTERN,	
5 ft. in diameter, holds	4·66 bbls.	5 ft. by 5 ft. holds	5·92 bbls.
6 " "	6·71 "	6 " 6 "	8·54 "
7 " "	9·13 "	7 " 7 "	11·63 "
8 " "	11·93 "	8 " 8 "	15·19 "
9 " "	15·10 "	9 " 9 "	19·39 "
10 " "	18·65 "	10 " 10 "	23·74 "

Capacity of Bins, etc., etc.

The capacity of the bushel of grain is 2,150 inches.

To Measure the Number of Bushels of Grain in a Bin.—Multiply height, breadth and length in inches, and divide by 2,150.

Example.—Given a bin 10 feet long, 4 feet wide; how much grain will there be if filled to a depth of 3 feet?

$$120 \text{ in.} \times 48 \text{ inches} \times 36 \text{ inches} = 207{,}360 \text{ inches.}$$
$$207{,}360 \div 2{,}150 = 96\tfrac{2}{5} \text{ bushels.}$$

To Measure Corn in the Ear.—Multiply the length, width and height of bin in feet together, and the result by 4; cut off the last right hand figure (*i.e.*, divide by 10), and those left express the number of bushels of unshelled corn.

Example.—Given a bin 20 feet long, 8 feet wide; how many bushels of unshelled corn will fill it to a depth of 6 feet?

$$20 \text{ ft.} \times 8 \text{ feet} + 6 \text{ feet} = 960 \text{ ft.}$$
$$960 \text{ ft.} \times 4 \div 10 = 384 \text{ bushels.}$$

To Measure for Roots.—Allow one cubic foot and two-thirds ($1\frac{2}{3}$) for each bushel, or $16\frac{2}{3}$ feet (in decimals about 16·66) for every 10 bushels. An easy mode of reckoning will be to use the rule above for measuring corn in the ear. To the quotient thus obtained add one-half the amount, and you will have about the number of bushels of turnips to be allowed for these dimensions.

Example.—Find the capacity for roots of a bin 10 ft. × 20 ft. × 8 feet. $10 \times 20 \times 8 = 1{,}600$ ft. Multiply by 4, or 6,400 feet, leaving 640 bushels as the capacity for unshelled corn. Add half to this: $640 + 320 = 960$, the number of bushels of turnips required.

The relative bulk of corn in ear, roots and grain may be calculated in reference to the first, as half as much again as the second, and twice as much as the last. In other words, a space that would hold twenty bushels of corn in the cob would contain thirty bushels of roots, and forty bushels of other grain.

DISTANCES OF DRAINS.

Width of Land or Ridge.	Number of turns of the plough (18 in. wide) to the land.	General Character of the Soil.	Distance from Drain to Drain, in common use.
feet. in.			
7 6	5	Tenacious and uniform clay.	7 ft. 6 in., 15 ft., 21 ft., or every furrow, every other furrow, every third furrow, &c.
16 6	11	Same as above, fine and silthing clays, with beds of fine sand interspersed.	Drains 1 rod apart.
18 0	12	Clays containing coarse sand and grit.	Drains 16½ feet or 1 rod apart.
21 0	14	Calcareous soils and clays, lighter than the above, with frequent intermixtures of sand and gravel.	Drains 21 feet apart.
24 0	16	Clays similar to the above, with rotten sandstone rock, and more frequent intermixtures of gravel, &c.	Drains 24 feet apart.
30 0	20	The lighter description of clays and clay gravels.	Drains 30 feet apart.
33 0	22	Stony, gravelly, and sandy soils, and the lighter description of lands, usually springy soils.	Drains 33 feet or 2 rods apart.
36 0	24	....	Drains 41ft. or 2½ rods apart.

TABLE *of the Diameters of Pipes through which a required quantity of water may be discharged in a given time.*

Cubic feet per minute.	Diameter in inches.	Cubic feet per minute.	Diameter in inches.	Cubic feet per minute.	Diameter in inches.
1	1	25	4¾	160	12⅛
2	1⅜	30	5¼	170	12½
3	1⅝	35	5⅝	180	12¾
4	1	40	6	190	13¼
5	2⅞	45	6½	200	13⅝
6	2⅛	50	6¾	225	14⅜
7	2⅝	55	7⅛	250	15⅕
8	2¾	60	7½	275	16
9	2⅞	65	7¾	300	16⅝
10	3	70	8⅝	350	18
11	3⅕	80	8⅞	400	19¼
12	3¼	90	9⅛	440	20⅛
13	3½	100	9⅝	529	22
14	3⅝	110	10	625	24
15	3¾	120	10½	729	26
16	3⅞	130	11	841	28
18	4	140	11⅜	900	29
20	4¼	150	11¾	1000	30

AVERAGE COMPOSITION OF LINSEED CAKE.

	per cent.	per ton.
Moisture	12·70	284·5 lb
Oil	11·32	253·5 "
Albuminous compounds*	28·21	631·9 "
Mucilage and other carbonaceous principles	29·42	659·0 "
Phosphate of lime, magnesia and other mineral constituents of food†	4·84	108·4 "
Woody fibre	12·46	279·2 "
Insoluble earthy matters	1·05	23·5 "
	100·00	2240·0
	per cent.	per ton.
*Containing nitrogen	4·50	100·8 lb
† " phosphoric acid	1·28	28·7 "
" potash	1·34	30·1 "

COMPOSITION OF RAPE CAKE (SIBSON).

	per cent.	per ton.
Moisture	11·28	252·7 lb
Oil	11·20	250·9 "
Albuminous compounds*	30·54	684·1 "
Non-nitrogenous matters	28·45	637·3 "
Phosphate of lime, magnesia, potash and other mineral constituents of food	5·60	25·4 "
Woody fibre	11·51	257·8 "
Insoluble earthy matters†	1·42	31·8 "
	100·00	2240·0
	per cent.	per ton.
*Containing nitrogen	5·66	137·8 "
† " phosphoric acid	1·17	26·2 "
" potash	1·54	34·5 "

COMPOSITION OF WHEAT, BARLEY, AND OATS.

	WHEAT.		BARLEY.		OATS.	
	per cent.	per ton. lbs.	per cent.	per ton. lbs.	per cent.	per ton. lbs.
Moisture	15·26	341·4	14·65	328·2	15·09	338·0
Albuminous compounds*	11·54	258·5	10·84	242·8	11·85	265·4
Starch, sugar and other carbonaceous matters	68·47	1533·7	68·31	1530·1	63·34	1418·8
Woody fibre	2·61	67·2	3·45	77·3	7·02	157·3
Mineral matters†	1·75	39·2	2·75	61·6	2·70	60 5
	100·00	2240·0	100·00	2240·0	100·00	2240·0
*Containing nitrogen	1·86	41·6	1·73	38·7	1·89	42·6
† " phosphoric acid	0·80	17·9	0·97	22·4	0·67	15·0
" potash	0·52	11·6	0·42	9·4	0·40	8·9
	One ton equal to 37⅓ bushels, at 60 lbs.		One ton equal to 41½ bushels, at 54 lbs.		One ton equal to 56 bushels, at 40 lbs.	

COMPOSITION OF PEA AND BEAN STRAW.

	PEA STRAW.		BEAN STRAW.	
	per cent.	per ton. lbs.	per cent.	per ton. lbs.
Water	16·02	358·8	19·40	434·5
Fatty matters	2·34	52·4	1·02	22·8
Albuminous compounds*	8·86	198·5	3·36	75·3
Gum and other carbonaceous principles	25·06	561·3	6·93	155·2
Woody fibre	42·79	958·5	65.58	1469·0
Mineral matters†	4·93	110·5	3·71	83·2
	100·00	2240·0	100·00	2240·0
*Containing nitrogen	1·41	31·6	·54	12·1
† " phosphoric acid	0·41	9·2	·27	6·0
" potash	0·59	13·4	·78	17·5

COMPOSITION OF MEADOW GRASS.

	Per Cent.	Per Ton.
Water	76·52	1714 lbs.
Fatty matters, chlorophyl, &c	1·40	31 "
Albuminous compounds*	2·25	50½ "
Sugar, gum, cellular tissue, &c	12·68	284½ "
Woody fibre	4·97	111 "
Mineral matters†	2·18	49 "
	100·00	2240·0
*Containing nitrogen	·36	8 "
† " phosphoric acid	·12	2½ "
" potash	·56	12½ "

COMPOSITION OF GREEN RYE.

	Per Cent.
Water	75·42
Fatty matters	0·89
Albuminous compounds	2·70
Cellular tissue, &c	9·13
Woody fibre	10·48
Mineral matters	1·35
	100·00

COMPOSITION OF VETCHES.

	Per Cent.
Water	81·30
Albuminous compounds	3·60
Carbonaceous principles	8·80
Woody fibre	4·46
Mineral matters	1·84
	100·00

COMPOSITION OF WHITE TURNIPS (SIBSON).

	Per Cent.	Per Ton.
Water	90·43	2025·6 lbs.
Albuminous compounds*	1·04	23·3 "
Pectin, sugar and other carbonaceous principles	5·45	122·1 "
Woody fibre	2·44	54·9 "
Mineral matters†	·63	14·1 "
	100·00	2240·0

* Containing nitrogen	·16	3·6 "
† " phosphoric acid	·06	1·34 "
" potash	·23	5·2 "

COMPOSITION OF SWEDES.

	Per Cent.	Per Ton.
Water	89·46	2003·9 lbs.
Albuminous compounds*	1·34	30·9
Pectin, sugar and other carbonaceous principles	5·93	132·8
Woody fibre	2·64	59·4
Mineral matters†	·62	13·9
	100·00	2240·0

* Containing nitrogen	·21	4·7
† " phosphoric acid	·06	1·34
' potash	·22	4·9

COMPOSITION OF POTATOES.

Water	75·0	1680·0
Albuminous compounds*	2·3	51·5
Starch, &c.	18·7	418·9
Woody fibre	3·0	67·2
Mineral matters†	1·0	22·4
	100·0	2240·0

* Containing nitrogen	·37	8·28
† " phosphoric acid	·14	3·13
" potash	·48	10·75

COMPOSITION OF PARSNIPS AND CARROTS.

	Parsnips.	Carrots.
Water	82·05	87·33
Albuminous compounds	1·28	·66
Sugar, pectin, starch and cellular fibre	15·74	11·27
Mineral matters	·93	·74
	100·00	100·00

COMPOSITION OF ASH OF GRASS (SIBSON).

	Per Cent.
Potash	25·40
Lime	15·21
Magnesia	5·30
Soda	6·24
Oxide of iron	0·18
Phosphoric acid	5·45
Sulphuric acid	7·08
Silicic acid	24·30
Chlorine	4 76
Carbonic acid and loss	6·08
	100 00

COMPOSITION OF RICH AND POOR MILK.

	1.	2.
Water	85·20	89 00
Butter and fatty matters	4·96	2·47
Casein or cheesy matters	3 68	2·69
Sugar of milk	5 03	5 08
Mineral matters	1·13	·76
	100·00	100·00

TABLE *showing the estimated value of the manure obtained from the consumption of one ton of different articles of food, each supposed to be of good quality of its kind.*

Description of Food.	Estimated money value of the manure from one ton of each food.
1. Decorticated cotton-seed cake	$31·50
2. Rape cake	23·00
3. Linseed cake	22·00
4. Linseed	17·25
5. Tares or vetches	17·35
6. Peas	15·00
7. Oats	8·36
8. Wheat	8·11
9. Indian corn	8·61
10. Malt	8·61
11. Barley	7·11
12. Clover hay	10·91
13. Meadow hay	7·29
14. Oat straw	3·37
15. Wheat straw	3·12
16. Barley straw	2·55
17. Potatoes	1·75
18. Mangolds	1·20
19. Swedish turnips	1·05
20. Common turnips	1.00
21. Carrots	1·00

FEEDING.

	Real food in 100 parts natural produce.	Quantities containing about an equal amount of real food.	Albuminous compounds in 100 parts natural produce.	Carbonaceous principles in 100 parts natural produce.	Proportion of albuminous to carbonaceous principles.
Wheat grain	82·1	1·0	11·54	68·74	1 to 6·0
Barley grain	81·9	1·0	10·84	68·31	1 to 6·3
Beans	81·9	1·0	7·72	72 44	1 to 9·4
Cotton-seed cake	81·9	1·0	41·25	54·90	1 to 1·3
Linseed	81·3	1·0	24·44	112·30	1 to 4·5
Indian corn	80·0	1·0	11·27	67·50	1 to 6·0
Oats grain	79·9	1·0	11·84	63·30	1 to 5·3
Rape cake	77·8	1·0	30·54	55·30	1 to 1·8
Bran	75·6	1·1	13·88	55·50	1 to 5·3
Bean meal	75·2	1·1	23·30	48·50	1 to 2·1
Linseed cake	73·9	1·1	28·21	55·75	1 to 1·9
Hay (meadow)	65·7	1·2	8·08	49·87	1 to 6·0
Hay (clover)	56·3	1·4	14·34	34·50	1 to 2·4
Pea straw	41·2	2·0	8·86	27·40	1 to 3·1
Oat straw	23·8	3·4	2·75	15·65	1 to 5·7
Wheat straw	22·5	3·6	2·93	15·40	1 to 5·2
Potatoes	22·0	3·7	2·30	18·70	1 to 8·1
Grass	18·5	4·4	2·25	14·08	1 to 6·2
Barley straw	18·2	4·5	4·43	9·57	1 to 2·2
Green rye	14·1	5·8	2·70	10·02	1 to 3·5
Kohl-rabbi	12·7	6·4	2·35	8·23	1 to 3·5
Clover (green)	12·5	6·5	3·19	7·69	1 to 2·4
Mangolds	11·0	7·4	1·54	8·54	1 to 5·5
Parsnips	9·9	8·2	1·28	7·71	1 to 6·0
Carrots	9·2	8·9	0·66	7·80	1 to 11·8
Cabbage	9·4	8·6	1·50	7·09	1 to 4·7
Green rape	9·4	8·7	3·13	4·64	1 to 1·5
Swedes	7·9	10·4	1·34	5 93	1 to 4·4
White turnips	7·1	11·5	1·04	5·45	1 to 5·2

The fresh ashes of wheat contain in 100 *parts*:—

Phosphate of potash	36·51
" of soda	32·13
" of lime	3·35
" of magnesia	19 61
Perphosphate of iron	3 04
Silica	·15
Coal and sand	4·99

—FRESENIUS.

The ashes of rye contain in 100 *parts*:—

Phosphate of potash	52·91
" of soda	9·29
" of lime	5·21
" of magnesia	26·91
Perphosphate of iron	1·88
Sulphate of potash and common salt	2·98
Silicate of potash	·34
Sand	·50

—FRESENIUS

The ashes of peas contain in 100 parts:—

Phosphate of potash	52·78
" of soda	5·67
" of lime	10·77
" of magnesia	13·78
" of iron	2·46
Sulphate of potash	9·09
Common salt	3·96

—WILL.

The ashes of barley contain in 100 parts:—

Potash	18·00
Phosphate of lime	9·20
Chloride of potassium	·25
Sulphate of potash	1·5
Earthy phosphates	32·5
Silica	35·5
Metallic oxides	·25
Loss	2·80

—SAUSSURE.

The ashes of oats, 100 parts:—

Potash	6·00
Soda	5·00
Lime	3·00
Magnesia	2·50
Alumina	·50
Silica	76·50
Sulphuric acid	1·50
Phosphoric acid	3·00
Chlorine	·50

—JOHNSTON.

The ashes of wheat straw, 100 parts:—

Potash	12·5
Phosphate of lime	5·0
Chloride of potassium	3·0
Sulphate of potash	2·0
Earthy phosphates	6·2
Earthy carbonates	1·0
Silica	61·5
Metallic oxides	1·0
Loss	7.8

—SAUSSURE.

The ashes of barley straw, 100 parts:—

Potash	16·0
Chloride of potassium	·5
Sulphate of soda	3·5
Earthy phosphates	7·75
Earthy carbonates	12·5
Silica	35·5
Metallic oxides	·5
Loss	2·25

—SAUSSURE.

The ashes of pea straw, 100 *parts* :—

Carbonate of potash	4·16
Carbonate of soda	8·27
Sulphate of potash	10·75
Common salt	4·63
Carbonate of lime	47·81
Magnesia	4·05
Phosphate of lime	5·15
Phosphate of magnesia	4·37
Phosphate of iron and alum	2·10
Silica	7·81

The ashes of good meadow hay, 100 *parts* :—

Siiica	60·1
Phosphate of lime	16·1
Phosphate of iron	5.0
Lime	2·7
Magnesia	8·6
Gypsum	1·2
Sulphate of potash	2·2
Chloride of potassium	1·3
Carbonate of soda	2·0
Loss	·8

The ashes of clover, 100 *parts* :—

Silica	5·438
Sulphate of potash	3·080
Chloride of sodium	1·670
Carbonate of potash	12·728
Carbonate of soda	13·528
Carbonate of lime	38·216
Magnesia	4·160
Phosphate of iron	1·240
Phosphate of lime	11·970
Phosphate of magnesia	6·790
Carbonaceous matter	0·160

—LIEBIG.

