Peats for Soil Improvement
Michigan State University
Cooperative Extension Service
Farm Science Series
Robert E. Lucas and Paul E. Rieke, Soil Science Department and Rouse S. Farnham, Soil Science Department, University of Minnesota
December 1965
16 pages

The PDF file was provided courtesy of the Michigan State University Library

Extension Bulletin No. 516
Farm Science Series

PEATS

for soil improvement and soil mixes

Cooperative Extension Service
MICHIGAN STATE UNIVERSITY

CONTENTS

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. N. P. Ralston, Director, Cooperative Extension Service, Michigan State University, E. Lansing, Mich.

1F-12-65-15M-HO

PEATS

for soil improvement and soil mixes

By Robert E. Lucas and Paul E. Rieke[1]
and Rouse S. Farnham[2]

The beneficial effects of organic matter in soil have long been recognized as essential for good plant growth. Practices generally used to maintain organic matter supply in the soil are application of manures, plowing down crop residue, and the addition of organic materials. Where a need exists in specialty crops for greatly increased levels of organic matter that will last for a period of years, the addition of large amounts of peat is recommended. This publication has been prepared to help both the buyer and seller evaluate the properties and uses of various peats.

The use of peat may bring about a number of desirable improvements, such as:

1. Increase the moisture-holding capacity of sandy soils
2. Increase the rate of water infiltration of fine-textured soils
3. Make soils more friable and better aerated
4. Decrease soil volume weight and thereby ease plant root penetration
5. Increase the buffering effect of the soil which make acidity and soluble salt levels more difficult to change
6. Increase microbial activity in the soil which may help produce desirable plant growth regulators and antibiotic substances
7. Serve as a source of slow-releasing form of nitrogen fertilizer
8. Make certain elements, such as iron and phosphorus, more available to plants.

Peat, especially the fibrous type, is popular for mulching purposes. Peat helps keep plant roots cool in summer and warm in winter, for peat is a poor conductor of heat. Because of their high moisture retention, peats deter the drying-out of the root system of ornamental plants, thereby helping to prevent winter injury or death. Peat mulches help prevent soil compaction and crusting, and increase percolation of water. Acid peat mulches help reduce weed growth and improve the aesthetic appearance of ornamental plantings.

1. Soil Science Department, Michigan State University
2. Soil Science Department, University of Minnesota

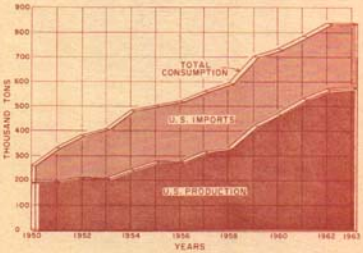

Figure 1. Utilization of peat in the United States (short tons). Compiled from U. S. Department of the Interior.

Peat is used in soil mixes because it can be purchased cheaply. It is usually uniform in quality and easily obtainable. On the other hand, organic amendments such as compost, leaf mold, manure, and "black dirt", while suitable as soil conditioners, are ordinarily quite variable in quality, may contain noxious weed seeds, and are often difficult to purchase locally.

Many kinds of "black dirt" or top soil sold locally are frequently too high in mineral content (sand, silt, or clay) to be effective organic amendments. Often, the addition of "black dirt" high in clay or silt, for example, will actually increase soil compaction.

PEAT INDUSTRY IN THE UNITED STATES

Information compiled by the United States Department of the Interior reports that there were 113 peat producers in 23 states in 1963. That year the harvest was 578,000 tons at a value of 5.5 million dollars. Michigan's 28 producers accounted for 44 percent of the national production with a value of 2.4 million dollars. Minnesota with the largest reserves of peat produces only a fraction of the total for the United States. Producers in the United States often report that the compilation is not complete. Figure 1 illustrates yearly consumption of peat in the United States.

TYPES OF PEAT

Peat can be defined as the organic remains of plants which have accumulated in places where decay has been retarded by excessively wet conditions. It takes 100 to 500 years to produce a foot-layer of the residue. The rate depends upon type of plant cover and environmental conditions.

Peats used for soil improvement are generally classified into three types: moss peat, reed-sedge, and peat humus. Peat deposits of any of the three types may contain a considerable amount of woody material.

