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DEPARTMENT OF MINES AND TECHNICAL SURVEYS

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EVALUATION OF PEAT BOGS FOR PEAT MOSS PRODUCTION

by

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FUELS AND MINING PRACTICE DIVISION

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"EVALUATION OF PEAT BOGS FOR PEAT MOSS PRODUCTION"

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ABSTRACT

Canada is one of the leading countries of the world in reserves of peat lands, which are estimated to cover more than 37,000 square miles, this being exceeded only by the USSR and Finland. The abundance and cheapness of other fuels in Canada precludes the use of peat fuel, at least at present. This paper describes how the Mines Branch of the Department of Mines and Technical Surveys attempts to assess the potential for commercial development of known peat deposits in terms of production of peat moss, a product which is extensively used in North America for agricultural and horticultural purposes. In this evaluation, study of maps and aerial photographs, field investigations, and laboratory analyses are conducted to consider the most important factors, including quality and nature of moss as determined by analytical methods, accessibility, location, topography, drainage, area, type of overgrowth, and depth of bog.

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EVALUATION DES TOURBIÈRES POUR LA PRODUCTION DE TOURBE DE MOUSSE

par

T.E. Tibbetts*

RÉSUMÉ

Le Canada est l'un des pays qui possèdent les plus vastes réserves de terres à tourbe du monde. On estime qu'elles couvrent plus de 37,000 milles carrés, et cette superficie n'est dépassée que par celles de l'U.R.S.S. et de la Finlande. De nos jours, tout au moins, l'abondance d'autres combustibles au pays empêche l'emploi de la tourbe. La présente étude décrit les méthodes essayées par la Direction des mines du Ministère des Mines et des Relevés techniques pour évaluer les possibilités de mise en valeur de gisements de tourbe connus quant à la production de la tourbe de mousse, qui est utilisée en très forte quantité en Amérique du Nord pour les besoins de l'agriculture et de l'horticulture. A cette fin, l'étude des cartes et des photographies aériennes, de même que les travaux de recherches sur le terrain et les analyses au laboratoire, permettent d'examiner les facteurs les plus importants de l'exploitation: la qualité et la nature de la mousse déterminées par les méthodes d'analyse, l'accessibilité, l'emplacement, la topographie, le drainage, la superficie, le type de tapis végétal au dessus, et la profondeur de la tourbière.

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"EVALUATION OF PEAT BOGS FOR PEAT MOSS PRODUCTION"

by

T.E. Tibbetts*

INTRODUCTION

Confined areas of organic terrain can be economic assets to Canada as distinct from the relatively unbounded areas which, because of the problems they create, are normally the subject of this Conference. These confined or bounded areas are commonly known as peat bogs and in recent years there has been a great increase in interest in the peat bogs of Canada. All who are interested in the need for garden soil improvement, for example, are beginning to realize the great economic importance of the deposits of organic material present in these bogs, material which nature has been storing up for many thousands of years.

The objectives of the Mines Branch in respect to peat bogs and peat materials are as follows:

1. To evaluate the peat resources in Canada with particular reference to the relatively unhumified residue of peat-forming plants generally referred to as peat moss;

2. To aid industry technically in determining the best means of exploiting the peat resources;

3. To assist industry in solving problems associated with marketing; and

4. To investigate additional uses of peat moss and other materials.

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PRINCIPAL USES OF PEAT MATERIALS

Peat, in one state or another, has been used from time to time for various purposes ranging from medicinal to construction materials. Small quantities are presently being used, particularly in Europe, as a raw material in the manufacture of such special products as seedling planting pots, peat "flour" used in the foundry industry, and chemicals. Major uses are limited to fuel (particularly for electric power generation) and agricultural and horticultural purposes.

Peat production data by various countries are presented in Table 1 and demonstrate the magnitude of the use of this material throughout the world.

In Canada there are estimated to be more than 37,000 square miles of workable peat deposits. More than 250,000 acres of our peat bogs have been surveyed and mapped. These are capable of yielding more than 200 million tons of highly humified material suitable for fuel, and more than 15 million tons of less humified material useful for other than fuel purposes. The availability of superior sources of fuel in Canada all but restricts the production from our bogs to the lesser humified material, formed mainly from sphagnum moss and commonly termed peat moss, which is used for agricultural and horticultural purposes in North America. In agriculture peat is used as a poultry and stable litter, and in horticulture it is used mainly to improve the physical condition of garden soils. As demonstrated in Figure 1, production of peat moss in Canada for horticultural purposes has grown to the point where our industry is based almost entirely on this use.

