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SOILS

OF MINNESOTA



by

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SOILS of MINNESOTA

P. R. McMiller

THE SOILS on a farm determine to a great extent the type of farming, selection of crops, and yields. Anyone who buys a piece of land or operates a farm should know what kind of soil he is working and what he has a right to expect from it.

The map in this bulletin does not attempt to show minor soil differences. The small scale on which it is prepared does not permit the delineation of small tracts within each area. The map cannot be used to select individual farms for purchase because the soils on such small tracts may be entirely different from the soil representing the area and described in the report. The characteristics of outstanding soils of each area are shown in the table on page 7. More exact information on the nature of the soils on any farm may be obtained from county soil maps which have been made for 41 counties in the state. Soil surveys of some counties are now being made, others are in the process of publication, and others about to be started.

The map in this bulletin is based upon information collected from various sources, particularly from counties having soil maps made cooperatively by the Minnesota Agricultural Experiment Station and the United States Department of Agriculture. The Soil Conservation Service has supplied invaluable information for some parts of the state. These together with the authors' knowledge gained in many years of soil work in Minnesota have made possible the compilation of the map.

The climate of Minnesota is an important factor in the farming activities in the state. It is characterized by wide variations in temperature in winter and summer. The average annual temperature ranges from 35° F. in the north to 45° F. in the south.

The average annual precipitation ranges from about 20 inches in the northwestern part of the state to 32 inches in the southeastern corner. The lines of approximately equal precipitation are shown in figure 1.

The length of the growing season over the greater part of the state is of sufficient duration for the maturing of all adapted crops. Rather wide variations in the number of frost-free days occur between the southern and northern sections. As shown in figure 2, the num-

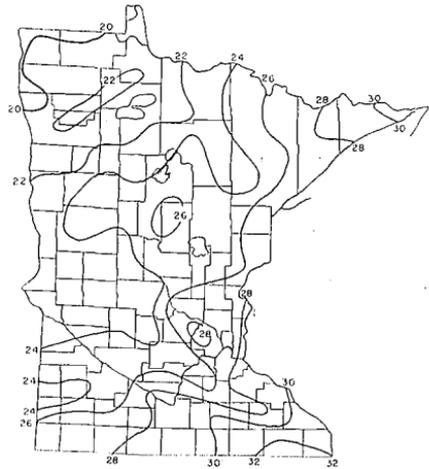


Fig. 1. Average annual precipitation in inches.

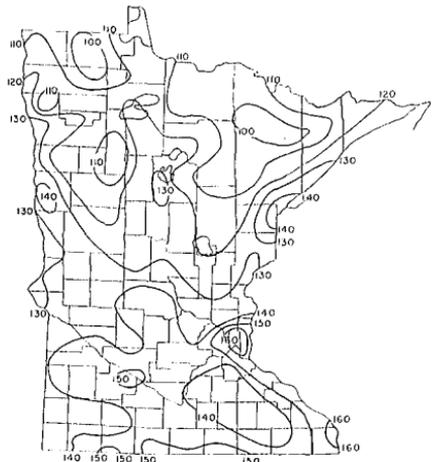


Fig. 2. Average crop-growing season in days.

ber of days without killing frost ranges from 100 to 110 in the northwestern section to from 130 to 160 in the southern. For the state as a whole the average length of the growing season is 133 days.

The 24 soil association areas in Minnesota, approximate acreage covered by each, and the proportion of the state they occupy are listed below:

