WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

E. A. BIRGE, Director. W. O. HOTCHKISS, State Geologist.

A. R. WHITSON, In Charge, Division of Soils

SOIL SURVEY IN COOPERATION WITH THE COLLEGE OF AGRICULTURE
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SOIL SURVEY

OF

JEFFERSON COUNTY

WISCONSIN

BY

A. R. WHITSON, W. J. GEIB, AND O. J. NOER

OF THE

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

AND

A. H. MEYER

OF THE

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INTRODUCTION

Before the greatest success in agriculture can be reached, it is necessary that the farmer should have a thorough knowledge of the soil upon his own farm. A soil may be well adapted to one crop, and poorly adapted to another crop. Clover will produce a vigorous growth and profitable yields on the average loam soil which contains lime and is in a sweet condition; but on a sandy soil which is sour, or in an acid condition, clover will not make a satisfactory growth. We may say, therefore, that failure is certain to be invited when such important facts are disregarded, or overlooked. The degree of success which it is possible to win on any farm is in direct proportion to the practical knowledge possessed by the farmer concerning the soil and its adaptation to crops. A thorough knowledge of the soil is as essential to the farmer as a knowledge of merchandise and business methods is to the merchant.

The State of Wisconsin, working in coöperation with the United States Department of Agriculture, is making a careful study of soils and agricultural conditions throughout Wisconsin, and is preparing soil maps and soil reports of all counties in the State. A soil map shows the location and extent of the different kinds of soil. Tracts of 10 acres and over are mapped, but often areas of even smaller extent are shown. The soil map is prepared by trained men, who go over a county thoroughly, and examine the soil by making a sufficient number of borings to a depth of 36 inches to keep account of all variations. A report is also made, to accompany and explain the map, and this is based upon a careful study of the soils within the region surveyed, and upon such other features as have a direct bearing upon the agriculture of the area.

It is the object of this survey to make an inventory of the soils of the State, and to be of practical help to farmers by locating and describing the different soils, by determining their physical character and chemical composition, and by offering suggestions for their management, based upon the work of the Soil Survey within the area, covered in the report, and upon the results of field tests made by the Experiment Station.

Soil fertility depends upon two factors: first, upon the physical characteristics of the soil, such as water holding capacity, workability, etc., and second, upon the chemical composition of the material composing the soil. The chemical composition depends upon the mode of origin of the soil, and the source of material from which the soil is derived.

Water holding capacity, and other physical properties of soil all depend chiefly upon *texture*, which refers to the size of the individual soil grains, or particles. A coarse sandy soil, for example, will not retain moisture so long as a loam soil, or clay loam, because the finer the soil grains, the greater will be the total soil-grain surface area to which moisture may adhere. Texture is determined in the field by rubbing the soil between the thumb and fingers, and with experience one soon becomes expert at judging the size of soil grains. This field judgment is verified in the laboratory by a *mechanical analysis*, which is made by a simple method of separating soil grains into different groups, of which there are seven. These are known as clay, silt, very fine sand, fine sand, medium sand, coarse sand, and fine gravel.

A chemical analysis is also made of the soil to determine the amounts of various essential plant-food elements which are present. A chemical analysis shows whether the soil contains a large store of plant food, or only a small quantity, and it indicates which kinds of plant food will probably be needed first. The amount of organic matter in the soil is also determined, and tests are made to show conditions relative to soil acidity.

SOIL CLASSIFICATION.

Soils are grouped according to texture into soil classes, a soil class being made up of soils having the same texture, though differing in other respects. A fine sand, for example, may be light colored and of alluvial origin, while another fine sand may be dark in color and of residual origin, while a third fine sand may have been blown into sand dumes by the wind, yet all of these soils would belong to the same class, because the greater proportion of the soil grains have the same size or texture. Thus we may have different kinds of clays, loams, sands, etc., and the class to which any soil will belong depends upon the size of the individual soil grains of which it is composed, and not upon its color, origin, topographic position, or agricultural value.

SOIL CLASSES

Soils Containing Less Than 20% Silt and Clay

Coarse sand.—Over 25% fine gravel and coarse sand, and less than 50% of any other grade of sand.
Sand.—Over 25% fine gravel, coarse and medium sand, and less than 50% fine sand.
Fine sand.—Over 50% fine sand, or less than 25% fine gravel, coarse and medium sand.
Very fine sand.—Over 50% very fine sand.

Soils Containing Between 20–50% of Silt and Clay

Sandy loam.—Over 25% fine gravel, coarse and medium sand.
Fine sandy loam.—Over 50% fine sand, or less than 25% fine gravel, coarse and medium sand.
Sandy clay.—Less than 20% silt.

Soils Containing over 50% of Silt and Clay

Loam.—Less than 20% clay, and less than 50% silt.
Silt loam.—Less than 20% clay, and over 50% silt.
Clay loam.—Between 20 and 30% clay, and less than 50% silt.
Silty clay loam.—Between 20 and 30% clay, and over 50% silt.
Clay.—Over 30% clay.

Soils may be grouped in another way. Where soils are closely related through similar sources of the material from which derived, mode of origin, topographic position, etc., so that the different soils constitute merely a graduation in texture of otherwise uniform material, such a group is called *soil series.* It corresponds to the family which is made up of different individuals having the same parentage. The Miami series, for examples, includes light colored,

glacial material where the soils have been derived largely from the underlying limestone, and the soils in the series range in texture from a clay loam to sand and gravel. The Plainfield series includes light colored soils in regions where no limestone is present, where the parent rock was largely sandstone, and where the material occurs as outwash plains or stream terraces. The soils in this series also have a wide range in texture. The name used for a soil series usually indicates the locality where that particular series was first recognized and mapped by the Soil Survey.

By uniting the name of the *soil class* which refers to texture, with the name of the *soil series* which refers chiefly to origin, we get the *soil type* which is the basis or unit of classifying and mapping soils. A *soil type* thus, is a soil which is uniform throughout its entire extent in texture, color, topographic position, and other physical properties, and having a distinct agricultural unity, that is, being adapted to the same crops, and requiring the same treatment. It is also uniform in the source of material from which it is derived, and the mode of origin which, taken together, determine the chemical composition. Since the soil type is the unit in classifying and mapping soils, and the basis upon which experimental work should be conducted, every farmer should be familiar with the soil types on his farm, and their leading characteristics.

It is fitting that in this report on the Soil Survey of Jefferson County recognition should be made of the distinguished services rendered to agriculture by Ex-Governor William D. Hoard whose home is in the county. This recognition has a peculiar fitness because of the important part which he, then a regent of The University of Wisconsin, gave toward the establishment of the Wisconsin Soil Survey by the legislature of 1909.

SOIL SURVEY OF JEFFERSON COUNTY, WISCONSIN

CHAPTER I.

GENERAL DESCRIPTION OF THE AREA.

Jefferson County is located in the southeastern part of Wisconsin. It is bounded on the north by Dodge County, on the east by Waukesha County, on the south by Walworth and Rock Counties, and on

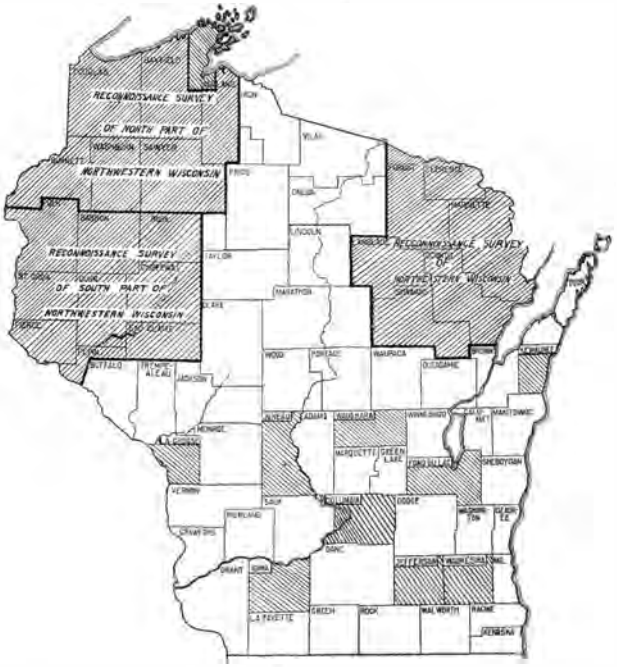


FIG. 1—Sketch map showing area surveyed

the west by Dane County. The eastern limit of the survey is 33 miles from Lake Michigan and the southern boundary is 24 miles from the Illinois State line. The county, which has the form of a square, each side measuring 25 miles, is composed of 16 townships

and comprises an area of approximately 570 square miles, or 364,800 acres.

