various soil profile horizons are two important factors which need to be included when evaluating an organic soil.

6. Soil Reaction Profile.

Organic soils are characterized by changes in reaction (pH) in the various zones or horizons in the profile. It is possible for the soils to be either low-lime, high-lime, or alkaline throughout the entire profile. However, any combination of the three soil reaction ranges may be present. A variation of extreme acid or alkaline horizons directly above or below each other may occur. A burned-over soil with pH of 7.3 on the surface 7 inches can be underlain by a horizon of pH 4.0 or below. In extreme cases a soil may require lime with a marl subsoil within 2½ feet of the surface. Acid mineral salts in the subsoil resulting from the oxidation of certain sulfides, the most important of which is iron sulfide, may be another factor. (See Fig. 36).

A classification based on a soil reaction profile is informative regarding the lime and sulfur requirements for the production of various crops. It is inadequate in that it does not include other important criteria associated with a classification scheme.

7. Classification of Michigan's Organic Soils.

The classification recently suggested by Michigan workers (Table 3) places organic soils in the intrazonal order and in the bog, great soil group. The series are differentiated on a basis of 4 criteria.

1. Botanical composition
2. Depth
3. Soil reaction
4. Materials underlying shallow deposits

Soil type consists of a series name together with the textural designation (peat or muck) of the surface. The classification integrates a number of criteria satisfactory for Michigan conditions. A depth differentiation of 48 inches between deep and shallow soils instead of 42 inches is suggested. This may be preferable because of the influence of depth of organic material on the length of life of the soil and on the installation of tile drains.

This classification could be modified to include such variants as boulders, layers that impede drainage, "itchy" muck, volcanic ash or bed rock.

TABLE 3—Michigan classificatio

Soil order—

Great soil group—O

Character of organic material				
(*a*)0" to 12"		12" to 42"	pH between 12"-24"	
Woody	Deciduous and conifers	Black, granular, well-decomposed woody over undecomposed brown fibrous	8.3 to 7.0	I
	Deciduous	Dark brown, slightly to moderately decomposed over undecomposed brown fibrous	7.0 to 5.0	C
	Conifers	Dark brown, slightly to moderately decomposed over undecomposed brown fibrous	7.0 to 5.0	C
	Conifers and deciduous	Brown to yellow undecomposed fibrous	6.5 to 4.5	F
Woody and fibrous	Conifers and marsh	Brown to yellow undecomposed fibrous	5.0 to 3.0	S
Fibrous	Leather leaf bogs	Yellow, undecomposed fibrous	5.0 to 3.0	C
	Marsh	Dark brown yellow finely fibrous	Calcar.	
	Marsh	Dark brown yellow finely fibrous	7.0 to 5.0	F
	Marshland	Undecomposed over semi-fluid mass or water	7.0 to 5.0	T

(*a*) The stage of decomposition of the surface 12 inch decomposed and moderately well-decomposed organic m peat type as Houghton muck and Houghton peat.
(*b*) Usually has a lower colloidal layer (anaerobic de
(*c*) Classification from E. P. Whiteside, I. F. Schneid

Distribution of

Organic soils may be found in pr are many millions of acres in the tr

[3] Acreage estimates obtained from foreign studen

TABLE 3—Michigan classification of organic soils, June, 1959 (c)

Soil order—Intrazonal								
Great soil group—Organic soils (bog)								
Character of organic material				Depth of organic material				
					(b)Shallow (12"-42")			
(a)0" to 12"		12" to 42"	pH between 12"-24"	Deep over 42"	Over sands	Over loams	Over clays	Over marl
Woody	Deciduous and conifers	Black, granular, well-decomposed woody over undecomposed brown fibrous	8.3 to 7.0	Lupton	Markey	045		Edwards
	Deciduous	Dark brown, slightly to moderately decomposed over undecomposed brown fibrous	7.0 to 5.0	Carlisle	Tawas	Linwood	Willette	
	Conifers	Dark brown, slightly to moderately decomposed over undecomposed brown fibrous	7.0 to 5.0	Carbondale				
	Conifers and deciduous	Brown to yellow undecomposed fibrous	6.5 to 4.5	Rifle				
Woody and fibrous	Conifers and marsh	Brown to yellow undecomposed fibrous	5.0 to 3.0	Spalding	Dawson			
Fibrous	Leather leaf bogs	Yellow, undecomposed fibrous	5.0 to 3.0	Greenwood	Dawson			
	Marsh	Dark brown yellow finely fibrous	Calcar.			—033		
	Marsh	Dark brown yellow finely fibrous	7.0 to 5.0	Houghton	Adrian	Palms	Ogden	Rollin
	Marshland	Undecomposed over semi-fluid mass or water	7.0 to 5.0	Tahquamenon				

(a) The stage of decomposition of the surface 12 inches is reflected by the type name. Except for the well-decomposed and moderately well-decomposed organic materials, each series may include a muck type and a peat type as Houghton muck and Houghton peat.
(b) Usually has a lower colloidal layer (anaerobic decomposition or sedimentary peat).
(c) Classification from E. P. Whiteside, I. F. Schneider and C. A. Engberg.

