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MINES BRANCH INVESTIGATION REPORT IR 64-59

# EXPLOITATION OF A SMALL PEAT BOG

MINES BRANCH  
JUN 23 1964  
OFFICE OF  
THE DIRECTOR

by

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FUELS AND MINING PRACTICE DIVISION

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JUNE 1964

CANADA  
DEPARTMENT OF MINES AND TECHNICAL SURVEYS  
MINES BRANCH  
OTTAWA

FUELS AND MINING PRACTICE DIVISION  
DIVISIONAL REPORT FMP 64/51 - PEAT  
(Summary of DR FMP 64/45)

"EXPLOITATION OF A SMALL PEAT BOG"

Presented at the 10th Annual Research Conference  
on Muskeg, Prince George, B.C., May 21, 1964.

by

T.E. Tibbetts and R.E. Kirkpatrick

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## EXPLOITATION OF A SMALL PEAT BOG

by

T.E. Tibbetts\* and R.E. Kirkpatrick\*\*

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**ABSTRACT**

Descriptions of the methods devised by a Canadian company to produce and process peat occurring in a small peat bog are outlined in this paper. The steps in bog preparation such as drainage, clearing and stripping are described. Production topics covered are bog layout, use of vehicle runways, cultivating, windrowing, loading, shredding and piling. Included in the description of the processing of the peat are the techniques followed for drying and packaging. Mention is made of the attempts to make commercial use of all materials occurring on, in, and under the bog such as floral moss, compost materials, and bog lime.

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## EXPLOITATION D'UNE PETITE TOURBIÈRE

par

T. E. Tibbetts\* et R. E. Kirkpatrick\*\*

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RÉSUMÉ

Ce mémoire décrit les méthodes élaborées par une compagnie canadienne pour la production et le traitement de la tourbe d'une petite tourbière. On y donne une description des diverses phases de la préparation de la tourbière, telles que le drainage, l'éclaircissement et la découverte. Les sujets de production traités sont l'aménagement de la tourbière, l'utilisation de pistes pour véhicules, l'extraction, la mise en longs tas, le chargement, le défibrage et la mise en tas. On a aussi inclus dans la description du traitement de la tourbe les techniques suivies pour le séchage et l'emballage. On fait aussi allusion aux essais d'utilisation commerciale de toutes les matières se trouvant à la surface, à l'intérieur et au-dessous de la tourbière, telles que la mousse florale, les matières à composte et la chaux de tourbière.

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# "EXPLOITATION OF A SMALL PEAT BOG"

by

T.E. Tibbetts\* and R.E. Kirkpatrick\*\*

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## INTRODUCTION

This paper is an attempt to outline the methods devised by R.E. Kirkpatrick, Production Manager, Grand Falls Peat Co. Ltd., Grand Falls, New Brunswick for the commercial exploitation of a small peat bog.

The methods described for the operation have been tried and for the most part adopted by that company. As development of the bog progresses and larger markets are established for the production it is anticipated that some of the present manual operations will be mechanized.

The primary purpose of the company was to devise a simple, fast and cheap method of producing peat material from a small bog. Experiments were made over a period of four years with various methods and suggested techniques that led to the methods outlined in this report. The minimum production capacity aimed for is one hundred railway carloads annually at a rate of one carload per day.

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Some time was spent on the site by Mr. T.E. Tibbetts and from the study made of the operation and from consultations with Mr. Kirkpatrick a detailed report was prepared incorporating many suggested operational techniques. The limitations of the proceedings of this conference restrict this presentation to a summary of that report. Publication of the full report by the Mines Branch at a later date is planned.

#### LOCATION AND TYPE OF BOG

The peat bog consists mainly of humified peat moss and covers an area of about forty-five acres contained within the boundaries of two forty-acre mining claims. It is located near California Settlement, a small community about twelve miles south of the town of Grand Falls in the province of New Brunswick. A lake formerly covered about fifteen acres of the property before it was drained by a ditch that was excavated during the early stages of developing the property for the purpose of producing peat.

Figure 1(E) represents a typical section through the bog and illustrates the layers of the various types of peat material of which the bog is comprised. The average depth of peat material in the bog is about 9 feet.

#### PREPARATION OF THE BOG

##### Drainage

Figure 1(A) is a sketch of the bog in section and in plan. The plan illustrates how the bog is all but divided into two separate areas (indicated by A and B) by the bed of the former lake, which, as was mentioned above, was

drained by an outlet ditch. This ditch was excavated initially to a depth of 20 feet at the south end of the bog tapping the lake at the bottom. It is approximately 3,000 feet to its lower discharge end. As development and working of the peat operation continues this ditch will follow the course of the small brook that presently passes through the approximate center of the bog and drains the upper bog area. As illustrated in Figure 1, a supplementary ditch drains the lower bog area carrying water to the main outlet ditch. This supplementary ditch, which was excavated manually, is two feet wide and six feet in depth. Where the occurrence of springs or small brooks necessitates supplementary drainage of the upper bog area other lateral ditches will be made.

Prior to the excavation of main and supplementary lateral ditches an area of the bog 12 to 15 feet wide was stripped of vegetation on either side of and parallel to the proposed ditch. This allowed piling of the peat material from the excavation on the bog without danger of contamination by surface vegetation.

It was found necessary to excavate the main or center ditch only a short distance ahead of the working area of the bog.

The manner of working the bog, as will be shown below, supplements the drainage of the established ditches.