The surface features of Jefferson County are characteristic of a glaciated region and the topography varies from level to rolling and hilly. A conspicuous result of the glaciation is the large number of rounded hills or drumlins that occur throughout the region north of Bark River and east of Rock River, where they form a series of parallel ridges running in a north and south direction. In a large number of instances throughout this region the intervening low areas consist of Peat marshes. In the eastern part of Oakland Township and in the southern part of Koshkonong Township the hills are higher than elsewhere, though the intervening areas are less broken. In general the hills or drumlins lying south of Bark River and west of Rock River are higher, with more irregular outlines than those in the eastern and northeastern parts of the county, and the intervening land usually consists of upland instead of Peat marsh. The average elevation of the county is between 800 and 900 feet above sea level.

Another pronounced topographic feature is the Kettle Moraine, which crosses the extreme southeastern corner of the county, running in a northeast and southwest direction. It covers about 6 square miles and includes the roughest portion of the survey. It attains an elevation of 1,040 feet, which is 265 feet above the level of Lake Koshkonong, the lowest body of water in the survey. Another, though less pronounced, moraine belt enters the county in the northwestern part of Sumner Township and extends to the northeast through Oakland and Lake Mills, terminating in the southeastern part of Waterloo Township. There are a number of small, flat areas associated with this belt.

To the northeast of Fort Atkinson there is a level to undulating tract several square miles in extent and a similar area occurs north of Jefferson on the west side of Rock River. Other small areas of like character occur in the northeastern part of Ixonia and Concord Townships.

There are a large number of low, wet areas, mostly Peat marshes, in the county, the most extensive of which lie in Palmyra, Cold Spring, Hebron, Jefferson, Sullivan, and Concord Townships. Other smaller areas of Peat are found scattered throughout the survey and associated with nearly all of the various soil types. Numerous areas of Clyde soils, level, low, and naturally poorly drained, occur in all parts of the county, though most extensively in Waterloo, Watertown, Koshkonong, and Cold Spring Townships.

The drainage of practically the entire county is through the Rock River and its tributaries into the Mississippi River. Rock River enters the northeastern corner of the county, flows south through Ixonia Township, thence northwest to Watertown, where it swings to the southwest, crossing the county and leaving it through Lake Koshkonong, in the extreme southwestern corner. Watertown, Jefferson, and Fort Atkinson are situated upon Rock River. Bark and Oconomowoc Rivers and several smaller streams enter the Rock River from the east, and Crawfish River and several creeks from the west. Two dams which furnish power for factories cross Rock River, one at Watertown and one at Jefferson. A number of dams have also been built along some of the smaller streams to provide power, chiefly for running grist mills.

The first permanent settlements in Jefferson County were made at Hebron, Watertown, and Aztlan during the year 1836, the pioneers coming largely from New York, Vermont, and Massachusetts. In 1842 a number of Germans, Norwegians, English, Scotch, and a few Irish immigrated to this region. The Germans located chiefly in Watertown, Ixonia, Farmington, Concord, Oakland, and Jefferson Townships; the Norwegians in western Oakland, Sumner, and Lake Mills Townships; the Scotch in Lake Mills, and the English in Palmyra and Cold Spring Townships. The population, which at present is composed mainly of persons of German descent, is well distributed, and all portions of the county are settled and improved agriculturally.

Watertown, situated on the Rock River, in the north-central part, is the largest city of the county, having a population of 8,829. It is in the midst of a good agricultural section, has a number of factories, and is a market and shipping point of importance. Fort Atkinson, with a population of 3,877, is located in the southwestern part of the county on the Rock River and is surrounded by well-improved farming country. It is quite a manufacturing community, contains two nurseries, is headquarters for important breeding associations and the home of one of the leading agricultural and dairy papers of the West. Jefferson, the county seat, with a population of 2,582, is near the center of the county on the Rock River. It is also a manufacturing and shipping point of importance. Waterloo, with a population of 1,220, is situated in the northwestern corner of the county. Lake Mills, with a population of 1,672, is also located in the northwestern part on Rock Lake, and is somewhat of a summer resort. Many pure-bred cattle raised in the surrounding country are sold in this town each year. Johnson Creek, Palmyra,

Hebron, Rome, Hubbleton, Sullivan, and Helenville are smaller towns and villages.

Jefferson County is well supplied with railroads. It is crossed by the main line of the Chicago, Milwaukee & St. Paul Railroad, and several branches of this road, and by two branches of the Chicago & North Western Railroad. The Milwaukee Electric Light & Railway Co. has an electric line running from Watertown to Milwaukee which crosses the northeastern corner of the county and is parallel with the main line of the Chicago, Milwaukee & St. Paul Railroad. These lines provide excellent transportation and shipping facilities and no point in the county is over 7 miles from a railroad.

The cities and towns within the county afford a market for a considerable part of the farm produce, though large quantities of milk, butter, cheese, poultry, live stock, and other products are shipped to outside markets. Of these, Chicago and Milwaukee are by far the most important. From Watertown to Milwaukee over the Chicago, Milwaukee & St. Paul Railroad it is 45 miles and to Chicago 130 miles.

In general the public roads of the county are kept in good repair. Macadamized roads lead out from Lake Mills and Fort Atkinson. There are excellent roads in the vicinity of Palmyra, where gravel is easily obtainable. In most sections the roads are graded and whereever gravel is available it is used in crowning them. There are sections of the survey, however, where good gravel can not be obtained without hauling long distances, and in these places the roads are frequently in rather poor condition. The mileage of improved highways is increasing each year; there are no toll roads in the county. All communities are reached by the Rural Free Delivery Service and the telephone is in common use among the farmers.

SOILS

Jefferson County lies entirely within the glaciated region and owes the general character of its surface to glacial action. The soil material forming the surface of the region was deposited by two ice lobes, both of which were a part of the Late Wisconsin ice sheet. Along the line of contact between these two ice sheets was formed the Kettle Moraine, or Medial Moraine, as it is sometimes called. This consists of a very conspicuous range of hills extending from near Delavan, in Walworth County, to the central part of Kewaunee County. Where it crosses Palmyra Township it is the most noticeable feature of the landscape. Outside of the Kettle Moraine the

material deposited by the ice sheet is known chiefly as gorund moraine, though there are numerous recessional moraines in various parts of the county, and in these sections the surface is quite rough. The surface of the ground moraine varies from level to gently rolling and rolling. It is freqeuntly in the form of elongated ridges or drumlins which are interspersed with numerous areas of low-lying, poorly drained land. The southern portion of the survey is traversed by an old preglacial valley extending from near Oak Hill to Fort Atkinson, and at present this is occupied by low, poorly drained soils and Peat marshes. Numerous old lake beds occur throughout the county, and many of these have become filled by the growth and decay of rank vegetation and by the accumulation of mineral matter washed in from the higher lands adjoining. Many of the level tracts in the upland consist of outwash plains, this material being deposited by streams flowing from beneath the glacial ice.

The glacial till which covers this entire region consists of a mixture of clay, silt, sand, gravel, and bowlders and extends to a depth varying from a few feet to several hundred feet. Throughout the central and eastern portions of the county it rests upon the Trenton limestone and along the western boundary the surface rock is the St. Peters sandstone. In the extreme northwest part of the county there is an outcrop of Baraboo quartzite, but this is of limited extent. There is also a very small area where the Lower Magnesian limestone is the first rock encountered. All of these rock formations have been ground down by the action of the ice, and the material now forms a part of the fine earth, gravel, and rock fragments which go to make up the mantle of soil.

Since its first deposition the glacial material has been influenced by the action of water, wind, and weathering, by the growth and decay of vegetation, and by other agencies, and has thus been modified to a considerable degree. Varying degrees of modification by different agencies have given rise to different soils. These soils are grouped into series mainly on the basis of color, structural characteristics, and origin, and into types on the basis of texture. In the present soil survey this soil material was classified into 7 soil series and 24 types*, with a number of phases. Many of these are of small extent, but nevertheless distinct.

The Miami series is the most extensive and consists of the light-

*The Clyde clay loam as described in this report includes what was mapped and described in the Bureau of Soils' edition of the Jefferson County report as Clyde silty clay loam.

The Fox silt loam, deep phase, covered by this report includes what was previously described as Fox silt loam, heavy phase, and the Fox fine sandy loam includes what was previously described as Fox fine sandy loam, deep phase, while the Fox loam includes what was previously described as Fox loam, deep phase.

The Plainfield fine sand as described in this report includes what was previously described as Fox fine sand, and the Plainfield sand includes what was previously classed as Fox sand.

colored, forested, upland soils derived from unassorted glacial till in which there is a quantity of limestone material. This series is of great importance in southeastern Wisconsin, Michigan, Ohio, Indiana, Illinois, and Minnesota. The types in this series mapped in Jefferson County are the silt loam, loam, fine sandy loam, gravelly sandy loam, and fine sand.