The ashes of the bran of wheat, 100 *parts* :—

Potash	14·0
Phosphate of lime	7·0
Chloride of potassium	·16
Earthy phosphates	46·5
Silica	·5
Metallic oxides	·25
Loss	8·59

— AUSSURE.

Analyses of several kinds of farm produce, 100 *parts of each, extremely dry :—*

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Ashes.
Wheat	46·1	5·8	43·4	2·3	2·4
Rye	46·2	5·6	42·2	1·7	2·3
Oats	50·7	6·4	36·7	2·2	4·0
Wheat straw	48·4	5·3	38·9	0·4	7·0
Rye straw	49·9	5·6	40·6	0·3	3·6
Oat straw	50·1	5·4	39·0	0·4	5·1
Potatoes	44·0	5·8	44·7	1·5	4·0
Beet	42·8	5·8	43·4	1·7	6·3
Turnips	42·9	5·5	42·3	1·7	7·6
Peas	46·5	6·2	40·0	4·2	3·1
Pea straw	45·8	5·0	35·6	2·3	11·3
Red clover stalk	47·4	5·0	37·8	2·1	7·7

Analyses of dry beef and ox blood, by which their constituents appear to be the same :—

	Beef.	Ox Blood.
Carbon	51·83	51·95
Hydrogen	7·57	7·17
Nitrogen	15·01	15·07
Oxygen	21·37	21·39
Ashes	4·23	4 42

—PLAYFAIR.

TABLE OF SOILS AND THE TREES SUITABLE TO THEM.

SURFACE SOIL.	SUBSOIL.	TREES.
Heavy and gravelly loams	Heavy loam	Oak, ash, chesnut, willow, lime, walnut.
Sandy loams	Ditto	Elm, beech, pine, spruce.
Flinty strong loams	Ditto	Willow, chesnut.
Gravelly and sandy loams	Gravelly loam	Ash, beech, oak, hazel, chesnut.
Flinty, dry, poor, gravelly loams	Ditto	Beech, oak, larch, etc.
Black loam	Dry sandy gravel	Birch, elm, ash.
Gravelly loam	Heavy and poor loam	Oak, ash, hazel, and beech.
Sandy gravel	Sand and gravel	Pine, larch, chesnut.
Gravelly loam	Gravelly, stony loam	Oak, chesnut.
Wet spongy land	Moist, boggy earth	Alder, willow, osier, etc.
Drier than above	Ditto, more dry	Poplar, willow, black ash.

TABLE *showing the number of plants which may be planted on an acre* = 160 *rods* = 4,840 *square yards* = 43,560 *square feet.*

Feet Apart.	No. of Plants.	Feet Apart.	No. of Plants.
1	43,560	10	435
$1\frac{1}{2}$	19,360	11	360
2	10,890	12	302
$2\frac{1}{2}$	6,969	13	257
3	4,840	14	222
$3\frac{1}{2}$	3,556	15	193
4	2,722	16	170
$4\frac{1}{2}$	2,151	17	150
5	1,742	18	134
6	1,210	19	120
7	889	20	108
8	680	25	69
9	537	30	48

How to make a hotbed.—" Sow in heat—Sow in a hotbed," are directions so commonly to be found in the notices of half hardy annuals, that we feel we shall be materially aiding those who are their own gardeners if we give a few simple directions on the subject of a hotbed, composed of stable manure, the most frequent and useful form in which it is to be found.

The preparation of the dung is a matter of great importance, and if the bed be expected to retain its usefulness for any length of time, it should be well worked previous to being used. If obtained fresh from the stable-yard, and found to be too dry, it should be well watered and thrown lightly together to ferment; this will take place in the course of a few days, and three or four days afterwards it should be completely turned, well shaken and mixed, keeping the more littery portion to the interior of the heap ; a second turning and watering may be necessary, although one will be generally found to be sufficient ; when thus cleaned of its rankness the bed may be made.

The situation for this should be dry underneath, sheltered from the north as much as possible and fully exposed to the sun ; it should be built up from two feet six inches to four feet high, and wider by six inches every way than the frame to be placed upon it. The dung should be well shaken and mixed while being put together, and firmly pressed by the feet. The frame should be kept close until the heat rises, and three or four inches of sifted sand or ashes should be placed on the surface of the bed ; in a few days it will be ready for use ; but air should be given night and day while there is any danger from the rank steam, and if the sand or ashes are drawn away from the side of the bed, they should be replaced.

When the hotbed is used for seeds only, nothing further is necessary; they are to be sown in pots or pans, placed or plunged in the bed, the heat of which will soon cause them to germinate. As this will, after some time, decline, what are called linings should be added, that is, fresh, hot, fermenting (but not rank) dung applied about a foot in width all round the bed ; this renews its strength, and will greatly aid its successful management.

A cold frame is formed by placing the ordinary hotbed frame upon a bed of light, rich soil, in some place in the garden where it will be protected from cold winds. They should both be shaded from the sun by mats during the middle of the day.

How thick the ground is covered by certain sowings.—A bushel of wheat contains 660,000 grains. If this quantity should be spread equally over an acre of ground, it would give nearly 10 square inches of space for each plant ; each plant would be a little more than 3 inches from the next, and there would be 15 plants to each square foot. If the seed were sown in drills 9 inches apart, there would be a plant to each inch in the drill. It is well known that in broadcast sowing much of the seed is covered too deeply, and some not sufficiently, and thus possibly a half of the seed sown is wasted. In drill-sowing a much greater proportion of the seed produces returns, because of its even covering and more regular germination. If each seed should produce but one perfect ear, the yield would be over 30 fold, but it is safe to say that every healthy wheat plant will produce at least three stalks ; so that, should the whole of the seed sown mature, a crop of 90 bushels would be the result. There is no doubt but drill-sowing will produce a better yield than broadcast sowing, as much more of the seed will successfully germinate, and the expense of drill-sowing being less than hand-sowing and harrowing afterwards, we would advise all those who can buy or hire a drill to abandon broadcast sowing.

FARM ACCOUNTS.

" *No one need be ruined who keeps good accounts.*"

The following system of keeping farm accounts is *thorough,* and at the same time *plain and simple* in form.

There is a place in which may be entered every transaction which it is necessary to record.

A boy who can read and write may understand the principles, and by devoting five minutes of every evening to the task, may keep the accounts thoroughly posted.

The book shows at a glance the following :—

What cash has been expended or received.

What the owner's liabilities are, and what is due to him, at any date.

The day on which a cow or other animal may be expected to ' come in."

The amount of feed that is being consumed on the farm.

The amount of hay, grain, roots, live-stock, milk, butter, or other produce that has been sold, or is at any time on hand.

Provision is made for opening an account with the grocer, blacksmith or any other tradesman or person.

From the columns of the main book, the actual expense of cultivation in any given field and of any given crop can be readily and exactly computed.

Finally, it is plain and simple.

If the farmer who has never been accustomed to making any regular entries of his farm transactions does not care to keep the accounts himself, let him entrust them to his son. It will be found a practical education of the very best and most useful kind.

BREEDER'S CALENDAR.

The following is the basis upon which the time is computed in entering in the page devoted to *Breeder's Memorandum* :—

Species.	Premature Labour.	Regular Labour.	Protracted Labour.
Mare	11 months or 330 days	11⅓ months or 340 days	14 months or 420 days
Cow..............	8 " or 240 "	9½ " or 285 "	11 " or 330 "
Sheep	4½ " or 135 "	4 4-5 " or 144 "	5⅓ " or 160 "
Sow..............	3⅔ " or 110 "	4 " or 120 "	4⅓ " or 130 "

CALVING TABLE.

Day Bulled.	Will Calve.	Day Bulled.	Will Calve.	Day Bulled.	Will Calve	Day Bulled.	Will Calve.
Jan. 1	Oct. 8	April 1	Jan. 6	July 1	April 7	Oct. 1	July 9
" 7	" 14	" 7	" 12	" 7	" 13	" 7	" 15
" 14	" 21	" 14	" 19	" 14	" 20	" 14	" 22
" 21	" 28	" 21	" 26	" 21	" 27	" 21	" 29
" 28	Nov. 4	" 28	Feb. 2	" 28	May 4	" 28	Aug. 5
" 31	" 7	" 30	" 4	" 31	" 8	" 31	" 8
Feb. 1	" 8	May 1	" 5	Aug. 1	" 9	Nov. 1	" 9
" 7	" 14	" 7	" 11	" 7	" 15	" 7	" 15
" 14	" 21	" 14	" 18	" 14	" 22	" 14	" 21
" 21	" 28	" 21	" 25	" 21	" 29	" 21	" 29
" 28	Dec. 5	" 28	Mar. 4	" 28	June 5	" 28	Sept. 5
Mar. 1	" 6	" 31	" 7	" 31	" 8	" 30	" 7
" 7	" 12	June 1	" 8	Sept. 1	" 9	Dec. 1	" 8
" 14	" 19	" 7	" 14	" 7	" 15	" 7	" 14
" 21	" 26	" 14	" 21	" 14	" 22	" 14	" 21
" 28	Jan. 2	" 21	" 28	" 21	" 29	" 21	" 28
" 31	" 5	" 28	April 4	" 28	July 6	" 28	Oct. 5
		" 30	" 6	" 30	" 8	" 31	" 8

LIVE STOCK ACCOUNT.

Date.	BOUGHT.		SOLD.		BUTCHERED OR DIED.	
		Paid.		Received.		Value.

Ledger.

Account with ______________________

Date.		Due me.			Date.		I owe.		

Produce Account.

Date.	PRODUCE.	Sold.	Bought.	Chopped.	FEED.				Threshed.
					Horses.	Cattle.	Pigs.	Sheep.	

Diary and Journal Combined.

From ____________ *the* ________ *day of* ____________, *To* ____________ *the* ________ *day of* ____________ 18__

Date.	Weather Record.	DIARY.	DAILY WORK.						CURRENT ACCOUNTS.						
												Cash.		Not Cash.	
			Field.	Work done.	Horses.	Hands.	Extra Hands.	Manure, Seed, &c., &c.	Date.	Ledger Folio.	Transactions.	Received.	Paid.	Due me.	I owe.

Breeder's Statement.

MARES.				COWS AND HEIFERS.				SOWS.				REMARKS.
Name.	Foaled.	To Horse.	Due.	Name.	Calved.	To Bull.	Due.	—	Pigged.	To Boar.	Due.	
Flora		14 June	May	Barti	-	Aug 14	May 22	86				

Dairy Account.

Date.		Amount of Milk.		Total of Milk.	BUTTER.				No. of Milch Cows.	Remarks.
		Morn'g.	Evening		Made.	Consumed	Sold.	Packed.		
Sunday.	3									
Monday	4									
Tuesday	5									
Wed'y..	6									
Thurs'y.	7									
Friday..	8									
Sat'day.	9									
WeeklyTotal										
..										
..										
..										
..										
..										
..										
..										
..										
..										
..										
..										
..										
..										
..										
Sunday.	24									
Monday	25									
Tuesday	26									
Wed'y..	27									
Thurs'y.	28									
Friday..	29									
Sat'day.	30									
WeeklyTotal										
Mon'ly Total										

N.B.—Each sheet may thus be made to account for Dairy transactions of one month of four weeks.

BUSINESS TRANSACTIONS.

PURCHASE OF PROPERTY.

Few men will buy a property without first consulting a solicitor; yet we have seen men badly taken in at auction land sales. Often because they did not, before bidding, make themselves properly acquainted with the terms of sale. These terms, it is reasonable to suppose, will in most cases be drawn as favourably as possible to the interests of the vendor.

Remember, when attending an auction sale, that the conditions of sale, whatever they are, will bind the purchaser, for by one of those legal fictions which abound in our law, the auctioneer, who is certainly the agent of the seller, becomes also (in conjunction with his clerk) the agent for the buyer. The fall of the hammer is the acceptance of the offer which completes the agreement to purchase.

No trustee or assignee can purchase property for himself, included in the trust, even at auction.

The only circumstance that can vitiate a purchase, which has been reduced to a written contract, is proof of fraudulent representation as to an encumbrance of which the buyer was ignorant, or a defect in title, but every circumstance which the buyer could have learned by careful investigation, the law presumes that he (the buyer) did know.

Interest on a purchase is due from the day fixed upon for completing; where it cannot be completed, the loss must fall upon the party with whom the delay has arisen and rests.

In agreeing to buy, say a house, see that the insurance is provided for between the agreement and the completion of contract.

Common fixtures pass with buildings, when nothing is especially agreed with regard to them.

THE RELATIONS OF LANDLORD AND TENANT.

Letting is performed by a proprietor of house, land, or house and land in three ways. By a tenancy-at-will, a yearly tenancy, or by lease.

A tenancy-at-will may be created by word or by written agreement; and as the tenant may be turned out when his landlord pleases, so may he leave when he himself thinks proper. This is a very inconvenient arrangement and is seldom resorted to.

When an annual rent is attached to a tenancy, a lease without limit is, in the eyes of the law, a lease from year to year. In such at least six months' clear notice must be given by the landlord to eject the tenant, or by the tenant to release himself from payment of regular rental and from the binding covenants of the lease, and the six months must be *before* the expiration of the current year, for it can only terminate at the end of any whole year from the time at which it began, so that a tenant entering say on the first of April, the notice must be served upon or by him, so as to terminate on the first of April in the current year.

Thus, if once in possession, the tenant has a right to remain a whole year, and if he receive no notice at the end of the first half year of his tenancy, he has a right to remain two years and so on for any number of years.

It is usual to stipulate that the tenancy may be determined by three or six months' notice, as the case may be, to expire on either of the quarterly or half yearly days appointed for payment of rent.

Tenancy by sufferance.—This is a form of tenancy that very frequently arises in practice.

On the expiration of a lease or agreement, if neither party take the initiative in a decided course for leaving, the tenant, remaining thus in possession becomes by sufferance, a tenant from year to year, which can only then be terminated by one party or the other giving the necessary six months' notice to quit at a time corresponding with the original tenancy.

LEASES.

A lease is a writing or instrument by which one person grants to another the use of certain lands or tenements for a certain term and in consideration of the receipt of certain considerations.

The proprietor is known in law as the lessor and the tenant as the lessee. The lessor grants the lease, and the lessee accepts that lease with all its conditions.

When leases are burdened with a covenant not to underlet without consent of the landlord, an underletting to mere inmates or lodgers is not included.

A lease for any term beyond three years must be under seal and in triplicate; but a verbal lease may be made for three years and under.

All signatures to leases, deeds, and indeed to agreements, should be witnessed.

The main *agreements* or covenants of a lease are on the following points :—Rent, term, insuring and rebuilding in the event of fire, cultivation in a husbandlike manner (the manner generally being more specifically stated as to selling straw, taking two wheat crops after one another, keeping up fences), &c.

Noxious trades.—It is generally customary to introduce a clause against the carrying on of certain trades, or noxious trades in a house.

The trades, that are to be tabooed, should be mentioned, for we remember a case in England, where it was held, that this covenant had been violated by the opening of a school, while an asylum was found admissible.

Fixtures.—The articles that may not be removed by a tenant are subject to considerable doubt, and are a fruitful source of dispute.

Removable articles have been defined as all articles " slightly connected with one another, and with the freehold, but capable of being separated without injury to the freehold. All goods and chattels, articles fixed to the freehold by nails and screws, bolts or pegs ; but when sunk in the soil or built on it, they are integral parts of the freehold and cannot be removed."

Thus a greenhouse or conservatory attached to a house by a tenant is not removable ; but the furnace and hot water pipes by which it is heated may be removed. A brick flue must remain. Window blinds, and every thing he has placed which can be removed without injury to the freehold, he may remove if they are separated from the tenement during his term, and the place made good. But all fixtures of this nature *must* be removed before the termination of the lease.

Notice to quit.—In the case of leasing for a specified term, no notice is required or if, by tacit consent he remains paying rent as heretofore, he becomes a tenant on sufferance or from year to year.

A notice may be given verbally, if it can be proved that the notice was definite or given at the right time, but it is better to give it in writing.

Recovery of rent may be by action at law, distress on the premises, or on goods away from the premises which have been removed therefrom after rent was due, and within thirty days after their removal—or by action of ejectment, under various circumstances.