#### Clearing

After the bog was drained sufficiently for traveling on, areas scheduled for early production were cleared of vegetation such as trees, shrubs, alders, blueberry plants and other small bushes. Except for the small bushes that were surrounded by clumps of sphagnum moss, all of this vegetation was cut close to the bog surface. Small pulp saws and ordinary

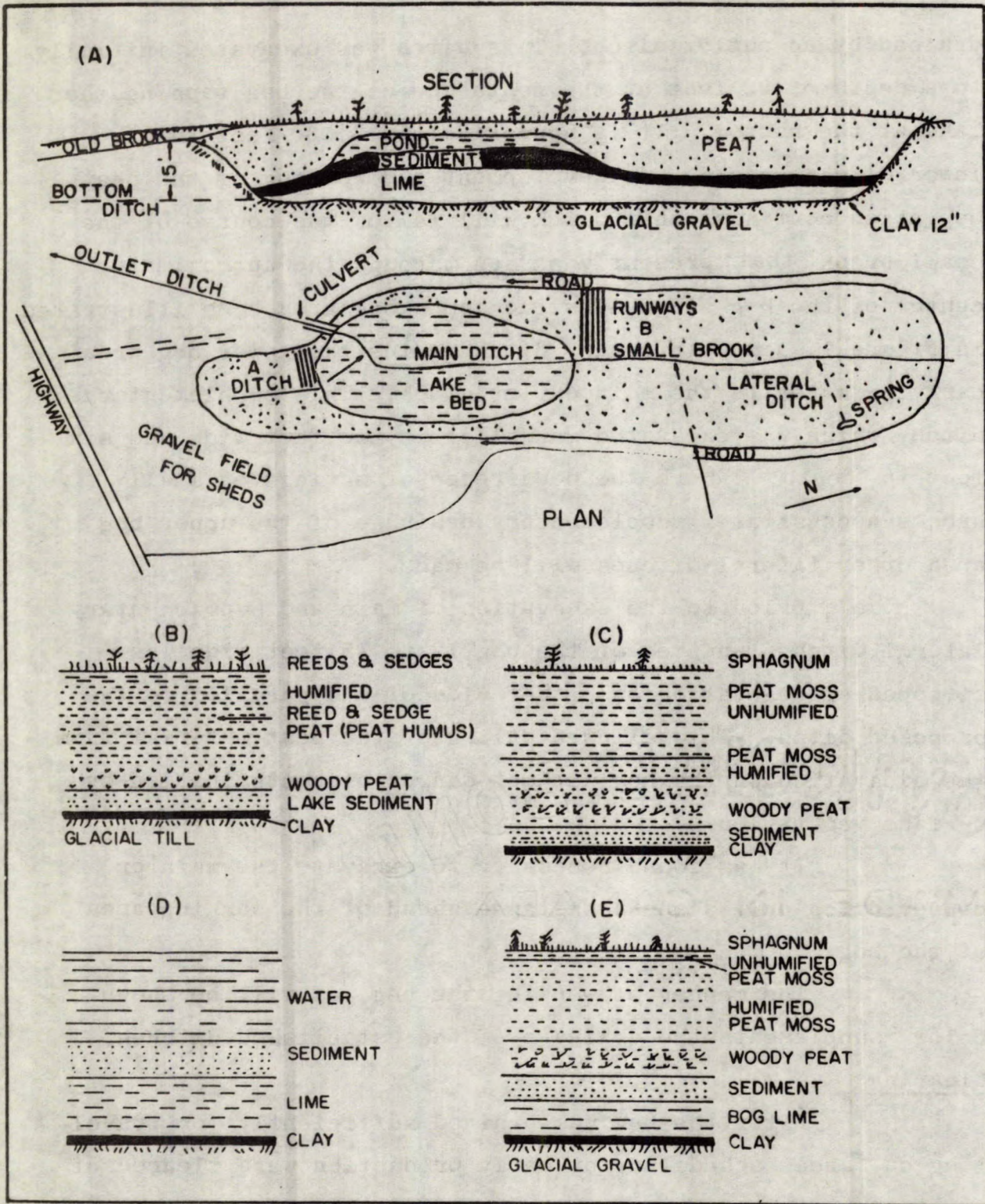


FIGURE 1 - PEAT AND LIME BOGS



chopping axes were used to cut the trees. Small axes were used to remove the shrubs and alders and bush hooks or scythes were used to cut smaller vegetation such as blueberry bushes. The bog was raked clean of twigs, leaves, boughs, etc. after clearing to prevent these from interfering with the stripping.

### Stripping

This operation pertains to the removal of the top 6 inches of the bog and includes trash, sod and sphagnum or floral moss suitable for floral use.

Trash consists of materials such as embedded wood, leaves, twigs, etc. which were not removed during the clearing operation. This is gathered and hauled off the bog and burned.

Sod consists of grass patches and partially rotted moss which is not suitable for floral purposes. It is cut to a depth of 2 to 6 inches, down to the humified peat or layer of peat moss, in 10 to 12 inch squares by means of a broad-bladed axe. This material is used to make up a compost pile.

Sphagnum or floral moss is removed by pulling upwards on the clumps of bushes which are generally found among the moss and then cutting the root systems. This allows the moss to be pulled clear of the bog in strips about 4 feet long and 12 inches wide. The strips are then extended on the surface of the bog and cut into three sections with the final cut being made near the bushes.

