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PEAT MOSS DEPOSITS IN CANADA

Investigations in 1942

by

H. A. Leverin

Industrial Minerals Division.

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Introduction

A survey of peat moss deposits in Canada offering industrial possibilities was started in 1939. Three reports of this investigation have been published in mimeograph form as Memorandum Series Nos. 76, 80 and 81, covering the work of the years 1939, 1940, and 1941. The territory surveyed in these years embraced the Maritime Provinces, Quebec and Eastern Ontario respectively. In these reports detailed descriptions are given of deposits not previously covered in the literature of peat moss as well as details of the work done on them, maps of the deposits,* descriptions of plants for handling the peat moss, markets for the products of Canadian peat moss, methods of operation of peat moss plants, drainage and operation of bog; the uses of peat moss in industry, for horticulture, agriculture, and as packing material.

The investigation for 1942 was centred mainly in Western Canada, where much interest has been evidenced in building up an industry, based on several large deposits, some of which are favourably situated in regard to transportation for export to the midwestern states of the United States, and on that account should

*Prints of the various maps prepared may be obtained on application at a cost of 50 cents each.

be in a strong position in regard to freight rates especially after the war when European competition will have to be faced. Furthermore, with the heavy demand in the State of Nevada for large quantities of high-grade peat moss for the production of magnesium metal by the new metallurgical process, there is a heavy drain on Canadian resources of peat moss, to meet which every available deposit within reasonable shipping distance may have to be utilized. The investigation also dealt with some deposits in the Eastern Townships near Waterville, St. Johns and Napierville, Quebec; the central parts of southern Ontario, and the Thunder Bay and Rainy River districts in Western Ontario. In the report are included notes on the technology of peat moss; the classification of various peats, and a description of the mosses and their properties; their commercial value as raw material in the peat moss industry; trade specifications of commercial peats; methods of sampling, chemical analysis, and physical testing to determine the commercial value of peat products.

To meet the many requests for early information in regard to the results of the 1942 field work a preliminary report in condensed form was published in October in mimeographed form, Memorandum Series No. 82. Publication of the full report had to await the results of the analysis of the many samples collected from the bogs investigated. The advance report gave localities of bogs examined, their depths, and a brief description of them, possibilities of drainage, field observations on the quality of the mosses and transportation facilities to the nearest shipping points.

The year 1942 showed great activity in the exploitation of our peat moss resources, and several new plants were built. In New Brunswick on the Pokemouche bog near Shippigan, in Gloucester County, a plant was built and began producing during the summer; the large Shippigan bog was being prepared for operation, work being underway on drainage; in Quebec a plant built on the St. Anaclet bog south of Father Point is producing and work has begun on the development of a large bog at Les Escumains in Bergeronne and Escoumain Townships in Saguenay county. In Ontario two plants went into production, one on the Crozier bog near Fort Frances and the other near Pine River in Nelles and Pattullo townships in Rainy River district. In Manitoba two new plants are in production on the Julius bog 60 miles west of Winnipeg, and in British Columbia two large plants on the Byrnes bog in Delta in the New Westminster district are working.

Technology of Peat Moss

Classification of Peats

Peat occurs in nature in two distinct forms, unhumified and humified, differing markedly in physical properties and chemical composition. Unhumified peat is the dead moss of sphagnum mosses, only slightly humified; it is fibrous, elastic, of light greyish green, yellowish to light brown colour, becoming on drying somewhat darker. It has an absorptive value of 10 to 26 times its own weight, is light in weight and porous. Humified peat in its natural state is dark brown to black, colloidal, plastic, homogeneous and somewhat elastic. It dries into a hard solid mass of a specific gravity higher than water. It has almost no absorptive value; a piece of dried humified peat may be under water for weeks without absorbing any water. Unhumified peat left in its natural state will humify in course of time and all fibrous matter eventually disappears. From the description of the peat moss bogs in this report it may be noted that the lower peat strata are darker and consist of intermixtures of humified and fibrous peat with a bottom stratum of well humified peat.

Humified peat in the trade is usually named 'fuel peat' and unhumified or slightly humified peat, 'peat moss'. The latter nomenclature may be considered correct in regard to unhumified Canadian peat products, because most of them are derived from sphagnum mosses, but there are many large deposits in Canada and in the United States that originated from carex and other sedges, reed, hypnum and a mixture of aquatic plants, and these should not be sold under the name of peat moss; these are of much lower quality than the sphagnum mosses. The name peat moss, however, has become the established trade name for unhumified and slightly humified peats and is likely to remain so, unless the trade accepts a standard classification for all peat products. Zailer* classifies fibrous peats suitable for the manufacture of peat litter and other peat products in three groups in accordance with their botanical origin, ranking in quality as follows:

1. Sphagnum mosses, and sphagnum mosses with intermixture of Eriophorum residues (cotton grass)

2. Sedge, carex, reed and hypnum mosses.

3. Wood peat, bog earth and heath humus.

*Torfstreu und Torfstreuwerke, mit besondere Berücksichtung von Neuanlagen, Hanover Verlag M & H Scharper, p. 17 by Dr. V. Zailer.

1. Sphagnum moss, sometimes termed 'white moss' or 'genuine peat moss' is by far the best raw material and yields the best grade of commercial peat moss. Although the sphagnaece consist of one genus, the number of species is very large and it requires the trained eye of a specialist to recognize them.* They form the typical dome-shaped high moors, have a water absorptive value of 10 to 25 times their own weight, and also absorb gases such as carbonic acid, ammonia, hydrogen sulphide and other gases having offensive odours. Such mosses dry somewhat more slowly than other kinds of fibrous peats but with less shrinkage, retaining from one-half to four-fifths of their original volume, depending on drying conditions. Litter and peat mull made from sphagnum peat moss are almost free from dust, and owing to their elasticity can be easily pressed into bales.

Sphagnum peat moss however seldom occurs in deposits in a pure state but is generally intermixed with the residues of Eriophorum (cotton grass), sedges, hypnum mosses, Andromeda glaucophylla (bog rosemary), Ledum decumbens (labrador tea), Vaccinium oxycoccus (cranberry) Empetrum nigrum (crowberry) Scheuchzeria palustris, Rubus chamaemorus (cloudberry) Sarracennia purpurea (pitcher plant) etc.

Canada possesses an abundance of sphagnum moss in every province and as it fetches the best price and costs no more to produce than the inferior grades of unhumified peat it should be possible to maintain the high quality of Canadian peat moss on the export market.

Eriophorum, of which there are several species commonly named cotton grass, is a sedge occurring in most Canadian sphagnum moss bogs. Residues of this sedge consist of strong reddish bundles of fibres from the stems and leaves as well as highly decomposed roots of the plant. In the pure state it is seldom found in quantity. Thus the trade name 'Fibre-Peat' which at times appears on the market, designating cotton grass litter, is misleading; it should be termed cotton grass - peat moss litter. The cotton grass residue forms a very useful constituent in a peat moss litter and is therefore much in demand. Owing to its high fibre content it serves as a bond in forming a solid non-crumbling bale, increases the porosity and elasticity of the litter bedding, and when handled as a manure is more convenient both in the stable and on the field. It does not, however, possess as high absorptive value as the sphagnum mosses. Cotton grass residue that has been screened and cleaned, consisting of tough fibres only, has found extensive use for bandaging by surgeons and veterinaries.

*Mosses with Hand-lens and Microscope by A. J. Grout, p. 51 & 52.

2. Carex peat is a characteristic low-bog peat distinguished by its dirty brown to brownish-black colour. In the dry state its elasticity is rather low and it can be easily disintegrated between the fingers. It consists mainly of the residues of straws, leaves and roots of the tall-stemmed sedges of the carex group, of which none of the many species can be identified in the peat by the naked eye. The newly-dug peat when exposed to the oxidizing action of the atmosphere quickly turns black. Possessing neither the elasticity nor the absorptive value of the peats previously described and disintegrating readily under the hoofs of animals to cause large amounts of dust, it does not yield a good litter. The plant nutritive value is, however, comparatively high. Its absorptive value varies from 8 to 13 times its own weight.

Reed and sedge peat consists of residues of these plants. In quality it compares in almost all respects with the carex peat. It has absorptive values from 3.5 to 8 times its own weight. The ash content is however, higher than that of carex peat.

Hypnum peat This is composed of the residue of the moss hypnum, of which there are many species. The hypnum mosses differ widely from the sphagnums both in anatomical structure and in chemical composition. Hypnum moss belongs to the low-bog mosses and is generally intermixed with carex reed and sedge peat, but often occurs alone in massive strata covering wide areas. The colour of this peat is yellowish brown to reddish brown and in its highest degree of humification dark brown. Hypnum peat is brittle and the most easily disintegrated, possessing not even a trace of fibre; it produces mull only, or, by less intensive shredding, pieces of hazelnut size, which posses neither elasticity nor porosity. In mixture with carex or reed peat, which usually occur in the same deposit, a somewhat better quality is attainable, but it is an inferior article.

Other peat mosses that occur in large strata or intermixed with other types are the star mosses originating from the mosses Meesia, Paduella, Verbera, Polyctrium etc. They produce inferior peat litters, which in value are comparable with hypnum peat moss.

3. Wood peat occurs in certain high bogs and in most low bogs, in the latter usually in strata of fair depth. It consists of decomposed or humified wood from birch in the high and from alder in the low bogs. This peat is crumbly, contains whole pieces of undecomposed wood and bark residue, and if made into a litter contains much dust. As a commercial article it has no value, but may find some local uses in composts, for sanitary purposes, cess-pools, etc.

Bog Earth and Hearth Peat are both formed in the surface strata of peat bogs that have been drained for a long time, and consist chiefly of the decomposed residues of the surface vegetation,

principally of the Vaccinium class, which produce humus-like, earthy peat. This class of peat has no commercial value except for uses similar to those of wood peat.