As these are all serious matters in which to make a false step. the landlord should commit them to his lawyer.

Of one thing we should take notice that the law does not regard the day as consisting of portions, and the popular notion that a notice to quit should be served before noon is an error.

The landlord may also remember that he is himself responsible for the illegal acts of the agent whom he may employ, though he would have a remedy against that agent.

AN I.O.U.

The law is not particular about spelling, indeed it distinctly refuses to be governed by stern rules of orthography.

The law in most cases insists on having everything written, but its decisions go by reading.

Therefore you may sue John Tichborne, by the name of Ticklebun, and if you can show that he is the party in default, the decision will be awarded, whether you have spelt his name ill or well.

Thus no stretch of orthography could convert " I owe you," into I.O.U, but the law allows this phonetic system to be binding.

Thus the following, being an admission of debt is as binding as any longer document.

1 August, 1873.

To Mr. Smith,

I. O. U.,

$25.50 Twenty-five $\frac{50}{100}$ dollars cash.

JAMES WALKER.

Should you however affix the time of payment, say a month, your memorandum is useless, for it is illegal, as it must be stamped if its value is $25.00 or more.

It then becomes a promissory note, and if stamped to its proper value, may be sued on default of payment

THE TABLE OF STAMP DUTIES (1873).

On every promissory note, draft, bill of exchange, not less than $25, one cent ; over $25 to $50, two cents ; over $50 to $100, three cents ; on every promissory note draft, bill of exchange executed singly, for the first $100, three cents ; for every additional $100 or fraction of $100, three cents.

These duties are to be paid by bill stamps (not postage stamps) to the requisite amount affixed to the note &c. And the person affixing the stamp must, at the time of affixing the same, write or stamp thereon the date at which it is affixed, and each stamp shall be held *prima facie* to have been affixed at the date stamped or written thereon, and, if no date be so stamped or written thereon, such adhesive stamp shall be of no avail.

Penalty for neglecting to affix stamps, or for wilfully writing or stamping a false date thereon, $100.

Stamped paper for the purposes of this Act may be prepared by direction of the Governor in Council.

HUSBAND AND WIFE.

When married, a husband is lia' le for his wife's debts contracted before marriage. In such a case, a creditor should proceed against both.

The husband is liable for debts of his wife contracted for necessaries while living with him.

If she voluntarily leaves his protection and lives in adultery, this liability ceases. He is also liable for any debts contracted by her with his authority ; and the law implies his authority where the debt is for necessaries, or in the common course of house-keeping, unless the contrary be proved. In civil cases a wife may give evidence for or against her husband ; in criminal cases she cannot be a witness, with the exception of the case of assault by him upon her.

A man used to be allowed to "correct" his wife with "a stick not thicker than the thumb." But this barbarity has gone the way of all such customs. But he may keep her under restraint to prevent her leaving him, provided he exercise no cruelty.

There are laws by which a wife can obtain security for her lawful earnings if her husband desert her.

WILLS.

Always let your will be drawn by a lawyer. More litigation and endless Chancery suits have arisen from wills drawn by incompetent persons, than from almost any other source of error. Better draw your will in common sense, every day conversational English, as, "I, John Smith, leave to   to be paid at my death, by   who I hereby appoint my executors," and let it be well witnessed, than allow intermeddlers who have a smattering of the wording of legal forms, to lead you into endless mistakes.

Depend upon it, much as it may be the fashion to upbraid the apparent contradictions and quibbles of the law, common sense English will generally be fairly construed by impartial judges and sensible juries.

There are a few ordinary points however to be borne in mind.

The witnesses must subscribe in the presence of the testator, and of themselves; and the testator must at the time be of sound mind.

A will may be revoked or annulled, but only by burning or entirely destroying, or by adding a codicil, or by making a subsequent will duly attested.

The act of running a pen through the signatures or down the page is not sufficient to cancel a will, without a written declaration to that effect signed and witnessed.

A will made before marriage is revoked thereby.

Any persons who can write their name, are qualified to witness a will, but such witnesses cannot be benefitted by the will. A bequest made to the husband or wife of a witness is void.

It is advisable to make a will in duplicate, and intrust one copy to the keeping of your executor, or some other person, in whom you have confidence, as it has not unfrequently happened, that a will has been suppressed or destroyed, or has not been forthcoming when required.

ACCOUNT BOOKS.

Cannot be received as evidence, unless their contents have been brought under the notice of and been admitted correct by both parties, as is usually the case with " pass" books, but complainant may be compelled to show his books.

A FEW WORDS TO EMIGRANTS.

Canada is yet young. Nearly all her population are emigrants, and have within the last century migrated from some other country. Let us for a moment dwell upon the inducements to emigrate.

It is a natural ambition that prompts the majority of men to seek the possession of a piece of land.

In Canada that ambition may be gratified by any man, who in the possession of health and strength, lives industriously and soberly.

In Canada we possess " *elbow-room.*" For this reason, the new countries are the most suitable fields for the poor and for the man of mediocre abilities. In Europe, say in England, the poor man who rises to a position of eminence, must be possessed of no ordinary gifts. His success must be attained over the heads of his contemporaries.

In these crowded countries, he who would attain position finds every step thronged, and like the individual, who, in a crowded hall, seeks to escape by a thronged up door from dread fire, he must not care, though in the frantic struggle to save his own life, he crush through regardless of all others, and trample upon those who, weaker than himself, have succumbed to the frightful pressure. Take the poor labourer of England, suppose him to be the most economical and saving man; suppose him to have amassed a little fortune from his scanty earnings, he cannot become an employer of farm labour.

When a farm falls vacant, there are many applicants in the field, the rent is to all intents and purposes put up to auction, and his little capital is but as a drop in the bucket, compared with the many who, rich themselves, and having rich friends at their backs, will secure the tenancy or property at any price.

The poor man's capital is labour. In crowded countries, capitalists of this class are so plentiful, that they must, perforce, cut down on one another. As all capital, when plentiful becomes cheap, so the poor man's capital—labour—when abundant becomes also cheap.

But what do we find on this side of the Atlantic: Here labour is wanted.

Money capital is actually hampered because we have not labour to employ it. Labour is the capital required in Canada, and without it our vast resources cannot be brought to light.

Thus are we suffering for want of labour ; and we will give a high price to obtain it.

This work may meet the eye of some who freshly landed in Canada, and led away by specious promises and delusive hopes, are thinking of throwing up the younger country and proceeding onward to the States. We ask any such to pause before they do so.

Canada is in possession of *all the advantages* of the United States, and in addition, she has many superior prospects.

The United States, governed by a Republic, is cursed by the abuse of the elective franchise.

The consequence is every day becoming more apparent that the " Almighty dollar" rules her, that corruption is rife in every department, and in none more so than in courts of justice ; her judges, the executors of her laws—have been over and over again convicted of receiving bribes for which their judgments have been falsely given.

In this Dominion, no such cases have ever been proven or suspected. Justice in Canada still wears her bandage, and her scales have no false balances.

In Canada, our taxes (amounting in most municipalities to two or three mills on the dollar) are as nothing compared to those of the United States.

The money wages of the States are greater on their face value than in Canada. But when contrasted, as all wages should be, with the taxes and expenses of living, it will be found that Canadian wages are at least equally high.

The States parade the principle of Equality, Fraternity and Liberty. We have all three in the most perfect and practical form.

Our *Liberty* is only curtailed when we break the very laws that we have ourselves laid down for the guidance of the community. Our *Fraternity* is pure and genuine, grounded on a love for all that is Canadian, and supported by a respect for those, who, possessing genuine talents, have by the destiny of providence and their own pluck and perseverance, raised themselves to fill a high position in the social scale. The law is readily accessible to the poor as to the rich, and is administered without fear or favour, ungoverned by bribery, intimidation or corruption.

As for *Equality*—we are as equal as God, in his all wise Providence, intended his creatures to be, as equal as are the various animate and inanimate works of nature, or as are the intellectual powers of different individuals.

The Emigrant naturally asks himself—Is there elbow-room for me in Canada ? Aye, indeed there is and ample in every line of life ; ranging from the parson to the crossing sweeper.

SIZE OF CANADA.	Sq miles.
Nova Scotia	18,660
New Brunswick	27,500
Quebec	377,045
Ontario	121,260
Manitoba	14,340
North West Territory	2,750,000
British Columbia	220,000
Dominion	3,528,805
United States (exclusive of Alaska)	2,933,588

SIZE OF UNITED STATES.	Sq. miles.
United States	2,933,588
Alaska	577,590

Thus the Dominion is nearly six-hundred thousand square miles *greater* in area than the United States.

ACREAGE AND POPULATION OF ENGLAND AND WALES COMPARED WITH THOSE OF CANADA.

	Population.	*Acreage.*
England and Wales in 1861	18,954,444	32,590,397.
Canada in 1871	3,576,656	2,258,435,200.

NUMBER OF INHABITANTS TO EVERY SQUARE MILE.

In England and Wales	3722.
In Canada	One.

The Canadian farmer must have labour and will give any wages in reason to the labourer.

There is not at present an average of three able bodied men to every hundred acres *under* cultivation.

Every acre additionally reclaimed from the forest requires extra labour in the country.

If you visit Canada and find our average crop below what you have been accustomed to at home, remember it is due to a want of sufficient labour, and not to any deficiency in quality of soil nor to bad climate.

In one Province—Ontario—every farmer, on 20,000,000 acres of land, is crying for more labour, and will pay for it as soon as it can be obtained.

Therefore in Canada, the working man, may be certain of work whenever he requires it, and of remuneration at a high rate.

There is a constant demand for labourers to work on railways.

What chance is there for a labourer becoming a farmer for himself?

Out of 78 million acres of good farming land in one province, only about 20 millions are yet occupied. There are yet 50 millions of land to be taken up by the men who possess the capital of stout hearts and strong arms.

There is no end to the absorption of labour. Every new labourer helps to clear new land; all that we can raise will find ready sale in the markets.

Let the Emigrant observe carefully three points ere he steps over the line to the south.

Our average soil is better than the average soil of the States, such soil as is poor amongst us has been made so by imperfect tillage.

We have abundance of water, and in this are far ahead of the Western States, the Australian Colony and New Zealand, all of which countries are extremely subject to droughts.

Not only have we plenty of water, but we have no stagnant water; and hence there is little or no fever and ague, such as is prevalent in many portions of the Western States.

The lie of our whole land is a gradual slope from the Laurentian range or watershed, north to Hudson's Bay and south to our five great lakes; from the Rocky Mountains, east to our lakes and west to the Pacific.

That the climate is very healthy may be readily seen by our registrations and the general appearance of the people, which is very different to that of the sallow westerner.

Advice to Emigrants.—Work hard. There is before any man in Canada a noble chance to obtain for himself a respectable home, to educate his children and to lay by for his old age. But the way of obtaining such lies through steady industry and strict sobriety.

Be careful of what little store of money you may bring.

The Canadian dollar and the U. S. gold dollar are of equal value; but U. S. paper is not equivalent in face value to gold or to Canadian paper.

The British sovereign is equal in Canadian money to about four dollars and eighty-six cents. There is a slight fluctuation, however in its value, but never more than a few cents.

Therefore to bring sterling pounds into dollars, multiply by 73 and divide by 15; dollars are brought into pounds sterling by the reverse process.

EXAMPLE.

$$\pounds 50 \quad 0 \quad 0 = \frac{50 \times 73}{15} = \$243.33$$

$$\text{And } \$243.33 = \pounds\ \frac{\$243{\cdot}33 \times 15}{73} = \pounds 50 \quad 0 \quad 0$$

Under this head, we show the Government Return of the average wages paid to labourers, and the price of living:—

RETURN OF THE AVERAGE WAGES PAID TO LABOURERS, MECHANICS, &c.

	Per Diem.	By month, with Board.
General Trades.	$ cts.	$ $
Bookbinders and Printers	1 00	15 to 20
Blacksmiths	1 25	20 to 25
Bakers	1 00	15 to 20
Brewers	1 00	15 to 20
Butchers	1 00	15 to 20
Brickmakers	2 00	25 to 30
Bricklayers or Masons	2 00	25 to 30
Carpenters, House	1 50	20 to 25
Do. Carriage	1 50	20 to 25
Cabinetmakers	1 75	20 to 20
Coopers	1 00	15 to 20
Coachmen and Grooms	1 00	15 to 20
Curriers	1 00	15 to 20
Engine-Drivers, per trip	....	....
Farm Labourers, skilled	1 00	15 to 25
Farm Labourers, common	0 75	10 to 15
Gardeners	1 00	15 to 20
Millwrights	1 50	20 to 25
Millers	1 00	15 to 20
Painters, House	1 50	20 to 25
Do. Carriage	1 50	20 to 25
Plasterers	1 50	20 to 25
Plumbers	1 50	20 to 25
Shoemakers	1 00	15 to 20
Sawyers	1 00	15 to 20
Shipwrights	1 50	20 to 25
Stonecutters	2 00	25 to 30
Saddlers	1 25	20 to 25
Stokers, Railroad, per trip	....	....
Tanners	1 00	15 to 20
Tailors	1 00	15 to 20
Tinsmiths	1 00	15 to 20
Trimmers, Carriage	1 50	20 to 25
Wheelwrights	1 50	20 to 25
Whitesmiths	1 50	20 to 25
Foundries and Machine Shops.		
Boilermakers	1 50	20 to 25
Fitters	1 50	20 to 25
Moulders	1 50	20 to 25
Patternmakers	1 75	20 to 25
Rivetters	1 50	20 to 25
Turners	1 50	20 to 25
Woollen Factories.		
Carders	1 50	20 to 25
Designers	1 50	20 to 25
Dyers	1 00	15 to 20
Finishers	1 00	15 to 20
Fullers	1 00	15 to 20
Spinners	1 00	15 to 20
Warpers	1 00	15 to 20
Weavers	1 00	15 to 20
Woollen Assorters	1 00	15 to 20

RETURN OF AVERAGE WAGES, &c.—*Continued.*

	Per Diem.	By month, with Board.
Cotton Factories.		
Card Room Hands	1 00	15 to 20
Overlookers	1 50	20 to 25
Weavers	1 00	15 to 20
FEMALES.		
Cooks	....	8 to 12
Dairymaids	....	4 to 6
Dressmakers and Milliners	....	8 to 12
Household Servants	....	4 to 6
Laundry Maids	....	6 to 8

☞ Take the first reasonable offer you get, until you become better acquainted with the wages of the country.

COST OF LIVING.

List of Retail Prices of ordinary articles of Food and Raiment required by the Working Classes :—

Provisions.	$ cts.		$ cts.
Bacon, per lb.	0 14	Tea, green	0 80
Bread, best white, brown	0 14	Tobacco	0 30
Butter, salt	0 20		
Do. fresh	0 25		
Beef, Mutton, Veal, Pork	0 12	*Clothing.*	
Beer, per quart	0 10		
Candles	0 20	Coats (under) Tweed	6 to 12 00
Cheese	0 15	Do (over) do	8 to 12 00
Coffee	0 25	Trousers, do	4 to 6 00
Corn Meal, per 100 lbs.	3 00	Vests, do	2 to 4 00
Eggs	0 25	Shirts, Flannel	1 to 2 00
Flour, per barrel, first quality	6 to 7 00	Do Cotton	1 00
Do do 2nd do	5 to 6 00	Do (under) "wove"	1 00
Do Buckwheat, per 100 lbs.	3 00	Drawers, Woollen, do	1 00
Fish, dry or green Cod, per cwt.	6 00	Hats, Felt	1 50
Firewood, per cord	7 50	Socks, Worsted	0 50
Ham, per lb.	0 15	Do Cotton	0 25
Shoulders, per lb.	0 14	Blankets	4 to 6 00
Herrings, per barrel	5 00	Rugs	2 to 4 00
Mustard, per lb.	0 20	Flannel, per yard	0 30
Milk, per quart	0 05	Cotton Shirting, per yard	0 20
Oatmeal, per 100 lbs.	3 00	Sheeting do	0 25
Pepper, per lb.	0 20	Canadian Cloth do	1 00
Potatoes, per bushel	0 40	Shoes, Men's	3 00
Rice, per lb.	0 05	Do Women's	2 00
Soap, yellow, per lb.	0 05	Boots, Men's	4 00
Sugar, brown	0 10	Do Women's	3 00
Salt, per bushel	1 00	India Rubber Overshoes, Men's	1 00
Tea, black	0 80	Do do do Women's	0 75

Rents are moderate, and good board and lodging may be obtained for about $3.00 per week.

Clothing is about 25 per cent. dearer than in Great Britain; but good clothing, suitable to the country, may be obtained at reasonable prices.