Distribution of Organic Soils[3]

Organic soils may be found in practically any climatic zone. There are many millions of acres in the tropics and extensive areas in arctic

[3] Acreage estimates obtained from foreign students and visitors if literature is not cited.

of phosphorus most available to plants is comprised of phosphate ions that replace the hydroxl ions of phenolic and carboxylic groups of the lignin-protein complex.

Sulfur is present largely in the organic form as a constituent of amino acids (cystine, cysteine, and methionine), that are present in certain proteins. Localized areas have a high concentration of sulfur in the form of iron sulfide, especially where bog iron has formed and the drainage waters are rich in sulfates. Sulfur content is generally lowest in highmoor, medium high in lowmoor, and highest in sedimentary peats.

Many minor elements are present in organic soils in small amounts. The deficiency of a minor element is determined by its availability to crops, rather than the total amount present in the soil. Soil reaction, moisture content over extended periods, and temperature are factors influencing their availability to plants. The need for minor elements is often indirectly determined by the pH of the soil. Further discussion of this factor appears in the section dealing with minor element deficiencies.

Physical Properties

Moisture Relationships

Water holding capacity.

The amount of water which organic soils will hold is several times higher than for mineral soils. It is determined by immersing a soil sample in water for two hours or longer and then allowing it to drain overnight in a bell jar. The difference between this weight and the oven-dry weight obtained by heating to constant weight at 105°C is the amount of moisture held. Charring may be a factor with slightly decomposed samples; thus, the temperature may require some modification. The amount of water held is dependent on the type of organic material and degree of decomposition. Values reported are 300 percent for wood-sedge peat, 1360 percent for sawgrass peat, and 3200 percent for sphagnum peat (62). Organic soils with a high content of mineral matter have correspondingly lower moisture holding values.

Moisture equivalent.

Moisture equivalent is the percent of moisture remaining in a saturated sample that has been centrifuged for 40 minutes at a force of 1000 times gravity. Values of
found for woody sedge, sawgrass
(62).

Permanent wilting point

The percent moisture at whic
may range between 24 and 80 p
composition of the particular soil.
one obtained by placing a soil u
is often used to increase the mo
soils. However, the amount of av
essarily greater in a mixture of pe
increase in the permanent wilting
in volume weight (62).

Hygroscopic coefficient.

Hygroscopic coefficient is the a
cent relative humidity. Values from
for organic soils.

Rewetting of organic soils.

When organic soils are dried,
are modified. The loss of water is as
to changes in atmospheric conditio
oxidation, temperature changes, an

Organic soils that are air-dried
maximum moisture holding perce
the moisture equivalent to as great
of peat is predominantly due to a
iron humates and not to the wax a
property peat has been termed an

The resistance of peat to rewe
ture utilization of some soils. Son
a depth of 3 or 4 feet for a peri
to rewet completely. During dry c
some of the effect of ensuing rain
through the cracks. Thus, the dr
The formation of "schalter" bumps
example of drying up in clay and p
pidatum subsoils shrink enormousl

TABLE 24—Adaptable crops; suggested varieties, time, depth and rate of seeding for Lansing, Michigan area

Crop	Recommended varieties	Time of planting in field	Rate of seeding or plants per acre	Distance between rows (inches)	Distance between plants (inches)	Depth of planting (inches)	Comments
Asparagus	Mary Washington	April 10 to May 10	3 or 4 lb. (seed)	48-84 16-20 (seed)	12-18 2-3 (seed)	6-8 1-1.5 (seed)	Spears susceptible to wind and frost damage. Muck soil good for crown production.
Barley	Mars (Spring)	April 20 to May 15	4-5 pecks	7	..	1.5-2.0	Lodging, weeds could limit production.
Beans	Field: Michelite or Sanilac Snap: Tendergreen Contender Black Valentine	May 20 to June 15	Field- 50 lb. Snap- 60 lb.	24-32	1-2	2	Beans are easily frosted. Responsive to manganese fertilizers.
Blueberries	Jersey (late) Earliblue or Bluecrop (early)	April	..	120-144	36-50	..	Preferred pH is between 4.0 to 5.0 Water table 15-20 inches. May need to use cover crops in late summer to lower soil nitrogen content.
Broccoli	Italian green sprouting	June 15 to July 1	12,000	32-36	15-20	0.8-1.0	