Chemical Composition of Unhumified Peats

In order to convey an idea of the chemical composition of unhumified or slightly humified peats, figures have been compiled giving the characteristic analyses of the various kinds.

Kind of peat	% organic matter	% ash	% nitrogen	% potash	% phosphoric acid	% lime
Sphagnum moss, slightly humified	98.0	2.0	0.8	0.06	0.11	0.12
Cotton grass slightly humified	99.4	0.6	0.9	0.06	0.06	0.12
Carex grass slightly humified	96.0	4.0	2.2	0.06	0.14	1.8
Reed slightly humified	85.5	14.5	1.7	0.24	0.39	0.9
Hypnum slightly humified	92.0	8.0	2.6	0.13	0.18	3.0
Birch wood peat	97.5	2.5	1.6	0.05	0.11	0.5
Heath humus	90.0	10.0	2.3	0.13	0.46	0.3

These analyses show in particular that the ash content varies appreciably with the botanical classification. It may reach as high as 25 per cent and over in some inferior peats. This is not however entirely derived from the ash of the plants from which the peats are formed but largely from inorganic matter deposited from running water or springs or from dust carried by the wind.

In general the limit set for the ash content of fibrous peat should not exceed 5 per cent for sphagnum - Eriophorum moss; 10 per cent for carex and hypnum; and 15 per cent for reed peat, all on the basis of dry substance.

High content of ash makes the products heavy, lowers their absorptive value and contributes to the formation of dust, besides adulterating the commodity with an inert material.

The organic substances in an unhumified peat consist of many compounds, albumen, starches, sugars, tannin substances, fats, acids, dye stuffs etc., which during the long process of humification by extensive chemical reactions are converted into a wide range of chemical compounds, the final substances being those of the humus acid series. The content of plant food such as potash, phosphoric acid, nitrogen and lime also varies in

accordance with whether it is high or low bog peat. As a rule sphagnum-cotton grass peats are impoverished in respect to these inorganic substances, which was to be expected from their low ash content; they should contain from 0.5 to 1.0 per cent of nitrogen, whereas carex and reed peats contain from 1 to 3 per cent. Reed peat is noticeably high in all plant food, but this advantage far from compensates for its physical inferiority.

Physical Properties of Peats

Of even greater importance than the chemical, are the physical properties of unhumified peat as these constitute the qualities most required of a good commercial article, which should have a good absorptive value for liquids and gases, be not too hygroscopic, suffer little loss from shrinkage in drying and possess high porosity, good elasticity and antiseptic qualities. It should not be liable to spontaneous combustion.

Absorptive value

The peat mosses possess higher adsorptive value than any other material used as litter. This is due to their high porosity and the capillarity of the plants from which they were formed enhanced by the peculiar anatomical structure of the sphagnum mosses, which by nature are built for the storage of water. The absorptive value of a peat is primarily dependent therefore on its botanical structure, only secondarily on its degree of humification and ash content.

The botanical composition plays an important part in the absorptive value, because the anatomic-morphological structure of the individual peat-forming plants is quite different and shows capillary tissues, pores and water-retaining cells, which are of importance in enhancing the capacity for absorption of water. The sphagnum mosses are in this respect the most highly specialized, not only because the stems, leaves and branches hold the water by capillarity, but also because they possess special water-absorbing organs. The stem is composed of thin, delicately walled, elongated cells (which later become woody), surrounded by cells of the hyaline 'bark' arranged in layers.* These hyaline cells have neither plasma nor chlorophyll and are particularly associated with the storage of the water, as are also the hyaline cells of the leaves. The structure of the leaves is quite different from that of other mosses. The cells of the branch leaves are of two sorts, very large hyaline rhomboidal or elliptical cells having the walls spirally thickened and often perforated by round pores, and the true chlorophylose cells, which are narrow and elongated and lie between each other.** The leaves

*Torfstreu und Torfstreuwerke by Dr. V. Zailer, p. 21
**Mosses with Hand Lens and Microscope by A. J. Grout, p.51.

of some species are pink or deep red and furnish microscopic mounts of great beauty. Beside the chlorophyll-free cells there also occur with the exception of the cymbifolium group, retort-shaped cells on the branches with openings towards the outside, which serve solely for water absorption. Other anatomical peculiarities of the sphagnum mosses are those of forming dense cushions and by having the branches, stems and concave leaves appressed to each other the capillarity is further increased to a considerable degree.

Not all sphagnum mosses possess equal absorptive value, which according to H. Paul* is appreciably greater for the high bog sphagnums than for those of the low bogs. The fact that the absorptive value of a moss depends solely on the species of sphagnum that built up the bog has been shown by V. Feilitzen** in his investigation on Swedish sphagnum mosses; as the Canadian sphagnum in the main are identical with those in Europe*** and the species included in his tabulation are common in the Canadian bogs, Feilitzen's figures are applicable to the Canadian sphagnum mosses.

The absorptive values of the various sphagnums are as follows:-

Sphagnum	molluscum	26.8	times	its	own	weight
"	papillosum	25.3	"	"	"	"
"	medium	23.2	"	"	"	"
"	cymbifolium	23.1	"	"	"	"
"	cuspidatum	20.3	"	"	"	"
"	auctifolium	18.6	"	"	"	"

In dried or partly dried and slightly humified condition, the sphagnum mosses, however, absorb much less water and so the absorptive value of commercial mosses is always much less than the maximum figure shown in the table, ranging from 12 to 20 times their own weight. The hypnum mosses are less suitable for water storage as they do not possess the cells typical of the sphagnum mosses and can absorb the water only by capillarity between small leaves close to the stem, none penetrating the cells. The relative absorptive value of the peat moss is therefore small, usually below 15 times its own weight.

Still more unfavourable in this respect are the star mosses, which occur in some bogs and have absorptive values of about 3 times their own weight.

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*Die Aufnahmefähigkeit des Torfmoose fur Wasser, Mitteil. der Kgl. bayr. Moorkulteranstalt, Pamph. 2, p. 111, by Dr. H. Paul.

**Svenska Mosskultur foreningens Tidskrift, 1888 Jonköping Sweden, p. 310.

***Mosses with Hand-lens and Microscope, by A. J. Grout, p.51

Other peat-forming plants such as carex, scheuchzeria, reed, and Eriophorum differ in this respect only slightly as they all consist of stems, leaves and roots of grasses and sedges without special capacity for storing water.

The absorptive value increases somewhat in species possessing finer stems and compact roots, which form more capillary tubes than do the coarser-stemmed and smaller-rooted plants.

By increased humification the absorptive value gradually decreases until the porosity of the sphagnum mosses is negligible and they become homogeneous and converted into a brown or black fuel peat possessing little absorptive value. Peats composed of a mixture of humified and fibrous peat are further reduced in value owing to their poor elasticity and tendency to form dust when utilized in stables and poultry pens.

The absorptive value of a commercial peat is increased proportionately to its disintegration. Feilitzen* in his investigation of Swedish peat litters and peat mulls found that this increased up to 330 additional parts per 100 parts. Screenings finer than $\frac{1}{2}$ millimetre, however, had a lower absorptive value, the explanation being that the finest grain classes consist not of fibrous peat alone, but principally of earthy humus, highly humified peat, and dust of inorganic composition deposited in the bogs by streams, springs and wind. This is especially the case with reed, carex peat and heath humus, which are heavy, dust freely and have absorptive values from 3 to 10 times their own weight.

By hard freezing of the wet sods and subsequent thawing and drying the absroptive value is appreciably increased. J. Nestler** investigating a number of varieties of peat found a marked increase in the absorptive value of peat that had been frozen; in some cases it was twice as high as for peat that had not been subjected to low temperatures. The peat became more porous and dried with less shrinkage. The subject is discussed under the heading "Shrinkage in drying".

*Svenska Mosskultur Foreningens Tidskrift, 1888, p. 311 .
** Wochenblatt des landw. Vereins in Baden No. 3, 1886

Manufacturers in most parts of Canada Therefore benefit by having the quality of their peat moss products improved without extra cost in the manufacture.

Hygroscopic quality. Closely related to the absorptive capacity for water lies the hygroscopic quality of peat, i.e. its capacity for absorbing moisture from the air. It is well known that humus matter exceeds all mineral bodies in this respect and this is especially true with very porous substances like the peat mosses, which absorb water vapour more readily than bodies of high density. The content of moisture increases with the humidity of the atmosphere for water vapour penetrates into the finest pores and capillaries, where it condenses.

Zailer* investigated samples representing characteristic peats placed in water-saturated atmosphere at a temperature of 15°C. examining them at intervals of one-half, one, and three weeks, when the hygroscopic quality was determined.

It was found that the hygroscopic quality as well as the rate of absorption from the air diminished with the degree of humification of the peat; the porous material is more hygroscopic than that of greater density. In accordance with their hygroscopic qualities the various kinds of fibrous peat are placed in the following order, sphagnum, hypnum, scheuchzeria, Eriophorum, carex and last, reed peat.

Hygroscopic quality is an important consideration in handling peat products in the trade. The manufactured bales and dried sods should be protected from moist atmosphere and kept in dry storage rooms, and the dry sods in the field piles should be protected from the weather and damp winds.

Absorption of gases: In the same way as water vapour, ammonia, carbonic acid, hydrogen sulphide and other gases of offensive odour are absorbed by the various kinds of peat. Of especial importance is the absorption of ammonia not only because it reclaims a valuable constituent of the manure of animals but its removal from the atmosphere of stables and poultry pens materially contributes to the health of the employees and animals. Constant breathing of ammoniacal air affects the respiratory organs and the eyes.

The absorption of ammonia is both physical and chemical. In peat that is not humified or only slightly so, and contains no appreciable amounts of humus acids, the absorption of ammonia is mainly by a process of condensation in the pores and in the minute

*Torfstreu und Tortstreuwerke by V. Zailer, 1915, p. 27-28

spaces between the particles, just as water is absorbed by the sphagnum peat mosses. In more humified peats, however, a chemical reaction occurs, the ammonia base reacting with the humus acids to form neutral compounds.