In the process of stripping the bog the workers clean carefully around all stumps and finally rake the whole area clean. Removal of stumps follows the stripping of the three products described. Using a double-bit axe the roots of the stumps are cut and usually the stumps can then be pulled clear of the bog by hand. Larger stumps can usually be removed with the aid of a

peavey and prying bar, although occasionally a tractor and a chain have been required.

## RUNWAYS AND BOG LAY-OUT

### Runways

The runways are the means of travelling on the bog with trucks which are used to remove the stripped materials and the humified peat moss as prepared on the bog. They are constructed as illustrated in Figure 2(C) from 1 in. x 4 in. and 1 in. x 8 in. boards, rough. They are from 8 to 16 feet long and 2 feet wide. The type of construction overcomes the problem of warping since the runways can be turned over periodically; travel is equally easy on either surface.

Figure 2(A) illustrates the manner in which the runways, designed to support a carrying load of up to 2 tons, are placed on the bog; they are parallel to one another and all are kept parallel within the various working sections of the production area.

### Lay-out of the Bog

Figures 2(A) and 2(D) illustrate the manner in which the bog is planned for production. The area to be worked is laid-out in units of 100 feet frontage, each unit is divided into two sections 50 feet wide and each section is divided into four working strips, A, B, C and D, each of which is 12 1/2 feet wide. All of these strips are parallel to one another and as near as possible to 90 degrees to the perimeter of the bog and the center-line ditch. Present working sections on this bog are 150 feet long and four sections are being worked. The peat is gathered from two sections

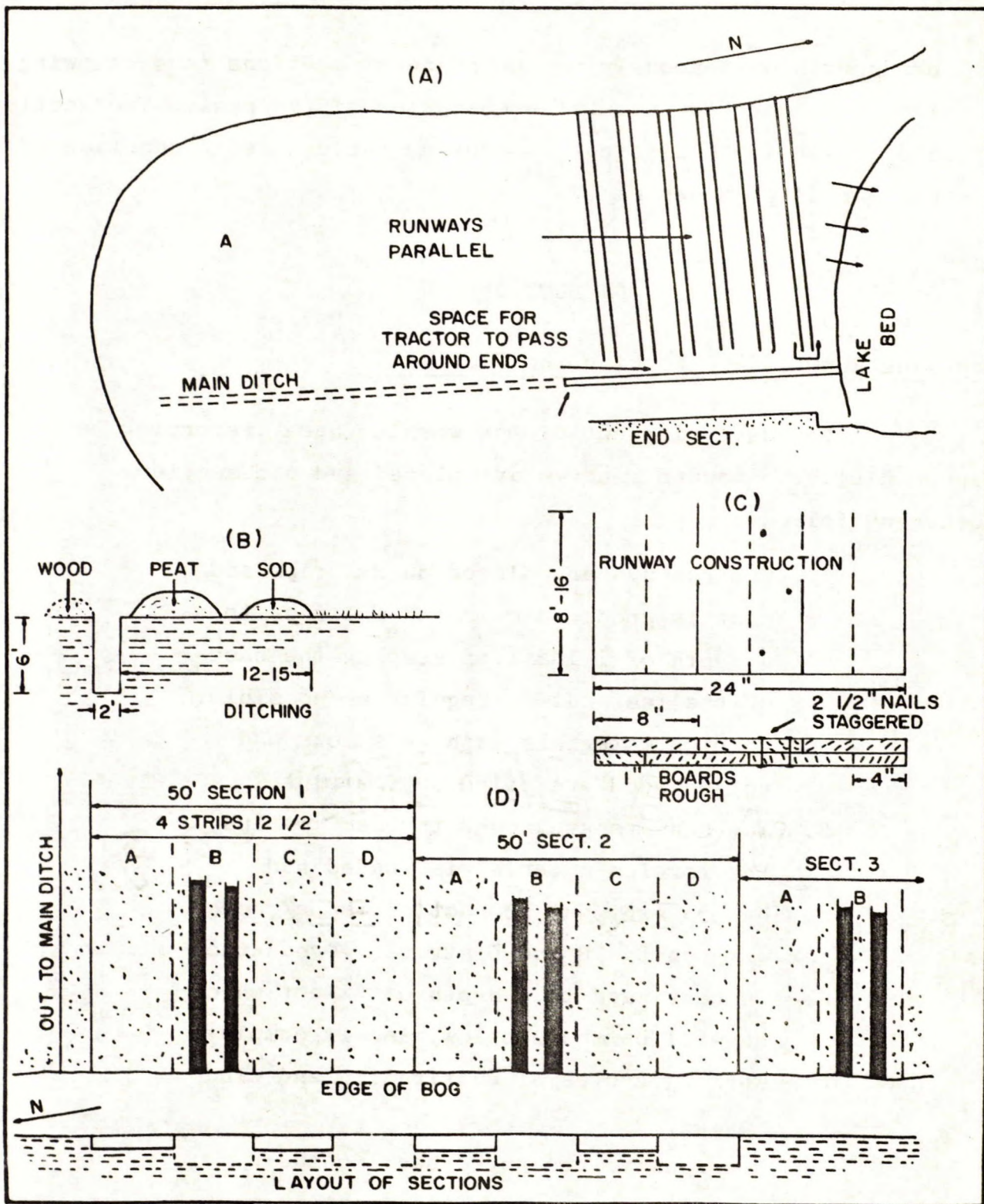


FIGURE 2 - LAYOUT OF BOG AND RUNWAYS

and prepared simultaneously on two adjacent sections thus allowing a full day or more for careful preparation of the peat. Two sections of this length are sufficient to provide the desired production of one carload of peat per day.

