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THE AGRICULTURAL USE OF PEAT MATERIALS

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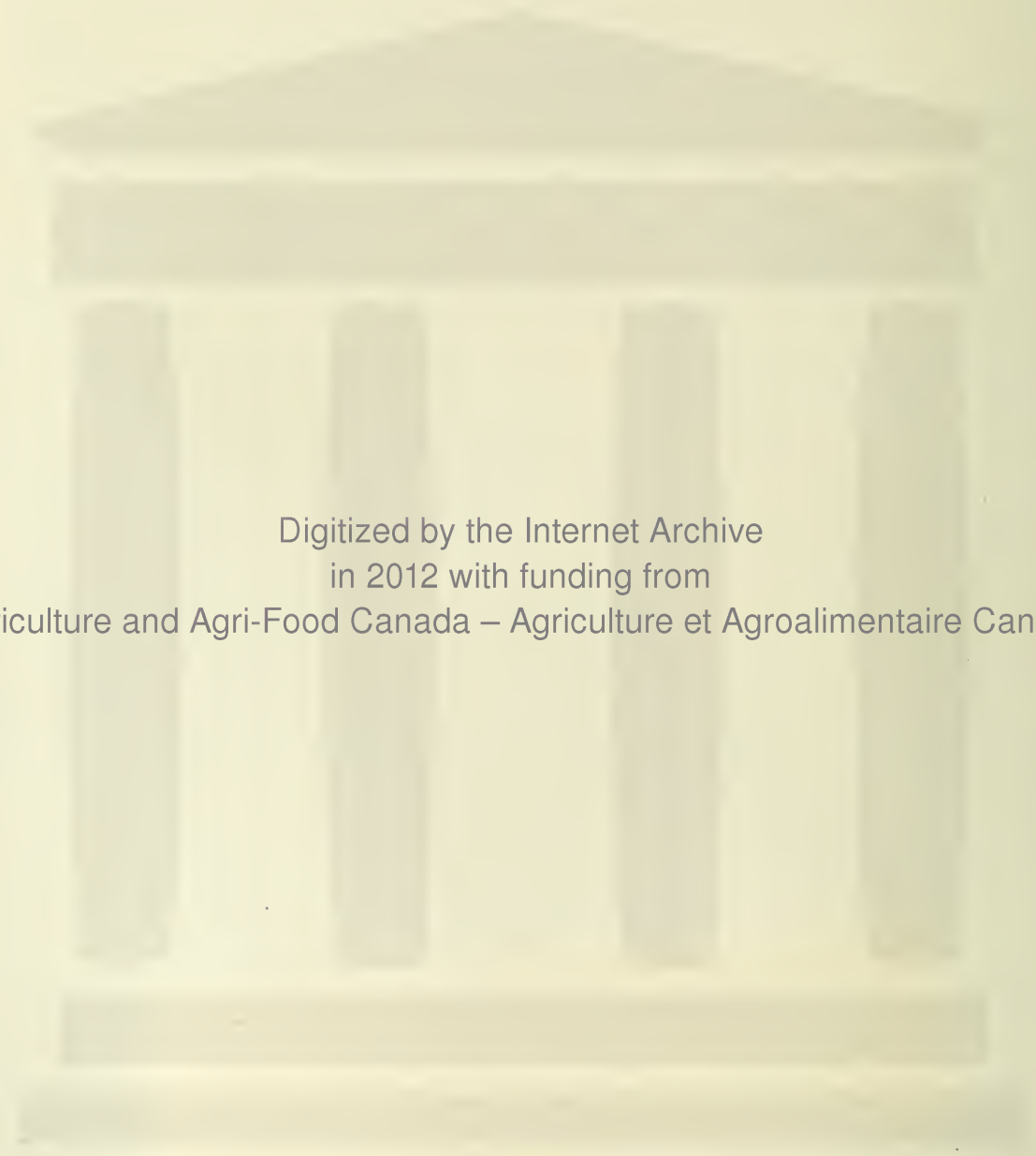

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THE AGRICULTURAL USE OF PEAT MATERIALS

Introduction

Peat moss is the dead fibrous moss that has been excavated from peat bogs, dried, shredded and pressed into bales or smaller packages. Its value depends upon its highly absorptive nature, and its main uses are in agriculture, for stable bedding and poultry litter, and in horticulture for soil conditioning and as a filler for commercial fertilizers.