Besides ammonia, peat litter readily absorbs appreciable quantities of carbonic acid, which is also attributed to a condensation process in the hyaline plant cells and in the finely porous interstices of the plant fibres and is therefore altogether of a physical nature. Born* has shown that of the air in the stables of the Berlin tramways, 1000 parts contained 1.0 part of carbonic acid, when peat litter was used, compared with 1.4 to 2.9 parts for straw litter. Similar conditions apply also to the hydrogen sulphide and other gases of offensive odour invariably present in stable atmospheres that are both unpleasant and detrimental to health.

Shrinkage in drying: A soft, elastic peat litter can be obtained only from a peat that dries with little shrinkage in volume. Sphagnum mosses lend themselves most readily to this because sphagnum peat dry substance weighs only from 148 to 190 pounds per cubic yard. For hypnum peat the weight ranges from 160 to 315 pounds, for carex 219 to 438, and for reed peat from 266 to 466.**

Whenever possible, in order to decrease shrinkage in drying, the wet sods should be allowed to freeze, which as already mentioned increases the absorptive value of the peat. At the Bremer Moorversuch Station (Bremen Peat Bog Investigating Station) in their investigation of frozen peat it was shown that frozen and unfrozen samples of the same kind of peat of equal volume, when dried to the same moisture content, measured 273 cubic centimetres and 134 cubic centimetres respectively or, converted into weight per cubic metre, 360 and 747 kilogrammes. According to Litzen*** the higher porosity and decreased shrinkage effected by hard freezing of the wet peat sods is not due to any chemical change in its constitution. A water-saturated substance like raw peat sods increases in volume when the water freezes, causing disintegration of the solids. In early spring a slow thawing takes place, but peat moss being a very poor conductor of heat the sods dry on the surface before they are thawed out and the solidly frozen core prevents shrinkage during drying. It has been estimated that frozen peat moss sods when dried to the desired water content of 25 to 30 per cent will decrease in volume on the average

*Torfstreu und Torfstreuwerke, by Dr. V. Zailer, p. 31
**Torfstreu und Torfstreuwerke, by Dr. V. Zailer, p. 32
***Uber die Veranderung feuchten Torfes durch Frost. Mitteil, d. Vereins zu Förderung d. Mosskultur in Deutches Reich 1914, p. 278.

only 20 per cent instead of 50 per cent as is the case with unfrozen sods. The fibres are, moreover, divided by fissures and a light and porous material results, easily and more effectively disintegrated by the shredder in the finishing mill.

The Canadian climate is therefore very favourable for a peat moss production; warm summers and cold winters and an abundance of excellent raw material put Canada in a position to produce an article superior to that of most countries and thus enable her to demand a better price than is obtainable by most European countries. Statistics of importation into the United States classify Canadian peat moss per ton almost $10.00 higher than German and $5.00 higher than Swedish moss.*

Heat Conductivity: Owing to its porosity and readiness to form air spaces peat moss is Nature's best insulator as well as a good sound-proofing material, and it has found extensive use in the building trade and in refrigeration plants. In Germany especially it is used extensively as an insulating material on ships, railway cars, aeroplanes, buildings, etc., replacing the cork formerly used. The manufacture of insulating boards made from peat moss is dealt with in this report.

Elasticity: The elasticity of a commercial peat moss is due to its fine fibres and the comparatively small shrinkage in the drying of the raw peat. Sphagnum-Eriophorum peat moss possesses the highest elasticity of all peats, because the Eriophorum sedge fibre especially is both fine and tough in texture. It has an absolute tensile strength of 1,87 kilogrammesper square millimetre.** The numerous brancing stems of the sphagnum moss give high elasticity to a litter but render the moss somewhat more difficult to disintegrate in the shredder. Carex and hypnum peats may be classed as rather brittle whereas wood peat and heath humus readily disintegrate when exposed to the air and yield litters of slight elasticity that dust freely. Reed peat possesses in its more unhumified state a felty cigarette tobacco-like consistency of high elasticity and softness, but it crumbles readily under the feet of animals and owing to its low absorptive value forms a slurry-like mass with the liquid manure.

Low bog peats in general, owing to their brittleness, after passing through the shredder, yield 40 to 50 per cent of mull and only 40 to 60 per cent of litter, whereas high bog peats yield only 15 to 20 per cent of mull.*** The injurious effect of dust formed from peat litter should not be attributed to small

*Commercial Intelligence Journal, Department of Trade and Commerce, Ottawa, November 9, 1940, p. 641.
**Die Eigenschaften der Torfstreu, ref. by V. Zailer, Torfstreu und Torfstreuwerke, p. 31.
***Torfstreu und Torfstreuwerke, by V. Zailer, p. 32.

particles separated from the fibres during the disintegration of the sods in the finishing mill, but to the finest particles of dust, barely discernible with the naked eye, consisting mostly of inorganic matter. These settle on and lacerate the mucous membrane of the respiratory and sight organs. This defect in a peat of inferior quality is easily detected by raking around the litter with the hand, when the dust adheres so firmly that it cannot be blown off.

Disinfective qualities: Much divergence of opinion exists in regard to the disinfective quality of peat mosses. Grout* refers to the subject, as does also Nina L. Marshall** who bases her opinion on the fact that the body of a woman dressed in haircloth was found in perfect preservation in a peat bog at a depth of 10 feet, having been there for several hundred years and that logs of trees found in bogs for comparable periods of time show no sign of decay. This may be due, however, to the lack of oxygen, a condition necessary for the process of humification to take place. Zailer quoting several authorities opines that although peat itself cannot properly be classed as a disinfectant, it possesses certain disinfective qualities, due to the strongly acid reaction of its humus substances, which are not, however, themselves altogether germ-free. This disinfective quality may also to a certain extent be traced back to the great absorptive value and resistance against decomposition of the peat moss itself, its deodorant quality, which to a certain extent prevents the increase of lower organisms, and to its low conductivity of heat. The antiseptic action of peat mosses has been evidenced in many ways, for example: foot and mouth disease among cattle is less prevalent and much less virulent where peat litter is used in stables; in chicken farms the loss through disease, especially bumble foot, has practically disappeared, sphagnum moss has also found uses for bandages and pads by surgeons and veterinaries, and for the packing of perishable foods, such as fruit, fish, eggs and meat, which keep fresh for several weeks. During the past year oranges, bananas and eggs packed in fine peat mull were sent overseas by parcel post to patients in military hospitals in England. The recipients state that the fruit arrived in perfect condition and that the eggs were fresh and had not the musty taste, as when other packing materials were used.

Inflammability: Peat moss as compared with other packing materials, straw, excelsior, paper, etc. is not easily ignited. The latter materials burn with a bright flame, whereas for peat moss the combustion is more smouldering and the fire is quickly detected by the peculiar odour of the smoke. The Bremer Moorversuch Station has determined the ignition temperature of sphagnum moss at 205°C. or 401°F.

*Mosses with Hand-lens and Microscope by A.J. Grout, p. 51
**Mosses and Lichens, by Nina L. Marshall, p. 110

Spontaneous combustion: As in the case of pressed semi-dried hay or baled cotton, spontaneous combustion may occur with peat moss but much more rarely. It is more likely to happen in large storage piles of air-dried peat sods, which may contain sods of higher content of moisture. Storage piles need therefore to be ventilated by air passages.

The cause of spontaneous combustion of peat moss has been given careful investigation but as far as can be learned without definite results.

E. Haglund* studied the matter in detail in his investigation of many Swedish peat mosses, and proved definitely that the increase in temperature of baled peat moss was due neither to the action of bacteria nor to the free access to the combustibles of the oxygen in the air, but originates internally and the fire may take weeks to reach the surface of the bale.

Spontaneous combustion has a very harmful effect on the quality of the peat moss, which assumes a dark shiny colour, becomes brittle and in composition resembles peat fuel. The weight increases from 187 to 339 kilogrammes per cubic metre and the carbon content from 50.8 to 52.3 per cent.

Standards and Specifications of Commercial Peat Moss

In the peat moss trade some confusion exists in regard to the quality of the products, no standard having been so far generally adopted in regard to the name of the products, the physical and chemical standards of the peat, and the size and weight of packages. Thus in Europe the products are usually named according to the size of the shredded material as peat litter, poultry litter, and mull, whereas in Canada and the United States the word peat moss is generally used, whether the product is derived from moss, sedge, reed or other aquatic plants. Bales and packages are of many sizes, in Europe ranging from 130 to 220 pounds, and in Canada they range from 75 to 130 pounds, and many other sizes of smaller packages are in use according to the requirements of the trade.

In Europe attempts to evolve standards for the evaluation of commercial peats have not led to their general acceptance.

Of great importance to the peat moss industry is the fact that the United States Treasury Department, through its Procurement Division, Washington, D. C. has adopted standards for the distinct grades of peat recognized commercially, and has issued specifications to cover their purchase by the Federal Government.**

*Svenska Mosskultur föreningens Tidskrift, pamph. 1, 1909.

**No. 563, May 19, 1942, Specifications for Peat (Moss, Reed and Sedge), and Technical Bull. No. 769, Peat Resources of Alaska, by A. P. Dachnowski-Stokes, U. S. Dept. of Agricultu p. 71.

In the event of an emergency, production in quantity will therefore not be delayed by lack of information, and the operating plants will be able to produce a uniform quality of peat material, when and where needed. The standardization of peat products implies the selection of a few types most suitable for the purposes desired. Specifications, on the other hand, deal with a description of the characteristics of the kind of peat to be procured. The peat industry can largely aid in the work of standardization by co-operating with the standardizing agencies concerned. Even producers and dealers not interested in obtaining government contracts should familiarize themselves with the specifications for the grade of peat produced. They are as follows:-

"Peat shall be furnished in the following types and classes, as specified in the invitation bids:-

Type I. Moss peat.