## PRODUCTION

### Handling Runways and Working the Sections

Following lay-out of the working area, referring to Figure 2(D), the wooden runways are placed and the sections worked as follows:

1. The runways are placed on B strips and peat is produced on A and C strips to a depth of 1 1/2 feet keeping the base of the last cut as regular as possible. Foreign materials such as sticks and rotten wood are piled on D strips.
2. The runways are moved to the C strips, the foreign material is loaded and hauled away and production is proceeded with on the B and D strips. Production is continued to a depth of 3 feet which, as will be shown below, is six complete working cycles of cultivating and wind-rowing.
3. The runways are moved back to the B strips and the production continues as in 1 and 2 above.

In working the sections the working base is kept level or slightly sloped towards the center ditch as this aids in the drainage of the area.

### Cultivating

This term pertains to the breaking up of the peat in the bog and is accomplished by means of a small commercially available walking-type tractor with a roto-tiller attachment at the rear. The roto-tiller is 30 inches wide and breaks up the peat to a depth of 6 inches at one time. The complete cultivating unit costs about \$550.00

Thorough cultivating, which can be done by passing the cultivator through the peat about six times, results in easier loading, hauling, unloading and shredding in addition to greatly increasing the rate at which the peat dries.

Referring again to Figure 2(D), strip A is cultivated followed by cultivating on strip C. While trucks are hauling off material from strips A and C of one section, corresponding strips in the next section are cultivated.

### Windrowing

This operation, which pertains to pushing the cultivated peat into windrows for loading, follows the cultivating and drying of peat on the bog. It is accomplished by means of a bulldozer-type blade attached to the front of the walking-type tractor as used for cultivating. The blade is attached at the required angle to push the peat to the desired position for loading. At present loading is by hand using shovels; therefore, the peat is windrowed towards the runways. When a loading conveyor is used, the windrows will be away from the runways.

Two strips can be windrowed simultaneously by moving in one direction on one strip and in the opposite direction on

the second strip on either side of the runways.

### Loading, Hauling and Unloading

Forks and shovels are used to load the peat from the windrows into trucks positioned on the runways. Currently 1/2 ton pick-up trucks are being used to haul the peat from the bog to the shredder. The trucks are backed-up to either side of the shredder and, when two trucks are being unloaded simultaneously, care is taken to shovel or fork the material alternately to prevent overloading of the shredder. As the shredder ejects stones and solid pieces of roots from the rear, for safety reasons the trucks must not be positioned at the rear of the shredder.

### Shredding or Beating

Shredding or beating of the peat is performed by the working unit, consisting of the concave and beating wheel, of the old-type threshing machine formerly used on farms and still available on many farms throughout this country. It is illustrated in Figure 3. It is powered by a tractor take-off but can be equipped with a separate 8 to 10 horsepower gasoline motor.

In addition to shredding the peat, the beater separates the peat and foreign material quite efficiently by centrifugal force. Peat is thrown up to 8 feet from the front of the machine, whereas dense wood is thrown 15 to 20 feet where it is stopped by a framed canvas back-stop erected to prevent contamination of adjacent peat piles. Some dense peat and light weight wood are sometimes thrown from 7 to 10 feet from the machine and this "middlings" product is returned to the beater.

A galvanized steel sheet, 8 to 9 feet long and 3 feet wide, with a sloped wall is placed against the front of the machine to serve as a shoveling surface.