The value of peat moss has long been recognized in Europe, where it is widely used, but in spite of the existence in Canada of deposits comparable with the largest in Europe, it has as yet found little use in this country. This bulletin has been prepared for the information of farmers, landowners and others who may be interested in the development and exploitation of peat moss for agricultural and horticultural purposes from peat bogs on their properties.

The term peat bog is a general one applied to deposits of plant materials that have accumulated in lakes, ponds, marshes and swamps. These deposits are formed in areas where a lack of drainage and consequent lack of aeration permits an accumulation of organic acids.

Areas of peat represent different stages in a process of development which, in many cases, has proceeded since the close of the Ice Age and is still in progress at the present time.

Peat is widely distributed in Canada and it is found in every province. According to an estimate made several years ago, there are at least 37,000 square miles of peat bogs in Canada, but only a small percentage contain commercial sized deposits of peat moss.

Formation and Origin

The formation of peat is dependent upon a special combination of climatic and topographical conditions. The principal factors are:—

1. An adequate supply of rainfall and surface water.
2. Growth of aquatic and moisture-loving plants.
3. A soil or subsoil that will retain water at the surface.
4. A sufficiently humid atmosphere to prevent too rapid evaporation.
5. A temperature high enough to allow a profuse growth of vegetation, yet low enough to check too rapid a decay of vegetable matter.

These conditions are more generally found in countries having temperate or cold climates, consequently the southerly portion of Canada and the northerly portions of the United States contain the most extensive deposits of peat on this continent.

The rate of growth of peat bogs is naturally slow and varies from a few inches to two or three feet per century.

Composition

Peat in its natural state consists of about 90 per cent water and 10 per cent partly decomposed and disintegrated vegetable matter. Although many varieties of plants are found in peat bogs, the bulk of the material has been supplied by a comparatively few varieties. Chief among the peat-forming plants are the mosses such as sphagnum and hypnum, marsh and heath plants, grasses, sedges, water plants and algae, etc. Sometimes the roots, trunks, and leaves of trees are also found.

The plant varieties forming the successive layers of a peat bog reflect the climatic conditions and topographic features of the bog. Changing conditions during the life of the bog cause changes in the growth and composition of the plant communities, and, as a result, successive layers in a peat bog may be composed of the remains of different plant communities and therefore possess different characteristics.

A vertical section of a peat bog might show the following strata:—

1. A bed 6-12 inches thick of living sphagnum mosses, overlying 6-10 feet of unhumified dead moss, which is known as peat moss.
2. A bed of well humified woody peat containing partly decomposed stumps and roots.
3. Beds of reed and sedge peat formed by the humification of reed or sedge plants.
4. Finally, a layer of dark jelly-like ooze, sometimes called sedimentary peat, resting on a clay or silty bottom.

There is, of course, considerable variation in the composition of different peat bogs, according to the climatic or other conditions under which they were formed, and not all bogs contain all the varieties of peat described above.