In short, living in Canada is cheap, when compared with Great Britain or the United States.

THE PROPORTIONS OF THE PRINCIPAL NATIONALITIES FROM WHICH THE INHABITANTS OF CANADA ARE DRAWN ARE:—

	Ontario.	Quebec.	New Brunswick.	Nova Scotia.
African or Negroes	13,435	148	1,701	6,212
Dutch	19,992	798	6,004	2,868
English	439,429	69,822	83,598	113,520
Irish	559,442	123,478	100,643	62,851
Scotch	328,889	49,458	40,858	130,741
Welsh	5,282	283	1,096	1,112
French	75,383	929,817	44,907	32,833
German	158,608	7,963	4,478	31,942
Indian	12,978	6,988	1,403	1,666
Jews	48	74	3	......
Other Nationalities	7,365	2,687	903	4,055
	1,620,851	1,191,516	285,594	387,800

THE PROPORTIONS OF THE PRINCIPAL RELIGIOUS DENOMINATIONS.

		Ontario.	Quebec.	New Brunswick.	Nova Scotia.
Church of England		330,995	62,449	45,481	55,124
Catholics, Roman		274,162	1,019,850	96,016	102,001
Methodists..	Methodists	8,128	4,363	3,439	1,662
	Wesleyan	286,911	26,737	26,212	38,683
	Episcopal	92,128	1,274	83	403
	Primitive	24,045	48	1	27
	New Connection..	30,889	1,546	......	1
	British Episcopal.	1,824	13	......	......
	Calvinists	44	15	......	1
	Bible Christians..	18,225	104	121	94
Without Creeds..	Atheists	19	1	......	......
	Deists	239	43	55	72
	No Religion..	4,650	376	76	44
Other Denominations		548,392	74,697	114,110	189,688
		1,620,851	1,191,516	285,594	387,800

Imports and Exports,

Showing the rapid progress of Canada in 20 years.

Years.	Total Trade.	Years.	Total Trade.
1850	$29,703,497	1860	$68,955,093
1851	34,803,461	1861	76,119,843
1852	35,594,100	1862	79,398,067
1853	55,782,739	1863	81,458,335
1854	63,548,515	1864—half-year	34,586,054
1855	64,274,680	1864–5	80,644,951
1856	75,631,404	1865–6	96,479,738
1857	66,437,222	1866–7	94,791,860
1858	52,550,461	1867–8	119,797,879
1859	58,299,242	1868–9	130,889,946

*** *Mark the last three years.*

1869–70	$148,387,829
1870–71	170,266,589
1871–72	194,070,190

The increase alone in these three years is almost as large as the total trade in 1850.

Exports in 1871–2.

Products of the Forest	$23,685,382
Do Agriculture	13,378,562
Animals and their Products	12,416,613
Produce of the Fisheries	4,348,508
Do do Mines	3,926,608
Manufactures	2,389,435

Showing the Value of the Forest Produce Exports.

Ashes—Pot	$578,814
Do Pearl	59,430
Timber—Ash	68,499
Birch	173,045
Elm	229,849
Maple	4,429
Oak	1,280,420
White Pine	4,155,974
Red do	387,976
Tamarac	9,720
Walnut	51,003
Basswood—Butternut—Hickory	524,510
Standard Staves	16,538
Other Staves	296,290
Battens	2,838
Knees and Futtocks	3,433
Scantlings	256,343
Deals	5,113,978
Deal Ends	25,193
Planks and Boards	8,527,249
Spars	227,602
Masts	13,225
Handspikes	149
Laths	161,145
Lathwood	9,490
Firewood	469,781
Shingles	240,730

Shingle Bolts	31,908
Stave Bolts	7,440
Oak Logs	8,028
Spruce Logs	27,559
Pine Logs	28,763
Sleepers and Railway Ties	194,698
Oars	2,451
Other Woods	496,165
	$23,685,381

THE FINANCIAL ASPECT OF CANADA.

The net debt of the Dominion in 1871, deducting assets, was $77,706,517.65 ; the net interest $5,302,812.80 ; the average rate of interest 5·54 per cent.

The net debt amounts to $21.72 per head of population, and the net interest to 1.20 per head.

The whole debt has been incurred for the construction of practical public works ; none by war.

THE STATISTICS OF BANKS.

Years.	*Paid up capital.*	*Deposits.*
1868	$28,529,048.	$30,168,536.
1869	29,651,674.	36,671,432.
1870	31,450,597.	50,229,788.
1871	36,415,210.	55,763,066.
1872	45,134,609.	64,720,489.

The combined Government and Bank circulation at the end of the last Fiscal year 1871-72 amounted to $35,090,348.

The Climate we will dwell but shortly on.

The most southern part of Canada is on the same parallel as Rome, in Italy; Corsica in the Mediterranean, and the northern part of Spain. The Northern shores of Lake Huron are in the latitudes of Central France, and vast territories not yet surveyed, embracing many million acres of land of good quality lie south of the parallel of the northern shores of Lake Huron where the climates are favourable to the growth and ripening of all the staples of the temperate zones.

But it is more practical to test the climate by what will grow under its influence.

WHAT WILL GROW TO PERFECTION IN CANADA.

Wheat.—A. 1. Canadian Flour is equal to any, and superior to most samples in Liverpool market.

Barley.—Sown in spring, a certain crop; and forms a regular crop in most rotations.

Peas and *oats* grow and mature well; the former much grown for the value of its straw.

Indian corn or maize ripens with certainty and produces from 20 to 40 bushels per acre, according to cultivation.

Flax, hemp, tobacco, buckwheat, Hungarian grass, millet, and *artificial grasses*; also every kind of *roots, potatoes, turnips carrots, sugar beets, mangolds &c., &c.,* with *tomatoes, peppers, Chinese yams* and other tropical roots and vegetables.

Apples.—Can rival the whole world.

Grapes, peaches, plums, melons, cucumbers, tomatoes, pumpkins, strawberries, and all the berries grow and ripen in the open air.

Now to quiet the doubts of those who are doubtful as to which choice they will make, the United States or Canada, we will quote from a lecture delivered by the author in 1870, before a large audience in Gloucester, England.

COMPARISON BETWEEN THE U. S. AND CANADA.

In nine years, we found that Ontario added from 46 to 65 per cent. to her population, while in the same nine years the United States only added from 35 to 58 per cent. That in nine years she added sixty-four cultivated acres to every hundred acres in cultivation in 1852, while the United States and territories, in ten years from 1851, only added forty-four acres to every hundred.

That the cash value of her farms per head of her population was greater in Canada than in the United States. That the value of her farms was greater by nearly six dollars per acre.

That the capital invested in agricultural inplements was greater in Ontario than in the United States in proportion to the breadth of land cultivated in each country. That she grew more wheat in 1860 (the year of the census) than any State in the Union. That she was greatly a-head even of the Western States as a wheat producing country. That in proportion to population she had more capital invested in live stock than the United States. That for every 100 of her population Ontario owned twenty-seven horses, and the United States only twenty; of sheep eighty-four and the U. S., only seventy-one; of milch cows thirty-two, and the U. S., only twenty-seven. That in 1860, she produced more than 19 lbs. of butter for every inhabitant and the U. S., only 15 lbs; of wool 2¾ lbs., for each inhabitant, and the U.S., 2lbs.

THE EDUCATIONAL SYSTEM

Is of such a nature, that the poorest may, indeed must, for the compulsory clause is now law, obtain a sound practical education for his children.

THE WAYS OF OBTAINING LAND.

First.—By Free Grant from the Government.

Second.—By purchase of wild lands now in the hands of private individuals or companies.

Third.—By purchase of improved farms, varying in price according to their situation and state of improvement.

Free Grants.—In the Provinces of Quebec, Ontario, New Brunswick, Nova Scotia and British Columbia, the free grant lands are held by the several Provincial Governments.

In Manitoba.—The valley of the Saskatchewan and the rest of the North-West Territory, the free grant lands are yet held by the Dominion Government.

In Nova Scotia.—There are now nearly four million acres of ungranted lands. The price of these lands is $44, (£8.16s. sterling) per 100 acres. No distinction is made in the price between 100 acres and smaller lots. Any quantity over 100 acres must be paid for at the rate of 44 cents per acre. The cost of survey is defrayed by the Government.

In Quebec, there are now nearly six million acres of farming land offered for sale by the Government at the rate of from 30 cents to 60 cents per acre (15d. to 2s. 5½d., sterling). The terms of sale are : One fifth of the purchase money is required to be paid on the day of sale, and the balance in four equal annual instalments,. bearing interest at six per cent. The surveys and roads are at the expense of the Government.

The purchaser must take possession of the land sold within six months of the date of sale, and must occupy it within two years. He must clear, in the course of ten years, ten acres for every 100 acres held by him, and erect a habitable house of the dimensions of at least 16 feet, by 20 feet. The letters patent are issued free of charge.

On eight of the great Colonization Roads, 84,050 acres are set apart as *Free Grants*—in lots of 100 acres each. Any person over eighteen years of age may demand a permit of occupation from any Crown Lands Agent; and if, at the end of four years, he has cleared twelve acres and built a house, the land is *freely granted* to him under a Crown Patent.

The parts of the Province of Quebec, now open to colonization, are the valleys of the Saguenay, St Maurice, and the Ottawa, the Eastern Townships ; the Lower St. Lawrence, and Gaspe.

Province of Ontario.—Has thrown open about three million of acres, included in fifty-three townships, as *free grant lands.* Every head of a family can obtain, *gratis,* two hundred acres of land, and any person, of eighteen years of age, may obtain one hundred acres in this district. As this offer is made without distinction of sex, a large family may obtain a large block of land. These free grants are made under certain settlement duties, which are: to have fifteen acres on each grant of one hundred acres cleared and under crop, of which, at least two acres must have been cleared and cultivated annually for five years; to build a habitable house, at least twenty feet by sixteen feet; and to reside on the land at least six months in every year.

Province of Manitoba.—In this Province the Government of the Dominion gives free grants of one hundred and sixty acres, subject to conditions similar to those imposed by Ontario under the free grant system, with the exception that the age must be twenty-one, and the number of years to elapse before the issue of a deed from the Crown to be three years.

Dominion Lands, in the Province of Manitoba and parts adjacent, may be purchased at any time at the rate of $1 (4s. 2d. sterling) per acre, but not more than six hundred and forty acres, being one square mile, may be purchased by one person.

For further particulars, let the emigrant apply to the Government Agents, whose instructions are to give him every information.

ADVICE TO EMIGRANTS.

There is much hard work before any man who would shoulder his axe and locate himself in the backwoods.

There are not many emigrants who are suited to follow out such a course. The art of chopping, the mysteries of logging, burning, clearing, and, above all, living in the backwoods, have to be learned. Should the emigrant determine to proceed direct to the bush he must purchase his experience; and it should then be his object to buy such as cheaply as possible.

The backwoods are the natural heritage of the Canadian, and life in them should not be lightly undertaken by any but such men as have served their apprenticeship to Canadian habits and ways.

On the other hand, the ambition that prompts the emigrant to go to the woods and hew out a home and an independence is worthy of all encouragement.

After five years have expired, and the duties have been performed in regard to settlement (and these must be years of steady work and close economy), then the emigrant will have a considerable clearance, a warm house and comfortable buildings, and a property, his own absolutely, with an unimpeachable title direct from the Crown; and, should the locality have been chosen with judgment, the property will be ever increasing in value, as emigration increases, roads are made, and markets are opened up.

But the backwoods settler cannot go into a new grant devoid of cash. He should have at least £50, because it is evident that upon his wild land he can have but very small returns of crop for the first year or so.

We should strongly advise the emigrant, who brings out such a sum or even more, to place it in a savings bank, where it will be perfectly safe, and will draw from four to five per cent., and hire himself out, at least for a year, with a farmer, before he attempts to go to the backwoods.

It is true that he will thus be retarded somewhat in gaining the object of his ambition—a clear title to a property—but that year will be very profitable to him in affording such experience as will save him many a shilling when he finally settles in the bush.

The following are a few of the many advantages to be gained by following such a course :—

First.—He will learn to know one kind of wood from another, an indispensable knowledge, for the only means of judging of the nature of the soil, are by the quality and class of the timber which naturally grows thereon.

Secondly.—In a choice of land from among some millions of acres, the experience gained by a year's residence in Canada will be found of immense advantage.

Thirdly.—It is upon the settler's judgment in his choice of *locality* that his future prospects will very greatly depend.

Fourthly.—He requires to have very many old-country prejudices rubbed off before he mix in the society of Canadian forest pioneers.

Fifthly.—He will obtain an insight into the value of staple articles, a ready knowledge of the currency of the country, and of the kind, amount and quality of stock to be laid in for a residence in the remote settlements.

Sixthly.—As an old countryman, "unco canny" though he may have been at home, he is green and inexperienced among backwoodsmen, and there are many, even amidst the innocence and natural purity of the woods, that would not hesitate to take advantage of him.

Seventhly.—It is far more profitable to be paid, whilst obtaining necessary experience, than to be compelled to purchase it.

Eighthly.—After working in Canada for a time, the emigrant may change his mind, and consider that the profits to be saved from wages, added to his little capital already in security, hold out sufficient inducements to persevere as a hired man, and in the future rent a farm in a more improved section of the country, or engage in some other business.

When the locatee—to use the Government name for a settler—is installed; his first duty will be to build a habitable dwelling, and to lay in such a stock of necessaries as may be requisite.

September is the best month in which to settle, for there is then time, and the harvest being over, he can obtain help to build a house and get comfortably ensconced ere the cold winter set in.

A log house, such as is usually built in the backwoods, would cost, if put up by contract, about £5 sterling; but with the assistance of the neighbours, which is always readily exchanged, it may be erected for very much less.

The walls of the shanty are composed of rounded logs, generally oak or elm, cut in the woods, of the full length of each side, let into and resting on one another at the extremities.

The interstices are filled with mud, and the inside roughly plastered.

The roof is covered with birch bark slabs, or basswood troughs or wooden shingles.

The chimney and the requisite furniture put a finish to the house, rough, it is true, but warm and comfortable.

There are required for the winter, a supply of cured pork, a few hundredweight of flour, and a stock of oatmeal, potatoes and groceries.

To keep the potatoes, a roothouse is generally built.

A yoke of oxen, a milch cow and a couple of hogs, make the usual live stock with which to commence operations.

But there is a time in the dreary lengths of winter, when every settler must feel lonely, and perhaps becomes home-sick; at times, he will be shut out, for days, by impassable roads, from all communication with his neighbours.

Beware of whiskey. Whiskey is the curse of Canada. Not only is the habit of intemperance a stumblingblock in the way of success in life, and the ruin of man, both here and hereafter, but the stuff that is in America dignified by the name of "spirits" is so adulterated that it can be rightly called by no other name than "rank poison."

Canada shows, in proportion to her population, an immense amount of crime, disease, accidents and loss of life, through the agency of drink; and it has been a fact well observed, that the drunkard who soaks himself with Canadian whiskey very quickly runs his course.

It takes but a short time for that poison to convert a strong, healthy man into an object upon whom is plainly stamped the fate of a premature and loathsome death.

Let the settler work steadily and keep sober, a slow but sure and happy independence is before him.

To-day the settler is one of a few isolated inhabitants; in a few short years his neighbours will have increased by the score.

Let him take care to assume that lead which his position offers.

Let him work for his own good and for the general welfare of his neighbourhood, that he may earn the right to be considered the brave pioneer to those who will undoubtedly soon follow him to the woods and, in his wake, will convert the wild waste places into a flourishing and influential section of the country.

It will be his duty to introduce the regular worship of God in the new land.

A few energetic members will soon raise and support His holy temple, even in the depths of a Canadian bush.

Look around you when you first land in Canada. As you travel through the richest, most perfectly cleared and best cultivated section of the agricultural portions, remember that forty years ago these noble farms were but slashings in the deep woods, that the men who now live in those handsome houses, that own those large and valuable herds, and whose sons now fill the senate and the bar, the pulpit and the counting house, were, not so very many years ago, but poor emigrants like yourself.

They struggled through difficulties, avoiding extravagance and intemperance, to wealth and sterling independence. Your chances in these days of wealth and railway enterprise are far better than were theirs.

BUYING FARMS IN CULTIVATED PARTS.

To the Old Country Farmer as an Emigrant.

There are many tenant farmers in England who would gladly move to a new country, but they cannot summon up sufficient courage to leave their old homes, break off their old habits, and commence life again in a far, and to them unknown land.

Let such, or any who should bring out capital to invest in farming in Canada, beware of some of the errors, to which they are liable in this new sphere of action.