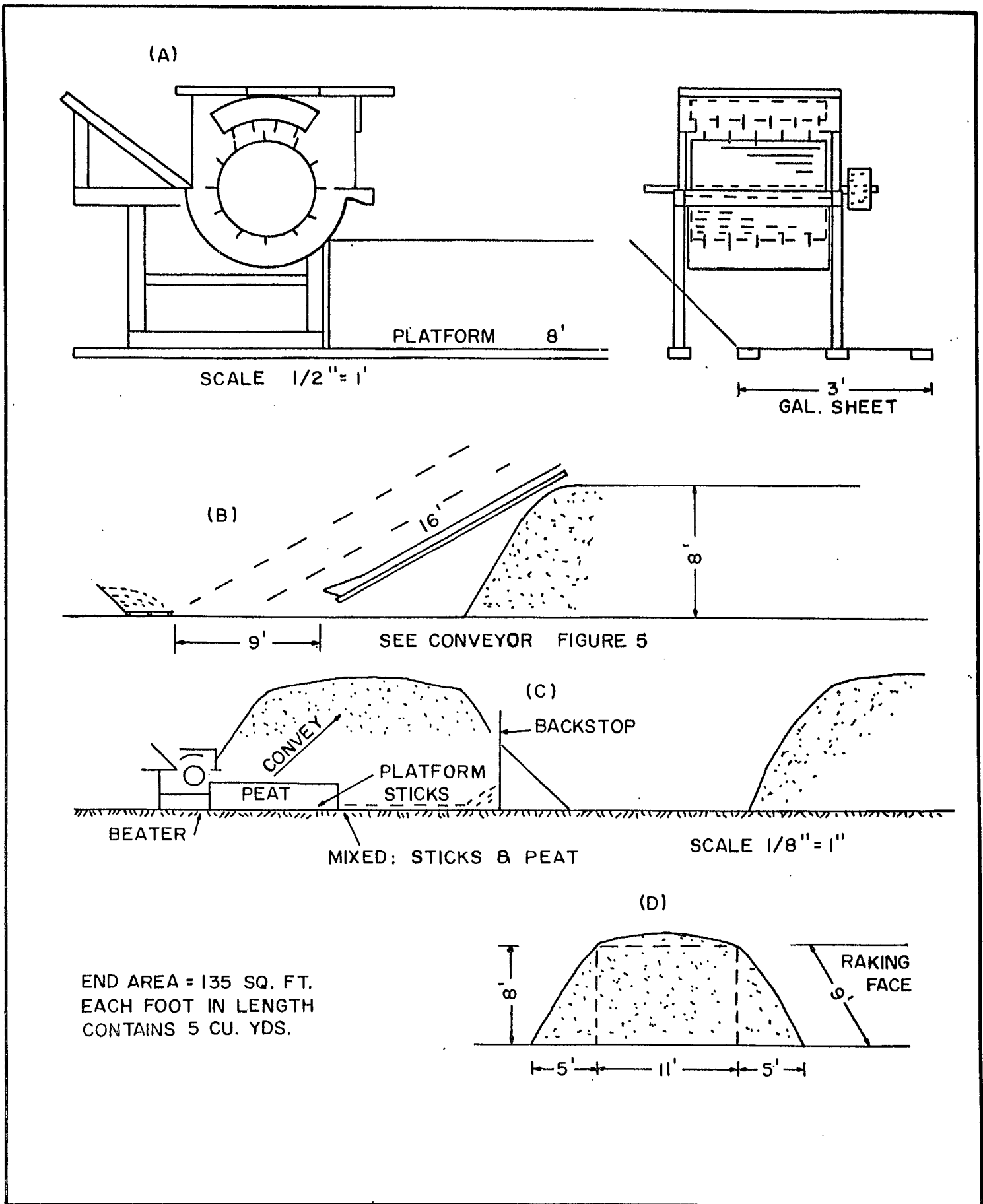


FIGURE 3 - BEATER (SHREDDER)

From the beater the peat is piled by hand into stockpiles in the open or in drying sheds.

## STOCKPILING, DRYING AND BAGGING

### Stockpiles

Stockpiles, in the open or in specially constructed drying sheds, are built up running east and west lengthwise in order to take advantage of the maximum sun heat for further drying the peat. These stockpiles are 21 feet wide at the base, 8 feet high and any convenient length. Each lineal foot of such piles contains approximately 5 cubic yards of peat.

### Drying

Some of the peat is hauled from the bog, shredded and stockpiled in special drying sheds that are positioned in an east-west direction lengthwise and constructed to take advantage of the maximum sun from the south side. The stockpiles in the sheds are built up similarly to those outside.

The drying shed is illustrated by Figures 4A and 4B. The most unique features of its construction are the placing of 2 in. x 4 in. rafters flat side down rather than on edge and the wire-mesh plastic used for the south-side roof and part of the wall to permit greater drying by the sun. Creosote treated posts driven into the ground form the foundation of this building. The floors consist of 4 to 6 inches of gravel taken from the excavated material of the main outlet ditch. The north wall is left open at the top to one foot below the eave. The shed is large enough to conveniently accommodate dump-trucks.

The overall cost of construction of such a shed is about \$1,200 per one hundred feet of length.