Soil association area	Acre	Per cent
Milaca-Brainerd-Hibbing ...	7,817,800	14.4
Clarion-Nicollet-Webster ...	7,093,900	13.2
Nebish-Rockwood	6,050,700	11.2
Barnes-Aastad	3,889,700	7.2
Peat	3,778,700	7.0
Rough stony land	2,798,500	5.2
Fargo-Bearden	2,568,900	4.8
Lester-Hayden	2,371,400	4.4
Rocksbury-Kittson-Peat	2,295,600	4.3
Wadena-Hubbard	2,251,800	4.2
Menasha	1,893,100	3.5
Fayette-Dubuque	1,564,200	2.9
Ulen-Sioux-Tanberg	1,517,200	2.8
Waukon-Barnes	1,104,000	2.0
Hayden-Bluffton	1,002,600	1.9
Ostrand-Kenyon-Floyd ...	939,600	1.8
Taylor-Grygla-Peat	946,000	1.7
Moody-Kranzburg-Vienna ..	900,000	1.7
Clarion-Lester	751,700	1.4
Tama-Downs	728,200	1.4
Zimmerman-Isanti-Peat	671,600	1.3
Ontonagon-Bergland	311,800	0.6
Skyberg-Kasson	308,600	0.6
McIntosh-Winger	247,700	0.5
Total	53,803,300	100.0

Below are brief statements setting forth the principal characteristics of the soils of each area:

BARNES-AASTAD (BA). Dark-colored, fine-textured prairie soils, Barnes soils are gently rolling; Aastad soils are slightly undulating. Soils are derived from limy, glacial till. Drainage is needed on the Aastad soils. These are productive soils but rainfall is somewhat less than in the CNW area. Sale of grain crops, livestock, and livestock products are main sources of income.

CLARION-LESTER (CL). Dark- and moderately dark-colored loams and silt loams with clay-loam subsoils. The Clarion soils are prairie soils; the Lester soils were originally prairie, but forests have invaded the areas and the soils are undergoing changes. Both soils are well drained and the surface ranges from gently rolling to strongly rolling. The lime supply is variable but usually sufficient. The soils are productive and are adapted to a

wide variety of crops. Erosion is serious on the steeper cultivated slopes. General farming prevails with dairying important.

CLARION - NICOLLET - WEBSTER (CNW). Dark-colored, medium- and fine-textured prairie soils. Clarion soils are gently rolling; Nicollet soils are slightly undulating; Webster soils are nearly level and need tile drainage. All are generally well supplied with lime. Very productive soils. Common crops are corn, soybeans, small grains, hay crops. Cash grain and livestock farming predominate.

FARGO-BEARDEN (FB). This area is known as the Red River Valley. Black, silty clay loams and clays with clay and silty clay-loam subsoils. Flat to nearly level. Drainage is generally poor. Fargo soils are finer textured than the Bearden. Lime is plentiful. Soils are productive when drainage is provided. Soils are derived from lake-laid deposits under prairie vegetation. Soils are productive and well adapted to small grains, potatoes, and sugar beets. Some livestock on farms.