Class A. Horticultural grade (fine shreds)
Class B. Poultry litter (medium shreds)
Class C. Stable bedding (coarse shreds)

Type II. Reed muck or sedge muck

Type III. Reed peat or sedge peat

Class A. Acid grade
Class B. Nearly neutral grade.

"DETAIL REQUIREMENTS:

Type I. - Moss peat shall be the poorly decomposed (fibrous or cellular) stems and leaves of any of several species of sphagnum mosses. Its texture may vary from porous fibrous to spongy fibrous and it shall be either crumbly or compact but fairly elastic and substantially homogeneous. It shall be free from decomposed colloidal residue, wood, sulfur and iron and shall be brown in colour, tinted grey, yellow or red.

"Acidity: - The PH value shall be not less than 3.5 and not greater than 5.5.

"Moisture content:- Peat shall be furnished in air-dry condition and shall contain not more than 35 per cent moisture by weight.

"Water holding capacity:- Shall be not less than 1100 per cent, by weight, on an oven-dry basis.

"Coarseness classification of shreds: - Peat shall be furnished in three classes of coarseness, as specified in the invitation for bids;

Class A (Horticultural grade) - Shall be finely shredded material suitable for horticultural purposes. Particles shall vary in size from dust up to the size of wheat bran.

Class B (Poultry litter) - Shall be medium shredded, suitable for use as poultry litter. It shall be coarser than Class A and lumpy. Individual pieces may be as large as walnuts.

Class C (Stable bedding) - Shall be coarsely shredded, suitable for use as stable bedding. It shall be coarser than classes A and B and may contain larger lumps.

"Note Where the highest grade of moss peat (type I) is not required, the purchaser may find satisfactory a grade containing up to 2 per cent of foreign matter, such as twigs and cotton grass. In this event, it should be so specified in the invitation for bids.

"Type II. Reed muck or sedge muck, shall be finely divided plant debris, in a fairly advanced state of decomposition (peat humus). It shall be furnished in granular form, of uniform composition and size, free from hard lumps. It shall be low in wood, sulfur and iron content and shall be dark brown to black in colour.

"Acidity:- The PH value shall be not less than 5.0 and not more than 7.5.

"Moisture content:- Shall be not more than 55 per cent by weight.

"Water holding capacity:- Shall be not less than 100 per cent, by weight on an oven-dry basis,

"Ash:- Shall be not more than 15 per cent.

"Type III. Reed peat or sedge peat shall be the moderately decomposed stems and roots of rushes, coarse grasses, sedges, reeds, canes, and similar plants. It shall be coarse or finely fibrous, and brown in colour. It shall be low in wood, decomposed colloidal residue, sulfur, and iron content. It shall have either a definitely acid reaction (Class A) or be slightly acid to slightly alkaline (Class B) as specified in the invitation for bids.

"Acidity:- Class A shall have a PH value not lower than 4.5 and not greater than 5.5.

Class B shall have a PH value not lower than 5.5 and not greater than 7.5.

"Moisture content:- Shall be not more than 50 per cent by weight.

"Water holding capacity:- Shall be not less than 350 per cent, by weight, on an oven-dry basis.

"Ash:- Shall not be more than 10 per cent.

PACKAGING, PACKING, AND MARKING FOR SHIPMENT.

"Packaging:- Unless otherwise specified, commercial packages are acceptable under this specification.

"Packing:- Unless otherwise specified, the subject commodity shall be delivered in standard commercial containers, so constructed as to insure acceptance by common or other carriers, for safe transportation, at the lowest rate, to the point of delivery.

"Marking.
Issue packages:- Unless otherwise specified, each package shall be marked with the name of the manufacturer.

"Shipping containers:- Unless otherwise specified, shipping containers shall be marked with the name of the material and the quantity contained therein, as defined by the contract or order under which the shipment is made, the name of the contractor, and the number of the contract or order.

NOTES

"Purchasers should exercise any desired options offered herein and should specify the types and classes required. Type I, moss peat, is generally designated by the trade as 'peat moss'.

"The various types of peat specified herein commonly have a water absorption capacity greatly in excess of the minimum specified. The following limits are characteristic of the respective types:

Moss peat	1100 to 2000 per cent
Reed muck or sedge muck,	100 to 350 per cent
Reed peat or sedge peat,	350 to 800 per cent.

"Peat having a higher moisture content than is permitted by this specification but otherwise meeting specification requirements, may be considered acceptable by the inspector, at an appropriate reduction from contract price."

In the above specification no mention is made in regard to the upper limit of ash content in the peat moss class. In most cases 5.0 per cent of ash computed on the dry basis is considered normal. Ash content in peat moss used in metallurgical processes,

however, should not exceed 2.0 per cent and absorption value should be not less than 12 times its own weight in water computed on the dry basis.

Peat moss used as a base for the preparation of various commercial stock foods must be prepared from the purest obtainable sphagnum moss free from dust and ground to a certain size grain.

Chemical and Physical Examination of Raw and Commercial Peats

Sampling: In determining the commercial value of a peat deposit it is necessary to collect samples from the bog carefully and systematically and from them determine the water and ash content, absorption value, both for liquids and gases, especially ammonia, the pH value, the content of nitrogen, potash, lime and phosphoric acid. It is of importance also to have microscopic examination made of the sample to determine the botanical species present, from which the classification of the peat can be predicted with fair accuracy. Notes should be taken of the characteristics of the bog surface, whether high or low moor, and of the vegetation from which the peat was derived. One need never expect, for example, to obtain a first quality sphagnum moss on a low grassy bog, but on the other hand, after taking the vegetation into consideration it is reasonable to expect good material for peat moss products from the stratum immediately below the layer of vegetation in a high bog, although this is not necessarily the case, and many deposits, especially in the provinces of Ontario and Quebec, yield strata of well humified peat underlying a heavy growth of sphagnum moss. In order to obtain a true conception of the structure of a bog, the quality of its different strata and their thickness, samples have to be taken at regular intervals in depth, using specially devised boring equipment and these samples are examined physically and chemically analysed. At the time of sampling a preliminary examination should be made in regard to the colour of the peat in the natural state and after the water is squeezed out. The colour of the water in the peat when squeezed in the hand gives a fair indication of the quality of the peat; if clear and white, only slight humification has occurred or none at all, but if coloured and muddy, humified peat is present. Raw peat that squeezes out between the fingers when pressed in the hand is usually in a fairly advanced stage of humification. The thickness of the strata should be determined as well as the character of the bottom of the bog, whether clay, sand, gravel, rock, etc. The drill holes must be distributed over the surface of the bog in accordance with the topographical characteristics and should be located especially in depressions and elevations.

The sampler used is termed a chamber bore*; it takes a sample at any depth of the bog. The samples should be placed in

*Torfstreu und Torfstreuwerke, by Dr. V. Zailer, p. 80, fig. 20

air-tight containers of glass or non-corrosive metal and sent to the laboratory for further examination, physical and chemical.

In order to obtain a true general sample of a shipment of processed moss at least every eighth or tenth bale should be sampled. To avoid opening the bale a special bore has been devised by Br. Tacke-Bremen* by means of which a core may be obtained right through the bale. The samples must be placed immediately in air-tight containers and on no account in paper wrappers or in sacks.

Methods of chemical analysis and physical tests

Moisture content: Place 5 to 10 grammes in a tared and covered weighing bottle and weigh to the nearest milligramme. Record the weight. Remove the cover and place vessel and contents in drying oven at 105° to 110°C. until constant weight is obtained. Before each weighing, cool the vessel and content in desiccator. Compute the per cent of moisture, based on oven-dry weight.

Acidity: Determine the hydrogen-ion concentration, pH value, by any convenient approved method. In preparing the solution for this test use distilled water of known pH value and sample in a ratio 4 to 1, respectively by weight, permitting the material to soak for 30 minutes at a temperature of 20° to 30°C. Determine the pH value at approximately 25°C.

Absorptive value: For this determination peat in the raw state must not be subjected to partial preliminary drying, because dried or partly dried peat or muck may not re-absorb water to its original absorbing capacity. The method of analysis is as follows: A sample of 30 grammes of the peat as described above, is weighed out and 1 litre of boiling water poured over it, then stirred up several times until the peat sinks to the bottom of the beaker.

After soaking for at least six hours the water is decanted off and the mass is turned into a mortar, then mashed with a pounder and the water that has been already decanted off poured on the peat moss.

When stirred by hand, no lumps should be felt, only loose fibres. The alluvial peat moss is poured into a graduated cube-shaped copper wire basket, having a mesh of from two to one millimetre, and a content of one litre. Peat substance that screens through the basket with the water is taken and poured into the basket with the other peat and screened again. No notice should be taken if the filtrate is muddied and still contains some small particles of peat.

*Torfstreu und Torfstreuwerke, by V. Zailer, p. 39, fig. 3.

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The basket is then inclined at an angle of 45° with one corner turned downward and kept in this position until less than one drop of water a minute passes from the basket. The basket with content is then weighed, standing in an evaporating basin.

The basket, peat and basin are dried at 105°C. until constant weight is obtained. Knowing the weight of the empty basket and basin the absorptive value is computed for absolutely dry peat and for peat of 25 per cent moisture content.

Absorption of Ammonia: One gramme of the sample, evenly disintegrated, is weighed out on a watch glass and placed for 24 hours in an atmosphere saturated with ammonia gas and afterwards aired for another 24 hours. The nitrogen content absorbed by the peat is determined by the Kjeldahl method. In calculating the ammonia, account must be taken of the nitrogen present in the original peat, which also must be determined. It is not permissible to calculate the absorptive value of ammonia on the basis of dry substance as the ammonia absorption is appreciably increased by the water content in the peat. Analysis should therefore report ammonia absorption on the sample as received, stating the moisture content of the peat.

Hygroscopic Quality: This determination is made by placing 5 grammes of peat for one half to one week's time into a glass bell with a water-saturated atmosphere. After that time the sample is weighed and from the increase in weight the moisture taken up is calculated in parts per cent.