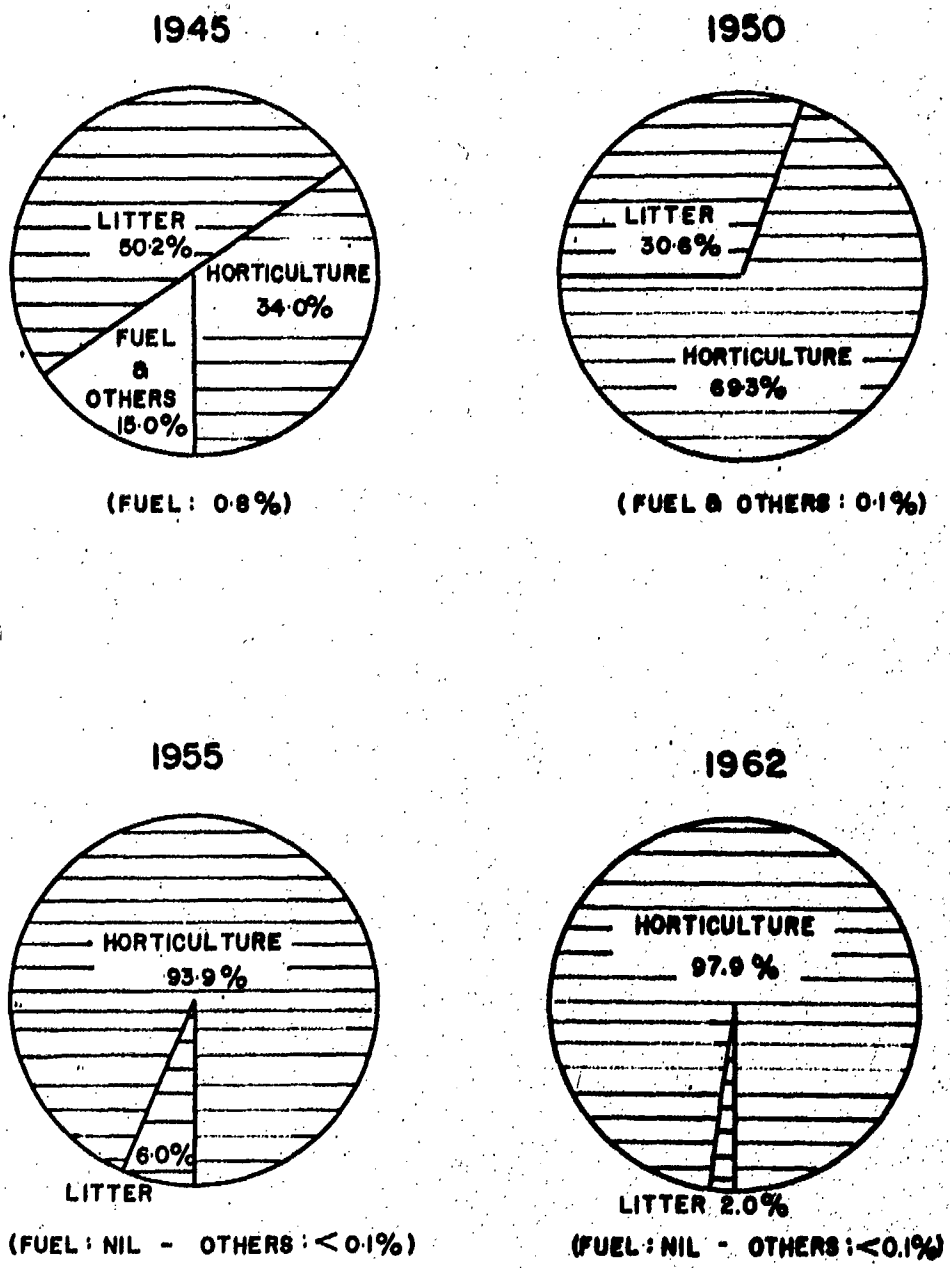
TABLE 1

World Production of Peat, 1960-62

(Thousands of short tons)

Country	Use	1960	1961	1962
USSR	Fuel	59,100	57,300	60,600
	Agricultural	100,000	100,000	100,000
	Total	159,100	157,300	160,600
IRELAND	Fuel	4,514	4,400	4,198
	Agricultural	14	19	24
	Total	4,528	4,419	4,222
WEST GERMANY ...	Fuel	871	830	880
	Agricultural	895	577	850
	Total	1,766	1,407	1,730
UNITED STATES ...	Agricultural	471	531	572
EAST GERMANY	Total	550	550	550
NETHERLANDS	Total	500	500	500
SWEDEN	Fuel	275	275	275
	Agricultural	70	70	70
	Total	345	345	345
CANADA	Agricultural	185	224	233
NORWAY	Fuel	198	180	160
	Agricultural	42	50	50
	Total	240	230	210
POLAND	Total	125	83	130
FINLAND	Fuel	132	116	116
	Agricultural	6	4	6
	Total	138	120	122
REP. OF KOREA	Agricultural	107	45	110
JAPAN	Total	80	80	80
DENMARK	Total	187	125	67
HUNGARY	Total	65	65	65
ISRAEL	Agricultural	50	55	55
FRANCE	Fuel	2	3	3
	Agricultural	19	33	33
		21	36	36
AUSTRIA	Fuel	40	40	40
ARGENTINA	Total	3	3	3

FIGURE I - CANADIAN PRODUCTION OF PEAT AND PEAT MOSS BY USES, 1945-62



The rapid growth in production and trade of our peat industry in the past decade is demonstrated by Figure 2. It is apparent that this growth has been due mainly to increasing demands for the Canadian product in the United States, where in 1963 about 80 percent of our production was exported at a value of almost $10 million. Production data of peat products by province for 1962 and 1963 are shown in Table 2.