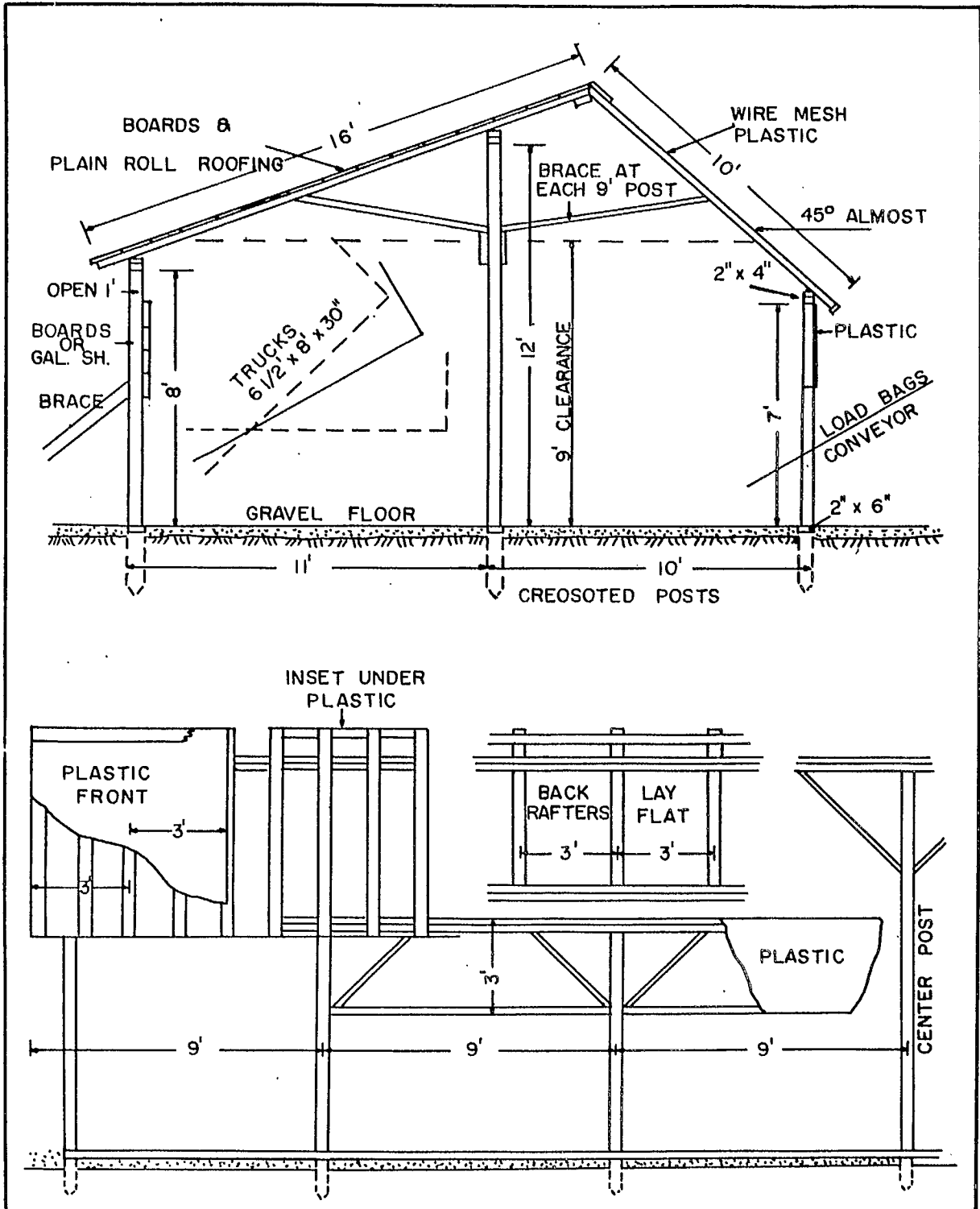


FIGURE 4A - DRYING SHED

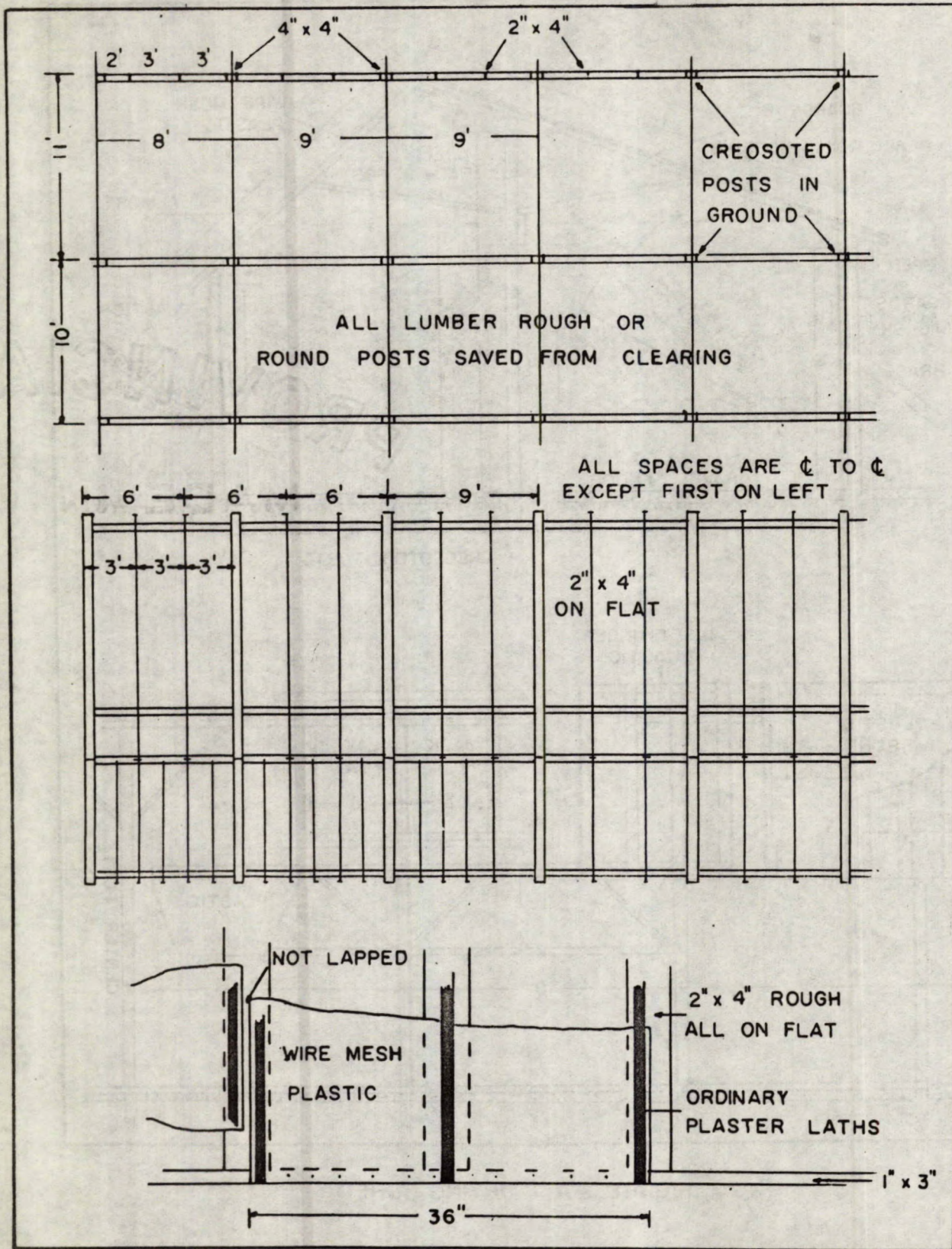


FIGURE 4B - DRYING SHED - LAYOUT OF POSTS AND FRAME

As the peat dries on the southern faces of stockpiles both in the open and in sheds it is raked or scraped down on this side to the base of the pile in layers about one inch deep. It is estimated that on an average drying day 3 inches of material can be sufficiently dried to allow it to be bagged. Drying at this rate on such piles yields 100 cubic yards, or one carload, of peat per day from a total length of 1,200 feet of stockpile. One worker can rake down one 100-cubic yard carload of peat per day, at a cost of 10 cents per cubic yard.

The degree of drying is checked by measuring the weight per cubic foot; about 20 pounds per cubic foot is considered the weight satisfactory for all markets with slightly greater weights for local delivery and for small bags.

### Bagging

With the exception of some local deliveries where the customer prefers a jute bag for the peat, all bags used are plain plastic with the only identification being provided by a tag which is placed on the bag after filling together with an instruction sheet on the use of humified peat moss.

The largest bag used has a capacity of 3 cubic feet and some distributors have advised that this size is preferable to the more or less standard 6 cubic feet size if the price per unit volume is comparable. Other bag sizes used range from 1 1/2 cubic feet capacity to 3 quarts.

The bags are filled by measuring the peat in special containers and shaking down, giving a weight and appearance similar to bales and packages of compressed peat moss.

Copper wire ties are used to secure the larger bags and plastic covered wire ties are used for the 3 to 8 quart capacity sizes.

The large bags of peat can be piled and stored outside even over the winter months but it is advisable to store those of less than 1 1/2 cubic feet capacity inside.

It is anticipated that shipping large quantities of the small bags of peat by large van or carloads will require that the bags be packed in cartons.

All bags of peat are presently loaded by hand but the advantage of a small loading conveyor is realized.