Bigotry and prejudice must be cast aside by any man who would lead in a new country. What our fathers and our fathers' fathers did in England will have no weight, apart from that given by intrinsic worth, out here.

If you come to Rome, you must adapt yourselves to Roman customs.

We live under a different clime. Your ways must be adapted to our manners and customs.

You cannot get us to array ourselves blindly under your old fashioned ideas of socialism or of agriculture. Cast off all your old fashioned prejudices.

As you come to labour on a different soil, and under a different face of nature, you must adapt your ways to those of a different country.

You, who have been accustomed to have everything done for you by servants, must turn to with a will yourselves out here.

Labour is very scarce in all new countries, and men, if they have reason to dislike a place, have no difficulty in obtaining new situations. Farm labourers here are accustomed to see the farmer work; here we have to lead, and cannot put our trust altogether in *orders*. It will not pay in haying and harvest to ride round the farm on "the cob," and pay ten shillings a day and board to your substitute.

The season for securing is short, wages are high, and labour at that time invariably scarce: every available hand is then required to safely house the crops.

Beware of *high improvement*. It will unquestionably pay in the end, but labour is scarce and wages dear. High farming must be cautiously engaged in.

The money required at home to properly stock a rented farm will purchase a good farm in Canada and yet leave sufficient capital with which to stock and on which to work for a few years, until the new comer gets into the ways of the country.

Let a man have been ever so good a husbandman at home, and understand thoroughly both the theory and practice of farming there, yet he has much to learn in a new country, much that can only be *bought* by experience. We know how different are the systems of farming in the Severn valley and that adopted on the plains of Norfolk.

Equally distinct are the systems upon which Canadian and old country agricultures are based; and there is moreover to be learned the differences of customs, of manners and of habits. To the man who is ground down under a harsh landlord, or who feels that the rent which he pays is far beyond its proper rate, we would say, by all means, come to Canada: but remember that, without steady industry, sober habits, and above all, a determination to study and fall in with the ways of the country, he cannot better himself by emigration.

Follow these, and you cannot fail to become a substantial yeoman, perfectly independent, and in a position to better your circumstances every year; and by giving your children the benefits of a good education and a fair start in the world, will live to bless the day when you became a landowner in the new country in place of a tenant in the old.

Good farms may be bought at various prices. Near our best markets, say on the lines of the main railways, at the ports and near the centres of trade, farms are usually worth from £10 to £20 per acre, the price varying with the state of cultivation and the value of the permanent improvements.

Moving back into a rougher, *i.e.*, less thoroughly cleared country, land may be bought, moderately well fenced, with or without buildings, at figures ranging from £4 to £8 per acre, the value being in great part governed by the species and quantity of the timber, the quality of the soil, and the amount of land under cultivation.

There are also government lands and lands in the hands of private companies sold at prices of about one dollar or (4s. 2d. sterling) per acre.

THE YOUNGER SONS OF ENGLISH GENTLEMEN, AS FARMERS IN CANADA.

Many gentlemen in England, who have younger sons to start in life, turn for that purpose to the Colonies. Many younger sons of gentlemen have, of late years, come to Canada.

Many of such men (especially where they have been brought up in towns) are scarcely fitted for the position of a Canadian farmer.

Their appreciation of the freedom and happiness of a country life is not generally sufficient to compensate for the loss of society, the steady hard work, economical habits, and very gradual independence which accompany the career of the Canadian farmer.

Unless a man becomes wedded to his farm, loves to be at work, and takes the greatest interest in the welfare of his stock and the growth of his crops, he simply throws himself away in coming to farm in this country.

Some have bought farms, settled down, and are doing well; others have become disgusted, and have either sought situations in towns, where, be it remembered, they have no influential friends to back them, or have returned to their homes.

Of the last two classes, the latter have, doubtless, been the wiser, for they have tasted colonial life and will, at least, know how to value any good thing that they may drop into at home.

Experience has been bought, and, if not paid for at too dear a rate, parents need not consider their money to have been altogether wasted.

For our own part, we consider that the gentleman who lives on his farm here has no reason to envy the man in the best of situations; but to act up to such a way of thinking, steady industry and strict economy must be practised.

Any young man coming out here to practise farming must be determined to *work hard* and *live cheaply*, or he cannot succeed.

Gentlemen must remember that their sons who come to farm in Canada lose many of the luxuries of home life, will see but little society, and will, in everyway, lead a widely different life from that to which they have been accustomed.

Parents cannot be too careful not to force their sons to a farmer's life in Canada, for there are few countries in which there are less restraints upon a young man, or more temptations to lead him "to the dogs."

At the same time, a year or two in Canada, should he remain no longer, will be found no bad "finish" to a gentleman's education.

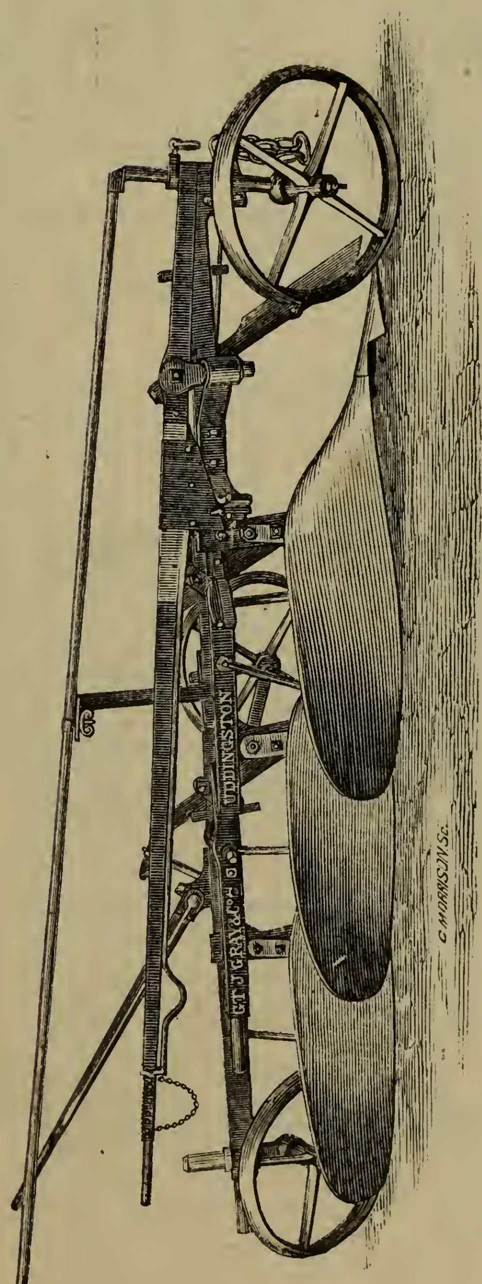
THE LABOUR REQUIRED IN CANADA.

The Department of Agriculture caused a number of circulars to be sent to different parts of the Dominion, to ascertain the number of immigrant labourers, of various kinds, required. The returns were imperfect; but, from a compilation of those sent in, we find the following numbers were required:

Province of Ontario	91,621
" " Quebec	27,336
" " New Brunswick	13,476
" " Nova Scotia	13,870
" " Manitoba	312
Total.	146,615

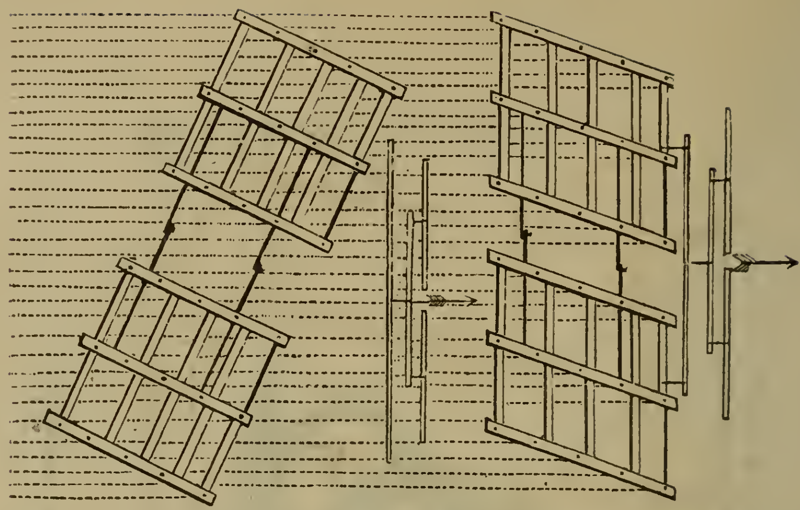
These figures do not include the requirements of contractors for the public works (Pacific Railway, &c.) to be undertaken.

APPENDIX.

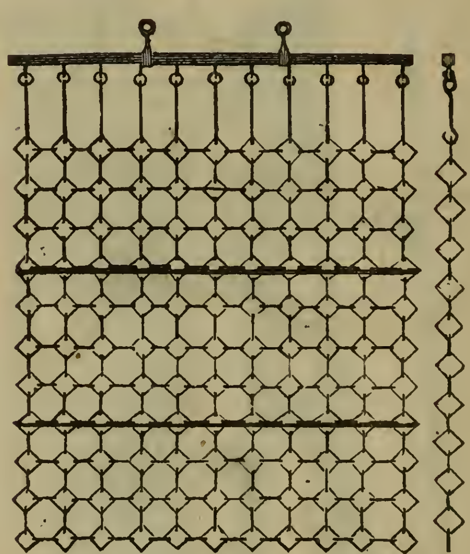


GRAY'S TRIPLE FURROW PLOUGH. (See p. 473.)

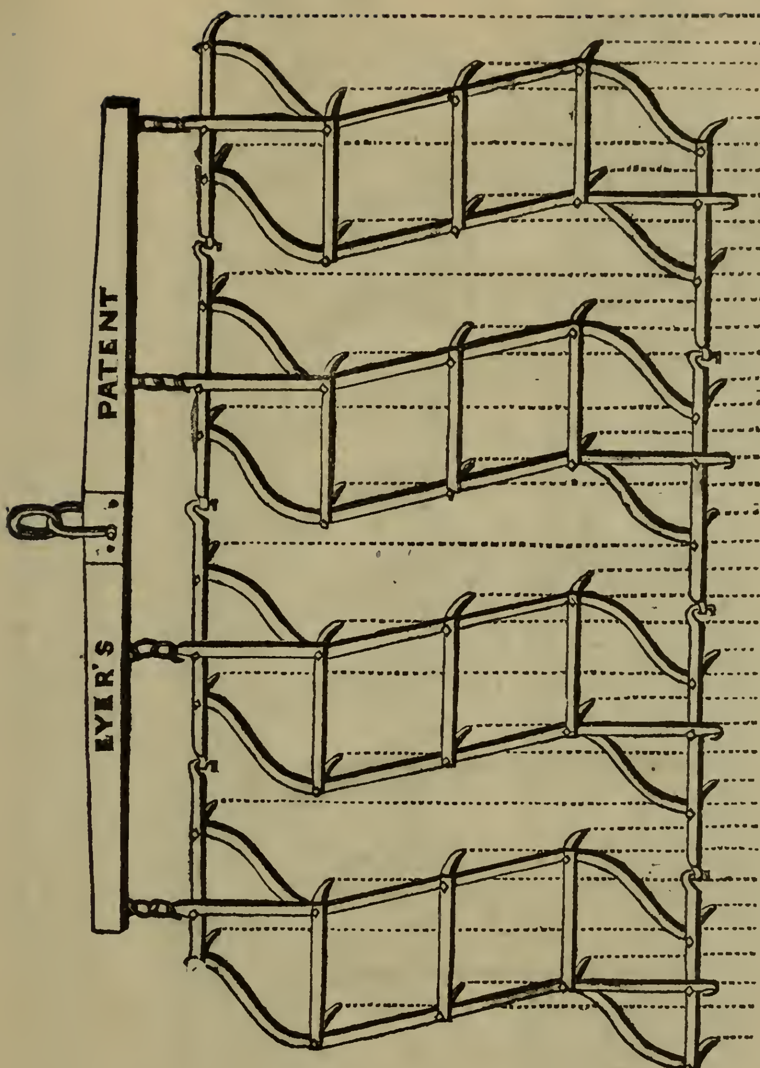
N. B.—A later and superior pattern (combining Gray's and Pirie's Patents) is manufactured expressly for, and can be obtained from Mr. William Rennie, Toronto, Canada.



RHOMBOID AND STRAIGHT-DRAWING HARROWS. (See p. 473.)

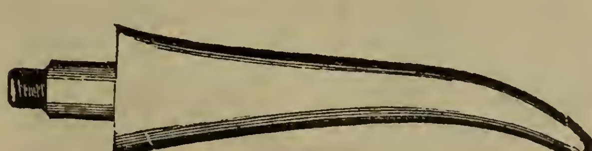


CHAIN HARROW. (See p. 474.)

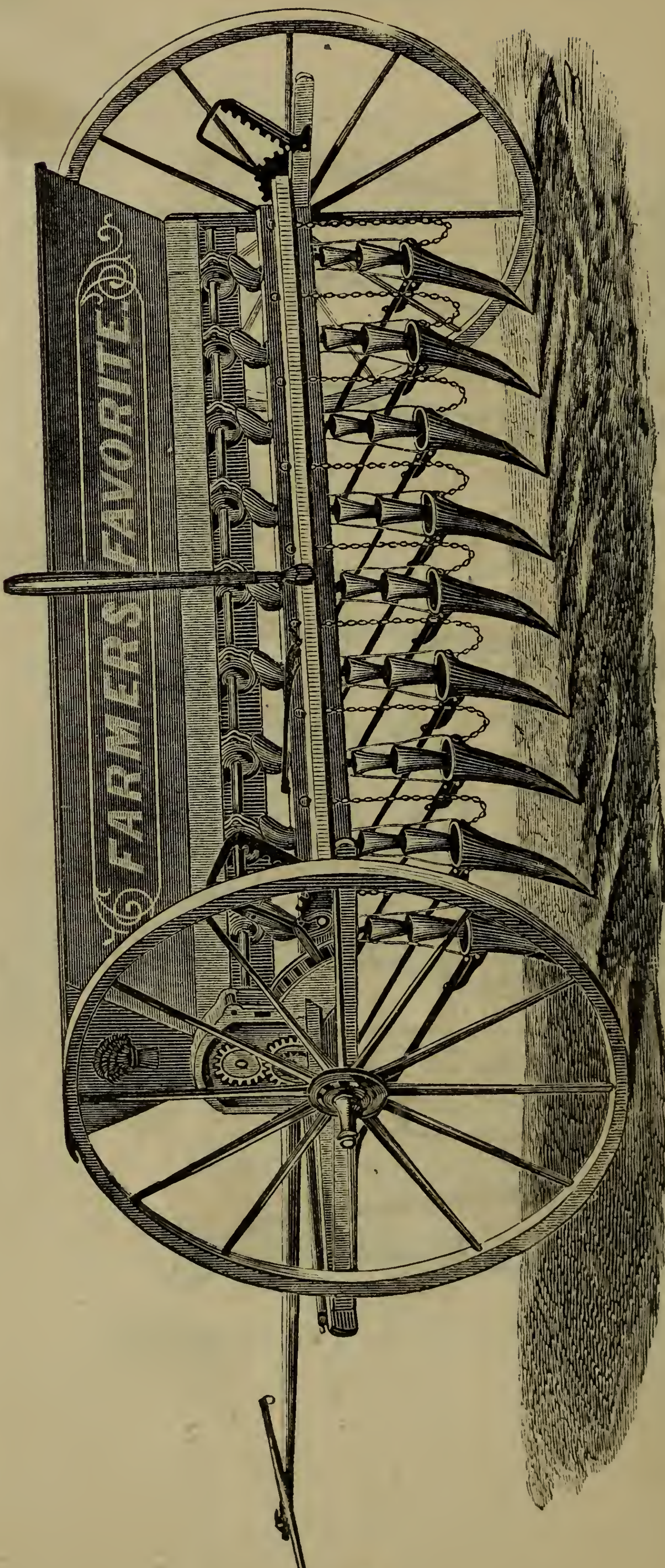


EYER'S PATENT HARROW. (See p. 474.)

A smoothing Harrow when drawn with convex side of teeth; a thorough Grubber and Cultivator when reversed. Mr. Wm. Rennie, Toronto, is the exclusive general Agent.