TABLE 2

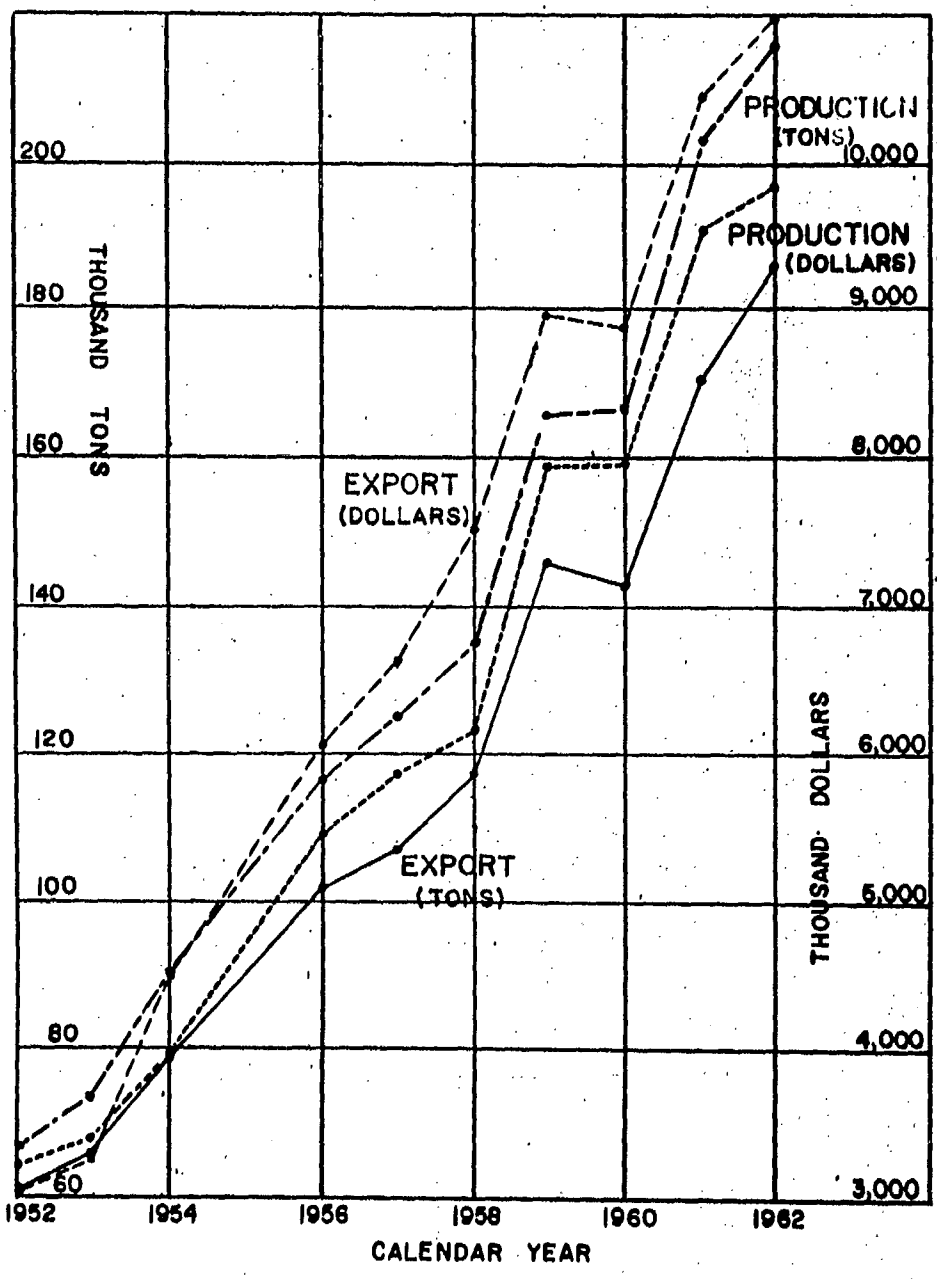
Production of Peat Moss by Provinces, 1962-63

Province	1963			1962		
	% of Total	Short Tons	Value $	% of Total	Short Tons	Value $
Nova Scotia & New Brunswick	13.7	35,480	1,373,200	16.7	39,744	1,540,299
Quebec	34.5	89,417	2,182,072	32.7	77,889	1,968,483
Ontario & Manitoba	20.1	51,960	2,368,360	18.7	44,521	1,268,550
British Columbia	31.7	82,000	3,000,000	31.9	75,881	2,703,064
CANADA		258,857	8,923,632		238,035	7,480,396

All provinces except Nova Scotia reported an increase in production in 1963.