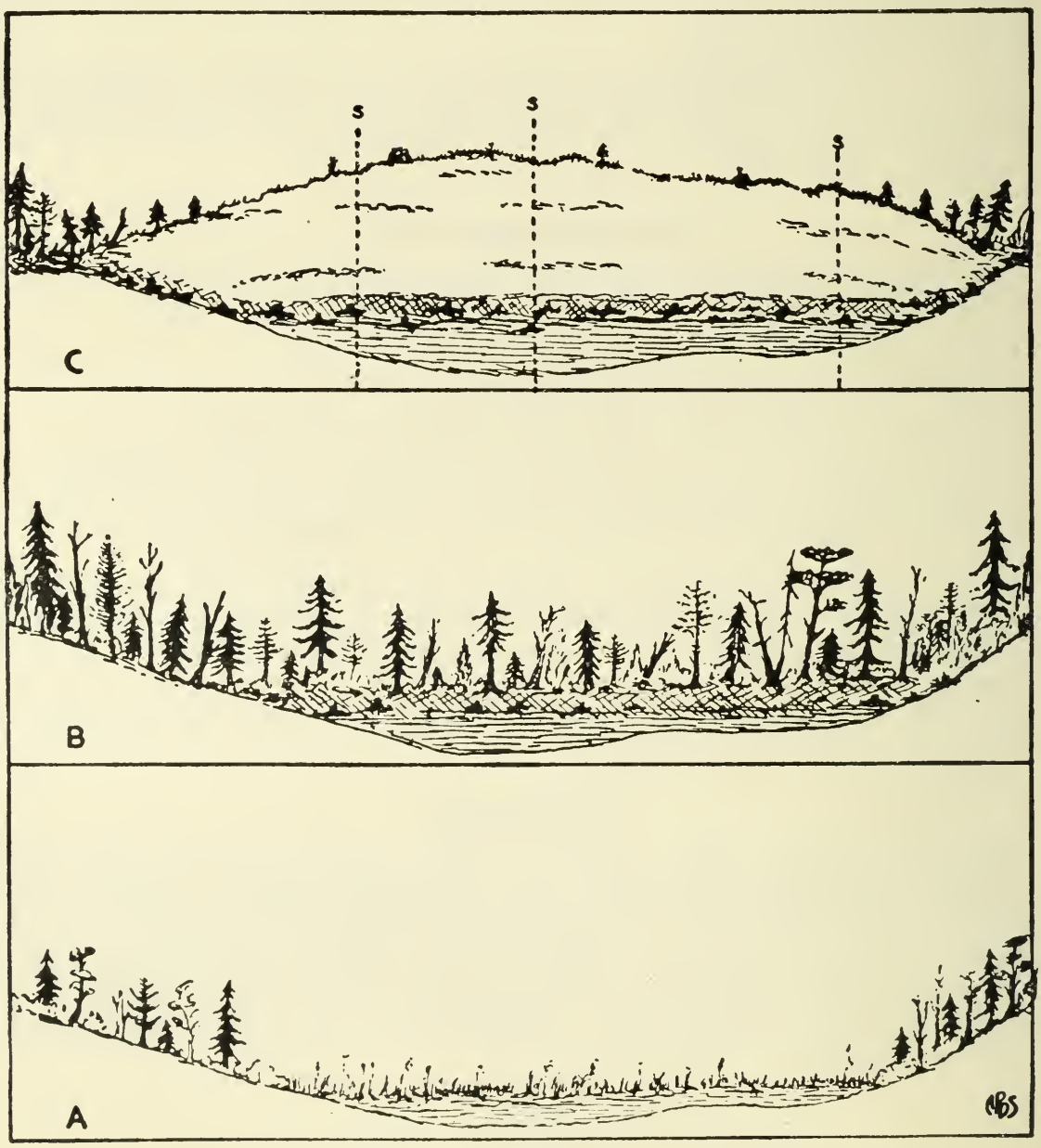

FIG. 1. Origin and development of a peat bog.

The foregoing diagram (Fig. 1) taken from Bulletin 167 of the U.S. Department of Agriculture, illustrates the origin, development, and structure of a deposit of peat moss.

The first stage A is a marsh, this is followed by stage B, a coniferous swamp forest, and the final stage C is the growth of the sphagnum mosses and plants characteristic of Arctic flora. The peculiar mode of growth of the sphagnum plants, increasing the length of their stems upward year after year, while dying at the roots, perpetuates their existence and raises the surface of the bog of which they form a part. The succession of vegetation forms a sequence of layers from sedge peat to woody peat and moss peat, each layer differing in composition, thickness and fundamental properties. Fig 2 illustrates the species of peat forming mosses, Fig 3 is a profile section of a peat bog and Fig 4 shows the structure of a sample of air dried peat moss.

Fig. 2. Species of peat forming mosses.

Moss Peat Manufacture

Commercial Scale Operations.—In selecting a deposit of peat moss for development, the following points should be noted:—

1. It must contain a sufficient amount of sphagnum moss of good quality with a minimum depth of four feet.
2. It must be capable of being easily and inexpensively drained.
3. The climatic conditions must be suitable for drying the peat to the required degree.
4. The site should be close to existing transportation facilities and not too far from the market.
5. Adequate working capital must be available as drainage and cutting must be done from one to two years in advance of manufacture and sale.

The first operation in the preparation of a peat deposit for commercial utilization is drainage. Good drainage is important not only for removing the excess water contained in the peat materials but also for producing a firm working surface. The drainage system, which consists of main and lateral ditches, should be adequate to remove any excess of water following a heavy rainfall without resulting in too great a lowering of the water-table. It is not

desirable to drain the entire bog at the start, the drainage work should be kept at least two years ahead of the cutting so that the peat will be in the right condition for excavation.