#### PREPARATION OF BY-PRODUCTS

As was mentioned in the introduction of this paper the company is endeavouring to eliminate waste as much as possible and to profitably exploit all materials removed from the bog. Use has been made of gravel from the excavation of the main outlet drainage ditch for floors for the drying sheds. Trees removed from the bog have been used for building purposes and for fuel while some have been marketed as Christmas trees. The most important by-products of the production of humified peat moss that have been prepared are floral moss, compost and mixed peat. Their preparation is illustrated in Figure 5.

##### Floral Moss

The unhumified sphagnum moss from the surface of the bog is taken to a special drying shed, similar to that described above, where it is cleaned and dried for two to three days on a raised deck of 1-inch-mesh chicken wire. It is packed in cartons and sold to florists for about 16 cents a pound.

##### Compost

This is prepared from the sod (which consists of grass patches, leaf-mould and partially decomposed sphagnum moss unsuitable for floral purposes) and removed from the bog during the

stripping operation. A pile is built up using layers of these materials and lime from the bog deposit. The compost is shredded and sold locally for use in gardens and on lawns.

#### Mixed Peat

The mixed peat pile consists of very wet and woody peat, highly humified peat and unhumified peat moss, which are removed from the bog during regular production but which occur in concentrations too large to permit blending with the current marketed product, humified peat moss. These materials are put down in layers on the pile in a similar manner to that used in building the compost pile. The product is sold locally after shredding.

#### COSTS, SELLING PRICES AND PROFITS

The cost of producing and loading the humified peat moss in bulk from the bog is \$1.50 per cubic yard. This includes the following individual costs: drainage ditches, \$0.05; clearing, \$0.05; stripping, \$0.10; roads and runways, \$0.05; buildings, \$0.15; equipment, \$0.15; salaries and overhead, \$0.25; royalty, \$0.20; cultivate and row, \$0.25; loading, \$0.25.

Additional costs for the shredded and dried product are as follows: hauling to the shredder, \$0.25; piling from the shredder, \$0.25; raking down the piles, \$0.10; and loading, \$0.40. Total cost for this product is \$2.50 per cubic yard, by bulk.

The costs of sacks, bags and tags range from \$2.20 to \$4.00 per cubic yard depending upon the capacity of the bags. The costs of bagging range from \$0.90 to \$5.00. Costs of loading the bags to shipping facilities range from \$0.30 to \$0.90.