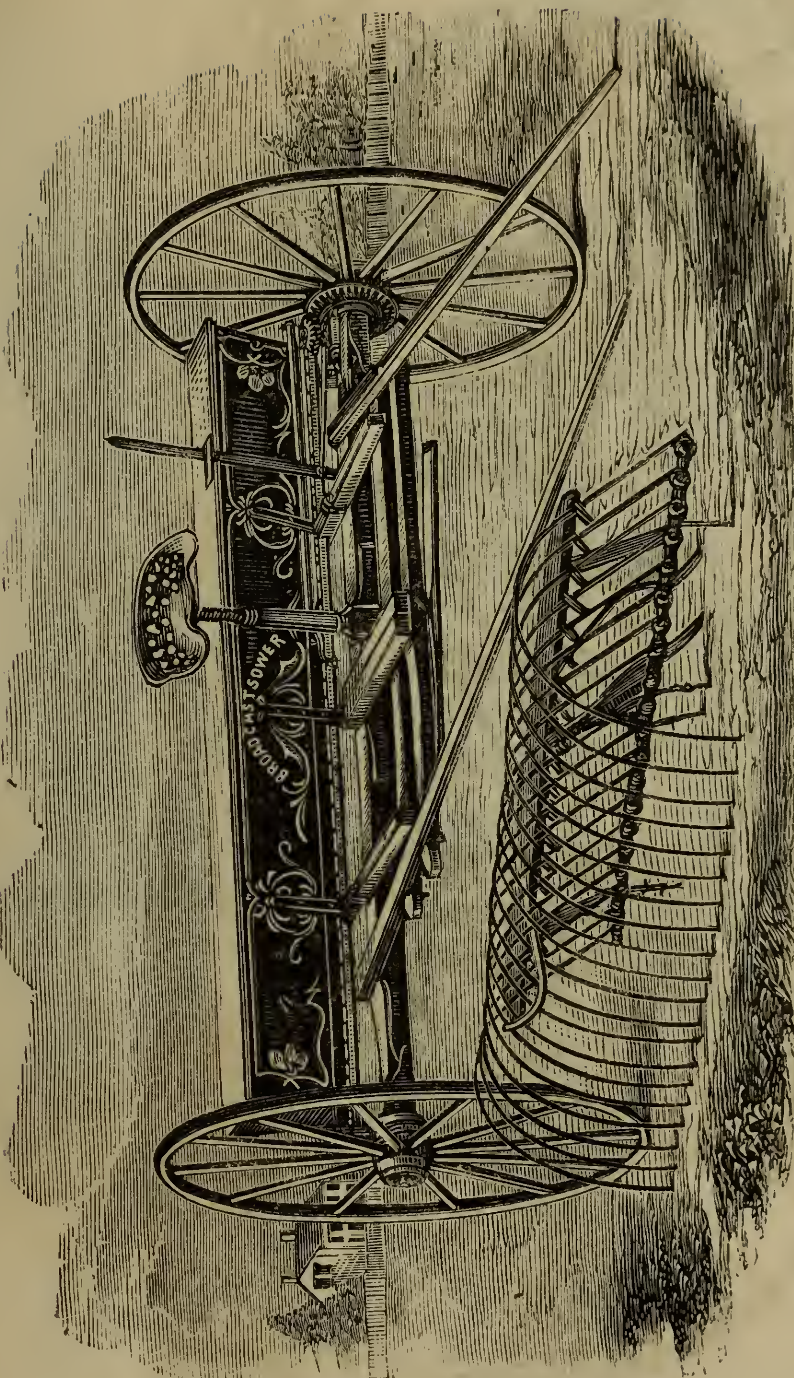


TOOTH OF EYER'S PATENT HARROW. (See p. 474.)



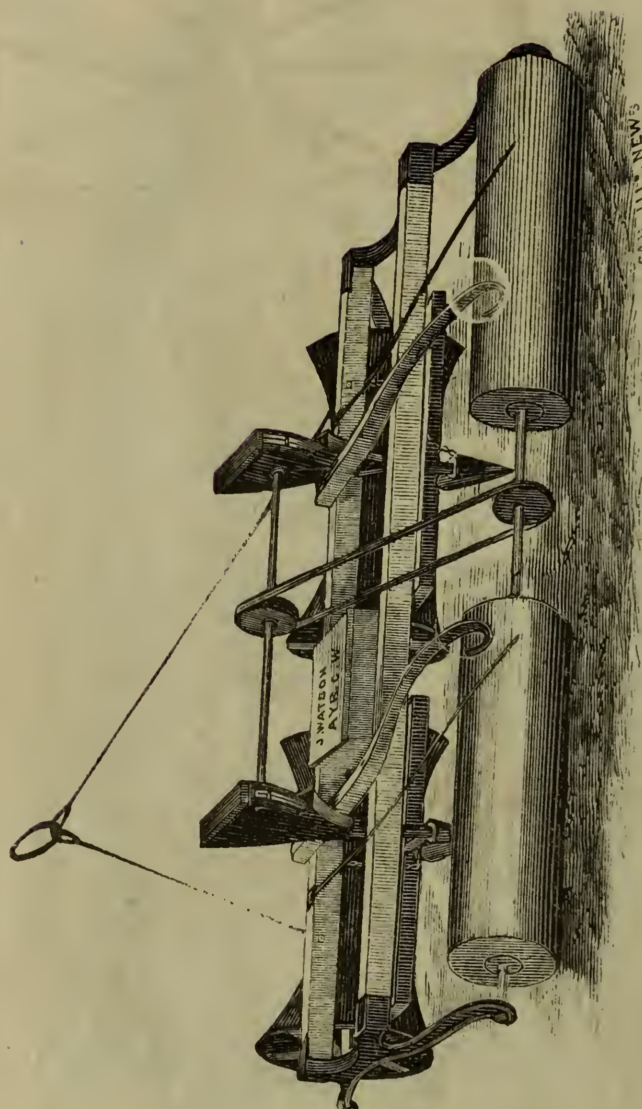
IMPROVED GRAIN DRILL. (See p. 479.)

Manufactured for, and supplied by Mr. William Rennie, Agricultural Warehouse and Seed Store, Adelaide Street East, Toronto, Ont.



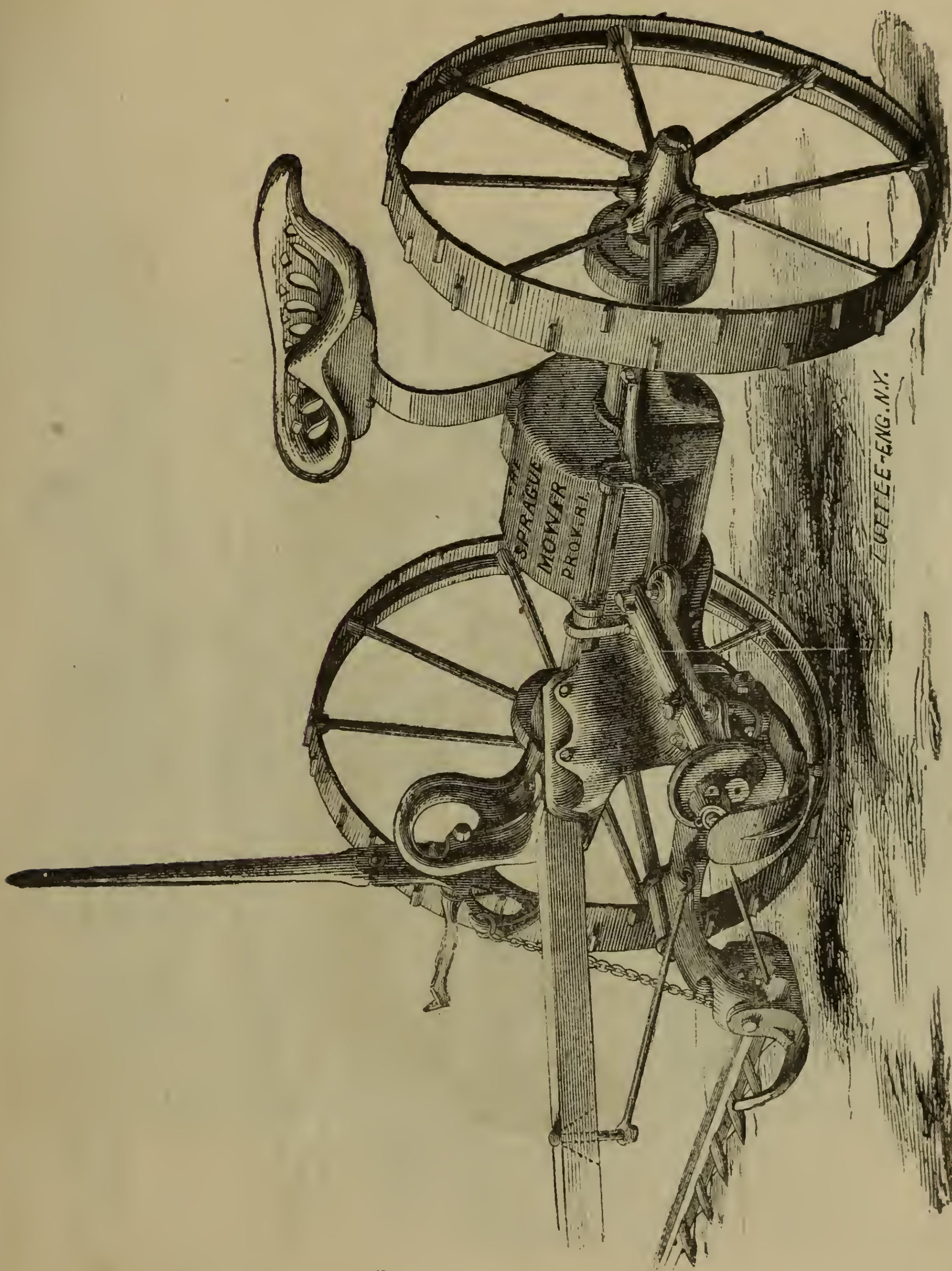
REENNIE'S BROADCAST SOWER. (See p. 479.)

The Rake Frame Attachment, which is very suitable for the purpose, as furnished in connection with Broadcast Sower can be procured either combined or singly, from Wm. Rennie, Toronto, Ont.



IMPROVED TURNIP AND SEED SOWER. (See p. 479.)

Manufactured by John Watson, Ayr, and for sale by William Rennie, Toronto, Ont.



SINGLE MOWER, WITH FORWARD CUTTING BAR. (See p. 491.)

The Sprague Mower was introduced in Canada by Mr. William Rennie, Toronto, about four years ago, and which he continues to offer at Agricultural Warehouse and Seed Store, corner Adelaide and Jarvis Streets.

THE CAYUGA CHIEF. (See p. 491.)

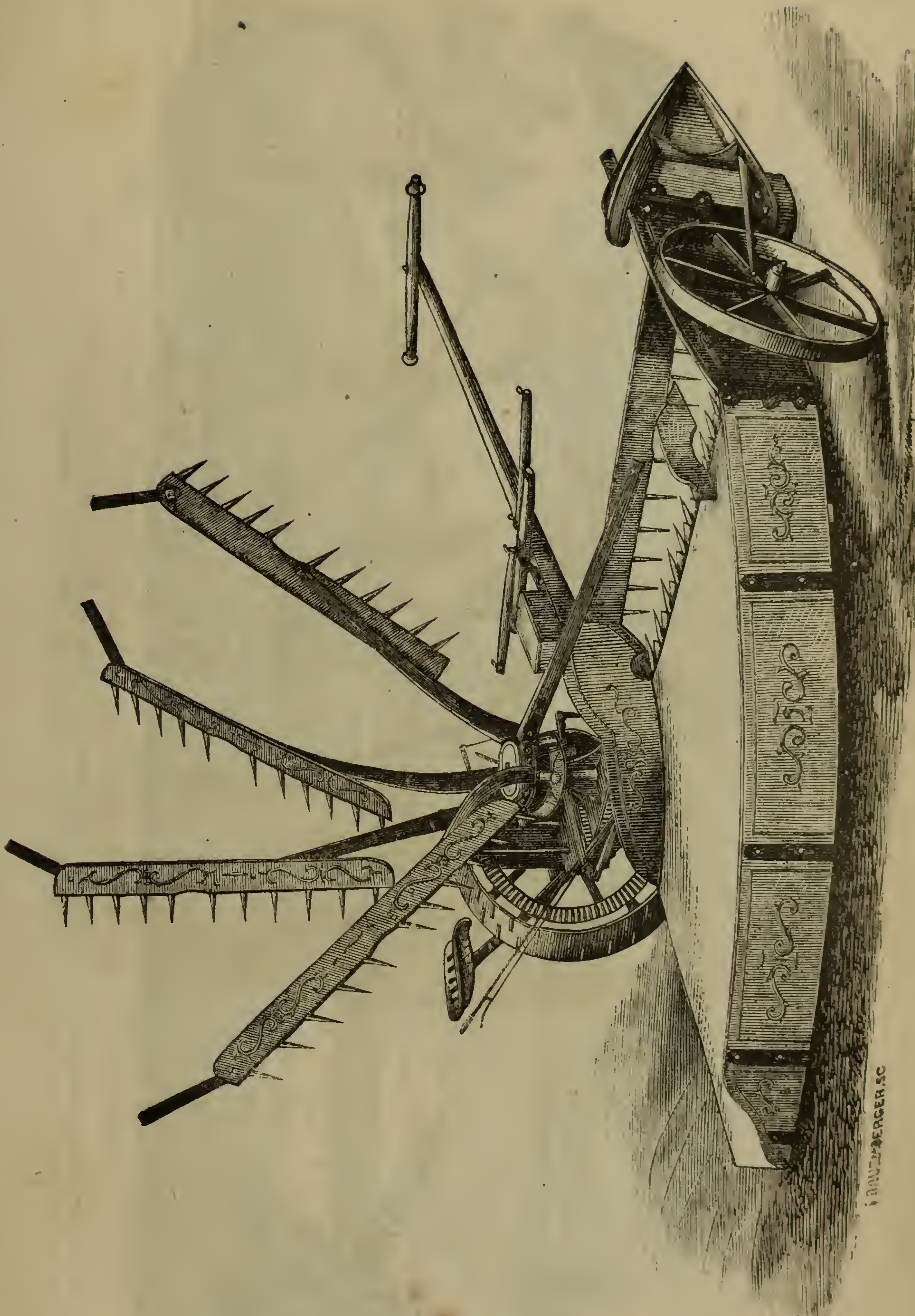
This Machine, with the valuable improvements recently added to it, is sold by Mr. Wm. Rennie, Agricultural Warehouse and Seed Store, Toronto, Ont.

AYR CLIPPER, MOWING. (See p. 491.)

Manufactured by John Watson, Ayr, and for sale by Mr. William Rennie, Toronto, Ont.

AYR CLIPPER, REAPING. (See p. 491.

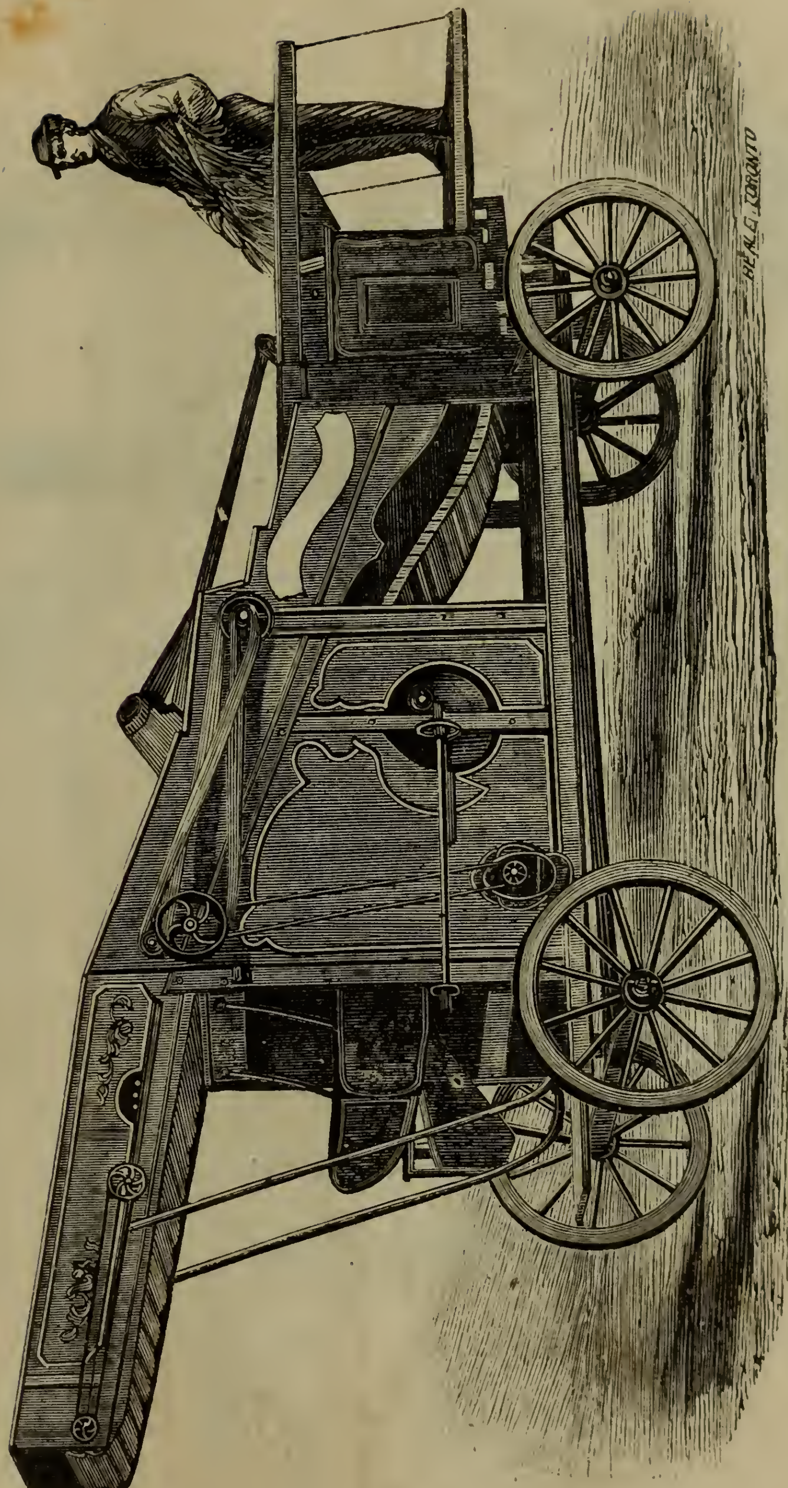
Manufactured by John Watson, Ayr, and for sale by Mr. Wm. Rennie, Toronto, Ont.