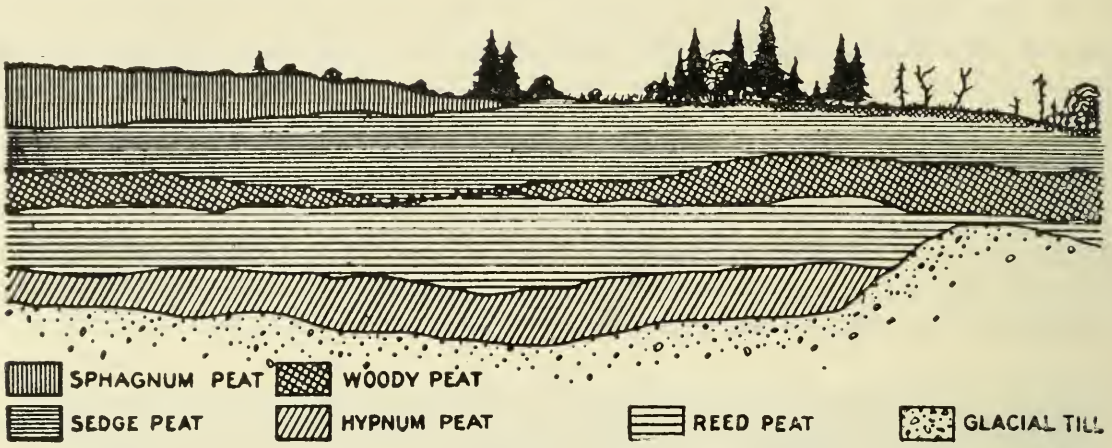

FIG. 3. Profile of peat bog.

FIG. 4. Air dried peat moss.

The peat is excavated by hand to a depth of about four feet, using specially shaped shovels and the blocks are first piled alongside the excavation, then, after a few days, either piled in heaps or placed on wooden racks to dry out. In Eastern Canada, it has been found advisable to let the partially dried peat

remain in the field all winter, as the frost bursts the plant tissues and thereby makes a more absorptive peat. In addition, the partially dried peat blocks thawing out in the spring benefit from the favourable drying conditions during the months of April and May with their prevailing high winds of low relative humidity. This procedure, however, cannot be followed on the bogs in British Columbia as, in the Fraser delta, there is virtually no frost, and, after the middle of September, when the rains start, the atmosphere remains humid all winter. The partly dried peat blocks, having no protective frozen surface, absorb water and by the spring have become as wet as they were when they were excavated. Consequently, in the Fraser valley, all the season's cut must be under cover by the middle of September.

The dried peat is brought to the mill either by tractor-drawn sleds, in cars running on a light railway or by belt conveyer, depending on the system in use at the bog. After arriving at the mill, it either goes to the storage shed or direct to the shredding machines. These shredding machines consist essentially of two drums, provided with teeth or knives, rotating against each other at different speeds, which can be adjusted so as to disintegrate the peat blocks into any desired size. A bucket elevator carries the shredded material to rotary screens, where it is separated into three sizes, the coarse for use as stable litter, the medium for poultry and small animal litter, and the finest material, usually termed peat mull, for soil conditioning, packing and insulating material.

After shredding, the material is air cleaned in order to obtain a non-dusty stable and pen litter. Each size of screened material is taken by conveyer to its respective storage bin placed above a press in which it is pressed to bales weighing from 100 to 150 pounds. The bales are covered with burlap or heavy paper and held together with laths and wire. An alternative method is packing in heavy fibre-board containers holding approximately 100 pounds. The bales and boxes are then sent to the warehouse or loaded directly into cars for shipment.

A peat moss factory requires a large force of labour, chiefly for digging and drainage work, etc., but, as the baling plant can operate during the winter, a large proportion of the labour can have year-round employment.

In certain cases, the "top moss" may also be utilized. This is the layer of live moss overlying the dead peat moss. This material is usually obtained by harrowing or raking the surface and placing the loosened material on racks to dry out. These racks are generally made of chicken wire, stretched on poles as shown in the accompanying photograph (Fig. 6). This moss is used by florists for packing and shipping flowers, shrubs, etc., in cold weather.

Small Scale Operation.—Bogs which are too small for commercial operation could be profitably developed by a single farmer for his own use, or by a group of farmers for their common use.

The first step to be taken, of course, is to sample the bog and determine the general suitability of the material for the production of peat moss. Samples can be sent to the Bureau of Mines, Ottawa, for test and report.