The Fox series is of smaller extent and of less importance. It includes the light-colored material occupying outwash plains and terraces along old filled-in valleys in the glaciated limestone region. The types recognized are the silt loam, loam, and fine sandy loam.

The Rodman series includes light-colored assorted glacial material chiefly in the form of kames and eskers. The soils are very droughty and have a low agricultural value. They differ from the Miami soils chiefly in being underlain by loose, open, stratified material instead of till. The types recognized and mapped in the present survey are the gravelly sandy loam, fine sandy loam, fine sand, and gravel.

The Plainfield series includes light-colored glacial material occupying outwash plains and river terraces where there is no limestone material present, or only such a small amount as to have no appreciable influence on the agricultural value of the soil. Two types belonging to this series were recognized in Jefferson County, the Plainfield sand and fine sand.

The Carrington series includes the dark-colored prairie soils in the glaciated region. The series is extensively developed in southeastern Wisconsin, in Fond du Lac, Dodge, Dane, Colubmia, Walworth, and Rock Counties, and in the adjoining States of Minnesota, Iowa, and Illinois. It is a very good general farming series. In this survey, however, it occupies only a very small area. The types mapped out are the silt loam, loam, and fine sandy loam.

The Waukesha series includes dark-colored outwash material, one type, the Waukesha loam, being mapped. It is inextensive.

The Clyde series occupies old lake beds in the glaciated region and is characterized by its dark color and high organic-matter content. The subsoil is usually calcareous and the surface seldom acid. The types mapped in Jefferson County are the clay loam, silt loam, loam, sandy loam, and fine sandy loam.

The material mapped as Peat (with included areas of Muck) includes the accumulation of vegetable matter in varying stages of decomposition, and occupies old lake beds, marshes, ponded valleys, and the valleys of present-day streams. It is very extensive in this survey, but little of it has been improved.

The following table gives the names and extent of the several types mapped:

AREAS OF DIFFERENT SOILS.

Soil	Acres		Per cent.
Miami silt loam	69,760		21.2
Deep phase	7,616		
Peat	69,248		19.0
Clyde silt loam	64,128		17.6
Miami loam	45,824		12.6
Miami fine sandy loam	30,400		8.3
Miami gravelly sandy loam	15,424		4.2
Clyde loam	14,592		4.0
Clyde clay loam	12,864		3.5
Fox silt loam	5,248		2.3
Deep phase	3,712		
Fox fine sandy loam	5,376		1.5
Rodman gravel	4,160		1.1
Fox loam	4,096		1.1
Miami fine sand	3,712		1.0
Rodman gravelly sandy loam	2,816		.8
Rodman fine sand	1,792		.5
Plainfield fine sand	1,024		.3
Clyde sandy loam	896		.2
Plainfield sand	768		.2
Carrington loam	448		.1
Carrington fine sandy loam	320		.1
Carrington silt loam	256		.1
Waukesha loam	192		.1
Rodman fine sandy loam	64		.1
Clyde fine sandy loam	64		.1
Total	364,800		

CHAPTER II.

GROUP OF HEAVY, LIGHT COLORED SOILS.

MIAMI SILT LOAM

Extent and distribution.—The Miami silt loam is the most extensive of the upland types and with the Fox silt loam includes the finest agricultural lands of the survey. It occurs chiefly in the western, northwestern, and northeastern parts of the county. The areas are very irregular and broken by areas of other types, mainly Peat, and the Clyde silt loam. In Oakland Township the silt loam is mingled with areas of Miami gravelly sandy loam.

Description.—The surface soil of the Miami silt loam consists of a brownish-gray silt loam extending to a depth of 8 or 12 inches, with an average depth of 10 inches. The soil has a very smooth and velvety feel as a result of the high silt content. The subsoil consists of a brownish-yellow or buff heavy silt loam which becomes heavier with depth and grades into a silty clay loam. At an average depth of 24 inches a yellowish-brown gritty clay loam is encountered which extends to a depth of 4 or 5 feet, where a light-buff till is found. The layer of extremely silty material included in soil and subsoil varies in depth from 20 to 30 inches, this difference being due to erosion, which has removed some of the material from the hills and upper slopes and deposited it on the lower slopes. There are usually a few limestone pebbles and fragments in the subsoil but rarely any in the surface soil. In the second and third foot the subsoil is quite compact and holds the moisture well, though below this the structure is looser. When properly handled it is loose and friable, but may become more compact when cultivated under unfavorable moisture conditions. Originally there were quite a few bowlders upon the surface in places, but these have practically all been removed from the cultivated fields.

Within the Miami silt loam type there are some variations worthy of note. The most important of these is the deep phase which has been indicated on the map and is described in detail following the description of the typical soil.

On many of the knolls and steeper slopes the heavy subsoil is exposed as a result of erosion, while in the smaller areas between

elevations and along lower slopes the surface soil is deeper than the average. In sections 1, 10, 12, and 13, Concord Township, sections 13 and 24, Ixonia Township, section 2, Milford Township, and section 9, Lake Mills Township, the type contains a considerable amount of fine sand in the surface and is lighter in texture than the typical soil. The subsoil is somewhat lighter and contains considerable limestone gravel. This phase approaches the Miami fine sandy loam, which it borders in places. In parts of section 17, Aztalan Township, and section 18, Sumner Township, the soil is darker than typical and approaches in character the Carrington silt loam. There are a few places in various parts of the county where the underlying rock comes close to the surface and frequently outcrops. Such tracts are usually too small to detract from the value of the soil for farming purposes, but in the southeast part of Waterloo Township there is a tract of about 10 acres, the value of which is greatly reduced by an extensive outcrop. Areas over which the soil is shallow are of very limited extent.

Topography and drainage.—The topography of the Miami silt loam varies from undulating to steeply rolling. The typical configuration, however, is gently rolling to rolling, and with the exception of a number of small tracts of a few acres each modern farm machinery can be used over all of the type. The uneven character of the type as a whole insures good surface drainage, though there are numerous depressions and draws in which tile drains could be installed to advantage. On some of the steeper slopes erosion is likely to prove damaging, and in order to protect such places it frequently becomes necessary to follow special methods of culture.

Origin.—The material composing the Miami silt loam consists chiefly of glacial débris laid down mostly in the form of ground moraine. The surface material, which is extremely silty and often stone-free, may have been deposited in part by the action of wind, as in places it has a loesslike appearance. The underlying material, however, is unassorted clay, sand, gravel, and bowlders, a typical glacial till.

A very large proportion of the gravel consists of limestone, and limestone material has entered largely into the formation of the fine earth of this type. The subsoil does not show an acid reaction, and is often quite calcareous, but the surface has been leached to such an extent that a slight acid condition has developed in places. Sorrel is often found growing on the acid spots. Throughout most of the type sweet clover is found growing along the roads.

Native vegetation.—The original forest growth on the Miami silt loam in the northeastern part of the county and between the Rock

and Crawfish Rivers consisted chiefly of white oak, black oak, maple, basswood, ironwood, some elm, hickory, and butternut. This region was covered with a heavy growth of trees, but the type as found west of the Crawfish and Rock Rivers was sparsely forested. Most of it was known as openings and prairie grass grew between the trees.

There were two small prairies on the type; the Vanderpool Prairie, lying in sections 17, 18, 19, and 20, Waterloo Township, and another in section 16, Jefferson Township.

*Present agricultural development**.—Approximately 95 per cent of the Miami silt loam is under cultivation, and the greater part of this is highly improved. The remainder of the type is in scattered wood lots, of which most farms have from 5 to 10 acres.

The type of agriculture followed most extensively on this soil at the present time consists of general farming in conjunction with dairying. The raising of hogs is quite general, and from 20 to 25 are fattened each year on the average farm by feeding the by-products of the dairy along with corn.

Oats, corn, hay, and barley are the chief crops. Some rye and a little wheat are produced. The largest acreage is devoted to oats, which do very well on this soil, the average yield being about 45 bushels, with a maximum of about 65 bushels per acre. Corn yields from 35 to 80 bushels per acre, with an average of about 50 bushels. Barley is grown to some extent, but, owing to continued cropping on the same field, the yields have tended to decrease in recent years. The average yield is about 30 bushels per acre, but from 40 to 45 bushels per acre are sometimes obtained. Only a small proportion of the type is devoted to rye. The usual yield is from 20 to 25 bushels per acre. The acreage of wheat is very small, and there are a large number of farms on which no wheat has been grown for a number of years. Owing to the fact that the Miami silt loam has associated with it a large area of lowland suitable for pasture and marsh hay, the quantity of clover and timothy grown is smaller than would be expected. Clover does well, however, yielding on the average about 2 tons of hay per acre. When mixed with timothy the yield is somewhat lower. Alfalfa is an important crop on this soil, having passed the experimental stage. Three and sometimes four cuttings are made in a single season. Three tons per acre is about the average yield, though from 4 to 6 tons have been obtained.