Earthy material and humus matter: These are determined by stirring up a weighed quantity of peat in a tall beaker filled almost to the brim with water and allowing it to stand for a short while. The fibrous peat floats to the surface while earthy material and well humified peat sinks to the bottom. The fibrous peat is skimmed and decanted off and the sediment is filtered on a tared filter, dried, and weighed.

The results obtained by this method are only approximate. Care must be taken not to allow too long time for the settling of the earthy and humus matter, because otherwise part of the fibre may become water-logged, sink to the bottom and yield high results.

Nitrogen, phosphoric acid, potash and lime are determined in accordance with methods of analysis used in soil analysis.

Peat Moss Deposits

The bogs examined in 1942 are situated in Quebec near Waterville, St. Blaise and Napierville; in Ontario near Brockville, at Branchton, two bogs near Fort William, six bogs in the Rainy River district; in Manitoba the Julius bog, three bogs in Lac du Bonnet district; in Alberta a bog near Edmonton; in British Columbia two bogs near Penticton, three bogs near Kelowna and some large bogs

in the Fraser Valley. Besides these a number of bogs reported to contain good peat moss were visited but found to contain no moss or else peat of inferior quality and of no commercial value.

As the territory covered was large, time did not permit of detailed work or mapping of deposits newly discovered, nor was it possible to visit all areas where peat moss deposits are known to occur; thorough sampling of the deposits investigated was not possible, samples in most cases being collected along a line across the centre of the bog, advantage being taken of roads or railways crossing the bog, wherever available. Drilled holes were placed 800 to 1000 feet apart and had a maximum depth of 15 feet. The samples from each stratum of a deposit were made into a composite sample and were analysed. Records were kept of the depth of the deposit, up to 15 feet, when sampled.

Quebec

Three bogs in the Eastern Townships had been reported as especially well situated for shipping to the United States eastern market and to contain a good grade of peat moss.

The Waterville Bog

The Waterville bog is situated 2 miles south of the village of Waterville in Sherbrooke county. A fair country road crosses the southern end. Its area comprises 200 acres of heavy growth of sphagnum moss.

The bog has been worked for some years past and produces annually about 1000 bales of moss, the greater part of which consists of floral moss i.e., dried top moss and a much smaller quantity of commercial peat moss.

Two lines were run across the deposit, the base line of 1500 feet and a cross line of about the same length, and holes were drilled every 200 feet. The samples recovered revealed a very light cover of moss underlying the top growth ranging from 5 to 8 inches in thickness. The bog therefore is suitable only for the production of peat moss as a by-product of a few hundred bales, as the top moss is stripped off.

The moss is sphagnum of good quality, only slightly humified, of light weight, light yellowish in colour and is elastic.

Analysis of Peat Moss*

Absorptive value, dry basis	18.0
" " 25 per cent moisture basis	13.5
Ash dry basis	4.0 per cent

No sample was collected of the floral moss. This type of moss finds a limited market for nurseries and in re-afforestation, and as packing material for shipments of trees, shrubs, roots, etc.

St. Blaise Bog

The St. Blaise bog is situated west of Girard station on the Canadian National railway and can be reached by roads one mile northwest and one mile southwest and thence by trail for two miles ending at the centre of the bog.

The centre of the bog is of the floating form, very wet, resilient, and difficult to traverse without sinking into it. It is an open bog with two small lakes, one at the centre and the other farther south. It has a heavy cover of live moss. From the central lake this kind of bog continues southward for 1700 feet, after which the surface growth becomes a mixture of moss, grass and sedges with small birch and tamarack to the end of the bog.

Northeastward from the floating portion is a narrow strip of high, dry land covered with thick bush and trees, beyond which lies a large open space with top growth mainly of bog rosemary and labrador tea.

A line was run through the centre of the bog and samples were collected every 1000 feet.

The central part of the deposit, which was expected to yield good peat moss, has a cover of only 2 feet of live moss and beneath this 7 feet of well humified peat. The north part of the bog is dry and firm and contains only well humified fuel peat of good quality. The moss of the southern part is of much the same character as that of the centre of the bog and extends 4800 feet southward from the central lake.

*The analysis in this report have been made by the Fuel Research Laboratories of this department.

Analyses of the peat

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
North part of bog	4.2	2.9	4.9	1.6
Centre " " "	5.6	3.9	6.3	1.6
South " " "	6.0	4.2	6.4	2.2

Analyses show the peat to be of inferior quality, unsuitable for litter and in agriculture. The report of the occurrence of peat moss therefore probably arose from the heavy surface growth of sphagnum covering the floating bog being mistaken for peat moss.

Napierville Bog

An investigation was made of the Napierville bog, which had been reported to contain a cover of unhumified peat, although reports of earlier investigations make no reference to this.

The bog is situated 4 miles southwest of the town of Napierville. The new Montreal - Champlain (N.Y.) highway crosses the deposit.

It is a large bog mostly covered with wood and bush, and its area as estimated by Anrep is 7,000 acres. A large area is partly drained by a canal as well as by the Little Montreal River.

The bog has a cover of partly humified peat of the sedge peat variety, but only 6 to 8 inches thick. Two composite samples were collected from this top stratum; No. 1 on the line parallel with and on the west side of the new highway, and No. 2 from the east part of the bog along the Little Montreal River.

Analyses of the top stratum of unhumified peat

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
No. 1	8.8	6.4	8.8	2.0
No. 2	8.5	6.1	8.0	2.1

Analyses show that the two samples represent an inferior quality of unhumified peat appreciably below standard requirements in regard to absorptive value, and of high ash content unsuitable for litter as bedding. The nitrogen content, however, is fairly high, wherefore this peat may serve some limited local uses such as in composts, or for sanitary purposes, and in cess-pools. The

peat is dark in colour with some intermixture of humified peat and is composed mainly of residues of sedges and grasses. The bog however contains good fuel peat to a depth of 5 to 10 feet. The analyses show an unusual similarity in the composition of the two samples in view of the fact that they represent two different areas of the bog.

Summary for the Province of Quebec

At the present stage of this investigation of peat moss deposits examined in the Eastern Townships of the Province of Quebec, no peat-moss bog of importance has been found. The deposits invariably run to fuel peat, humified peat or a mixture of fibrous and humified peat underlying the cover of vegetation of live moss, grasses or sedges. In this part of the province there is some production of peat humus for horticultural use and as filler for artificial fertilizers; there is a small production of floral moss used by florists and the forestry service as packing material, and also a small production of peat fuel. In regard to large peat moss deposits in other parts of the province reference should be made to Memorandum Series Nos. 80 and 81.

Ontario

The Brockville Bog

This bog is situated a short distance north of the city of Brockville and can be reached by a good road. It has an area of about 1000 acres and at one time was worked for peat fuel. Little remains of the old plant, which discontinued operation over 35 years ago, nor are there any signs of old workings near it.

As the western part of the bog has been reported to contain unhumified peat this was examined but it was found that drainage of the bog by cultivation and by adjoining fields for several years past has dried the surface of the bog and the fibrous peat has been destroyed.

The Luther Bog

A brief description of the Luther bog, based on the results of a cursory examination made in the autumn of 1940 appears in Memorandum Series No. 80. Since then an appreciable amount of drainage work has been done in its southern part. The drainage system consists of a main drain 3 to 4 feet in depth, extending about 2500 feet as far as a lake running north and south; lateral drains have been dug 300 feet apart running east and west. From these cutting lanes extend at right angles. The drainage system

is sufficient and has produced a dry surface without pools or soft areas, and the bog has become of sufficient buoyancy to support the weight of a tractor and trailer.

The peat moss cut is estimated at 300 tons. It has been dried on the field and placed in 20 stacks.

The stratum of unhumified moss has a thickness of 18 inches, which appears to be uniform for the 400 acres of the drained area. Underlying this is a 6-inch stratum composed of partly humified peat intermixed with small branches and roots, probably residues from surface growth of small bushes and dwarf trees. Below this stratum lies well humified fuel peat of good quality to a depth of 5 to 7 feet which forms the bulk of the deposit. Between the lake and concession VI is an open area of 300 to 400 acres, with a cover of moss of 18 inches, a thickness apparently uniform for the open areas of the bog. Eighteen inches of peat moss appears a very light cover and of doubtful value as a deposit of peat moss, yet the operators of the bog, basing their estimate on the cost of the initial production of 300 tons of air-dried sods, believe the cost to be well within the margin of profit. This fact is interesting because, according to all precedents, deposits less than 3 feet in depth are not considered good prospects.

Analyses of the Luther Bog

No. 1 General sample of 18-inch peat moss stratum, south part of bog.

No. 2 " " " 18- " " " " from cutting lane east and west

No. 3 " " " 18 " " " " between lake and Conc. VI east.

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
No. 1	13.8	10.8	4.5	---
No. 2	12.8	9.3	3.6	---
No. 3	16.0	11.7	4.0	0.9

Analyses show the peat moss to be of a fair grade, except that No. 2 approaches the lower limits allowable for absorptive value, which the Procurement Division of the United States Treasury Department places at 11.0. The colour of the moss is brown, it is slightly humified and elastic.

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The Branchton Bog

The Branchton bog is situated on Peter Di Maggio's farm on the south half of lot 6, concession VII, near Dumfries, Waterloo county.

The deposit is small, covering only a few acres, but it is of appreciable depth and contains a good grade of sphagnum peat moss, light yellow, light in weight, elastic and of high nitrogen content. The moss is produced for local consumption on a comparatively small scale.

Analyses of Branchton Peat Moss

	Absorptive value Dry basis	Absorptive value 25% Moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Average of stratum				
0 to 3 feet	18.1	13.4	5.2	1.9
3 to 6 feet	16.8	12.3	7.5	1.9
Bottom stratum	10.9	7.9	3.7	2.2

The Clinton Bog

This bog is situated on the McKenzie farm near the east end of the town limits of Clinton, and its area is only eight acres. It has been worked on a small scale for several years, producing peat moss for insulating material in the building trade. The annual production, sufficient for the insulation of 15 to 20 houses, is shipped in the loose state.