It is generally expected that the demand for peat material, particularly for use as a soil conditioner, will continue to grow in North America.

FIGURE 2 - GROWTH OF PEAT INDUSTRY IN CANADA, 1952-62.



YEAR	THOUSAND TONS*	GROSS VALUE THOUSAND DOLLARS
PRODUCTION		
1952	67.9	3257
1953	74.1	3432
1954	90.4[x]	3966
1956	116.2	5451
1957	124.9	5899
1958	135.5	6185
1959	166.9	7909
1960	167.6	7937
1961	203.2	9551
1962	215.9	9818
EXPORTS		
1952	61.9	3128
1953	66.7	3290
1954	79.2	4500
1956	102.8	6089
1957	106.9	6669
1958	117.1	7507
1959	146.2	8976
1960	142.9	8826
1961	170.2	10415
1962	196.1	10999

[x] Includes 584 tons of peat fuel.

* Metric Tons (2205 lbs)

SOME CONSIDERATIONS IN EVALUATING PEAT DEPOSITS

As mentioned above, one of the prime objectives of the Mines Branch in respect to peat is to evaluate the potential of peat deposits for commercial exploitation in terms of the non-replaceable peat material of which they are comprised. In view of the indications of continued and accelerated growth in the demand for such material, this objective must be regarded as ever increasing in importance.

In the evaluation of our peat resources several major considerations are involved, including location and size of the deposits, drainage potential, land clearing problems, methods and scale of operating, and markets.

Intensive use is made of topographical maps and aerial photographs and it is highly important that at least one of these aids, and preferably both, be examined prior to field and laboratory investigations. Topographical maps provide information on such important factors as bog location, size, drainage patterns, accessibility, transportation facilities, and power and labor sources. Aerial photographs permit more accurate estimations of the open areas of peat bogs and supply, as well, information about the vegetation on and bounding the bog area. In addition, areas of organic terrain exhibit features which, to the experienced eyes of some scientists such as Dr. Radforth and others, can within limits be interpreted both qualitatively and quantitatively with respect to the peat material present.

Accompanying, or indeed even preceding, other phases of peat bog evaluation, there should be at least a preliminary market analysis carried out with a view to commercial exploitation.

Some knowledge of current and possible future demands for peat material in specific market areas is essential if economic failure is to be avoided. Many of our peat bogs, capable of yielding high-quality fibrous peat moss, for example, are located at considerable distances from the large markets in the United States. Because of the costs of transporting the peat products to these markets and of providing loading facilities, many of such bogs would at present be considered economically unattractive.

The actual bog area required for an economic operation is difficult to define and naturally depends to a great extent on the depth of marketable peat material. The scale and method of production anticipated are of great importance in establishing the area requirements. To be commercially attractive on other than a part-time basis, a supply to support production in the order of 150,000 6-cu.-ft. bales per year is considered the minimum requirement. An area of about 100 acres is considered the minimum requirement to support such production. Complete mechanization of the production, using the milling or "scratch" method, for example, would demand a larger operating area than hand-cutting methods for the same production.

The extent of land clearance necessary to prepare a bog for peat production is another important consideration in evaluating a peat bog. As mentioned earlier, much information on this facet of bog evaluation can be derived from aerial photographs. Removal of small bushes is normal practice in bog clearance. However, the presence of larger growth is discouraging, not only because of surface clearing costs but also because such growth sometimes indicates the presence of root systems within the peat deposit which can seriously hinder production both by hand-cutting and mechanized methods. Such root systems, preserved

by the peat, increase the costs of production and place limits on the extent of mechanization which can be undertaken, at least with presently proven machinery.

Ordinary processing costs for peat are relatively uniform in Canada. Increasing labor costs have, where technically feasible, encouraged mechanization of peat winning operations. This mechanization, coupled with adverse climatic conditions, can necessitate the employment of artificial drying in order to maintain a guaranteed supply of peat material to the market. As costs of labor and climatic conditions across Canada are considerably varied, they must be considered in evaluating the production potential of a peat deposit. The need for artificial drying--using costly thermal dryers such as those shown in Figures 3, 4 & 5, for example--could place a peat bog located in a particular region in a non-competitive position in respect to other sources of supply where such drying is normally not required. In non-mechanized production natural air drying is normal, the hand-cut blocks being piled on the bog, in a fashion similar to that shown in Figure 6, and later removed to larger piles which can be covered with polyethylene sheets (see Figure 7) or placed in storage sheds (see Figure 8).