In many cases it may be necessary to carry out a certain amount of drainage, and the system adopted will depend on local conditions. In opening up a bog it is neither necessary nor desirable to excavate the main drain down to the bottom. Three or four feet will be sufficient for the first year.

The excavation of peat moss is made by hand (mechanical excavators have been tried, but without success), using a flat sharp spade, and the top four to six inches, consisting of bush and scrub, discarded. The general method of digging and piling the sods on the sides of the cut is shown in Figs. 7 and 8. After 10 to 14 days drying they are piled in small heaps or "chimneys" in such a way

FIG. 5. General appearance of a peat bog.

FIG. 6. Drying top moss on wire racks.

that the air can circulate freely through them—see Fig. 9. When sufficiently dry, the sods are either piled in stacks ten to twelve feet high or stored in field storage sheds to finish drying as shown in Fig. 11. Good air dried peat moss should contain about 20 per cent moisture, but in practice this is difficult to attain, at least for the whole season's output, unless the drying conditions are unusually favourable. In most bogs the peat moss is underlain by dark humified peat (fuel peat) and when digging, care must be taken not to excavate below the peat moss layers. This humified peat can later be used for soil improvement purposes.

Fig. 7. Digging peat moss.

Fig. 8. Peat moss stacked alongside digging ditch.

The dried peat blocks have to be shredded for stable or poultry use. This may be done with some type of shredding equipment which is available on most farms. A small power driven or, for very small lots, a hand operated cutting box of the type ordinarily used for cutting hay or fodder corn, would be very useful for this purpose. Similarly, a silo filler, if available, would do an excellent job and would handle relatively large quantities of material. Some threshing machines are equipped wth straw shredders to shred the straw just before it enters the blower. An old machine might be just the thing for breaking up the

FIG. 9. Peat moss drying in 'chimneys'.

FIG. 10. Peat moss drying in racks.

peat for litter. It might also be possible to construct a home-made device such as two wooden rollers, nine to twelve inches in diameter, and eighteen inches to two feet wide studded with nails, and driven by hand or gasoline motor. The nails should be of 3-inch size, driven in so as to project half an inch, and the heads removed. These rolls would be held in a frame, with a hopper on top and a chicken wire screen at the bottom to hold the desired size of material. The

coarse material, 1½ to 2 inches in diameter, is used as stable litter, the medium for poultry and small animal litter, and the fines, usually termed peat mull, for soil conditioning, packing, and insulating material.

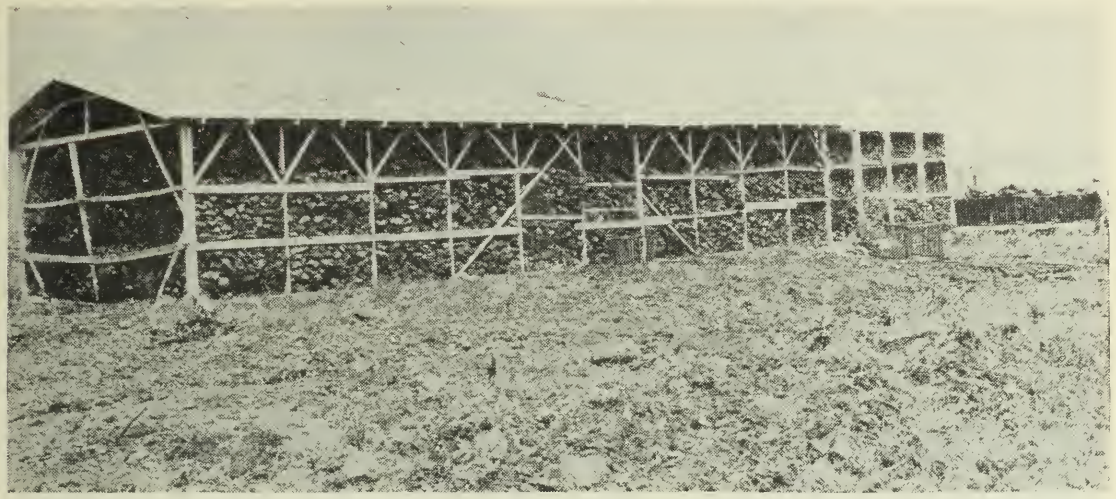

Fig. 11. Field storage shed.