Most peats produced in the United States are either the reed-sedge or humus type. In recent years, however, production of sphagnum moss peat has started in Minnesota, Michigan, Maine, and Washington. Practically all peat imported from Canada or Europe is derived from sphagnum moss.

Moss Peat

Moss peat is that type which has been formed principally from sphagnum, hypnum, and other mosses. Moss peat, often called "peat moss" as usually found in the market is derived mostly from sphagnum moss and is the least decomposed of the various peat types. It is light tan to brown in color, light weight, porous, high in moisture-holding capacity, high in acidity, and low in nitrogen. Hypnum moss peat is a darker brown color, has low acidity, and possesses physical characteristics similar to reed-sedge peat. Moss peats having high acidity are slowly decomposed. On the other hand, after liming, exposure to air, and incorporation in soil, they decompose at moderate rates because of the high cellulose content.

Sphagnum moss is the young residue or live portion of the plant often called "top moss" and should not be confused with moss peat which has aged and partially decomposed. Sphagnum moss (top moss) is marketed for tender plants for shipment and for starting root cuttings and seedlings and also for mulching.

Reed-Sedge Peat

This type is formed principally from reeds, sedges, marsh grasses, cattails, and other associated swamp plants. The peats of this type found on the market differ considerably in the degree of decomposition and acidity. Fibrous, partially decomposed peats are brown to reddish brown in color. More decomposed peats are darker in color. The moisture-retention capacity and the nitrogen content are of medium range.

Peat Humus

Peat that is of an advanced stage of decomposition and in which the original plant remains are not identifiable is called "peat humus." It is usually derived from reed-sedge or hypnum moss peat. Peat humus is dark brown to black in color, has low moisture-retention capacity, and a medium to high nitrogen content. This type has a high amount of lignin material which is difficult to decompose. For this reason, peat humus is more resistant to decomposition than the moss and reed-sedge peats.

SOILS HIGH IN ORGANIC MATTER

In addition to the three major types of peat, there may be other organic soils offered for sale. Some of these types are called sedimentary peat, top soil, "black dirt," muck soil, or black humus. They are often low in quality. Such materials can be recommended for soil improvement only if they are inexpensive and have acceptable mineral content and acidity readings. Such information can only be obtained by having the soil tested.

Sedimentary peats are found in the bottom of lakes and ponds and in the lower levels of most peat deposits. They are derived from algae, plankton, pond weeds, and similar plant species. Such peats often contain considerable marl and mineral soil impurities. For most purposes, sedimentary peats are too finely divided, and shrink and swell greatly with varying moisture content. Some that are found near the bottom of a peat deposit have a sheet like structure which turns hard upon drying.

Muck soil is highly-weathered peat that has been modified greatly by soil micro-organisms and is usually granular in structure. It has low moisture retention and is seldom advised for soil improvement.

RECOMMENDED USES OF PEAT

If the purpose of the peat is to increase organic matter content of the soil, then most sources are acceptable, providing they are high in organic matter. There are other users who are looking for peats that increase soil acidity, increase moisture retention, or are suitable for mulching purposes.

Peats used for mulches around plants should be coarse, unweathered, and light brown in color. The purpose of these characteristics is to obtain material that has good aeration, conducts heat slowly, reflects light, and has low surface-moisture evaporation.

Peats used for potting purposes should have some standard uniform characteristics so that the grower can better estimate lime and fertilizer requirements. Once he has found the ideal mixture, he can obtain uniformly reliable plant performance. Sphagnum moss peat from different sources shows the least variation in characteristics. Peat humus and mucks which have been heavily fertilized or are from saline areas are not recommended. Upon heat sterilization (pasteurization), such peats release excessive salts or toxic quantities of ammonia and manganese.

The information in table 1 helps summarize the best uses of different types of peat.

TABLE 1—Recommended Uses and Application Rates for Different Types of Peat.