Market requirements in terms of the physical characteristics of peat moss, such as weight per unit volume, degree of humification, water absorbing or holding capacity, acidity and proportion of organic matter, certainly must be considered in any evaluation of peat deposits. The specifications of any market area must be correlated with the potential quality of the material from a particular peat bog; thus the importance of sampling and analysis.

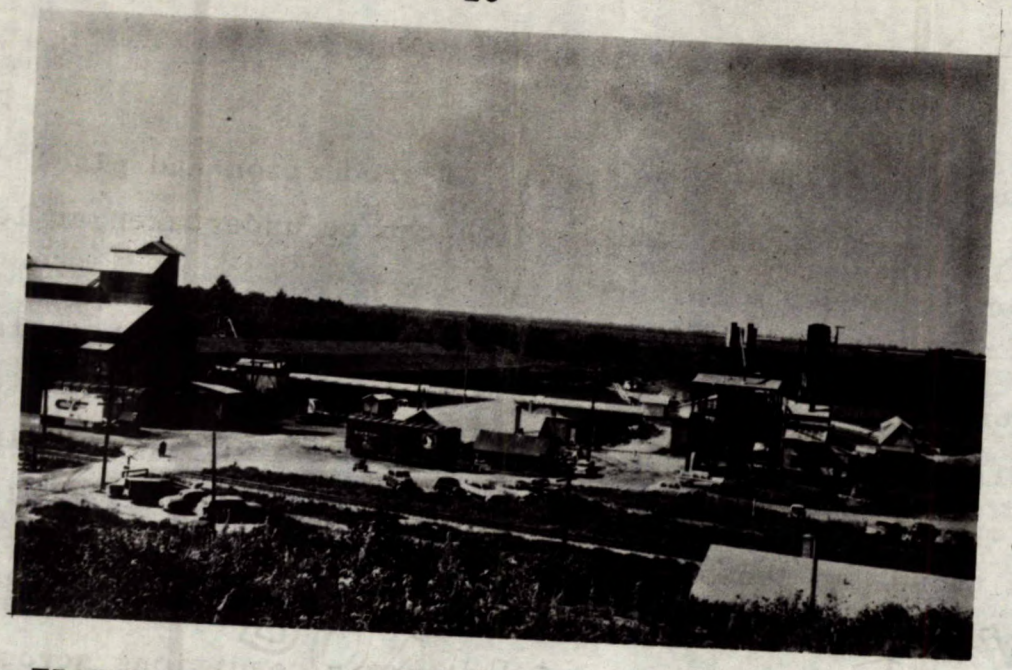


FIGURE 3 - Peat Moss Factory with Thermal Dryer

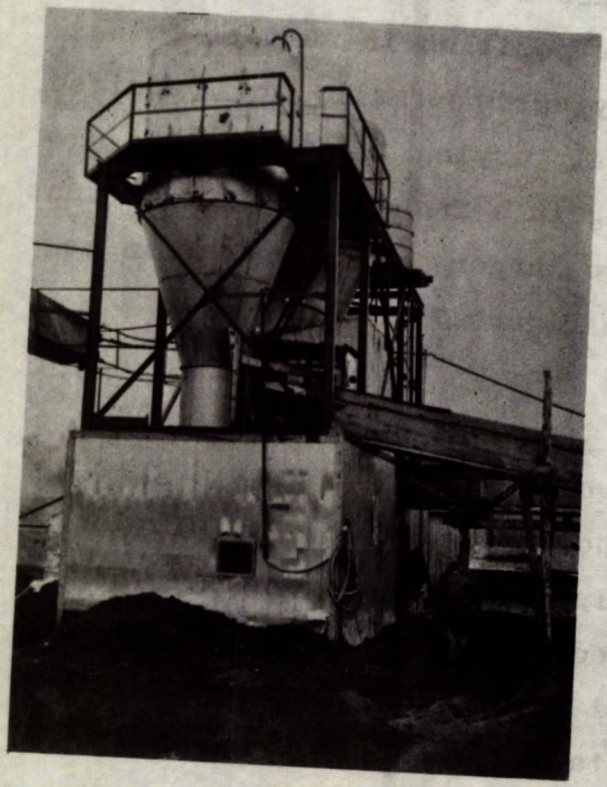


FIGURE 4 - A Thermal Dryer Used in Nova Scotia

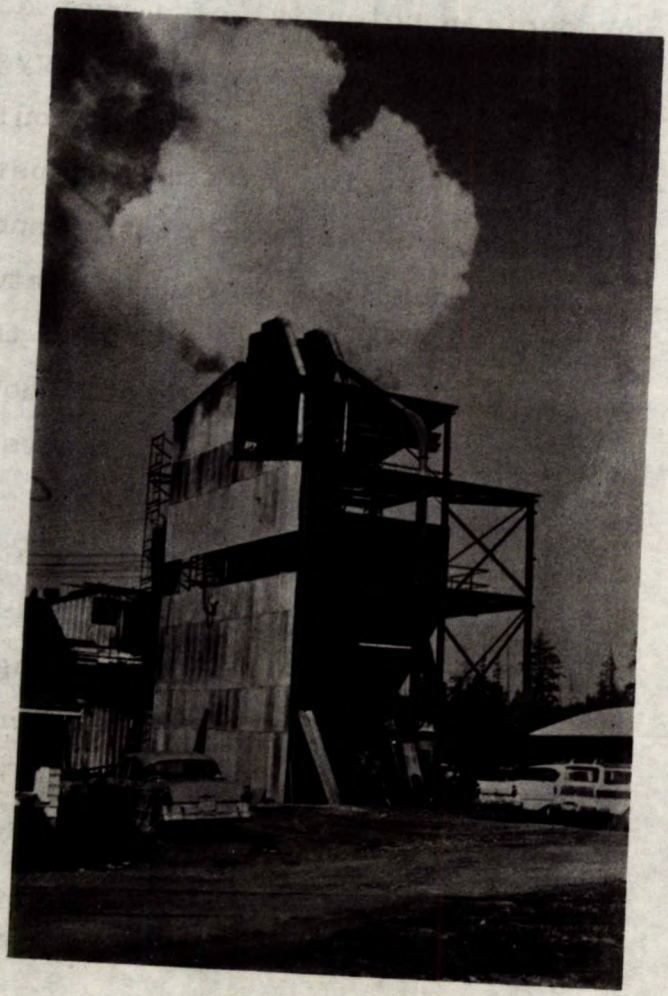


FIGURE 5 - A Thermal Dryer Used in British Columbia

FIGURE 6 - Peat Moss Blocks Piled to Dry

FIGURE 7 - Peat Moss Blocks Protected with Plastic Sheets

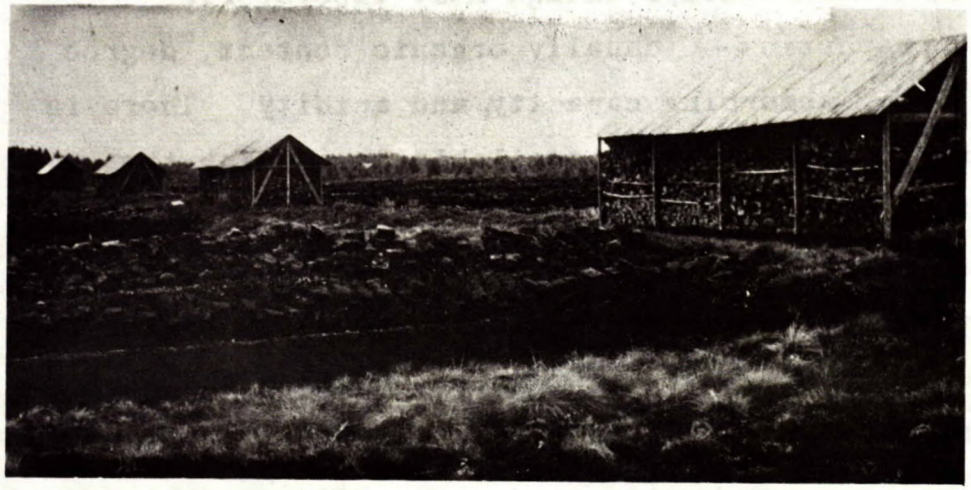


FIGURE 8 - Peat Moss Blocks in Storage Sheds

The methods of sampling and analysis followed by the Mines Branch are described in some detail in the prepared paper and therefore they will not be reported here. As regards sampling, certain weaknesses, including sample size, have been experienced with the present sampling tool shown in Figure 9. Core diameter is only 3/4 in.; thus a very small sample is collected during one operation. The sampler shown in Figures 10 and 11 is manufactured and widely used in Sweden. This sampler, with a diameter of 35 mm, is being purchased by the Mines Branch. It is designed to overcome some of the failures of the present sampler now in use. The screw tip and cutting-edge side opening of this sampler are expected to reduce or even overcome completely the difficulty presently experienced in sampling fibrous material. Removal of the peat core from the sampler should be more readily accomplished, with less disturbance of core thickness and layers. A prototype of a portable gasoline-motor-operated sampler supposedly capable of collecting an undisturbed column of peat 3-1/2 in. diameter has been demonstrated in the field by the designer. Present status of this machine is not known, but it is believed that the untimely death of the engineer in charge of the project has interrupted the development.