Of the special crops, peas, tobacco, sweet corn, sugar beets, and potatoes are the most important. In the vicinity of Waterloo and north and northwest of Fort Atkinson about 1,000 acres of peas are

* For chemical composition and improvement of Miami silt loam, see page 28.

grown anually for the local canning factories. This type is well adapted to the crop, producing heavy yields of sweet-flavored peas. In the vicinity of Waterloo a few hundred acres of field peas are grown each year for seed, the average yield of which is about 20 bushels per acre.

In the southwestern part of the county, along the county line, some tobacco is grown. The yields range from 1,200 to 1,300 pounds per acre, and the net return in good seasons is from $50 to $75 an acre. From 5 to 15 acres represents the range in the size of the fields. The crop is grown only in this part of the county.

Sugar beets do very well on the type, but the acreage devoted to this crop is small. In the vicinity of Fort Atkinson sweet corn is grown for canning. The stalks and poor ears are either put into the silo or allowed to ripen and are fed to cattle in the form of stover. Potatoes are grown to a small extent by nearly all farmers for home use. Only in a few instances is any effort made to grow this crop on a commercial scale.

The value of a definite crop rotation is coming to be quite generally recognized. The most common rotation consists of one year corn, two years oats, or if there is no lowland on the place, one year barley and one year oats, two years clover and timothy, and one year pasture. When alfalfa is substituted for clover and timothy it occupies the land three or four years.

Stable manure is the chief fertilizer used. It is usually applied to sod land in preparation for corn. The summer accumulation is often spread upon the stubble fields. When alfalfa is grown a liberal application is given the field before seeding. Manure is usually applied at the rate of 10 to 15 tons per acre every three to five years. The supply is seldom sufficient to cover the whole farm at this rate and some fields receive but little, if any, manure. The plowing under of green crops to supplement the stable manure is practiced by some farmers, but the practice of green manuring has not been developed on this soil to any marked extent. Commercial fertilizers are not in common use. Some lime has been applied and rock phosphate has been used to a limited extent.

MIAMI SILT LOAM, DEEP PHASE

The surface soil of the Miami silt loam, deep phase, has the same color and structure as the typical soil, but averages slightly deeper and contains a somewhat higher percentage of silt, which gives it very smooth feel. The subsoil is a brownish-yellow or buff silt loam becoming heavier with depth. It contains slightly more silt than the

typical subsoil and grades into the silty clay loam at a slightly greater depth. The gritty clay loam is usually encountered at 30 to 36 inches, while in the typical soil it is found at an average depth of about 24 inches. The section in which the silt content is high may vary from 24 to 40 inches. The underlying typical till bed is usually found at about 6 feet.

The chief difference between this phase and the typical soil is that it has a slightly higher silt content and the stone-free section is somewhat deeper. This difference is not sufficient to justify classing it as a separate type.

Areas of the deep phase occur almost entirely in the western two rows of sections in Waterloo and Lake Mills Townships. The surface is undulating to gently rolling, as a whole less rolling than the typical soil, and the slopes are never steep enough to make erosion serious. The natural drainage is good. It has the same origin as the typical soil, but may have been influenced to a greater extent by wind action, thus accounting for the deeper silt layer. This phase was found in the forest "openings."

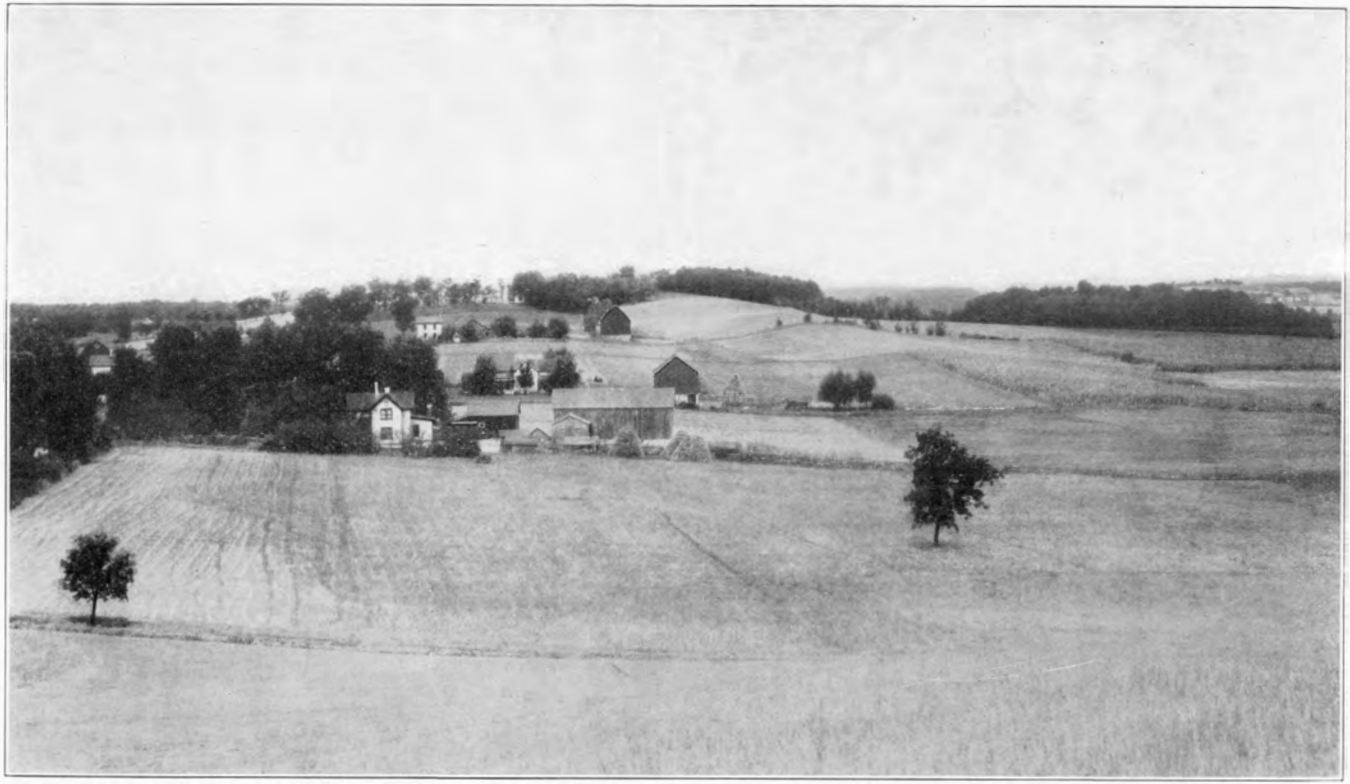
The methods of cultivation, crops grown, rotations followed, and crop adaptation are the same as for the typical soil, though the yields may be slightly greater.

MIAMI LOAM

Extent and distribution.—The Miami loam is the second upland soil in the county in importance, though there are several types which are more extensive. The type occurs chiefly east of Rock River, extending north from Hebron nearly to Watertown. There are no very extensive, unbroken tracts as the type is interspersed with numerous low-lying areas of Peat and soils of the Clyde series.

Description.—The surface soil of the Miami loam consists of a grayish-brown loam of medium to fine texture, extending to an average depth of 10 inches. The type contains a considerable percentage of fine sand and silt and frequently grades into a silt loam so gradually that no sharp boundary can be drawn. The type has a friable structure, but as a whole is somewhat deficient in organic matter. Originally there was quite a scattering of bowlders on the surface, but most of these have been removed from the cultivated fields. A little gravel is found on the surface in places.

The subsoil consists of a heavy brownish-yellow loam, which becomes heavier and more compact with depth, until at about 18 inches a gritty clay loam, frequently with a reddish cast, is encountered. This usually extends to a depth of 3 or 4 feet, where



VIEW OF MIAMI LOAM SOUTH OF WATERTOWN, SHOWING CHARACTERISTIC TOPOGRAPHY, BUILDINGS, AND HIGHLY IMPROVED FIELDS.

This view is also typical of Miami silt loam. These two types make up 33.8 per cent of the county and include the most highly improved land in the area surveyed. General farming and dairying are the leading types of agriculture followed.

it rests upon lighter colored, unassorted till. Considerable gravel and fine rock fragments, 35 to 50 per cent of which are limestone, occur in portions of the subsoil.