Peat use	Normal application*	Sphagnum moss peat	Hypnum moss peat	Reed-sedge peat	Peat humus (decomposed)
Soil conditioning	2" layer worked into soil	Fair	Good	Good	Good
Top-dressing lawns, golf courses	1/8-1/4" layer worked into soil	Fair	Good	Good	Good
Surface mulch	2" layer	Excellent	Fair	Fair	Poor
Potting soil mix	50% peat 50% vermiculite or soil	Excellent	Good	Good	Fair
Golf green soil mix	80% sand† 10% clay loam 10% peat	Poor	Good	Good	Excellent
Rooting cuttings	50% peat 50% vermiculite	Excellent	Good	Fair	Poor
Seed flat germination	Pure milled peat	Excellent	Good	Fair	Poor
For acid-loving plants	25% mixture in soil	Excellent	Not recommended	Good if below pH 4.8	Not recommended
For acid-intolerant plants	25% mixture in soil	Recommended only if limed	Good	Good if above pH 4.8	Good
Shipping tender plants	Wrap roots (wet)	Excellent	Fair	Fair	Poor
Adding stable organic matter	2" layer worked into soil	Poor	Fair	Good	Excellent
Liquid absorbent (litter)	2" layer on floor	Excellent	Fair	Fair	Poor
Nitrogen source	Soil mixes top-dressing	Poor	Good	Fair	Good

* By volume.

†General Formula—U. S. Golf Association. Often needs modification for specific situations.

Acidity

Sphagnum moss peats and certain reed-sedge peats are very acid. They are preferred for certain acid-loving plants such as azaleas, rhododendrons and blueberries. The material should have a pH value between 3.8 and 4.5. Acid peat is also preferred for conifers and other ornamentals growing on slightly acid or alkaline mineral soil.

Most reed-sedge peats have a pH between 4.5 and 7.0. Those with a pH below 5.0 usually need liming if used for plants sensitive to excess acidity. Peats with pH higher than 6.0 contain considerable calcium and magnesium and lack the acidifying properties of most peats.

Potting soil mixes containing peat normally require adjustment of the acidity. The liming recommendations shown in table 2 are for peats used in soil mixes. Because of the variability in the chemical nature and volume weight of different peats, the liming rates may differ greatly even if the peats have the same initial pH. Thus, it is generally necessary to modify the suggestions shown in table 2. Usually less lime is needed for fibrous peats and greater amounts for peat humus. The reason is that the density of peat humus is about twice as great as that for fibrous materials.

Users of peat for soil mixes should keep records and recheck the pH of the treated soil after it has been kept moist for one month. Adjustment then can be made for new mixes.

WHAT TO LOOK FOR IN PEAT

The value of peat depends upon its uses and a number of other factors. Information shown in table 1 serves as a good guide for determining the best uses of peat.

Specific information often requested by the buyer includes the percent of organic matter, degree of decomposition, pH (acidity), percent of water (moisture), and kind and quantity of weed seed. Additional items sometimes requested are the structure, color, maximum water holding capacity, and the nitrogen content. The processor or supplier of the peat should be able to give such information.

Bulk or baled peat is usually sold on the volume basis in units of cubic feet or yards. Baled peat is pressed so as to give 2 to 3 times its volume of loose material. Volume measure for peat sold in bulk partially corrects for differences in the moisture content but does not allow for shrinkage upon drying.

The organic matter content of acceptable peat should run over 80 percent and choice material over 95 percent on a dry weight basis. The organic matter content is usually calculated indirectly after the ash and water contents have been determined in the laboratory.

The equation is:

100-(% ash + % water) = % organic matter

For example, if a peat sample contains 4 percent ash and 60 percent water, it contains 36 percent organic matter. *The Cost of Each Pound of Organic Matter Is One Important Way to Compare The Values of Different Peats.* To illustrate, a 50-pound package containing 20 pounds of organic matter, selling at $1.00, costs $.0.05 per pound for the organic matter.

The degree of decomposition is usually expressed in the U.S. as fibrous (raw), partly-decomposed, or decomposed. The decomposed peats are usually called peat humus. (The amount of fiber a peat contains and the preservation of the fiber is a good estimate of the degree of decomposition.) European and some U.S. buyers use the one-to-ten-point system of Von Post. For example, the value of H-3 means the peat is about 30 percent decomposed.

The pH scale is used to designate the degree of acidity or alkalinity. A pH of 7.0 is neutral. Very acid peats have a pH of 3.6 to 4.2. Acid peats have pH 4.2 to 5.0. Peats with pH values from 5.0 to 7.0 are low in acidity. Those with a pH over 7.0 are alkaline. Peats are sometimes classified into two major acidity types. Those with pH values below 5.0 are called "low lime" and are calcium deficient. Peats above pH 5.0 are called "high lime" and are calcium sufficient.