The analytical methods by which peat quality is determined are not standardized, although most laboratories evaluate the same properties -- usually organic content, degree of humification, water absorbing capacity, and acidity. There is a considerable amount of literature available expounding the benefits of the addition of peat material to a soil: — it changes the physical characteristics of a soil by breaking up heavy clay but adding body to sandy soils, thus making these soils easier to work; it supplies humus to the soil, thereby creating the proper environment for bacterial activity so essential to the well-being

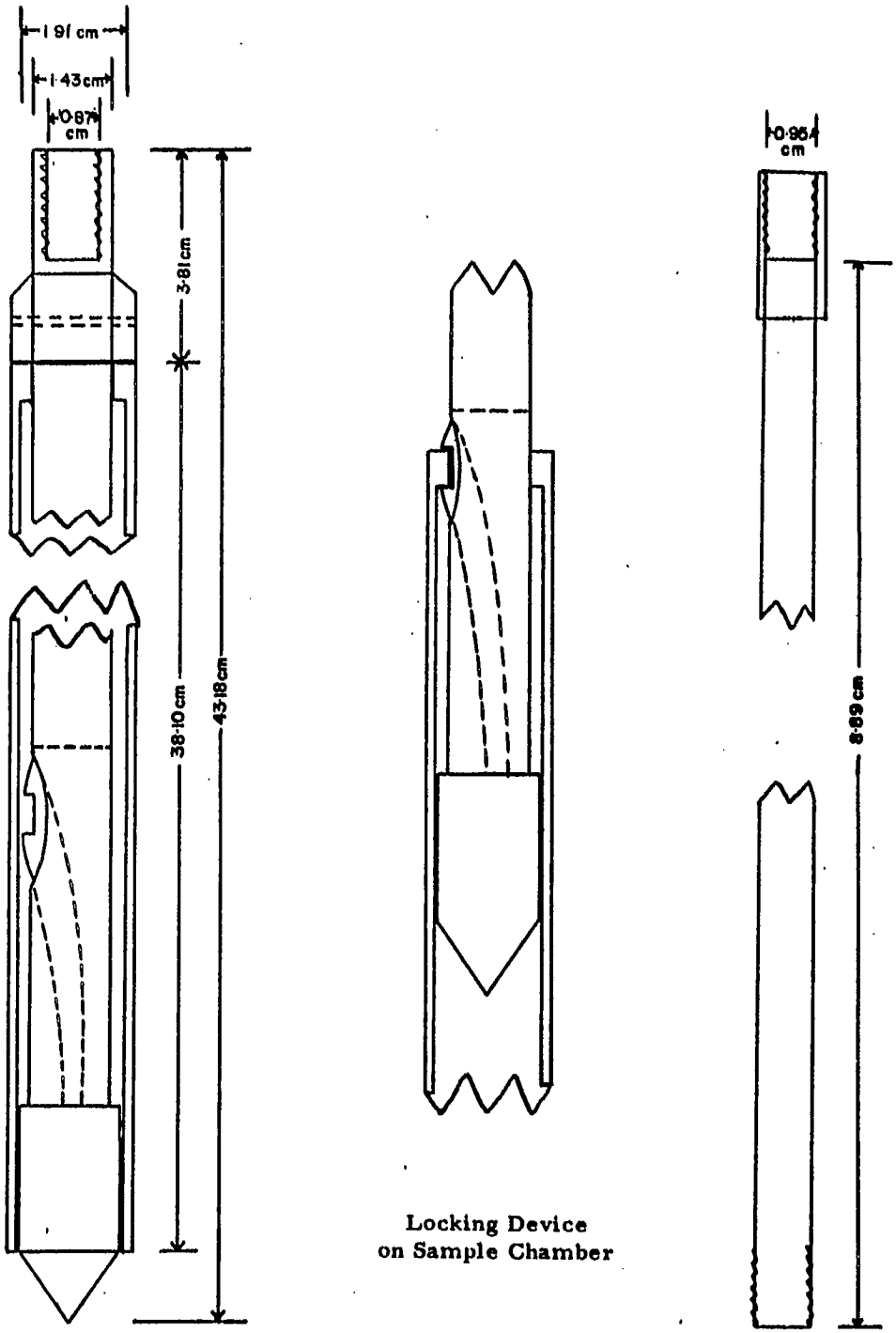


FIGURE 9 - Peat Sampler, Fuels and Mining Practice Division

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FIGURE 10 - Peat Moss Sampler Used in Sweden