Analysis of the Clinton Moss

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Average sample of moss stratum	9.3	6.7	10.9	2.1

The analysis shows the peat moss to be of rather low absorptive value, high in ash, but of high nitrogen content. Although it is suitable as an insulator its low absorptive value and high ash content and a comparatively high content of humus matter preculude its use as a litter. On the other hand the high value as plant food would make it suitable in gardens for compost and top dressings.

Several properties reported to contain peat moss were visited in central and southern Ontario and the Muskoka district, some of which were small with no moss cover; others were peat fuel bogs with and without live sphagnum moss cover but carrying no peat moss strata, and many were reed marshes containing neither peat moss nor fuel peat.

The Arthur Bog

The Arthur Bog is situated 9 miles west of Fort William on the road forming the continuation westwards of Arthur street and crossing the bog. The Canadian National railway track crosses the south end of the bog and Canadian Pacific track the north end. The area of the bog carrying peat of more than 5 feet in depth is 900 acres.*

The report of 1921 describes the bog as heavily wooded with dwarf spruce, and dwarf birch; and with open spaces suitable for drying fields. Since then however there has been a very heavy increase in the bog growth. Open spaces have almost disappeared and large trees cover the bog, in fact when drilling the deposit it was difficult to reach the bottom of the bog without striking a tree root. Clearing the bog of trees and roots would involve much expense.

Several test holes were drilled and two composite samples were made; one representing the northern part was collected on a line parallel with the road that crosses the track of the Canadian Pacific railway and runs through the centre of the bog, and the other representing the southern part from a line running north and south to Slate River station on the Canadian National railway. Other appreaches to the bog were difficult owing to the intense growth of trees and bush.

The samples were collected from a stratum of 3 feet consisting of a mixture of humified and fibrous peat with preponderance of the former. Underlying this the peat is well humified fuel peat. Examining the drill hole samples at various depths there appeared to be no stratum of unhumified or slightly humified peat.

*Geological Survey, 1921, D. p.7, by A. Anrep.

Analyses of Peat from the Arthur Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
North part of bog	7.2	5.2	14.4	1.6
South " " "	6.4	4.6	19.5	2.3

Analyses show the samples to represent a rather poor grade of peat unsuitable for litter or agricultural moss, owing to its low absorptive value and high degree of humification, and unsuitable as a fuel on account of its very high content of ash.

There has been no development on the Arthur bog.

Twin Cities Bog

The twin Cities bog is situated within the city limits of Fort William, in fact the bog before 1920 was laid out for improved city land as a garden city but the project was dropped after the surface had been cleared of trees and bush and a certain amount of drainage of the bog done.

It is a large bog, estimated by Anrep* at 895 acres, but only about 100 acres has a depth of 5 feet and over.

The bog has a cover of growing sphagnum moss and is sparsely wooded with small spruce and tamarack, with some open spaces. It can easily be cleared of the surface growth. Within the 100-acre area the bog has a peat moss cover of 3½ feet depth.

Samples were taken of the moss stratum along two lines, one running southward at right angles to the road crossing the bog, and the other running east and west on the north side and parallel with the same road, and composite samples were made.

Analyses of the Twin City bog mossstratum

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
South line	11.9	8.7	8.1	1.1
East and west line	10.4	7.5	7.4	1.2

* Geological Survey, Summary report, 1921, Part D, p. 9.

These analyses show that the moss is not of good quality, the absorptive value being low and the ash content high. As the analyses of the two samples differ little, the chance of finding better grade moss in the deposit would appear small. From the appearance of the moss stratum when sampled better results had been expected as the moss was light yellow in colour, only slightly humified, and when air-dried found to be light in weight and elastic.

Rainy River District

The Crozier Bog

The Crozier bog, also named the Arctic bog, is situated 9 miles southwest of Fort Frances sections 5 and 8, in Crozier Township. It is accessible by a good road, which crosses the bog.

The area of the bog is one square mile.

The bog has been under development for some years and went into production this year, being operated by the Arctic Peat Moss Corporation, Ltd., Winnipeg, Manitoba. It has been well drained by a canal discharging into Rainy River with lateral ditches at right angles. The surface of the bog is dry and firm so that it can support tractors and trailers for bringing the air-dried moss sods to the baling mill, thus obviating the much more expensive field-railway equipment, which is cumbersome to operate, involving the moving of tracks, attending to switches, etc.

The peat moss stratum has a depth of about 4 feet, is of a light brown colour and at the lower level is intermixed with roots of trees and undecomposed woody material. The moss is composed mainly of sphagnum, some hypnum and a smaller quantity of carex and aquatic plant residues.

Analyses of the Crozier Bog Peat Moss

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Sample of working face, west end of bog	10.1	7.3	6.2	1.3
Sample poultry litter, average run	12.2	8.9	6.1	1.3
Sample peat mull	14.2	10.4	5.0	1.1

The plant comprises tractors and trailers for working the bog, and the baling mill with hammer mill for disintegrating the sods, shaking screens and four baling presses.

The Polar Bear Bog

The Polar Bear bog is situated in Pattullo township, sections 19 and 30, and in Nellies township, sections 24 and 25. The bog can be reached by a good country road extending through the entire length of the bog northwards.

The deposit covers the larger part of four sections, the exact area bearing peat moss not having been determined. The deposit is slightly dome-shaped with a slope towards Pine River and its tributaries. The surface growth is mainly sphagnum moss intermixed with smaller quantities of hypnum moss and grasses, labrador tea, bog rosemary and aquatic plants. The total depth of the bog ranges from 4 to 12 feet. The stratum of 4 feet at present being worked consists of a fair quality moss but becomes somewhat more humified at lower levels. There is, however, sufficient peat moss available in the 4-foot stratum to maintain a fairly large production throughout the life of the plant. The quality of the moss is spotty; there is plenty of quite good moss in most parts of the deposit but in some places however it approaches the lower limit in regard to absorptive value; it should average a fair grade of commercial peat moss, by judicious cutting and by avoiding pockets of humified moss.

For this reason the samples of the 4-foot stratum taken at each 500 feet were analysed separately. They were collected along a line running north and south parallel with and west of the road, beginning at the north end.

The moss is fairly free from roots, twigs and grass residues, is of light brown colour, light in weight and elastic.

Analyses of Peat Moss from Polar Bear Bog

Sample No.	Absorptive value Dry basis	25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
1, north end	12.9	9.4	6.7	
2	13.0	9.5	6.1	
3	17.2	12.7	4.8	
4	13.9	10.2	5.6	
5	12.3	9.0	5.6	
6	13.4	9.8	3.9	
7	12.0	8.8	5.1	
8	16.5	12.1	6.6	
9	15.8	11.6	5.5	
Bottom stratum at 12 feet, composite sample	10.7	7.8	6.7	
Composite of above M. S. 83.			5.0	1.2

Some 200 acres has been drained, the main ditch 2 miles long running north and south, and 13 lateral ditches east and west at right angles on both sides of the road, one for every 500 feet on the area east of the road and for every 1000 feet west of the road.

The drainage is northwards into Pine River and to one of its tributaries.

In the beginning of July an appreciable quantity of moss sods had been cut and placed in small chimney piles in the field and was ready for baling. The baling plant, consisting of shredder, screen and one baling press about completed, was being tested. The bog is operated by the Polar Bear Peat Moss Products, Reg'd.

Bog in Carpenter Township

In Carpenter township on Range V a large bog extends from the Kenora highway to the road leading from Emo to Barnhart, 5 miles north of Emo. The two roads skirt the west and the east ends of the bog, respectively.

The bog probably covers more than two square miles, but how much is moss-bearing has not been determined. There are large open spaces wooded at the edges and occasional clumps of dwarf spruce and tamarack. The surface growth on the bog is chiefly sphagnum moss, some Eriophorum and the usual aquatic plants. The surface was fairly dry and traversable.

Several holes were drilled at the west end, east of the Kenora highway, an average depth of 6 feet of peat stratum being recorded, of which 3 feet was fairly good moss of light brown colour only slightly humified. The underlying stratum however is darker in colour and is a mixture of humified and fibrous peat. The deposit at the east end, from records of several drill holes, averages 15 feet in depth, of which a 4-foot stratum is very good moss, light yellow in colour, elastic and light in weight and in the two underlying strata at the 8 and 12 foot levels the moss is somewhat darker in colour with some admixture of humified peat. The quality of the peat is fairly uniform in composition for these two strata. The 12-to 15-foot bottom stratum is fairly well humified.

Analyses of the Peat Moss of Carpenter Township Bog

Sample collected from	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
east end of bog 0 to 4'	16.2	11.9	6.6	0.8
" " " " 4 " 8'	12.1	8.8	4.4	0.9
" " " " 8 " 12'	13.0	9.5	6.9	0.8
west " " " 0 " 3'	14.5	10.6	6.6	1.3
" " " " 3 " 5'	11.4	8.3	6.0	1.0
" " " " 5 " 6'	9.1	6.6	5.2	0.8

The analyses show a very good quality of moss especially for the 4-foot stratum of the east end of the bog, where the deposit is of appreciable depth. The ash content is high, but it must be borne in mind that the samples reported are few for such a large area and a more systematic sampling of some areas of the bog might yield even more favourable results.

Drainage can be had to the west into a creek running north-west of the deposit with outlet into Rainy river.

The deposit is a virgin bog and there has been no development of any kind.

This bog would appear a good prospect for production of peat moss on a large scale and deserves further investigatory work to determine the area that carries moss of good quality and close sampling of the various moss strata throughout its entire length and width.