The type has some variations, though the areas departing from the typical soil are too limited in extent to be classed separately. On the tops and upper slopes of hills and ridges the surface soil has frequently been eroded, leaving exposed the heavier subsoil, while on the lower slopes the wash from the higher land has accumulated, giving a deeper soil. In these lower places the soil often approaches a silt loam. A light phase is found, usually where the type borders sandy or gravelly soils. In such places both soil and subsoil contain more fine sand than is typical and the structure of the material is looser.

Topography and drainage.—The Miami loam has a gently rolling to rolling topography. Drumlins are numerous and the slopes of some of these are steep enough to cause erosion. The natural surface drainage is good, though there are a few narrow draws and some small depressions where a single line of tile would be beneficial.

Origin.—The Miami loam has been derived from glacial material in the form of ground moraine deposited by the Green Bay Glacier of the Late Wisconsin Ice Sheet. The glacial débris contains considerable limestone material, but the surface soil has been leached to such an extent that the lime has been largely removed and in some places an acid condition has developed. The subsoil, however, is usually found to contain considerable lime. While sorrel is found growing in a number of fields, there is a rank growth of sweet clover along the roadsides over much of the type.

Native vegetation.—The native vegetation on this type consists chiefly of white oak, black oak, maple, some elm, hickory, a little cherry, and ash. The few areas south of the Bark and west of the Rock River were largely "openings." Only about 5 per cent of the type is now in forest, and this is in small woodlots, largely of second growth.

*Present agricultural development.**—Approximately 95 per cent of the type is under cultivation, the type of agriculture being mainly of general farming in conjunction with dairying. A good many hogs are raised. The tendency at present seems to be toward an extension of the dairy industry.

The usual crops grown are corn, oats, barley, hay, alfalfa, rye, and a little wheat. Oats are grown more extensively than any other crop and do well on this soil, giving an average yield of 40 to 45 bushels per acre. Not so large a proportion of this soil is devoted to corn as

* For chemical composition and improvement of Miami loam see page 28.

is the case with the Miami silt loam, yet it produces good crops and yields an average of about 40 bushels per acre. Only a comparatively small amount of barley is grown. The ordinary yield ranges from 25 to 30 bushels per acre. Rye and wheat are grown only to a limited extent. The former yields about 20 to 25 bushels and the latter from 20 to 30 bushels per acre. Owing to the fact that there is so much low, poorly drained land associated with this type, there is not much clover and timothy grown. Clover yields on the average 2 tons per acre, and when mixed with timothy about 1½ tons. Alfalfa is coming to be an important crop. Three cuttings are made each year, the yields ranging from 2 to 4 tons per acre, though as much as 5 tons per acre has been obtained in exceptional cases.

Special crops are not produced to any marked extent. Some potatoes are grown by nearly all farmers, but chiefly for home use. The usual yield is from 125 to 150 bushels per acre. In the extreme southwestern part of the county there is a small area of the Miami loam where tobacco is being produced. From 1,000 to 1,400 pounds per acre is the usual yield.

The crop rotations followed, and methods of cultivation are practically the same as on the Miami silt loam.

FOX SILT LOAM

Extent and distribution.—The type occupies over 12 square miles and is more extensive than any of the other Fox soils in the present survey. It is developed northwest of Fort Atkinson, in the vicinity of Lake Mills, south of Ripley Lake, north of Lake Koshkonong, and east of Hubbleton.

Description.—The surface soil of the Fox silt loam consists of 8 to 10 inches of brownish-gray, friable silt loam. The amount of organic matter present is small, the silt content is sufficiently large to impart a very smooth feel, and with the exception of a few cobblestones here and there the soil is free from coarse material.

The subsoil consists of a brownish-yellow silt loam, becoming heavier with depth and passing at 20 inches into a silty clay loam, and into a gritty clay loam at about 30 inches. At depths of 2 to 5 feet, with an average depth of about 3 feet, stratified gravel and sand are encountered. The areas over which they occur at 2 feet are small and could not be separated from the deeper portions on the scale used in the present survey.

In Milford Township the type is underlain at 2 feet by a yellow very fine sand, mottled with gray. The type as a whole is quite uniform, but the depth to stratified material is deeper than typical

for the Fox silt loam. It is very similar in texture and color to the Miami silt loam, but differs from that type in being level and underlain by assorted material instead of till.

Topography and drainage.—In general the topography is level to gently undulating; locally the surface is somewhat pitted. Over the greater part of the type where the underlying gravel comes to within 3 feet or less of the surface the drainage is good, but where the depth of surface material is greater than 3 feet tile drains could doubtless be installed to advantage.

Origin.—The type has been derived from glacial material which has been reworked and redeposited as outwash plains by streams issuing from beneath the ice sheet. It may also occur as a terrace above present flood plains. The surface material was probably deposited in quiet waters and may have been influenced to some extent by wind action. The soil is frequently found to be in an acid condition, but the subsoil contains limestone fragments and is not acid. The gravel underlying the type is about 95 per cent limestone. Sweet clover was seen growing along the roadside over most of the Fox silt loam.

Native vegetation.—The native vegetation consisted chiefly of black, bur, and white oak, though most of the type would be classed as "openings," as the trees were scattered, with considerable areas of prairie grass between them.

*Present agricultural development.**—Probably as much as 98 per cent of the Fox silt loam is under cultivation at present. The type of agriculture followed most extensively consists of dairying in conjunction with general farming and the raising of hogs. The type is well adapted to this system of farming and to the production of all of the general farm crops common to the region. The yields of oats vary from 40 to 50 bushels per acre, though a yield of 70 bushels has been reported. Corn produces from 40 to 55 bushels and barley from 35 to 40 bushels per acre. Clover grows well, yielding about 2 tons per acre when sowed alone, or about 1½ tons per acre when mixed with timothy. Alfalfa makes a satisfactory growth and three cuttings are secured each season, giving a total yield of 3 or 4 tons per acre.

Special crops are not grown to any extent on this type. Potatoes are grown for home use chiefly. Sugar beets thrive and yield about 12 tons per acre, but the acreage is small. The sugar content is higher than in beets grown on the Clyde soils. Peas and corn for canning are grown near Fort Atkinson and good results are obtained. The peas have a sweet flavor, which is desired on the market. Some

* For chemical composition and improvement of Fox silt loam see page 28.

tobacco is grown in the southwest corner of the county, but the amount on this type is very small, though the yields secured are satisfactory.

The rotation of crops most commonly followed consists of corn, barley, and oats one year each, followed by clover and timothy. When barley is not grown oats may be grown for two years following corn. Stubble land is usually plowed in the fall and sod land in the spring. Manure is usually applied to sod land in the winter for corn at the rate of 10 to 15 loads per acre every 4 or 5 years. But little difficulty is experienced in the cultivation of this type and it usually works into a mellow seed bed as readily as the Miami silt loam.

Farms on this type range in value from $125 to $200 an acre.

FOX SILT LOAM, DEEP PHASE

This phase is very similar to the Fox silt loam, except that the fine surface material is deeper than is usually included in that type. On account of its depth, the soil has a greater water-holding capacity than the typical Fox silt loam and its agricultural value is considered somewhat higher. It was therefore considered advisable to classify the material as Fox silt loam, deep phase.

A heavy phase was found in a number of places where the surface soil consisting of a heavy silt loam was underlain by a silty clay which becomes very stiff, compact and of a yellowish color below 24 inches. It is quite calcareous and contains numerous lime concretions. The depth to which this heavy material extends is variable, but it is always greater than is found in the typical Fox silt loam. In Sullivan Township, and in the old pre-glacial valley between Oak Hill and Fort Atkinson the heavy subsoil extends to a depth of 40 inches or over, while in the areas north of Jefferson along Crawfish and Rock Rivers, and east of Jefferson Junction along Johnson Creek it is known to extend to a depth of 6 or 7 feet before beds of fine sand are encountered.

The deep phase is of limited extent. Aside from the tracts mentioned above most of this soil is found in Lake Mills and Oakland Townships.

The surface of this phase is level to very gently undulating, and on account of the heavy nature of the subsoil the natural drainage is somewhat deficient. Tile drains would be beneficial especially where the heavy subsoil is the deepest.

A portion of the deep phase of Fox silt loam may be a till plain or it may be glacial outwash material. It is thought that all of the type is underlain by stratified material, but over some of the areas

no cuts or well records could be found, and borings with the soil auger could not reach stratified material. The origin of the extremely heavy material may be comparable with that of the Clyde clay loam—that is of lacustrine origin. It occupies a somewhat higher position, has better drainage conditions, and this would account for a lighter vegetable growth than that which contributed to the black color of the Clyde soils. The sand which is found underlying the type in places, and which is probably continuous, doubtless was deposited in moving waters by streams from beneath the ice sheet.