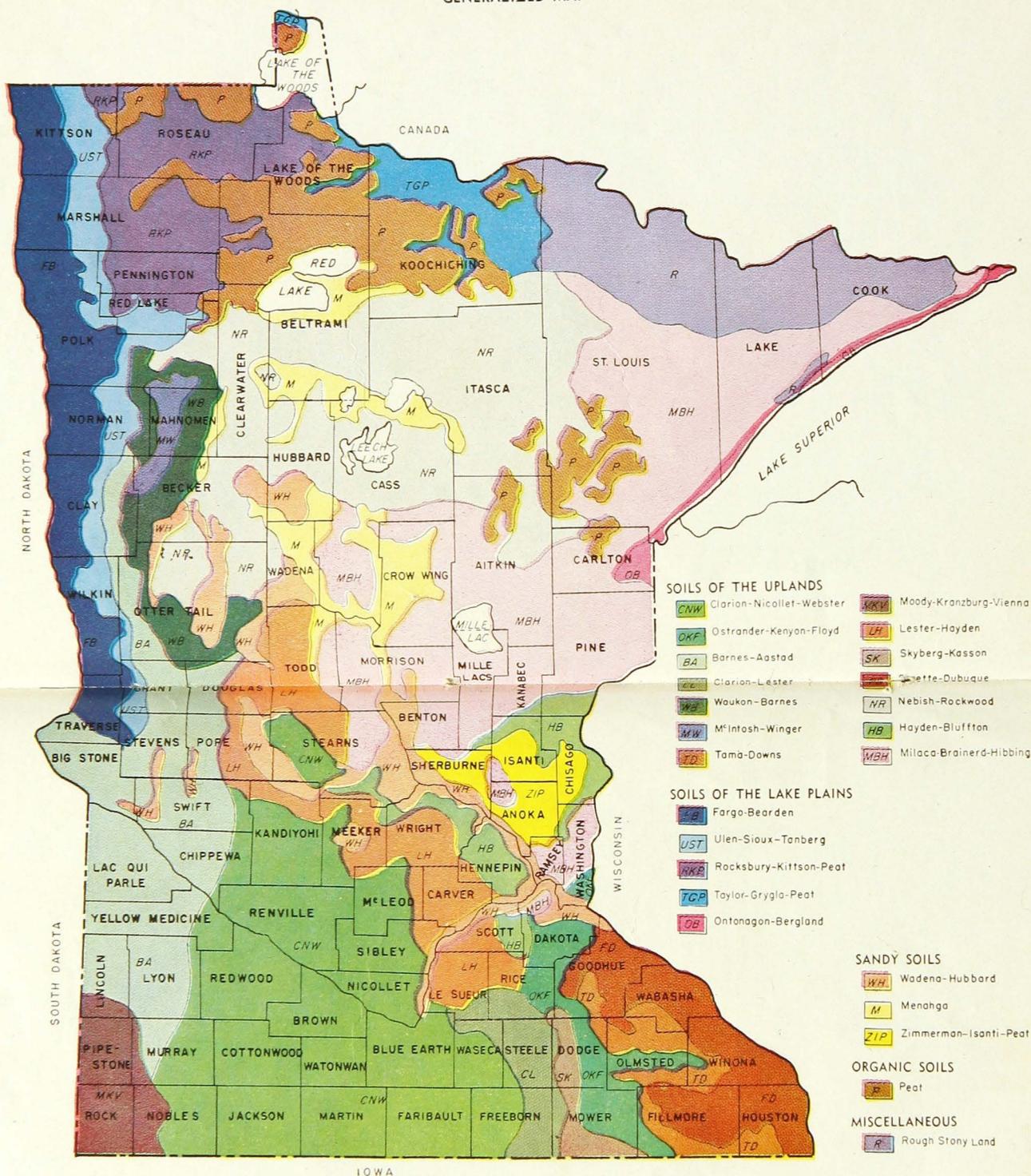
FAYETTE-DUBUQUE (FD). Light-colored, silty soils developed under forest vegetation and underlain by limestone. Fayette soils are deep and have silty subsoils. Dubuque soils are shallow with clayey subsoils over limestone. Surface ranges from rolling to steep. Erosion is serious. Soils are acid. Corn, small grains, and tame hay are grown. Dairy farming predominates.

HAYDEN-BLUFFTON (HB). Grayish-brown forest soils with limy, clay-loam subsoils. Surface is gently rolling to hilly. Erosion is severe on the steeper cultivated slopes. The Bluffton soils occupy the wet depressions, many areas of which are interspersed with areas of the Hayden soils. Stones are abundant in some places. Mixed farming with dairying prevails. Near the twin cities of Minneapolis and St. Paul, truck crops are grown and orchards are common on many farms.

LESTER-HAYDEN (LH). These soils are derived from limy, clay-loam till. Areas of the Lester and Hayden soils occur together and a separation of the two is often difficult to make. The Lester soils have a moderately dark surface but the Hayden soils are gray or brownish gray. Both are gently rolling to rolling. The soils are equally productive, the Lester more so than the Hayden because of higher organic matter content. Erosion is severe on the strongly rolling areas. General farming prevails with considerable dairying.

SOILS of MINNESOTA

GENERALIZED MAP



Map compiled November 1954; subject to revision.

How Minnesota Land Is Used

AREA OF STATE	MILLIONS OF ACRES	USE OF FARM LAND	MILLIONS OF ACRES
Farms	32.8	Harvested crop land	20.0
Forests	20.0	Pasture land	8.3
Urban	1.0	Wood lots	4.5
Total area	53.8	Total farm land	32.8

MENAHGA (M). Light-colored sandy soils with sand subsoils. Located in the cutover region of northern Minnesota. Originally supported jack and red pine. The surface ranges from undulating to rolling. Practically no stones are found on or below the surface. They are poor soils for farming because of their extreme droughty nature. A few scattered farms are developed with small fields of oats, corn, and tame hay.