Bog in Blue Township

A fairly large bog is situated in Blue township covering parts of sections 38 and 39. Its area has not been determined. It can be reached by the Spohn road crossing the bog in a north and south direction. Samples were collected along a line 500 feet east and parallel with the Spohn road, the average depth recorded being 6 feet, 2 to 3 feet of which consists of only slightly humified fairly light brown moss, light in weight and elastic but in the 3-to 6-foot stratum it becomes appreciably darker with admixture of humified peat.

Analyses of Peat Moss of the Blue Township Bog

Sample from	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Top cover 3 ft. thickness, average sample	13.0	9.5	5.0	0.9
3 to 6 ft. depth, average sample	9.2	6.7	8.5	1.7

The analyses show the quality of the moss to approach the lower limit set as regards absorptive value; the ash content would be acceptable in a standard commercial moss, but below the 3-foot level the quality depreciates sharply. As the bog is large, moss of higher grade may yet be found and it therefore merits further

exploratory work in regard to areas workable for peat moss. The deposit is virgin and the only development has been the digging of the ditches, along the Spohn road, which to some extent drain the adjacent bog. If the ditches were deepened they might be used for draining the bog southward.

Bog in Shenston Township

A bog of about 160 acres is situated in Shenston township and covers the northwest corner of section 24 and part of section 25, 4 miles north and one-half mile west of Barwick. The bog can be reached by a good country road, which crosses the bog.

The surface of the bog is open and wooded at the edges. The top growth is mainly sphagnum moss, with some Eriophorum, bog rosemary and Labrador tea.

Holes were drilled along a line parallel with the road and they record a 6-foot cover of moss fairly uniform in quality, light brown in colour, light in weight and only slightly humified.

Analysis of Moss of the Shenston Township Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Composite of 6 foot stratum	13.9	10.2	7.2	0.9

Analysis shows the moss to be of only fair absorptive value and somewhat high in ash. This is contrary to what was expected from the examination of the moss when sampled. A check sampling is therefore desirable. The deposit merits further investigatory work.

Drainage can be had into a creek running in a southwesterly direction. Partial drainage has already been made by ditches running on each side of the road emptying into the creek. Apart from this there has been no development to improve the bog.

Grass Bog

A very large area of bog land covers the following sections:

Curran township, sections 10, 11, 12
Worthington " " 7 and 8
Blue " " 17 and 18
Wild land " " 45, 46, 47.

Part of this bog has been drained for agriculture and pasture. It was not possible to cover every section in this large area, but where examined the peat was found to be well humified and

unsuitable for litter. As the vegetation appears to be mainly grasses and sedges with no sign of growing mosses, the chance of finding peat moss in this area would appear small.

Bog in Mather Township

A fairly large bog is situated on ranges II and III lot 10, Mather Township, 1 mile east and 2½ miles north of Chapple.

The area of the bog was not determined. The deposit has wide open areas with the edges fairly heavily wooded. The growth on the bog is heavy sphagnum moss with some Eriophorum and immediately underlying the top growth is well humified peat, a good quality fuel peat. Only the southern part of the bog was examined. In view of the very heavy growth of sphagnum the deposit may carry peat moss in other areas and deserves further investigation than time permitted during the past summer.

Summary for Ontario

The peat moss deposits so far investigated in Ontario, south and east of Georgian Bay are few and mostly small, Some of fair size have only a light cover of marketable peat moss. The Erie Peat Limited at Welland has the only bog that produces commercial peat moss on a large manufacturing scale, and with modern machinery. Nevertheless, the smaller bogs in Ontario have undergone more varied development and a wider range of products has been marketed than in any other province in Canada. The plant at Welland has a heavy export to the United States of peat moss— horticultural and chicken litter; - south of Chatham the Canadian Industries Limited has considerable production of peat humus used as filler in artificial fertilizers; in Beverly township the Canadian Humus Products, Reg'd, reported for 1941 a production of 4,000 tons of Hu-Mar, a mixture of humified peat and marl, and a number of small bogs produced peat moss for horticulture, litter for poultry, humus for lawn dressing, moss for insulation in the building trade, floral moss for florists and for reafforestation, and there is also a production of a few thousand tons of peat fuel.

In the western part of the province the investigation so far has not revealed any deposits in the Thunder Bay area carrying a good grade of peat moss. Several deposits near Port Arthur and Fort William are not described in this report as they are of little or no commercial value, being usually heavily wooded, the peat being of inferior quality and generally well humified.

Potential peat moss deposits have been reported west of Fort William and on St. Ignace Island by timber cruisers of a large Fort William lumber company.

In Rainy River district substantial development has taken place at some deposits and several undeveloped bogs carry a good grade of moss; moreover there are good prospects of finding others in the western part of the district and in the Kenora area.

MANITOBA

Julius Bog

The Julius bog, also named the Shelley bog, is situated 60 miles east of Winnipeg between the Julius and Whitemouth stations on the Canadian Pacific railway and extends over wide areas north and south.

Its total area was estimated by Anrep* at 4,000 acres. A later estimate of the area carrying moss adequate for a profitable operation amounted to one square mile, of which the Winnipeg Supply and Fuel Company has acquired the part north of the railway track, which covers 500 acres, and the McCabe Bros. Grain Company, the part south of the track, about 120 acres.

The square mile of workable bog forms a single block of high moor, having a large open area in the centre, south of a small lake, extending south of the railway track. The depth of the centre of the bog is 15 feet of which 10 feet is moss of very good quality, thinning towards the edges, where it runs into darker, more humified moss with intermixture of carex peat and roots, and then into wooded areas of spruce, tamarack, poplar and low bush with an insignificant cover of moss. The growth on the bog is chiefly sphagnum moss with some carex towards the edges and a smaller amount of aquatic plants. The moss is of very good quality, light yellow in colour, only slightly humified, elastic, porous, and light in weight, in fact appreciably lighter than the mosses produced in Eastern Canada.

Analyses of Peat Products from the Julius Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash%	Nitrogen%
Type of peat, mull	15.6	11.4	6.9	0.7
Poultry litter	21.3	15.7	4.9	0.5

Analyses show the absorptive value to be quite high for poultry litter and satisfactory for the mull. As the analyses were made on dry material, results are expected to be lower than in the natural state of the peat. Mull is usually higher in ash and lower in absorptive value because of intermixture of dust of inorganic origin and earthy material of the fine-grain classes that pass through the screen.

The north end of the bog has been well drained; a large drainage canal runs west and east with laterals north and south.

*Bull. No. 8 Investigation of Peat Bogs and Peat Industry of Canada, by A. Anrep, 1910-11, p.24.

The main canal has a depth of 8 feet, a width of 4 feet and a length of 8,000 feet, and it connects with the Whitemouth river. On the south end of the bog the drainage system has not yet been completed. Absence of culverts under the railroad bed prevents its being connected with the main drain on the north end of the bog, and so it is carried eastward toward Shelley.

The surface of the workable parts of the northern and southern areas has been cleared of trees and bush. The surface especially in the northern end is dry and of buoyancy sufficient to support tractors and trailers for transportation of the dried sods to the storage piles.

The equipment on the north part of the bog consists of four Ford tractors and trailers, and of large stack sheds with covered sides loaded by portable conveyors. Permanent conveyor belts bring the sods from the sheds to the baling plant, which is equipped with shredder, shaking screens and one baling press, and is operated with automatic feed and doors. The baling press has a high working efficiency, turning out 55 bales per hour.

The McCabe Brothers Grain Company, Ltd., was erecting a similar plant at Shelley station in July. The Company has produced a considerable quantity of air-dried sods, stored in nine large stacks on the drying field.

Lac du Bonnet Bog

A fairly large bog situated west of the village of Lac du Bonnet consists chiefly of fuel peat except for an area of 30 to 40 acres that carries a good grade of peat moss, and can be approached by a road from Lac du Bonnet railway station, running west and parallel with the railway track for 2 miles, and then half a mile south.

Development at the bog consists of drainage and road but no building has been erected and the baling press is operated in the open. The cover of peat moss has a depth of 2 to 5 feet and underneath is a stratum of well humified peat.

Analysis of Peat Moss from Lac du Bonnet Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash%	Nitrogen%
Average sample of the moss cover	23.0	17.0	3.2	0.5

The analysis shows this peat moss to be excellent in quality, in fact equal to the best New Brunswick mosses. Absorptive value is very high, ash low, the moss is of light brown colour, elastic, and light in weight, but unfortunately the deposit is very small.

The bog is operated by Norman McMillan, Lac du Bonnet, Manitoba.

Bog near No. 1 Highway

This bog is situated on section 9, township 13, range X, Lac du Bonnet district and lies one mile north of Highway No. 1 from Winnipeg to Kenora. It may be reached from the highway by a road running northward between sections 2 and 3 for one mile to a gravel pit, thence west across country for about half a mile.

The deposit consists of a chain of three bogs running northwest and southeast, the southern part covering 160 acres, the centre part 320 acres, and the northwestern part 80 acres.

The surface of the bogs is covered with a heavy growth of sphagnum with only slight growth of other bog plants. The southern part is open and has a depth of 5 feet of peat, a mixture of fibrous and humified peat, which becomes less humified as it approaches the centre bog, which in turn is covered with trees, mostly spruce 8 to 10 feet high. The growth of trees is not too thick for it to be traversed without difficulty. Several holes were drilled and samples were collected on the centre bog from an average depth of 15 feet. The moss is good to the 12-foot level, the remaining 3-foot stratum being darker in colour and much humified. In drilling the holes no roots were encountered below the top cover, so that after clearing off the surface growth, the cutting of the sods should meet no obstruction because roots of trees growing on a bog usually follow the surface.

The northern lobe is somewhat spotty in quality but good moss is obtainable above the 7-foot level, similar in quality to that of the centre lobe.

Analyses of the Peat Moss of the Centre Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Composite sample of 8-foot stratum	16.8	12.3	3.9	0.8
4- " "	17.2	12.6	3.9	0.7

The analyses show the stratum to the 12-foot level to be uniform in composition and of a very good quality, low in ash and of high absorptive value. The peat moss is light yellowish brown, only slightly humified, light in weight and should yield a good grade of commercial moss.