The native growth consisted of oak, maple, basswood, elm, and some hickory.

About the same proportion of this phase is cultivated as of the typical soil. Yields are frequently somewhat higher but the methods of farming are the same as on the typical soil.

FOX LOAM

Extent and distribution.—The Fox loam is inextensive and occurs chiefly in Sullivan and Concord Townships, with a few scattered areas in other parts of the county.

Description.—The surface soil of the Fox loam consists of a grayish-brown, medium-textured light loam, of low organic-matter content, a rather loose, open structure, and about 10 inches deep. There are no bowlders on the surface, but a little gravel is frequently seen scattered over the soil.

The subsoil consists of a yellowish-brown, rather compact, gritty loam, extending to a depth of about 24 inches, where a bed of reddish-brown, loose, water-worn gravel and sand is reached. This material is stratified and extends to 36 inches or more. The layer directly over the sand and gravel is compact and often sopken of by the farmers as "hardpan."

Patches of sandy loam are often found scattered through the type, but they are too small to be indicated on the soil map. In Milford and Watertown Townships the type is underlain at 24 inches by very fine sandy loam, which at 30 inches rests upon an almost white, calcareous silty clay loam.

A phase somewhat heavier than typical occurs in Lake Mills and Oakland Townships.

Topography and drainage.—The surface of the type is level to gently undulating, and, on account of the loose material underlying it, the natural drainage is excessive. The soil frequently suffers from drought unless the rainfall is equally distributed over the growing season. The heavy phase retains moisture better than the typical soil.

Origin.—The Fox loam has been derived from glacial material which has been reworked by streams flowing from beneath the ice sheet and laid down as outwash plains or terraces. The gravelly subsoil contains a high percentage of limestone, but the lime presumably in the surface material has been leached out and the soil in many places is in an acid condition. Sorrel grows upon many of the fields, but the roadsides support, in places, a good growth of sweet clover.

Native vegetation.—The native vegetation consisted chiefly of white oak and black oak, with some hickory and a little basswood. Practically all the forest has been removed.

Present agricultural development.—Probably over 95 per cent of the Fox loam is under cultivation. It is used mainly for dairying and general farming. Most of the general farm crops common to the region are grown. Oats yield an average of 30 bushels, corn 35 bushels, rye 20 to 25 bushels, and barley about 25 bushels per acre. Rye is grown more extensively on this type than on the heavier soils, but the acreage of barley is relatively small. Clover does well when there is sufficient moisture, but it frequently suffers from drought. The yield of clover and timothy ranges from 1 to 2 tons per acre. As there is considerable lowland associated with the type, only a small acreage is devoted to hay or pasture. But few farmers have succeeded in getting a stand of alfalfa. Potatoes and tobacco, with peas and corn for canning, are special crops grown in a small way.

The rotation most commonly followed consists of corn one or two years, oats one year, followed by clover and timothy. Rye may follow oats for one year. Either fall or spring plowing is practiced, depending chiefly upon the convenience of the farmer. The type can be worked under a wide range of moisture conditions and no difficulty is experienced in getting a good seed bed. Stable manure is the only fertilizer used, but the supply is not sufficient to be applied to all the fields.

CHEMICAL COMPOSITION AND IMPROVEMENT OF MIAMI SILT LOAM, MIAMI LOAM, FOX SILT LOAM AND FOX LOAM.

In texture, structure, and color the types of soil in this group are quite similar. In chemical composition they are also closely related, but some variations have been observed. The Miami silt loam and loam contain approximately 1200 pounds of phosphorus per acre in the surface 8 inches, while the Fox silt loam contains about 960 pounds and the Fox loam a somewhat smaller amount. The phos-

phorus content of this group of soils, especially the Fox soils, is somewhat lower than should be maintained in order to keep up or increase their productivity.

The total amount of potassium present in these soils is ample and ranges from about 30,000 to 40,000 pounds per acre in the surface 8 inches. The problem of the potassium supply is to have a sufficient amount of organic matter to produce the necessary chemical changes in the inert potassium compounds to make them available to plants.

This group of soils has a rather small amount of organic matter and consequently a small amount of nitrogen, the average being approximately 3000 pounds per acre 8 inches for all of the types except the Fox loam, which contains only about 2200 pounds.

The amount of lime or lime carbonate in these soils is variable. As a rule, fields which have been cropped for a number of years have lost nearly or quite all of the lime originally contained in the surface soil, and have in many cases become acid. The subsoil, however, often still contains large amounts of this material, but for the insurance of good growths of plants requiring lime, especially alfalfa, this will have to be supplied in all cases where the surface shows a distinct acid reaction, as indicated by the use of the litmus test or the Truog test* for soil acidity.

In the improvement of this group of soils the factor which may well be given first consideration is a means of increasing the amount of organic matter and the supply of nitrogen. As the supply of stable manure is usually inadequate, it should be supplemented by green manuring crops, of which the legumes are the best. Plowing under a second crop of clover once during each rotation will greatly assist in increasing the productivity of the soil. This will not only increase the supply of nitrogen in the soil but it will also improve the physical structure. The presence of a large amount of organic matter will also assist in making available for the plant a larger amount of potassium, which is present in sufficient quantities in these soils, but which is often in such a form as to be of little use to the plant.

A number of tests have been conducted which indicate that these types of soil will respond readily to the use of ground rock phosphate. This may be applied at the rate of from 500 to 1000 pounds per acre, for the first application and somewhat smaller amounts once during each rotation. It may be applied with a fertilizer distributor the same as ground limestone is sometimes applied, or it

* The "Truog Test" for determining soil acidity is a new method which has been perfected by E. Truog of the Soils Department of the University of Wisconsin, by which the relative degree of acidity can be accurately determined in the field or laboratory in a few minutes' time. For a detailed description of this method write the Soils Department, College of Agriculture, Madison, Wis.

may be sprinkled on top of manure in the manure spreader and scattered over the fields in this way. It may also be sprinkled in the stables during the winter, and taken up with the manure. This is probably the simplest and most effective way of applying ground rock phosphate. In this form the phosphorus is only slowly available so that there will be but little if any loss if larger applications than indicated are given.

Where an acid condition is found to exist on any of these soils this should be corrected by the use of some form of lime. Ground limestone rock will be found very effective, and this may be applied at the rate of at least 1500 to 2000 pounds per acre, and some times considerable more, depending upon the degree of acidity. The limestone may be applied at any convenient time as it is slowly soluble and will remain in the soil for a number of years.

Another factor of importance to be considered in the permanent improvement of these soils is that of thorough cultivation. Plowing should be done when the moisture condiditons are favorable, and before a crop is planted the soil should be thoroughly pulverized, and the seed bed in a loose mellow condition. All after cultivation of intertilled crops should be sufficiently frequent to maintain a good surface mulch, to conserve the moisture, and to permit a free circulation of air through the soil.

Attention should be given to the selection of crop rotations best suited to these soils and to the types of farming followed.

A rotation in quite common use consists of corn, one year followed by oats and barley one year each, then by clover and timothy for two years. A leading agricultural authority in the county recommends a rotation consisting of two years corn, one year barley or oats and three to four years of alfalfa, after which the field should be plowed again and planted to corn. The manure may be applied to sod land before plowing for corn. This rotation is giving very good results where followed and should be put into more general practice.

Since the soils of this group cover 37 per cent of the county and include the finest agricultural land in the region, it will be realized that the question of keeping up or of increasing their productivity is one of great importance, and one which should receive the careful consideration and study of every farmer located on these soils.

CHAPTER III.

GROUP OF FINE SANDY LOAM SOILS.

MIAMI FINE SANDY LOAM

Extent and distribution.—The Miami fine sandy loam is one of the important upland types, though it is not as extensive as the silt loam. It is confined chiefly to the southern half of the county, the largest area lying directly south of Fort Atkinson and extending to the county line. Another area of smaller extent is located in southeastern Sullivan and northeastern Palmyra Townships. Small tracts occur in every township in the county, but throughout the northern half the areas are small and scattered. The type is interspersed with a number of small patches of Miami gravelly sandy loam and with areas of Peat or soils of the Clyde series.

Description.—The surface soil of the Miami fine sandy loam consists of a light-brown fine sandy loam with a depth of 8 to 10 inches. Some medium and coarse sand particles are found in the soil and the type in places approaches a medium sand in texture. The material is friable in structure and sometimes loose and porous. The content of organic matter is small. A considerable number of bowlders were originally found upon the surface, but most of these have been removed from the cultivated fields. Over the surface of many areas a sprinkling of gravel occurs and a small amount may be found within the soil mass.