Percent water in peat can be expressed on a dry-weight basis or on a moist-weight basis. Soil scientists always express water content on an oven-dry basis since this is a constant value. By this system, when the weight of water equals the dry weight of peat, the water content amounts to 100 percent. This method of calculation is not commonly understood by the consumer. For this reason, the water content in peat offered for sale is generally expressed on the weight of peat as sold (moist weight basis). Thus in the above example the water content would be 50 percent.

According to a survey made by the U.S.D.A., baled peat ranged from 21 to 49 percent water in the product as sold. Peat in moisture-proof packages ranged

TABLE 2 — Pounds of Dolomitic Limestone[1] or Sulfur Needed per Cubic Yard of Peat.

Original pH of peat	Desired pH of peat		
	pH 4.5 to 5.2[2]	pH 5.3 to 6.2[3]	pH 6.3 to 7.0[4]
3.4 to 3.9	8 lb. limestone	14 lb. limestone	18 lb. limestone
4.0 to 4.4	4 lb. limestone	10 lb. limestone	14 lb. limestone
4.5 to 5.2	none	5 lb. limestone	10 lb. limestone
5.3 to 6.2	2 lb. sulfur	none	5 lb. limestone
6.3 to 7.0	4 lb. sulfur	2 lb. sulfur	none

1. If obtainable, a mixture of equal parts of dolomitic and calcic limestone is preferred to all dolomitic limestone.
2. Desirable pH for azaleas, gardenias, camellias, rhododendrons, and many conifers and tropical plants.
3. Desirable pH for most bedding plants and tree nurseries.
4. Desirable pH for many bedding plants and potted plants. Manganese fertilizer is often needed.

from 30 to 80 percent water. *The Variability in Water Content of Different Peats is a Basis for Much Concern to the Buyer.* Appearance can be deceiving. Care should be taken by the peat producer to dry the material as much as possible. A suggested value for baled moss peat is about 25 percent moisture and packaged peat humus about 55 percent. It is not practical to dry peat excessively, as this increases costs and makes the material dusty, chaffy, and difficult for the user to rewet.

Weed seed contamination is of concern to buyers of reed-sedge and peat humus from certain deposits. Top soil, especially from fields previously in cultivated crops, can be heavily weed-infested. Heat sterilization of the soil will destroy germinating seed. Subsoil peat and sphagnum moss peat are practically free of weed seed.

Structure refers to physical properties of peat. Terms used to describe structure include fibrous, felty, pulpy, spongy, granular, or pitchy. Most baled peats are described as fibrous or felty in structure. Packaged products are usually described as pulpy or spongy.

The water-holding capacity is of special interest to users requesting a liquid absorbent, such as for litter. Sphagnum moss peat in its natural state can absorb 20 to 30 times its dry weight in water. After air-drying, the capacity may be only 10 times. Hypnum moss and reed-sedge peat can absorb 5 to 7 times their dry weight. Although these differences in water-holding capacity exist in pure peat, only small differences in available water for plants result when the peat is used in the various soil mixes.

Nitrogen content is important when estimating nitrogen fertilizer needs for plants. Sphagnum moss peat contains 0.6 to 1.4 percent, reed-sedge 1.5 to 3.5 percent, and peat humus 2.0 to 3.5 percent nitrogen, based upon the organic fraction. Thus, sphagnum moss peats require considerable nitrogen fertilizers for plant growth. The nitrogen value of peat humus containing 60 percent water is about $3.00 a ton if the nitrogen content is one percent and is worth $0.15 a pound. Peat does not release nitrogen to plants as quickly as chemical fertilizers because much of the element remains tied up in the resistant organic residue. On the other hand, the nitrogen from peat continues to be released for several years as the organic matter decomposes.

Table 3 summarizes some of the physical and chemical values found in different types of peat.

TABLE 3 — Analyses of Common Horticultural Peats.

Type	Range in pH	Range of water absorbing capacity* percent	Range in ash content* percent	Range in volume weights* lb./cu. ft.	Range in nitrogen* percent
Sphagnum moss peat	3.0-4.0	1500-3000	1.0- 5.0	4.5- 7.0	0.6-1.4
Hypnum moss peat	5.0-7.0	1200-1800	4.0-10.0	5.0-10.0	2.0-3.5
Reed-sedge peat (low lime)	4.0-5.0	500-1200	5.0-15.0	10.0-15.0	1.5-3.0
Reed-sedge peat (high lime)	5.1-7.5	400-1200	5.0-18.0	10.0-18.0	2.0-3.5
Decomposed peat	5.0-7.5	150-500	10.0-50.0	20.0-40.0	2.0-3.5

* Oven-dry basis.