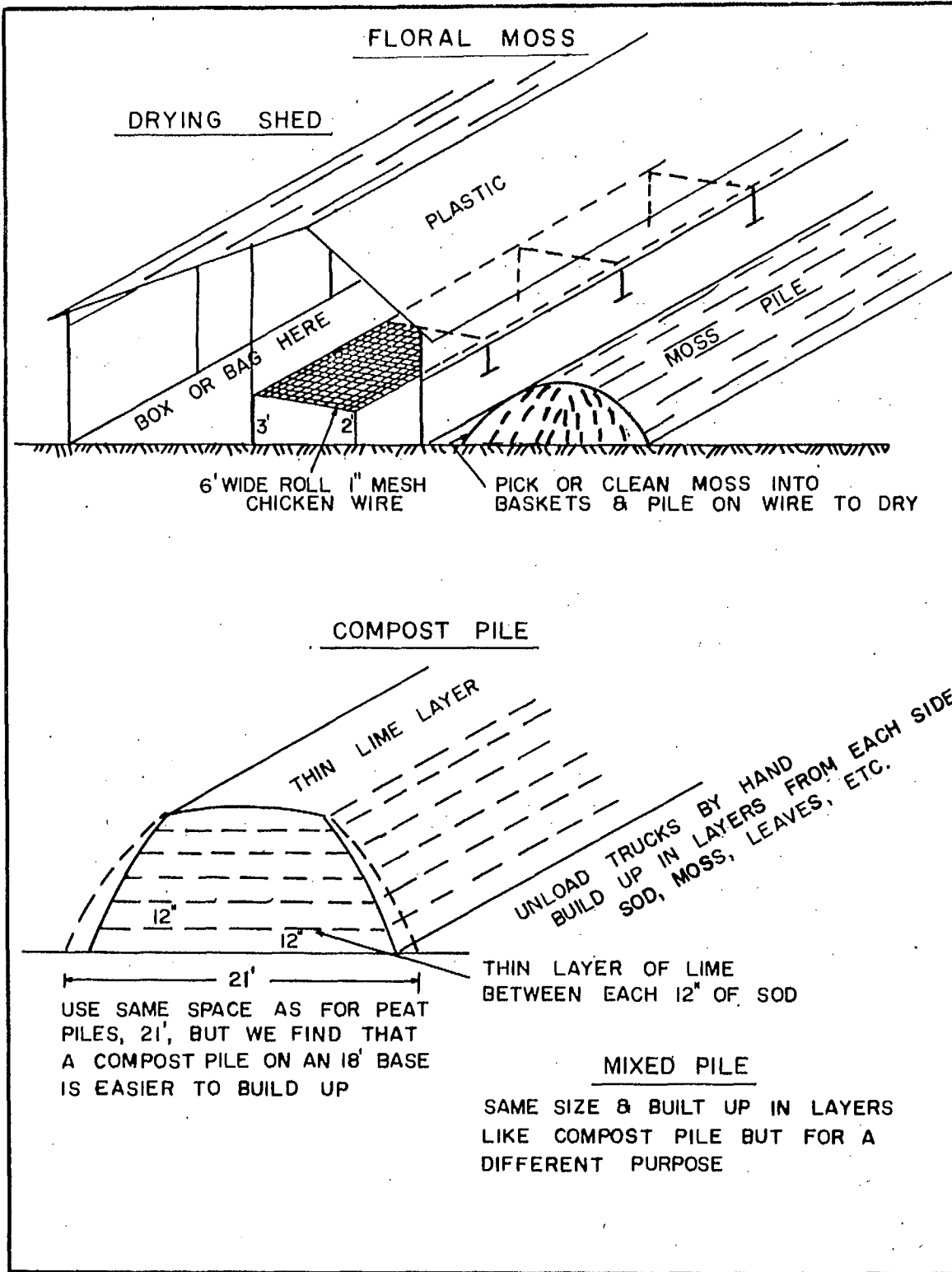


FIGURE 5 - PREPARATION OF BY-PRODUCTS

Total costs then range from \$2.50 per cubic yard by bulk to \$12.00 per cubic yard for the peat in 3-quart capacity plastic bags.

Costs, selling prices, and profits from the sale of completely prepared humified peat moss in bulk and in plastic bags are tabulated below (all values are in dollars).

Unit Size	Cost Allowed	Selling Price*			Per Unit	Per Cu. Yd.
		A	B	C		
Cubic Yard	2.50	6.00	-	-	-	3.50
3 cu. ft.	0.60	1.20	1.00	0.90	0.30	2.70
1 1/2 cu. ft.	0.30	0.75	0.60	0.50	0.20	3.60
8 qt.	0.10	0.40	0.25	0.20	0.10	8.00
5 qt.	0.08	0.30	0.20	0.16	0.08	9.60
3 qt.	0.06	0.25	0.16	0.13	0.07	14.00

\*A refers to local sales, B to local dealers and C to distributors.

The selling prices to distributors are lower than to dealers and to local customers; therefore, the profits indicated are minimum.

Peat moss loaded to the buyer from the bog costs \$1.50 to produce and is sold for as much as \$4.50 per cubic yard.

Cost of compost is given as \$2.00 per cubic yard and is sold for as much as \$5.00 per cubic yard.

Cost of mixed peat is \$2.50 and sold to the customer for as much as \$5.50 per cubic yard.

## ACKNOWLEDGMENTS

R.E. Kirkpatrick wishes to express great appreciation for the work and helpful suggestions provided by Sandford Radgate and Harry Hamilton, both of Grand Falls, during the four years of experiments and to Dr. Edgar Chiasson, President of Grand Falls Peat Co. Ltd. for his encouragement and financial assistance. T.E. Tibbetts, who spent several days in the field studying the operation and in consultation with Mr. Kirkpatrick, wishes to gratefully acknowledge the unique cooperation of Mr. Kirkpatrick in supplying the details of the operations of the Grand Falls Peat Co. Ltd. Without this superb effort on the part of Mr. Kirkpatrick this report would not be possible.

Acknowledgment is also due William Goodwin, a retired mining engineer and presently residing in Manotick, Ontario, who encouraged this project.