To a depth of about 18 inches the subsoil consists of a brownish-yellow, light-textured loam. Below this it gradually becomes lighter in color, somewhat heavier in texture, and more compact until a sandy clay loam is reached. At 36 to 40 inches the true unassorted till is encountered and this extends to a depth of at least 40 or 50 feet. Lenses of sand frequently occur in the subsoil. The gravelly material, angular fragments, and bowlders found in the subsoil are largely limestone.

There are several variations in the type, but none of these were found to be of sufficient importance to map separately. Most of the areas in Watertown Township are lighter than typical, both in the soil and subsoil. In Milford Township the type is also light. Here the sand is of a finer texture and of a more pronounced yellow color.

A small area in Palmyra Township consists of a light-brown fine sand about 8 inches deep, underlain by a sticky fine sand which becomes a fine sandy loam at about 16 inches. The deep subsoil below 24 to 30 inches contains considerable clay and some fine gravel.

Topography and drainage.—The topography varies from gently rolling to rolling and the type is subject to erosion in only a few places. On account of its topography and the sandy nature of the soil, the drainage is thorough, in places excessive, and the crops may suffer somewhat during dry spells of unusual length.

Origin—The Miami fine sandy loam is of glacial origin. It is derived from the ground moraine. The subsoil is filled with gravel, small rock fragments, and bowlders, mainly limestone. The surface soil has been leached to such an extent that practically all of the lime originally present has been removed and an acid condition was found to exist over nearly all of the type.

The subsoil is frequently found to be slightly acid, but in most cases varying amounts of lime carbonate still remain and have an appreciable influence on the agricultural value of the soil.

Native vegetation.—The native forest growth consisted chiefly of oak, maple, and hickory. A portion of the type was only sparsely forested and was termed "openings." Most of the areas west of the Rock River were in the "openings," where the scattered tree growth was chiefly bur oak and black oak, with a sprinkling of hickory.

*Present agricultural development.**—Probably over 90 per cent of the Miami fine sandy loam is under cultivation. General farming in conjunction with dairying is the leading type of agriculture, though the dairy industry is not as highly developed as it is on the Miami loam and Miami silt loam types. Hogs are raised on most of the farms.

Oats are grown more extensively than other crops. The yields are lower than on the heavier types of the series, 35 bushels per acre being about the average. Corn is an important crop and yields from 25 to 40 bushels per acre. Barley is grown to some extent, but seems to be better adapted to a heavier soil. Yields range from 20 to 30 bushels per acre. Rye is grown on many farms and is well adapted to the type. Only a small acreage is sowed to wheat. In recent years the yields have ranged from 15 to 25 bushels per acre. A mixture of clover and timothy is usually grown for hay and yields of 1 ton to 1½ tons per acre are obtained. When clover is grown alone the yield is somewhat larger. During dry seasons some difficulty is experienced in getting a stand of clover. The number of

* For chemical composition and improvement of Miami fine sandy loam see page 37.

VIEW OF MIAMI FINE SANDY LOAM, SHOWING TYPICAL SURFACE FEATURES AND AVERAGE BUILDINGS.

There are about 30,000 acres of this kind of land in Jefferson County.

VIEW OF RODMAN GRAVEL, SHOWING UNEVEN, PUMPY TOPOGRAPHY

This soil has a very low agricultural value. The view is typical of all soils of the Rodman series found in the morainic region south and east of Palmyra in the southeastern part of the area.

For description of Rodman gravel see page 43.

poorly drained areas from which hay is often cut have the tendency to reduce the acreage which would otherwise be devoted to grasses and clover. Some alfalfa is grown, though not so much as on the heavier types of the series. The usual yield is from 2 to 3 tons per acre, with 5 tons as the maximum reported.

Special crops are grown only to a small extent on this soil. About 100 acres of sweet corn is grown for the canning factory at Fort Atkinson each year. The average yield is from 3 to 3½ tons of snapped ears per acre. Some peas are also grown for the canning factory, but the quality is inferior to that of peas grown on the silt loam. A few sugar beets are produced south of Fort Atkinson, and while the yield is low, being from 8 to 10 tons per acre, the sugar content is larger than in case of beets grown on the silt loam. In the extreme southwest corner of the county a small quantity of tobacco is produced. Potatoes do well on the type, yielding an average of 150 bushels per acre. This crop, however, is not grown to any extent for the market.

The rotation of crops most commonly practiced consists of one year corn, one or two years small grain, followed by two years clover and timothy. If there is no lowland pasture, the hay field is usually pastured the second year. Oats and rye are the small grains most often grown, though barley may be used in the rotation. There are a number of farmers who do not follow any definite crop rotation.

FOX FINE SANDY LOAM

Extent and distribution.—This type, comprising a little more than 8 square miles, is most extensively found in Oakland and Sumner Townships, though small patches occur in various parts of the survey. Small areas having the heavy stratum in the subsoil lie in the preglacial valley along Scuppernong and Bark Rivers between Oak Hill and Fort Atkinson.

Description.—The surface soil of the Fox fine sandy loam to an average depth of 8 inches consists of a light-brown fine sandy loam which contains a large percentage of medium sand. The soil is loose and open in structure and the amount of organic matter present is small. The surface soil is underlain by a brownish-yellow sandy loam extending to a depth of 18 inches, where it grades into a sandy clay. Medium sand is reached at about 30 inches and cuts show this material and the gravel which is found at about 4 feet to be stratified. There are a few places where the subsoil from 24 to 36 inches consists of a very fine sandy loam, but such places are of small extent.

A variation occurs in which the subsoil at about 32 inches is a pale-yellow, stiff, compact silty clay, containing lime concretions. The thickness of this heavy layer was not determined, but it is probably underlain by the stratified sand at 5 to 6 feet.

A heavy phase of this type is found in a few places where both soil and subsoil are heavier than typical. Such areas, however, were too small to be indicated separately on the soil map.

Topography and drainage.—The surface is level to gently undulating, the natural drainage thorough, and during dry seasons the crops are apt to suffer from lack of moisture, though less on the areas with the heavy subsoil layer than elsewhere.

Origin.—The type is derived from glacial débris which has been deposited as outwash material by streams issuing from beneath the ice sheet. It may also occur as terraces lying above present overflow. The surface soil is in an acid condition, though in the deep subsoil there is a considerable quantity of limestone gravel. Sorrel was found growing in most of the fields.

Native vegetation.—Originally the areas were covered with an open forest growth consisting chiefly of black oak, bur oak, and white oak. In the openings in the forest considerable areas supported prairie grass.

*Present agricultural development.**—Over 95 per cent of the Fox fine sandy loam is under cultivation, being devoted to general farming and the production of a few special crops. Oats, corn, rye, and hay are the chief general farm crops grown. Tobacco, potatoes, and peas are the main special crops. Yields of all these are slightly lower than on the Fox loam. It seems to produce a better grade of wrapper tobacco than any of the other types in the county. Where tobacco is grown the most common method of cropping consists of turning under the sod and planting tobacco for two or three years, corn one year, oats one year, followed by clover and timothy for two years. But little hay is produced, as the type is associated with low, poorly drained land which provides marsh hay and pasture.

MIAMI GRAVELLY SANDY LOAM†

Extent and distribution.—The Miami gravelly sandy loam is not so extensive as the Miami loam or fine sandy loam, but it occupies a larger area than the fine sand. The largest tract is found in the southern part of Sullivan Township. Concord, Cold Spring, and

* For chemical composition and improvement of Fox fine sandy loam see page 37.

† Because this type is similar in chemical composition and has about the same value as the fine sandy loams it has been included with the fine sandy loam group of soils.

Koshkonong Townships contain a number of smaller areas and a few scattered patches are to be found in every township in the survey.

Description.—The surface soil of the Miami gravelly sandy loam consists of a grayish-brown sandy loam to heavy sandy loam 8 inches in depth. Where typically developed the material is friable and the structure is rather loose. There is frequently a sprinkling of gravel on the surface and it is often found throughout the soil section. Bowlders were originally numerous on the surface, but most of the largest ones have been removed from the cultivated portions of the type.

The subsoil consists of a reddish-brown, gritty clay loam, extending to a depth of about 22 inches, below which it becomes more sandy and gravelly. The upper subsoil is often quite compact, though it may contain some gravel and stones. The unassorted till contains considerable gravel, stones, and bowlders and a large percentage of these are of limestone.

Variations in the type are numerous, but usually of minor importance. On the hill tops and steeper slopes the surface material has frequently been eroded away and the underlying compact subsoil exposed. In such places the surface is heavier than typical. Along the lower slopes the surface is deeper than ordinary, owing to the wash from the slopes above. A few areas were noted where the surface soil approached a loam, but such tracts were of only small extent. In a few localities the surface soil was lighter and deeper than typical—a loamy sand with gravel—but the subsoil in such places was sufficiently heavy to make a change in classification unneccessary.