THE JOHNSON SELF-RAKE. (See p. 492.)
Address orders to Mr. William Rennie, Toronto, Ont.

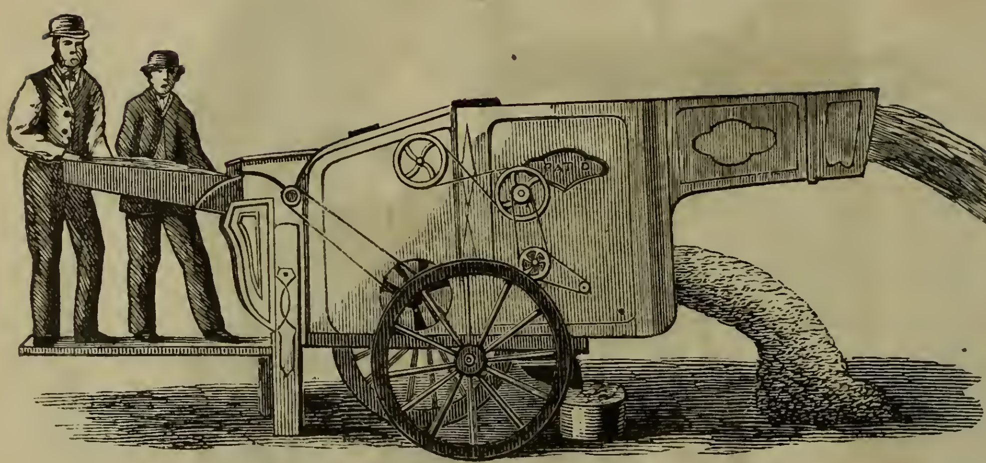
THE KIRBY COMBINED—A SELF-RAKING REAPER (BURDICK RAKE). (See p. 492.)

This Machine was awarded the First Prize for progress, at the World's Exhibition, Vienna, 1873. For sale by Mr. Wm. Rennie, (Agent), Agricultural Warehouse and Seed Store, Adelaide Street, Toronto, Ont., Canada.



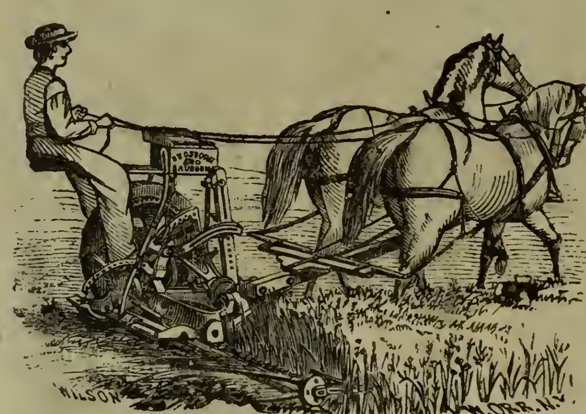
IMPROVED TEN HORSE PITT'S SEPARATOR. (See p. 493.)

Manufactured by John Watson, Ayr, for sale by Mr. William Rennie, Toronto, Ontario.



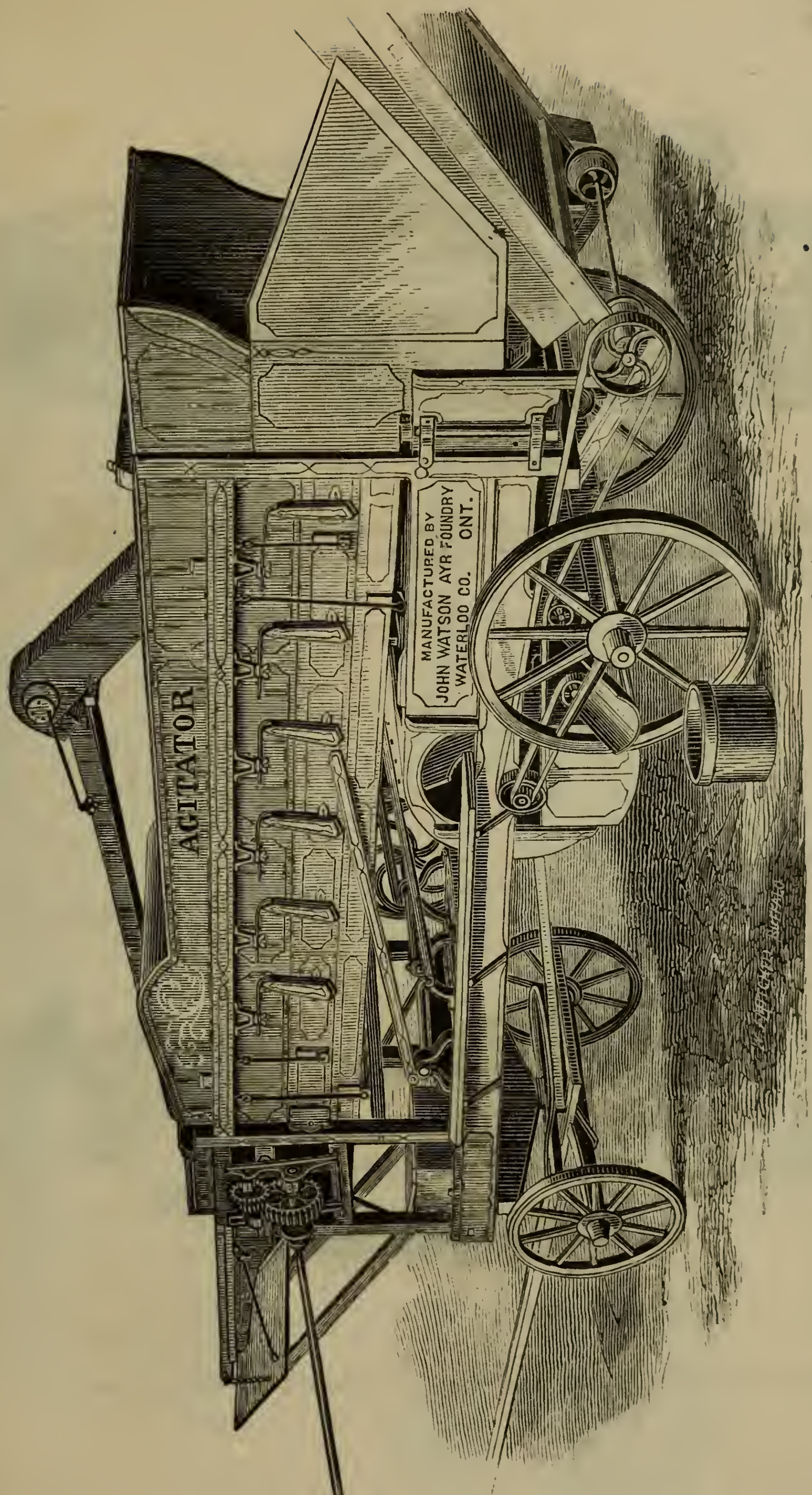
THE LITTLE GIANT THRESHER AND SEPARATOR. (See p. 494.)

Mr. William Rennie, Toronto, Ont., gives further information respecting this Machine on pages 55 and 56 of his Illustrated Catalogue (Fifth Edition), a work to which our readers are referred.



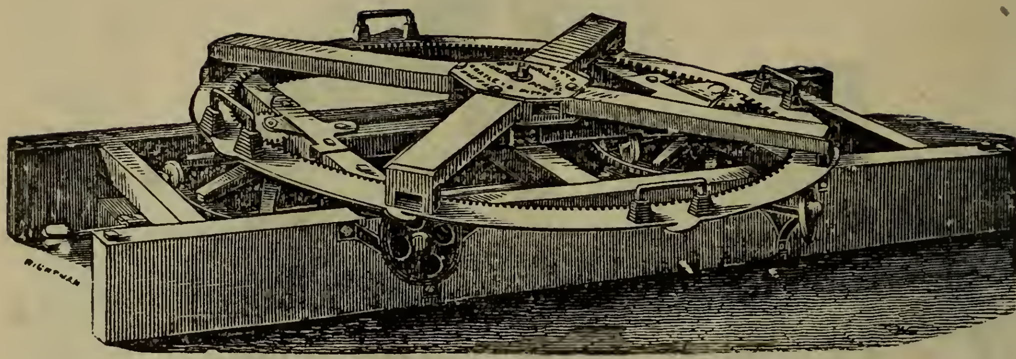
THE KIRBY AS A MOWER, WITH CUTTING BAR IN REAR. (See p. 491.)

For sale by Mr. Wm. Rennie, Toronto, Ont.



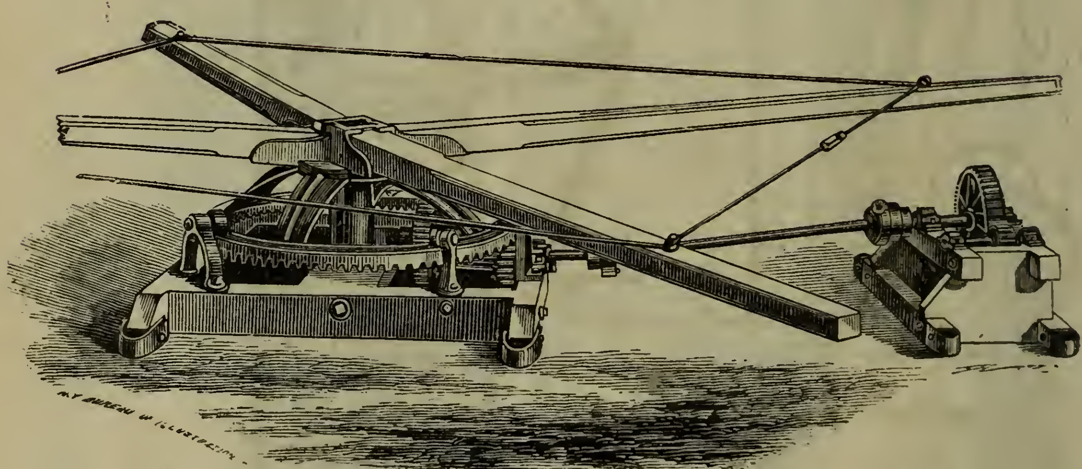
THE AGITATOR. (See p. 495.)

Manufactured by John Watson, Ayr, for sale by Mr. William Rennie, Agricultural Warehouse and Seed Store, Toronto, Ont.



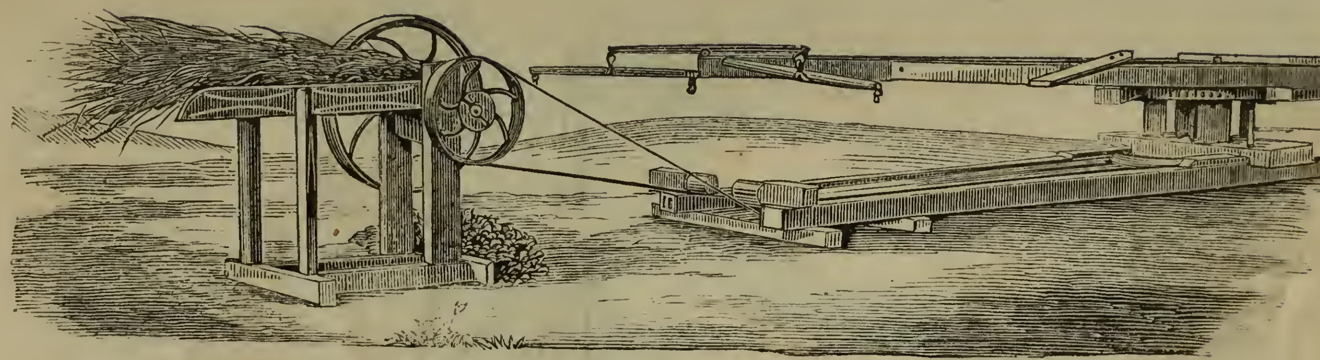
TEN HORSE POWER. (See p. 497.)

Horse and Dog Powers of several styles and numerous sizes are offered by Mr. Rennie, Agricultural Warehouse and Seed Store, Corner Adelaide and Jarvis Streets, Toronto.

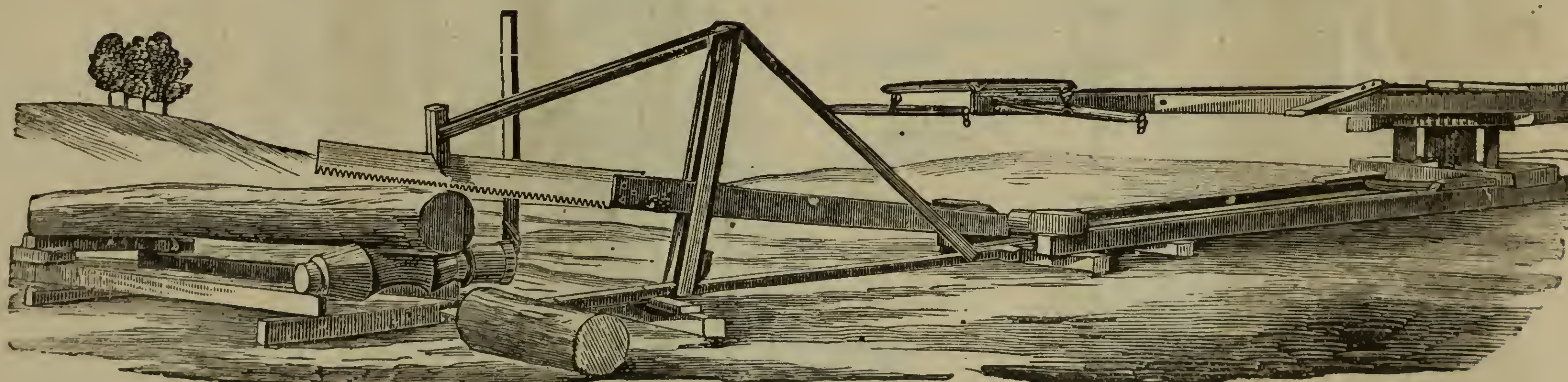


FARMERS' HORSE POWER. (See p. 497.)

Manufactured by John Watson, Ayr, for sale by Mr. Wm. Rennie, Toronto, Ont.



TOTMAN POWER APPLIED TO A STRAW CUTTER. (See p. 498.)