MILACA-BRAINERD-HIBBING (MBH). Grayish-brown, tree-covered sandy loams and silt loams with brown or reddish-brown sandy loam or sandy clay subsoils. Milaca soils are gritty, grayish-brown loams of variable thickness overlying reddish, sandy, clay-loam subsoils. The Brainerd soils are similar to the Milaca soils but they are derived from a brown-colored, sandy till in contrast to the reddish till of the Milaca. The Hibbing soils have a grayish-brown surface soil with a fine-textured, compact, reddish till mixed with some fine material laid down in glacial lakes. The topography of this area ranges from undulating to strongly rolling. Stones are often numerous at and below the surface. Many tree-covered peat bogs are interspersed with areas of mineral soils. The soils are generally acid. Found in large areas of undeveloped land.

MOODY - KRANZBURG - VIENNA (MKV). Dark-colored, fine-textured prairie soils. Moody soils are derived from silty material; Kranzburg soils are like Moody, but clay-loam till is encountered at depths from 20 to 36 inches; Vienna soils are formed from fine-textured, clay-loam till. Lime is generally abundant. All soils range from undulating to rolling. Corn, soybeans, small grains, and tame hay are grown. Livestock is important.

MCINTOSH-WINGER (MW). These soils are moderately well to poorly drained, dark soils with limy subsoils. They are derived from a layer of silty material of variable thickness which overlies lake-washed, glacial till. They have an undulating surface. The Winger soils are associated with the McIntosh soils but occupy slightly lower positions and are more poorly drained. Both soils are limy in the surface soil and subsoil. Farming methods are similar to those on the Waukon-Barnes soils.

NEBISH-ROCKWOOD (NR). Gray, loam soils with limy, clay-loam subsoils developed under forest vegetation. Peat bogs and wet areas are intermingled with areas of the better

drained soils. Surface ranges from undulating to rolling. Lime is abundant. Stones are numerous in some areas. Agricultural development is limited. Dairying prevails.

ONTONAGON-BERGLAND (OB). Timbered soils with gray, loam surface soils on fine-textured, red, clay subsoils. Bergland soils are poorly drained and wet. Many peat bogs intermingled with the better drained soils. Small agricultural development. Farms are small; most of the land is in timber. Soils are well adapted to tame hay crops.

OSTRANDER-KENYON-FLOYD (OKF). Dark-colored, fine-textured prairie soils with clay-loam subsoils. Ostrander soils are gently rolling. Kenyon soils are nearly level to undulating, and Floyd soils are flat to nearly level. Floyd soils need drainage. The soils are acid. Erosion is troublesome on the Ostrander soils. Soils are productive. Adapted crops grow well. Corn, soybeans, small grains, and tame hay are grown. General farming prevails with dairying predominating.

PEAT (P). Peat soils consist of plant remains in various stages of decomposition. The well decayed peats are black in color, those less decayed are brown and fibrous. The thickness of the peat layer ranges from a few inches to several feet. This overlies a sandy or fine-textured, mineral soil which often is stony. Peat occurs in low-lying wet situations and is not suitable for farming unless sufficiently drained, but this is often difficult to accomplish because of no suitable outlet. When drained and a seedbed prepared, peat soils must be treated with phosphate and potash to make them productive. Summer frosts, flooding, and fires are hazards.

ROUGH STONY LAND (R). This area includes rough stony land with outcrops of granite bedrock. Not adapted for farming, suitable for forests.