SPECIFIC RECOMMENDATIONS FOR PEAT

Lawns, Gardens, Flower Beds, and Nurseries.

Peat may be used in establishing new lawns, gardens, and flower beds so as to increase the organic matter content of the soil. It is especially recommended around homes where subsoil materials are used for fill. A suggested rate is about 3 to 6 cubic yards of loose peat or 6 to 12 compressed bales (6 cubic foot size) for each 1000 square feet. This rate is equivalent to a surface application of 1 to 2 inches of peat. It then should be worked into the soil for a depth of 4 to 6 inches. Peats left on the surface are not suitable for lawns because the turf is easily torn and the danger of disease is increased. Under such a practice one also loses the benefit of improved aeration, moisture retention, and root penetration.

Peat used for lawns, etc. should have a pH of 4.5 to 7.0. Acid peats having pH values below 4.5 can be used if some lime is applied or if the mineral soil

TABLE 4 — Effect of Moss Peat on Composition of a Soil Mix.[1]

Peat to work into top 4 inches of soil	Peat required per 1,000 square feet	Peat in soil mix by volume	Moss peat[2]	
			Dry peat required	Percent by weight in mix
inches	cubic yards	percent	pounds	
1	3	20	600	2
2	6	33	1,200	4
3	9	43	1,800	6
4	12	50	2,400	8

1. Rates based on 1,000 square feet of area.
2. For peat humus, double the weight of dry peat. This also doubles the percent of peat by weight in mix.

is naturally high in lime.

After construction of a new house or the renovation of old lawn, the soils are invariably in poor tilth and quite compact. One of the best ways to improve the physical condition of these soils is to add peat,or peat and sand mixtures, prior to seeding or sodding. Sandy soils (soils with less than 15 percent silt plus clay) are best amended by the addition of peat alone. Clay soils need about 2 inches of sand and 1 inch of peat, worked well into the upper 4 to 6 inches of surface soil.

Table 4 shows the amount of peat required for various soil mixes.

The preferred flower bed or garden soil is a well-drained loam in good physical condition. Often, however, one has little choice in the location and soil type. If the soil is heavy and clayey, it can be permanently improved by putting on a 2-inch layer of coarse sand, followed by some 2 inches of screened peat. Mix the two into the top 2 inches of clay soil by plowing, spading, or rototilling. Additions of limestone and fertilizer can be incorporated with the sand and peat. Droughty, sandy soils can be greatly improved by mixing 1 inch of clay loam soil and 2 inches of peat into the top 4 or 6 inches of soil.

Tree Nurseries

Production of pine, spruce, and birch tree seedlings is highly successful in Finland when grown in milled peat in plastic greenhouses. The peat is composed of a mixture of acid sphagnum and reed-sedge peat having a pH of 3.6 to 4.0. Seed beds are prepared in the normal manner and then a 2-inch layer of peat is spread over the bed. The ingredients added to the peat per cubic yard before spreading are:

Dolomitic Limestone	12 pounds
Potassium sulfate	3 pounds
Superphosphate (20%)	3 pounds
Rock phosphate	4 pounds
Manganese sulfate	50 grams or 2 ounces
Copper sulfate	25 grams or 1 ounce
Zinc sulfate	15 grams or 0.5 ounce
Borax	10 grams or 0.3 ounce
Sodium molybdate	2 grams or 0.1 ounce

After the peat is spread over the beds, it is watered thoroughly and seed is broadcast with the aid of a sieve. The rate of seeding for pine is about 7 grams per square yard. Then a 1/4-inch layer of coarse sand or fine gravel is spread by machine over the sown areas and watered. The purpose of the fine gravel is to help warm the soil, prevent packing of the peat when watering, to retard the growth of algae, and to increase water percolation. Two weeks after seeding, nitrogen fertilizer is broadcast at the rate of 125 pounds of ammonium nitrate per acre. Another top-dressing of nitrogen is applied 4 to 5 weeks after seeding.