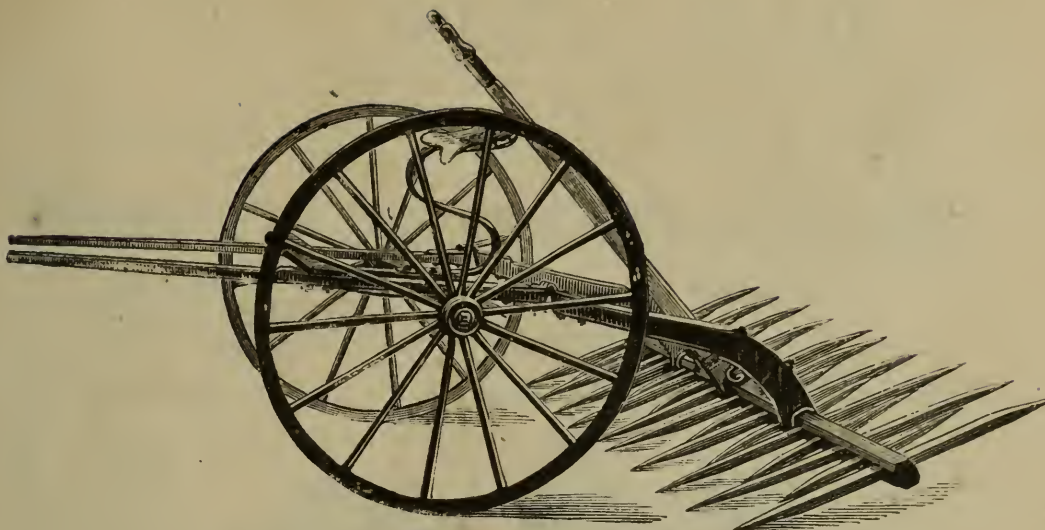


TOTMAN DRAG CROSS-CUT SAWING MACHINE. (See p. 498.)

Orders for any of these machines may be sent to Mr. Wm. Rennie, Agricultural Warehouse and Seed Store, Toronto, Canada.

SCREW STUMP MACHINE, (See p. 501.)

This Stump Machine is manufactured, either complete with wood work, &c. ; or iron work ; or screw, nut and cap only. Address orders to Mr. Wm. Rennie, Agricultural Warehouse and Seed Store, Adelaide Street East, Toronto, Ont.



SULKEY REVOLVING HORSE RAKE. (See p. 502.)

For sale by Mr. Wm. Rennie, Toronto, Ont.

LOCK LEVER SULKEY HAY RAKE. (See p. 502.)

Manufactured by John Watson, Ayr, and for sale by Mr. Wm. Rennie, Toronto, Ont.

SEEDS! | SEEDS! | SEEDS!

JOHN A. BRUCE & CO.,

Importers and Growers of Seeds,

SEED WAREHOUSE, - Corner King and McNab Streets,

SEED FARM, - - - - Main Street East,

ESTABLISHED 1850. **HAMILTON, ONTARIO.**

FARM SEEDS in great variety, comprising all the leading and most esteemed varieties of Turnip, Mangel, Carrot, Sugar Beet, Kohl Rabi and Parsnip.

CLOVER and GRASS SEEDS; also, choice samples of SEED GRAIN.

VEGETABLE SEEDS—A most extensive collection of all the really valuable and standard varieties now in cultivation; also, FLOWER SEEDS, comprising a collection of 800 varieties.

Bruce's Selected East Lothian Swede Turnip.

Also, a choice collection of FLOWERING BULBS, for Parlour, Conservatory and Flower Garden Decoration.

Horticultural and Agricultural Implements, Fertilizers, and a great variety of Garden Requisites.

IMPROVED EXCELSIOR LAWN MOWERS.

The following CATALOGUES are published during the year, and will be forwarded post free to all applicants:—

No. I.—Illustrated Seed Catalogue, published 15th January, a descriptive list of Agricultural Vegetable and Flower Seeds, Culinary Roots, Garden Implements, Spring Flowering Bulbs, &c.

No. II.—Wholesale Catalogue of Seeds, &c. (for the Trade only), published 15th January.

No. III.—Bulb Catalogue, published September 1st, containing a choice collection of Double and Single Hyacinths, Tulips, Polyanthus Narcissus, Crocus, Snow Drops, Crown Imperials, Jonquils, Lilies, &c., &c.

PLANTS AND SEEDS CAREFULLY PACKED FOR ALL CLIMATES.

JOHN WATSON,

AYR AGRICULTURAL WORKS,

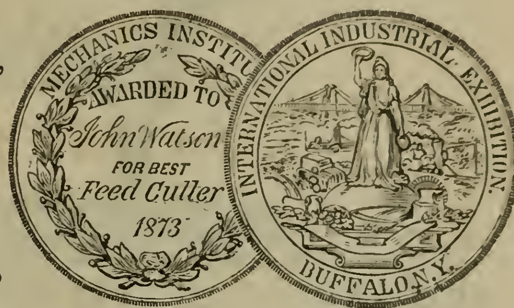
—MANUFACTURES—

Reaping, Mowing and Threshing Machines,

GRAIN DRILLS,

SULKY HAY RAKES,

Drag and Circular Saws,



STRAW & ROOT CUTTERS,

CHOPPING MILLS,

AND ALL KINDS OF

Agricultural Machines and Implements

OF THE VERY BEST PATTERNS.

Having taken FIRST PRIZES at every Provincial Exhibition for the last fifteen years, I, last year, gave up the idea of competing, and entered for exhibition only. But, with the view of testing the merits of my machines, I entered my STRAW AND ROOT CUTTERS at the Buffalo International Exhibition, competing against the First Prize Canadian as well as the best American Machines, and was awarded the Medals and Diploma.

Catalogues and all information sent by mail on application.

JOHN WATSON.

Ayr, Ont.,
24th April, 1874.

RENNIE'S PRIZE

PURPLE-TOP SWEDE TURNIP.

RENNIE'S PRIZE

PURPLE-TOP SWEDE TURNIP.

Send for my

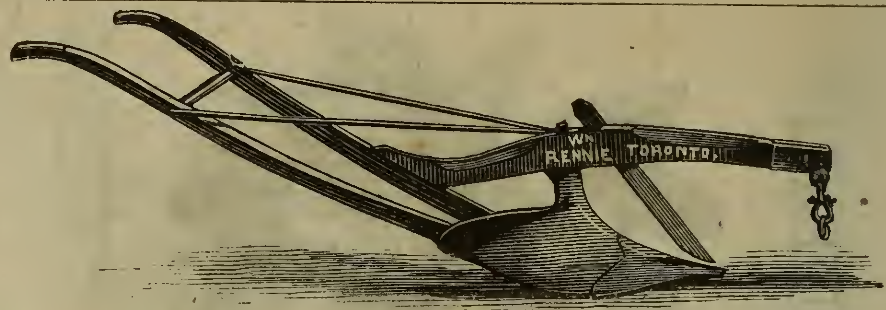
ANNUAL DESCRIPTIVE SEED CATALOGUE

of Field and Garden Seeds, Fertilizers, &c.

WILLIAM RENNIE,

AGRICULTURAL WAREHOUSE AND SEED STORE,

Corner Adelaide and Jarvis Streets, Toronto.

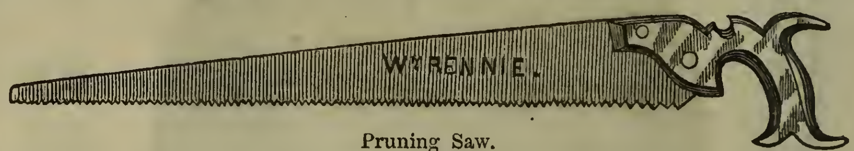


Wrought Beam Plough, suitable for general purpose work, substantially made, for two horses.

HORTICULTURAL REQUISITES,

A General Assortment of Best Manufacture, comprising the Most Approved Styles, for sale at the

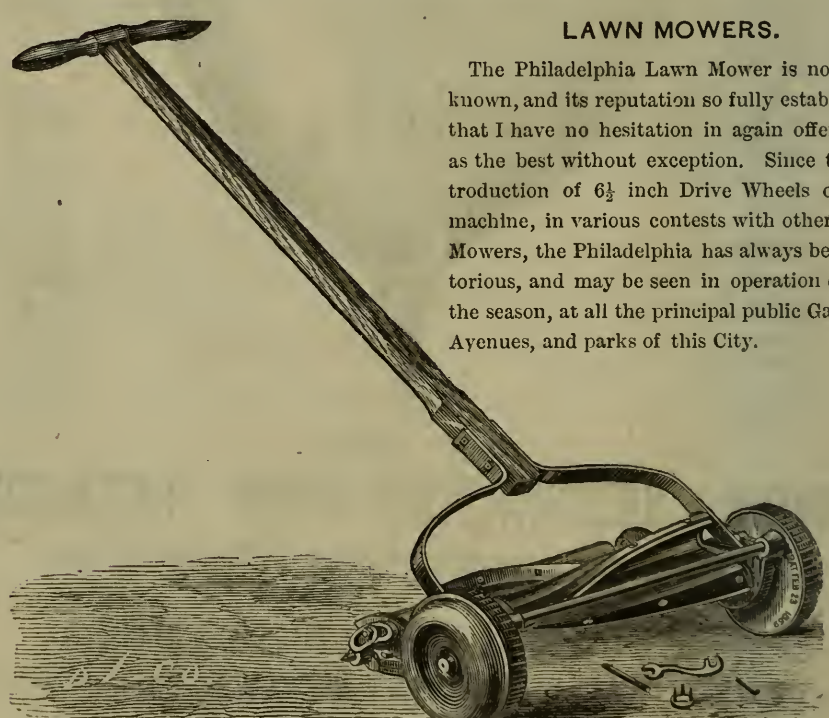
AGRICULTURAL WAREHOUSE & SEED STORE,



Pruning Saw.

WILLIAM RENNIE,

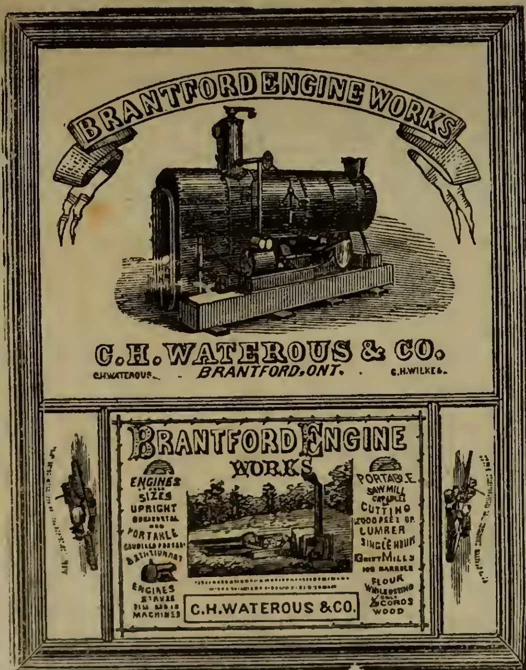
Corner Adelaide and Jarvis Streets, - - Toronto.



LAWN MOWERS.

The Philadelphia Lawn Mower is now well known, and its reputation so fully established, that I have no hesitation in again offering it as the best without exception. Since the introduction of 6½ inch Drive Wheels on this machine, in various contests with other Lawn Mowers, the Philadelphia has always been victorious, and may be seen in operation during the season, at all the principal public Gardens, Avenues, and parks of this City.

The Philadelphia Lawn Mower, No. 1 Jr. or 14 inch.



Patent Portable
DIRECT ACTION SAW MILLS.

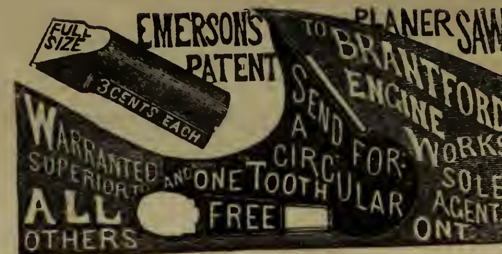
20 Horse-power, with 52 inch Saw. Can be taken, up, loaded, moved 8 or 10 miles, and put in operation again in 2 to 4 days. Will cut, with 3 to 4 men, 6,000 to 10,000 feet per day.

25 Horse-power Mill, with 6(inch Saw, Semi-portable. Will cut, with 4 to 5 men, 8,000 to 12,000 feet per day.

C. H. Waterous and Co. Colchester Station, Canada Southern R.R., April 22, 1874.

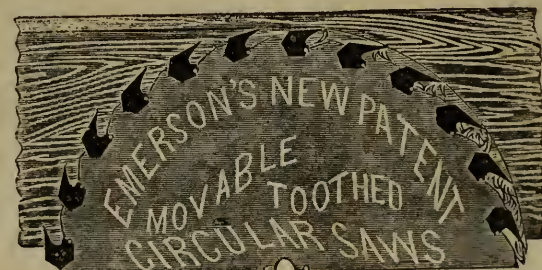
The 25-H.P. Mill far exceeds our expectations. We tried her for one hour, and, with six men, cut (2927) Two Thousand Nine Hundred and Twenty-seven feet of inch lumber,

SICKLESTEEL & STRUTHERS.



REFERENCES FOR PLANER TOOTH SAWS:—Firstbrook & Son, Stayner, Ont.; Wesley Sutton, Fingal, Ont.; W. and S. B. Anglin, Kingston, Ont.; R. S. Wood, Oakville; Charles Anderson, Cainsville, Ont.; E. C. R. Davies, Henfryn P.O. Ont.; T. and R. Owen, Stonefield, Ont.; Spies and Awrey, Courtland, Ont.

500 Points given with each Saw, which should cut 500,000 feet of Timber. When Saw once rounded or pointed it always remains so: requires no experienced sawyer to run it; when teeth get dull they can be sharpened from one to three times.

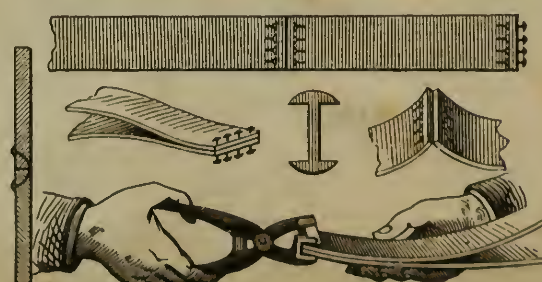


The Cheapest Inserted Tooth Saw in existence. 60in Saw, only, $190, less 10 per cent. cash. Extra Teeth, 50c. each.

We give the Patent Adjustable Jaw Swage with this Saw.

BLAKE'S PATENT BELT STUDS.

BEST BELT FASTENER IN EXISTENCE.



MODE OF USING STUDS.

ROTARY PUMPS.

No. 5 Fire Pump.

We are making six sizes of above Pumps, from one to five.

Having perfected machinery by which the gearing and water-pinions are cut out of solid iron castings, we can guarantee all sizes to be perfectly made. We also use the best charcoal iron for castings, and steel for shafts, thus insuring durability.

Would refer to

Napanee Mills Paper Manufacturing Company, H. M. WRIGHT, President, Napanee (have four of our pumps in use).
JOHN PENMAN, Knitting Mills, Paris, Ont.
CLAY & REITH, do. do.
YATES & STRATFORD, Brantford, Ont.
SAMUEL KILLAM, Yarmouth, N.S.

Sole Manufacturers of

Waterous' System of Fire Protection and Water Supply,

For Cities, Towns, and Villages.

Patented Feb. 8, 1871.

In use in Brantford, Windsor, Lindsay, &c.

We keep constantly in stock Climax Emery Wheel Saw Gummer, Stone's Original and Eclipse Gummer, Goddard Emery Wheel, Gummer Bits, all sizes, Belt Studs, Belting Files, Cant Hooks, and seven different styles of Saw Swages. Send for Illustrated Saw Furnishing Circular, contrining valuable information how to hang and run Circular Saws; also large Machinery Pamphlet, to

C. H. WATEROUS & CO.
Brantford, Ont.

RUNING RED RASPBER BUSHES.

A. O.—Raspberry bushes were pla in the early spring and have gr ell. I have cut out the old ca d about about half of the n owth. Should the new shoots t e coming up be removed?

Ans.—The raspberry canes or sho hich gro wthis year will bear uit next year, hence you shou ve the new shoots and only rem e canes which bore this year, wh e after fruiting. As the plants ler, however, more shoots come an it is desirable to leave. T e weakest ones are removed at d of the growing season each y d also the canes which bore , out seven o fthe strongest new ca t to bear the fruit.—W. T. M.

SMALL RHUBARB STALKS.

R. D., B.C.—Rhubarb of the Vict riety was grown from seed. lks are very slender and I wish t them to grow thicker. The light with gravelly subsoil.

Ans.—Rhubarb requires rich soil well, and we should advise pla on heavier soil or else keeping ound enriched by heavy applicati barnyard manure. If, however, l is very dry this also would in why the stalks are small, ubarb needs a good supply of m e.—W. T. M.

CABBAGE MAGGOTS.

. B. H., Alta.—Will you please in-
rm me of the best way to get rid
the white maggots which eat up
e roots of the cabbage plants?
Ans.—T
he cabb
dy is kn
ures ca
he troub
hould:
place ea
solutio
he root
m de as
hard soa
and add
For use
times it
c) Pla
inches i
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of the
set out.
(d) E
mosquit
as soon