ROCKSBURY-KITTSOON-PEAT (RKP). These are dark-colored soils developed from lake-washed limy till in the basin of glacial Lake Agassiz. The soils range from sandy loams to silt loams with gravelly clay loam subsoils. The Kittson soils have less coarse material in the subsoil than the Rocksbury and are somewhat better drained. The surface ranges from flat to undulating and drainage outlets are often lacking. Within this area the soils are extremely variable in the color and thickness of the dark surface soil. In some places the soils are sandy, in others a silt loam or clay loam. Stones are

Identifying Features of the Soil Associations

(Listed in order appearing on map key, pages 4 and 5)

Area and symbol on map	Location in state	Topography	Surface soil color	Subsoil color	Surface soil texture	Subsoil texture	Soil-forming material	Inherent fertility	
CNW	Clarion-Nicollet-Webster	South central	Nearly level to rolling	Black	Yellowish gray	Loam to silty clay loam	Clay loam	Limy glacial fill	High
OKF	Ostrander-Kenyon-Floyd	Southeast	Nearly level to rolling	Brownish gray	Yellowish brown	Loam to silt loam	Clay loam	Leached glacial till	High
BA	Barnes-Aastad	Western	Nearly level to rolling	Black	Yellowish gray	Loam to silt loam	Clay loam	Limy glacial fill	High
CL	Clarion-Lester	Southeast	Gently rolling	Dark grayish brown	Yellowish gray	Loam to silt loam	Clay loam	Limy glacial fill	High
WB	Waukon-Barnes	Northwest	Rolling	Dark grayish brown	Grayish yellow	Loam to silt loam	Clay loam	Limy glacial fill	High
MW	McIntosh-Winger	Northwest	Nearly level to undulating	Dark grayish black	Dark gray	Silt loam	Clay loam	Limy lake-modified fill	Good
TD	Tama-Downs	Southeast	Gently rolling	Black to grayish brown	Yellowish brown	Silt loam	Silt loam	Leached loess	High
MKV	Moody-Kranzburg-Vienna	Southwest	Gently rolling	Black to grayish brown	Yellowish brown	Silt loam to clay loam	Silt loam to clay loam	Limy loess and till	High
LH	Lester-Hayden	Central	Gently rolling	Grayish brown	Yellowish gray	Loam to silt loam	Clay loam	Limy fill	Good
SK	Skyberg-Kasson	Southeast	Nearly level to undulating	Grayish brown	Grayish yellow	Silt loam	Sandy clay loam	Leached fill	Fair
FD	Fayette-Dubuque	Southeast	Rolling to hilly	Yellowish brown	Yellowish brown	Silt loam	Silt loam	Leached loess	Good
NR	Nebish-Rockwood	North central	Undulating to rolling	Gray	Grayish brown	Loam to silt loam	Clay loam	Limy till	Good
HB	Hayden-Bluffton	East central	Rolling	Grayish brown	Yellowish gray	Loam	Clay loam	Limy fill	Good
MBH	Milaca-Brainerd-Hibbing	Northeast	Undulating to rolling	Grayish brown	Reddish brown	Sandy loam to loam	Sandy clay loam	Leached till	Fair
FB	Fargo-Bearden	Northwest	Nearly level	Black	Olive gray	Silt loam to clay	Silty clay loam	Limy lakeloid	High
UST	Ulen-Sioux-Tanberg	Northwest	Nearly level to undulating	Dark brownish gray	Yellowish gray	Fine sandy loam	Sand	Limy lakeloid	Fair
RKP	Rocksbury-Kittson-Peat	Northwest	Undulating	Dark gray	Grayish yellow	Loam to silt loam	Clay loam	Lake modified limy till	Fair
TGP	Taylor-Grygla-Peat	North central	Undulating	Grayish brown	Grayish yellow	Sandy loam to silt loam	Sandy clay to clay loam	Lake modified limy till	Fair
OB	Ontonagon-Bergland	Northeast	Undulating to rolling	Grayish brown	Reddish brown	Silt loam to clay loam	Silty clay loam	Lakeloid	Fair
WH	Wadena-Hubbard	Central	Undulating	Grayish brown	Yellowish brown	Sandy loam	Sand or gravel	Outwash sand	Fair
M	Menahga	North central	Undulating	Grayish brown	Yellowish brown	Loamy sand	Sand	Outwash sand	Low
ZIP	Zimmerman-Isanti-Peat	East central	Undulating	Grayish brown	Yellowish brown	Loamy sand	Sand	Outwash sand	Low
P	Peat	North central and northeast	Level	Brown	Brown	Fibrous	Fibrous	Plant remains	Low
R	Rough stony land	Northeast				Not agricultural land			

often present on the surface. Many peat areas are intermingled with areas of the mineral soils. Most of the peat bogs are tree covered and undrained. Much land is undeveloped.