In spite of heavy rainfalls just before the visit in September and the fact that the summer was generally wet, the bogs were traversable dry-shod, indicating natural drainage. Further drainage is possible for the southern and central lobes to a creek running in an easterly direction to Winnipeg River, and from the northern lobe to a creek on section line 9, running east into Winnipeg River.

The deposit is favourably situated in regard to transportation and should require the building of less than one mile of road to connect with No. 1 Highway. From this point there is an additional six miles to the nearest railway station at Julius on the Canadian Pacific Railway.

No development work has been done.

The deposit appears to be a good prospect for a fair-sized production of peat moss and merits further investigatory work. The moss is of very good quality; the growth of trees on the parts carrying the best moss is not particularly dense and they are comparatively small. Clearing of the central and northern lobes need not entail a large expense.

The Transmission Bog

This bog is situated in sections 19 to 21 and 28 to 30, township 15, range XII, in the Lac du Bonnet district. The total area of the bog was estimated by Anrep* at 1375 acres. The peat is chiefly fuel peat and is not of very good quality because of its high ash content as shown in analysis below:-

Analysis of Peat from Transmission Bog (dry basis)

Volatile matter	56.8 per cent
Fixed carbon	24.2 " "
Ash	19.0 " "
Nitrogen	1.6 " "
Phosphorus	0.047 " "
Fuel ratio, fixed carbon:volatile matter	0.43

The peat is not well humified, but is a mixture of fibrous and humified peat.

*Bulletin No. 8, Investigation of Peat Bogs and Peat Industry of Canada, 1912, by A. Anrep, p. 19.

In this bog there are several smaller areas carrying peat moss. On one area south of the highway, where it crosses the transmission line, is a stratum of moss of 2 to 3 feet depth. The moss, especially the 1-foot top stratum, is of very good quality, light yellow in colour, elastic and light in weight.

Analyses of the Peat Moss from the Transmission Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
1-foot top stratum	22.1	16.3	5.9	0.6
2- " underlying stratum	13.3	9.6	9.2	1.3

The moss-bearing area cannot be easily estimated because of the heavy growth of trees and bushes of several kinds. Owing to the rather thin cover of moss, notwithstanding its high quality the deposit could be worked on a small scale only, and it is therefore a question whether the expense of clearing the bog surface would be warranted.

The Pine Falls Bog

The bog begins 2½ miles southwest of the Canadian National Railway station at Pine Falls.

It is a very large bog extending 7 miles east and west and 10 miles north and south, and has a flat surface mainly covered with grass and reed, some small birch, tamarack and spruce, but on the whole is an open-space bog. No growing sphagnum moss was noted. Several rock islands emerge from the deposit. Samples collected parallel with the track revealed depths of 3 to 6 feet. The upper stratum of two feet is only slightly humified. Underlying this is a bed of fairly well humified peat, the upper part of which is somewhat granular and intermixed with fibrous peat.

Analyses of the Peats of the Pine Falls Bog

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Top stratum of 2 feet	14.4	10.6	8.9	2.7
Lower " 2 to 5 feet	8.9	6.5	8.4	3.4

The analyses show the top stratum to be of fair quality in regard to absorptive value and the lower stratum well below standard requirements of a good peat moss. Ash content in both samples is high as is also the plant-food value, a condition usual with peats composed of the residues of sedges and reeds. The upper 2-foot stratum consists of only slightly humified, light brown, and fairly elastic peat. The lower stratum is of inferior value as a litter owing to its low absorptive value.

Transportation facilities are favourable, the Canadian National railway crossing the bog and having a long siding at mile-post 12.

Near the railway track the bog is partly drained by ditches connected with streams, one running north at mile-post 12 and the other at mile-post 17, both emptying into the Winnipeg River.

The bog is undeveloped. Notwithstanding the shallow depth of the unhumified peat stratum, it may be possible to work the top stratum for horticultural and compost peat, because the deposit is very large, easily drained, and transportation facilities are favourable. Sedge peats are not considered suitable for litter because of the friability of their fibres and the high ash content, which cause dust, detrimental to the health of the employees, and to animals in stables and pens.

Bog on Henry Leclair's Farm

This bog is situated 5 miles north of Highway No. 2 on a country road 3 miles east of St. Claude almost due south from Portage La Prairie.

It is undeveloped as regards drainage or buildings of any kind. The sods are dug and transferred to high ground to dry.

Analysis of the Peat Moss on Leclair Farm

	Absorptive value		Ash%	Nitrogen%
	Dry basis	25% moisture basis	Dry basis	
Sample of 2-foot stratum	16.7	12.3	7.6	1.7

The analysis shows the moss to be of good quality in regard to absorptive value and plant food. The ash content, however, is somewhat high. The moss is fairly light brown, light in weight and elastic.

Investigation of several deposits in the Lac du Bonnet area and south of Portage la Prairie yielded no practical results, some of them being very small, some were peat-fuel bogs, and several, especially south of Portage, had been deeply burnt during the long drought preceding 1939.

Summary for Manitoba

At the present time only one large peat moss deposit has been developed in Manitoba and operated on a large manufacturing scale. On this bog two plants have been built by separate companies. Two smaller bogs produce an occasional carload or truckload of baled and loose moss. Undeveloped bogs offering good prospects are situated in the Lac du Bonnet area, and at Pine Falls, where the large bog may warrant development for production of a certain type of peat. Forest cruisers and other sources considered as fairly reliable, report several large areas likely to contain peat moss, such as the bog along the Mafeking - The Pas highway, at Novra, and at Swan River. Forest rangers and lumber company officials who have visited these districts speak of extensive areas of peat moss. Other districts considered worthy of investigation are the bogs of the Marchand and Greater Winnipeg district, the vicinity of Whirlpool Lake, Riding Mountain Park and in the vicinity of Camp Shilo near Sewell, southwest of Portage la Prairie.

A peat industry in Manitoba has the advantage of being near to the market of the midwestern United States, of importance especially after the war when Europen competition will have to be faced. Atmospheric conditions are very favourable for the air-drying of peat sods, warm spring and summer weather with high winds of low relative humidity and hard freezing of the wet peat moss sods during the winter months which will further improve the already high quality of the Manitoba peat mosses.

Saskatchewan

No peat moss deposits in Saskatchewan have as yet been investigated by this Department.

From a cruiser of a lumber company at Melfort and from owners of peat bogs in other parts of the province, information was obtained regarding large deposits of considerable depth of peat moss on the Melfort - Carrot River branch line of the Canadian National Railways, of bogs of large area and depth at the end of rail, extending a distance of 20 miles, and in the Prince Albert district.

Alberta

The province of Alberta has a bog producing peat moss 5 miles west of Edmonton on the Jasper highway, operated by Moss-Tex Limited, of Edmonton, for some years. A plant erected on the property has produced horticultural moss, poultry litter, insulating boards and, more recently, moss pads. The pads are used in packing asparagus cuttings for shipment to keep the vegetables moist and fresh until marketed.

The bog has an area of 60 acres with a cover of good grade peat moss to a depth of 3 feet. Underlying this the peat becomes darker and more humified, and this supplies the raw material for the manufacture of insulating boards.

Analyses of peat moss products of the Moss-Tex Ltd.

	Absorptive value Dry basis	Absorptive value 25% moisture basis	Ash% Dry basis	Nitrogen% Dry basis
Poultry litter	17.5	12.8	8.0	1.0
Horticultural moss	15.6	11.5	7.5	0.9
Peat moss pad	12.8	9.4	9.2	0.9

Analyses show the peat products to be of good absorptive value. As the analyses were made on air-dried products the absorptive values are appreciably lower than those of the moss in its natural state. The ash content is somewhat high. The moss is of light greyish-yellow colour, light in weight and elastic.

In the manufacture of insulating boards the wet moss is mixed with excelsior (in some plants the waste from the manufacture of coco-mats is used) which serves as a bond and the mixture is treated in a closed vessel with steam. The moss is then fed into a press consisting of two steel frames with plungers, one frame being filled while the other is pressed. Some of the water is removed in the pressing after which the wet slabs are transferred to trays and left on racks to dry, then trimmed to the required size and crated. The plant has supplied several thousand houses in Edmonton and surroundings with this insulating material.

The method used in the manufacture of moss pads is as follows. At the top of the elevator bringing the air-dried peat moss sods to the baling factory the cleanest sods, free from fissures and strata of dark and humified peat, are selected and transferred to a belt bringing them to the shaping machine. There they are sawn into the desired sizes, reduced in volume by hydraulic pressure and crated for shipment, 500 to a crate. The cuttings from making the pads are run into the baling mill, where they are shredded, screened and baled.

The deposit is nearly depleted and the operator is trying to acquire fresh deposits. Adjacent bogs, at one time looked upon as reserves for future use, have become too dry during the long period of drought and the fibrous peat is destroyed.

British Columbia
Penticton

Two bogs in the Penticton district were investigated. Both cover only a few acres and the peat is well humified and of no commercial value.

Kelowna

A large bog 4 miles west of Kelowna reported to contain peat moss was investigated. Part has been reclaimed for agriculture and on it are raised large crops of vegetables, mainly celery. The other part contains mostly sedge peat of shallow depth and of not very good grade. It might find local use as a soil conditioner and for compost but is unsuitable for export. Two other deposits in the same vicinity were found to be small and similar to those near Penticton, and of little commercial value.

In the southern part of the province near New Westminster, large deposits of high-grade moss are being worked on a big scale. Information regarding them, the quality of the moss, production, methods of manufacture, etc., cannot at present be published.

In British Columbia large deposits have been reported on Graham Island of the Queen Charlotte Islands group, between Massett Landing and Skidegate, and much interest has been shown in them by the Provincial Government as well as by individuals as, because of the large production of peat moss in the Fraser Valley, it may before long become necessary to look for raw material elsewhere.