Acid-demanding Plants

Certain plants, such as azaleas and rhododendrons, require acid soil low in clay content. The ideal mineral soil would have a pH between 4.5 and 5.2 and should be quite sandy. Because the soil around buildings often is slightly acid or alkaline, it is advisable to use strongly acid peat. If the mineral soil contains lime or is too compacted for good drainage, it should be replaced by more acceptable friable soil. A desir-

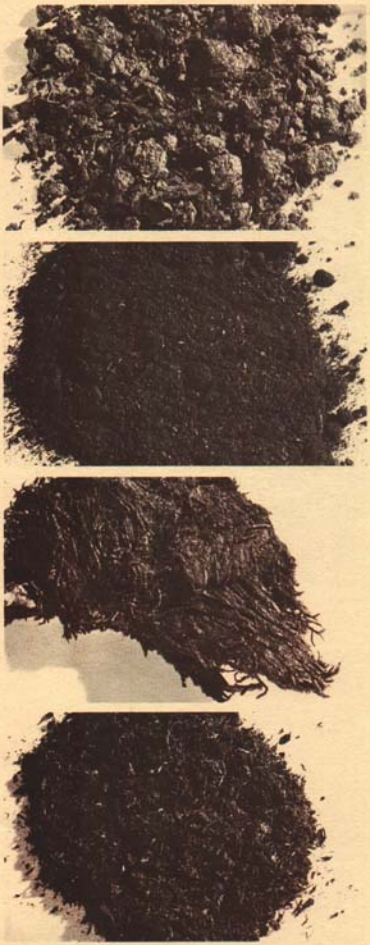

Figure 2-A—Peat Types. From top to bottom: sphagnum moss peat typical of European source; peat humus; hypnum moss peat before processing; hypnum moss peat after processing.

Figure 2-B—Peat Types. From top to bottom: reed-sedge peat with some hypnum before processing; reed-sedge peat after processing; sphagnum moss before processing; sphagnum moss after processing.

Figure 3. (Top) Recently drained reed-sedge peat which contains considerable wood. (Bottom) Air drying Michigan peat in ridges; later piled at roadway and then hauled to shed for screening and packing.

Figure 4. Using peat moss around the base of an ornamental plant which requires an acid soil.

able mixture is about 30 to 50 percent of peat by volume for the soil located around the plant.

The hole for transplants should extend 1 to 2 feet wider and deeper than the transplant ball. Set the plant slightly higher than the surrounding soil to allow for settling caused by peat decomposition and to improve drainage. The area around the plant is ridged up with the peat-soil mix and then mulched with a 2- to 3-inch layer of fibrous acid peat or leaf mold.

Golf Courses

A base formula used in the construction of greens suggested by the **Golf Association Magazine** is by volume 80 percent sand, 10 percent clay loam, and 10 percent peat. This mixture is applied at least 12 inches deep over pea gravel and coarse sand.[1] Usually, the semi-decomposed peat or peat humus which is more resistant to decomposition is used in such mixtures. Topdressing mixes for turf grasses containing peat should be nearly the same texture as the soil in the upper 6 inches.

Some developers of golf greens use a formula of 2 parts loam, 2 parts medium sand, and 1 part peat. Others prefer a mix containing 50 percent peat and 50 percent sand by volume, which is spread thinly (1/8 to 1/4 inch) over the surface of the turf after aerating with special equipment. The top dressing mix is then worked into the holes of the aerified soil so that the mix is well down into the rooting zone of the turf grass (see Fig. 5).

Greenhouse Soil Mixes

Peat is used in many greenhouse mixes for cut flowers in beds or benches, as well as mixes for potted plants. A mixture that has worked well in the production of chrysanthemums, carnations, and roses as well as such potted plants as poinsettias and lilies,

1. Information can be obtained from the September, 1960 issue of the United States Golf Association Magazine, *40 East 38th Street, New York 16, N. Y.*

is by volume 2 parts loam (sterilized), 1 part sand, and 1 part peat. To one cubic yard of the soil mixture is added 5 pounds of fertilizer containing by weight 1 part ammonium sulfate, 2 parts 20 percent superphosphate, and 1 part potassium sulfate.

In recent years, there has been much interest in the use of peat-sand mixtures for container-grown plants such as outlined by the University of California.[2] By staying within certain specifications, the grower can obtain fairly reproducible results. The fine sand should range from 0.05 to 0.5 millimeters in particle size. The formula shown in table 5 is one of the recommendations.