SKYBERG-KASSON (SK). These dark, grayish-brown soils are developed from old glacial-leached till. They have subsoils that are plastic and slowly permeable. Although there is considerable sand and fine gravel mixed with the clay the subsoils become very hard when dry. The Skyberg soils are somewhat better drained than the Kasson. The surface ranges from flat to slightly undulating. The original vegetation was prairie grasses mixed with hardwoods. Soils are used for tame hay, small grains, and corn. In wet years, the soils remain wet for some time.

TAMA-DOWNS (TD). Gently rolling dark to moderately dark silt loams. Both soils are deep with silty subsoils. Tama soils are darker and deeper than Downs. Erosion is serious. Soils are acid. Corn, soybeans, and tame hay are grown. Dairying predominates.

TAYLOR-GRYGLA-PEAT (TGP). Soils are gray loams and sandy loams often underlain with heavy, limy till. Many peat bogs and poorly drained depressions are scattered throughout the area. The area occupies the eastern portion of glacial Lake Agassiz. Forests occupy a large proportion of the area. The surface ranges from nearly level to undulating. Dairying is principal farm enterprise. Hay is an important crop and legume seed is produced. The Taylor soils have silty, clay-loam subsoils; the Grygla soils have a sand covering overlying fine-textured material.

ULEN-SIOUX-TANBERG (UST). Black sands and sandy loams. Soils occur in outer edges of Red River Valley. The Ulen soils are deep, fine sandy loams, occasionally with clay subsoils; the Sioux soils occupy ridges with dark, shallow, sandy, surface soils underlain with sand and gravel; the Tanberg soils occupy depressions and are wet. The surface ranges from depressional to flat and undulating. Except for the Tanberg soils, crops often suffer from drought. Soil blowing is often serious. Lime is plentiful. Small grains and some corn are grown. Mixed farming prevails.

WAUKON-BARNES (WB). The Barnes soils have dark-colored, silt-loam surface soils with limy, clay-loam subsoils. They are undulating to gently rolling prairie soils. The Waukon are transitional soils occupying areas which originally were prairie but have now been invaded by forests. The forest vegetation has changed its characteristics so it now has some of the properties of the typical forest Nebish soils. Both soils are about equally productive. Some boulders are scattered on the surface. Small grains, corn, and tame hay crops are grown with some livestock farming.

WADENA-HUBBARD (WH). Dark-colored, well drained, sandy loams overlying sand or gravel at depths from 20 to 40 inches. Originally prairie soils. Their sandy nature causes them to be droughty. The Wadena soils are less droughty than the Hubbard because of a more retentive upper subsoil which permits a larger reservoir for water. The surface ranges from undulating to gently rolling. The soils are generally acid. Wind erosion is often serious particularly in unsheltered fields. Because of their sandy nature and relatively low water-holding capacity these soils are not very productive unless the sand and gravel are more than 40 inches below the surface. General farming prevails. Fall-sown rye, corn, and oats are principal crops grown.

ZIMMERMAN-ISANTI-PEAT (ZIP). Light and dark-colored sands and fine sandy loams. The Zimmerman soils are derived from sorted fine sands and occupy undulating and rolling areas; the Isanti soils occupy flat, poorly drained areas and are wet. Peat occupies the depressions and supports tamarack, spruce, reeds, and sedges. The upland soils are acid. In dry seasons they drift badly. Some of the sandy soils associated with the Zimmerman have clay bands in the upper part of the subsoil separated with layers of sand. Where these bands occur the soils are more productive than where they are absent. Some of the peat soils have been drained and are planted to small grains, potatoes, and truck crops which do well when fertilized. Tame hay crops do well on the drained peat soils if fertilized.

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