FIGURE 10 - Peat Moss Sampler Used in Sweden

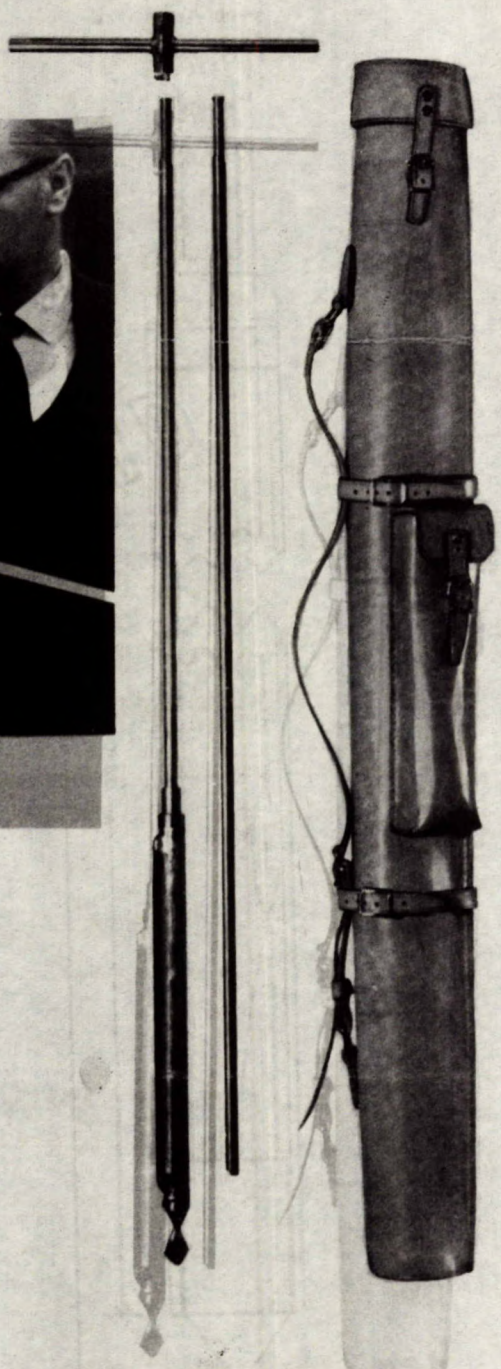

FIGURE 11 - The "Djos" Peat Borer (Sweden)

FIGURE 11 - The "Djos" Peat Borer (Sweden)

of plants; it stores moisture and thus prevents loss of plant food; it promotes aeration of the soil, an essential for good plant growth; it insulates the soil; it brings about an acid environment for the many acid-loving plants — all of these and others are mentioned as benefits of using peat and have placed peat moss, in particular, in a position where it is being universally demanded by the successful horticulturist and home gardener. For some uses the specifications of a peat material are well defined: for example, peat used for fuel is highly humified and dense, with the mineral-matter content only of economic concern; peat "flour" for foundry use is highly humified, but with limits on mineral-matter content for technical reasons; peat used in agriculture as a poultry and stable litter must be long-fibred and non-dusty and possess a high capacity to absorb and hold water; peat used for the manufacture of planting pots is described as "white peat", or formed from sphagnum, and must be only slightly humified, fibrous, and of low mineral-matter content. In North America the peat materials used for horticultural purposes have the greatest possible range of properties. In general, the Canadian product that enjoys such a large demand in the United States is relatively unhumified sphagnum peat moss which is fibrous, low in mineral-matter content, has a high water-absorbing capacity, and is usually acid. However, in the United States, and to a lesser degree in Canada, a domestic product also is marketed with considerable success which does not necessarily possess any of the qualities of the Canadian sphagnum peat moss. It can be, and often is, of high mineral-matter content, of high moisture content, of low absorptive capacity, so highly humified as to be completely lacking in fibres, and may owe its origin to other than sphagnum moss. Products with such seemingly greatly different properties and characteristics, but used for the

same purpose, are bound to arouse controversy as to the merits of each. Such controversy demands resolution through research and experimentation.

On the Canadian scene, as stated earlier, with the possible exception of areas in proximity to Montreal, Toronto and Vancouver, a successful large-scale peat operation will be largely dependent upon the great metropolitan areas of the United States. Thus, long-distance transportation of the products is likely to be involved. Under such circumstances economic considerations alone, irrespective of the controversy over peat properties and soil beneficiation, will dictate the specifications of the product from Canada's peat bogs that can be traded on a large scale in world markets. It is therefore expected that, at least in the foreseeable future, commercial exploitation of these peat bogs on a large scale will to a great degree be dependent on their capacity to yield a slightly humified, fibrous, porous, low-moisture and low-mineral-matter-content product — in other words, a product of low weight per unit volume of organic material.

At present in North America, standards and general specifications for defining and testing peat materials do not exist. Germany appears to be most advanced among European countries in this regard, particularly in standardizing of test methods and in putting the determinations of the degree of humification and water-absorbing capacity on more scientific bases than has been the case in the past. With the recent organization of a committee to study peat standards, by the American Society for Testing and Materials, namely Committee D-29, Peats, Mosses, Humus and Related Products, it is hoped that in the future the various peat materials will be clearly defined and that scientific methods of evaluating their properties will be established and accepted throughout the industry.

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