Cornell University specialists[3] have pointed out the problem with the U-C mix is that of obtaining suitable fine sand and the fact that it weighs about 90 pounds per cubic foot. Cornell specialists have tested vermiculite and perlite, which weigh 6 to 8 pounds per cubic foot. Trays containing 50 percent peat and 50 percent perlite or vermiculite are less than one-half the weight of peat-sand mixtures. A typical recommendation with these materials based upon several years of experience is shown in table 6.

TABLE 5 — The U-C Mix, Using One-half Peat and One-half Sand.

1/2 cubic yard of fine sand
1/2 yard of sphagnum moss peat
7 pounds of dolomitic limestone
3 pounds of calcic limestone
2 1/2 pounds of powdered 20% superphosphate
4 ounces of potassium sulfate
4 ounces of potassium nitrate

Supplemental feed with a fertilizer high in nitrogen after plants are well started.

TABLE 6 — The Cornell Peat-lite Mix A, Using One-half Moss Peat and One-half Vermiculite.

11 bushels* vermiculite No. 4 size
11 bushels shredded moss peat
5 to 10 pounds finely ground limestone
1 pound of powdered 20% superphosphate
2 to 12 pounds of 5-10-5 fertilizer

*11 bushels amount to about 1/2 cubic yard.

In early publications, the Cornell mix called for higher rates of limestone and superphosphate. Yellowing of the plants — called chlorosis — developed on certain varieties. This yellowing is believed to be iron deficiency. Lower rates of limestone and phosphate helped to correct the problem. Hydrated lime and water high in bicarbonates also increased the deficiency and should not be used. If an iron problem appears, use 1/2 level teaspoon of chelated iron in one gallon of water and apply as a spray. If a noticeable improvement in leaf color is not seen at the end of one week, the application should be repeated.

When growing petunias in the Cornell mix A, use only 2 to 3 pounds of 5-10-5 fertilizer. Tomatoes need 6 to 8 pounds per cubic yard.

DOMESTIC PEATS FOR SOIL MIXES

Michigan, in common with other northern states, has a plentiful supply of reed-sedge peat. Local sources of such material often are called "domestic peat." Many growers are using these peats with success. Objections to their use are variability in

2. *"The U-C System for Producing Healthy Container Grown Plants," Manual 23. University of California, 22 Giannini Hall, Berkeley 4, California*

3. *Reported in "American Vegetable Grower" magazine, April 1963 and January 1965 series.*

Figure 5. Applying peat-sand mix as a topdressing for a golf green. Top picture shows an aerator used for punching holes in golf green. Lower figure shows the spreading and raking of the soil mix into the holes with a steel mesh mat.

nutrient level, botanical composition, acidity, and degree of decomposition. Thus, it is somewhat difficult to standardize the formula.

Weed seed, nematodes, and damping-off organisms and other soil borne diseases are common problems with certain peat sources. These problems are especially noticeable for topsoil collected from land recently in cultivated crops. Certain peats found in western states contain considerable alkali and salts. Such peat should not be used for soil mixes.

The formulation shown in table 7 is a suggested mix for the production of bedding and container-grown plants, using domestic peat of acceptable quality. The peat should be put through a shredder or a 1/2-inch mesh wire screen. A cement mixer can be used to obtain uniform mixing.

TABLE 7—Potting Soil Mix Using Domestic Peat.

1/2 cubic yard of screened peat
1/2 cubic yard of vermiculite No. 2, or sharp sand
Dolomitic limestone at one half rate suggested in Table 2
2 pounds of powdered 20% superphosphate
1 to 2 pounds of 6-24-12 or 10-20-10 fertilizer
100 grams of micronutrient mixture shown in Table 8
Supplemental fertilizer after crops are well started. (See pointer No. 8.)

MICRONUTRIENTS FOR PEAT MIXES

Peat is naturally very low in micronutrients which are necessary for plant growth. Manganese is especially needed for naturally well-limed reed-sedge peat. Copper, molybdenum, and iron are needed for sphagnum moss peat and fibrous acid sedge peat.