An alternative method which can be used when the bog is sufficiently dry is as follows:—the top layer of scrub and bush is first removed and then the peat moss harrowed to a depth of three or four inches and allowed to dry. After three or four days, it is generally sufficiently dry to be raked into windrows and then loaded into wagons and hauled to the storage shed. One drawback to this method is that the peat is generally too fine for use as litter, but it is suitable for horticultural use. The use of a spring-tooth cultivator would, perhaps, produce a coarser material which would be more suitable for litter.

Uses for Peat Moss

The most noticeable properties of peat moss are its high absorptive capacity for liquids and gases, resistance to decomposition and low heat conductivity For these reasons, it makes an excellent stable litter for horses and cattle, and is of special value for poultry litter. Although not a fertilizer in itself, it makes a valuable soil conditioner; and it is also used in the building trade as an insulator for heat and sound.

For stable and pen bedding, one ton of peat moss serves as long as two and a half tons of straw; work in the stables is lightened, and less storage space is needed. The animals rest on a warm, clean, and dry bed, and so less grooming is needed because the bedding can easily be kept dry and clean, if only the damp parts be removed and replaced by fresh litter moss. Such bedding lasts a month before an entire change is necessary. Peat moss absorbs the nitrogen and retains the valuable constituents in the animals' droppings. Gases such as carbonic acid, ammonia, and offensive odours are absorbed in the moss, and the sanitary conditions in the stables are improved for the employees and the animals.

The manure thus made is not only useful as a fertilizer, but also adds organic matter to the soil and improves its physical condition.

Peat moss is of special value to poultry breeders, because, in addition to its absorptive qualities, it retards bacterial growth, and lice, mice, and other vermin do not thrive on it. More sanitary conditions are possible when peat litter is used. It would be reasonable to assume, therefore, that a flock could be maintained in a healthier condition where this litter is used and particularly so if it

FIG. 12. Manual transport of dried peat moss.

is properly managed. Adequate ventilation in the poultry house and stirring up of the litter from time to time to avoid packing would increase its useful life as well as maintaining more sanitary conditions.

Shippers find peat moss an excellent packing material for certain perishable goods such as fruit and vegetables, and, as it is one of Nature's best heat-insulating materials, it protects them against frost in winter, or, if they are chilled in summer, they keep cool for an appreciable time. Peat moss forms an ideal packing for overseas shipment of articles that absorb moisture, fragile goods such as glass and crockery, and roots, bulbs, etc. Ordinary packing material is a nuisance to the recipient, a fire hazard if kept, and irksome to dispose of, but peat moss owing to its many uses, would be a welcome by-product to the receiver of goods in many cases.

Horticulturists already recognize the advantage of the use of peat moss; they get better lawns, more luxuriant flowers and stronger and more advanced plants and shrubs; they use it as a packing material in the shipment of flowers, shrubs and tubers, in making compost, and as a diluent in the application of artificial fertilizers, which otherwise are likely to "burn" the plant.

The increased use of Canadian peat moss by agriculturists and others would not only help to develop one of the national resources, but it would also improve the general farm economy.

Peat for Soil Improvement

The need of organic matter for soil improvement creates a problem that is becoming increasingly acute. The depletion of soil humus has become an important factor in impoverishing cultivated soils and subjecting them to erosion. A deficiency in soil humus, which already exists in certain sections, cannot be allowed to continue if agriculture is to prosper.

On account of scarcity and high cost, stable manure often cannot be used with profit as the sole source of organic matter. While the use of crop residues and legumes for soil improvement is fairly general practice, the relatively rapid

decay of the organic matter of green crops leaves the soil without any marked improvement after the lapse of a few years. Humified peat, especially certain grades of reed and sedge peat, already referred to would provide a satisfactory and relatively persistent material for soil improvement.

As a source of organic matter, the better grades of peat play a significant part in modifying the physical, chemical and biological properties of mineral soils and in making them more favourable for the growth of plants. Adequate additions of commercial fertilizers to remedy nutritional deficiencies can often be combined with the use of peat humus, as the efficiency of commercial fertilizers may be increased by maintaining the content of organic matter in the soil.

A series of investigations is being started by the Departmentof Agriculture to ascertain the value of Canadian peats for restoring fertility to impoverished soils. It is hoped to report results of this work at a later date.

NOTE: Figs. 7-12, Courtesy of Premier Peat Moss Corp.