If plant deficiency problems appear, the mixture shown in table 8 is suggested for each cubic yard of peat in a soil mixture. Use only powdered or fine crystalline materials and mix them together. Then add the micronutrient materials to the superphosphate and mix. Apply to the peat and again mix completely. Most of the micronutrients can be obtained from a fertilizer company or at an agricultural chemical supply store. Neither the California nor the Cornell formulation call for micronutrients.

TABLE 8—Suggested Micronutrient Mixtures for One Cubic Yard of Peat.

Compound	Weight needed
Iron chelate or ferrous sulfate	50 grams (2 ounces)
Manganese sulfate	30 grams (1 ounce)
Copper sulfate	10 grams (0.3 ounce)
Zinc sulfate	6 grams (0.2 ounce)
Sodium borate (borax)	3 grams (0.1 ounce)
Sodium molybdate	1 gram (0.03 ounce)
Total mix	100 grams (3.6 ounces)

Additional Pointers When Using Peat in Soil Mixes

1. Peat, after drying, is difficult to rewet. Use warm water at the rate of one gallon per bushel or a wetting agent such as "Aquagro." If soil mixes are to be used soon after preparation, it is well to moisten peat before removing from mixer.
2. Vermiculite size No. 4 is equally as good as size No. 2 when using coarse, fibrous peats.
3. In greenhouse tests at Michigan State University, plants grown on peat-vermiculite mixes showed less nutritional problems than those on on peat-perlite mixes.
4. Plants in special peat mixes often grow faster than in standard soil preparations because of favorable physical conditions for root growth and less root disease problems.
5. Sphagnum moss peat from a new bale seldom needs to be sterilized since it is low in content of weed seeds and plant disease-producing organisms.
6. Hydrated lime is **not** recommended for peat mixes because of the adverse action on organic nitrogen and the possible fixation of manganese and phosphorus into unavailable forms.
7. If obtainable, for liming materials, use equal parts of dolomitic and calcic limestone so as to obtain a better calcium-to-magnesium ratio.
8. Good plant production can be obtained by using only superphosphate fertilizer in the soil mix, and then applying nitrogen and potassium fertilizer after the plants have emerged. Suggested supplemental fertilizers include water-soluble 20-10-20 or 22-0-22. A mixture of equal parts of ammonium nitrate and potassium nitrate gives a 23-0-22. Dissolve one ounce of the mixture in 5 gallons of water and apply through a sprinkling can.

   An alternative program is to apply liquid fertilizer with each watering. Prepare a liquid stock solution of the all-soluble fertilizer by dissolving 1 pound of the fertilizer in 1 gallon of water. This stock solution is injected into all irrigation water at the rate of 1 to 200 through a proportioner installed in the water line.
9. Use sanitary precautions so as to prevent damping-off disease. See that all tools, trays, and flats are clean and do not come in contact with dirt floors or other contaminated soil. If disease starts, use acceptable fungicides immediately.

Figure 6. A good tray of petunias growing in a 50-percent moss peat and 50-percent vermiculite mix. See table 6 for a typical treatment.

Figure 7. A chlorotic disorder in petunias growing in a peat-perlite mix. This disorder is less likely to show up in a peat-vermiculite mix. The disorder is believed to be an iron deficiency.

Suggested References

Davis, J. F. and R. E. Lucas (1959). Organic soils — their formation, distribution, utilization and management. Mich. Agr. Exp. Sta. Spec. Bul. 425.

Anderson, M. S., S. F. Blake, and A. L. Mehring (1951). Peat and muck in agriculture. U.S.D.A. Circ. Bul. 888.

Baker, Kenneth F., et al. The U-C system of producing healthy container-grown plants. Univ. of Calif. College of Agr. Manual 23.

Cornell Univ. Cornell recommendations for commercial floriculture crops. March 1965.

Musser, Turf Management. 1962.

Tyson, James. Making A New Lawn. Michigan State University Extension Folder F-211, 1956.

Better Lawns. U. S. Department of Agriculture Home and Garden Bulletin 51, 1964.

Ferguson, Marvin. "When You Build A Putting Green, Make Sure the Soil Mixture is a Good One." U. S. Golf Assn. Journal, Greens Section, Vol. VIII, No. 6, 1955.

Anderson, M. S. "Sawdust and Other Natural Organics For Turf Establishment and Soil Improvement." ARS 41-18, 1957.

Kellogg, C. E. Our Garden Soils. 1955.

NOTES

NOTES