Topography and drainage.—The surface of the type is gently to steeply rolling and the natural drainage is thorough, sometimes excessive, crops frequently suffering from lack of moisture. The steep slopes are subject to erosion and in many places gullies have been formed in the hillsides. The type often occurs as long, narrow ridges, as drumlins, or as a capping of hills.

Origin.—While the Miami gravelly sandy loam is derived chiefly from the ground moraine, some of the areas appear to have their origin in materials of recessional moraines. The underlying material consists of unassorted glacial till. Leaching has carried away most of the lime carbonate from the surface soil and an acid condition is sometimes found to exist. The subsoil, however, usually contains considerable lime.

Native vegetation.—The native forest growth consisted chiefly of bur oak, white oak, black oak, hickory, and some maple. Some of

the type is still covered with trees, which are valued chiefly as a source of fuel.

*Present agricultural development.**—About 25 or 30 per cent of the type is under cultivation at present, the remainder being in pasture and wood lots. The largest cultivated area is in Sullivan Township, but even here much of the type is not under the plow. The Miami gravelly sandy loam is frequently found associated with some better soil which may be used for the cultivated crops and the former for pasture. The grazing is good in early summer, but later the grass frequently dries up and furnishes but little pasture.

Oats, hay, rye, corn, a little wheat, and barley form the principal crops on this soil. Oats are grown more extensively than other grains. From 25 to 40 bushels per acre is the ordinary range in yields. The yield of corn is about 35 bushels, rye 20 to 25 bushels, wheat 15 to 25 bushels, and barley 20 to 30 bushels per acre. Clover and timothy do fairly well, but are not grown extensively. June grass is the principal pasture grass. Considerable alfalfa is grown, and in most instances it does very well. Special crops are not grown to any extent upon the Miami gravelly sandy loam. A few potatoes are produced, but only for home use.

While many farmers do not practice a definite crop rotation, the one most commonly followed consists of corn one year, small grains two years, and clover and timothy two or more years. Where alfalfa is grown it is allowed to remain from three to five years.

The following table gives the results of mechanical analyses of fine-earth samples of the soil and subsoil of this type:

Mechanical analyses of Miami gravelly sandy loam.

Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Soil	0.8	12.6	20.5	19.4	6.2	34.5	6.1
Subsoil	1.9	12.1	20.2	22.3	7.7	26.7	9.1

RODMAN FINE SANDY LOAM

Extent and distribution.—This soil is of very small extent and occupies less than one-half square mile. It is found in Palmyra Township, where it forms a part of the Kettle Moraine. A small patch also occurs in Oakland Township.

Description.—The surface soil of the Rodman fine sandy loam consists of a light-brown fine sand, extending to a depth of about

* For chemical composition and improvement of Miami gravelly sandy loam see page 37.

6 inches. The material is loose and open and contains only a very small quantity of organic matter. The subsoil is a reddish-brown, sticky sandy loam to a depth of 30 inches, where a bed of stratified sand and gravel is encountered.

The type is similar to the light phase of the Miami fine sandy loam in texture, structure, and color, but differs from that soil in origin and in being underlain by stratified material instead of till, which makes it more subject to drought.

Topography and drainage.—The topography is rolling and the natural drainage excessive, causing the crops to suffer from drought nearly every year.

Origin.—The material composing the type consists of assorted glacial débris which was deposited beneath the ice sheet chiefly in the form of kames and eskers. While the gravel in the subsoil contains much limestone, the surface soil is in an acid condition, and fields support a growth of sorrel.

Native vegetation.—The native forest growth consisted chiefly of scrub oak. Most of this has been cut and the land placed under cultivation.

Present agricultural development.—About 90 per cent of the Rodman fine sandy loam is under cultivation. It is used for general farming, although better adapted to truck crops. The chief crops grown are corn and rye, but the yields are low. It is difficult to get a stand of clover, on account of the acid condition and droughty nature of the soil.

The agricultural value of this type is probably slightly inferior to that of the Miami fine sandy loam.

CHEMICAL COMPOSITION AND IMPROVEMENT OF MIAMI FINE SANDY LOAM, MIAMI GRAVELLY SANDY LOAM, FOX FINE SANDY LOAM AND RODMAN FINE SANDY LOAM

Chemical analyses indicate that the soils of this group contain smaller amounts of all the essential plant food elements than are found in the group of heavy, light colored soils. The phosphorus content is variable, but in the Miami fine sandy loam, which is by far the most extensive type in the group, there is approximately 900 pounds for the surface 8 inches per acre. The Miami gravelly sandy loam is about the same, while the samples of the Fox and Rodman fine sandy loams analyzed indicate that these types contain a considerable lower amount of phosphorus.

The supply of potassium present in this group of soils may be considered as a fair amount, and sufficient for the demands of grow-

ing crops, when proper methods of cultivation are followed. The amount present ranges from 25,000 to 35,000 pounds per acre in the surface 8 inches.

The amount of organic matter and nitrogen in these soils is more uniform than the phosphorus supply, but the total amount is comparatively small. The amount of nitrogen present is only about half that found in the Miami loam and silt loam types, the total supply being approximately 1500 pounds.

The lime content of these soils was originally high, many of the coarser particles being made up of limestone. The surface soils however, have been leached to a considerable extent so that in places an acid condition is found to exist. The subsoils are seldom acid. Each farmer should have his soil tested for acidity to determine the need of lime, especially for the growth of clover and alfalfa. An acid condition may be readily corrected by the use of ground limestone, the amount required depending upon the degree of the acidity. It is doubtful if more than one ton per acre would be required to correct the most pronounced cases of acidity in this group of soils.

One of the greatest needs of the soils in this group is a larger supply of organic matter. This may be supplied by supplementing the stable manure with green manuring crops of which legumes are best. This decaying vegetable matter will increase the water-holding capacity of the soil, and it will also assist in making available for the plants the potassium which is now securely locked up by various chemical combinations.

The phosphorus supply may be increased by the use of ground rock phosphate, which should be applied at the rate of 500 or 600 pounds per acre for the first time, followed by smaller amounts once during each crop rotation.

Careful attention should be given to the selection of crop rotations best suited to these soils. Where the location is suitable, and where there are adequate facilities for marketing, the trucking industry could well be developed on a commercial scale. Bush berries and strawberries thrive and their culture should be encouraged. Where general farming and dairying are the chief lines of agriculture followed, as is usually the case, the growing of alfalfa should be extended after the soil has been made productive, and inoculated.

CHAPTER IV.

GROUP OF FINE SANDS AND GRAVELLY SOILS.

MIAMI FINE SAND*

Extent and distribution.—This type is of very small extent in the present survey. It is confined almost entirely to the southeastern part of the county. The largest tract lies in the immediate vicinity of Palmyra.

Description.—The surface soil of the Miami fine sand to a depth of 6 or 8 inches consists of a loose, light-brown fine sand, containing little organic matter. The subsoil consists of a loose, yellow fine sand. A little gravel may be scattered upon the surface and mixed with soil and subsoil, though typically they are usually free from coarse material. When unprotected the soil drifts to some extent.

Topography and drainage.—The type is very gently rolling, except in Palmyra Township, where it has a somewhat rougher surface. The natural drainage is excessive and the type droughty.

Origin.—The material composing the Miami fine sand is derived from glacial débris forming the ground moraine. An acid condition was found to exist in the surface soil in practically the whole type.

Native vegetation.—The original timber growth consisted chiefly of red, bur, and white oak, with some hickory. The tree growth, however, was not as thrifty as on the heavier types of soil.

Present agricultural development—Over 90 per cent of the Miami fine sand is under cultivation at present, the remainder being in wood lots. Dairying and general farming are the chief types of agriculture followed. Most of the crops common to the region are grown, but the yields are low. Corn yields from 10 to 20 bushels, rye from 10 to 12 bushels, and clover from one-fourth ton to a ton. Oats and barley are not grown to any extent. Cucumbers and potatoes are special crops. The former do very well, giving gross returns of $125 to $150 an acre. While the latter are of good quality, the yields are low.

* For chemical composition and improvement of Miami fine sand see page 44. In the future soil of this character will be correlated with Coloma fine sand since the lime carbonate in subsoil is lacking or in such small amounts as to be of no agricultural value.

PLAINFIELD FINE SAND

Extent and distribution.—The type is of relatively small extent, occupying only a little more than 1,000 acres in the whole county. The largest area is in the immediate vicinity of Oak Hill. Other patches occur chiefly in Palmyra Township, though there are a few small tracts in other parts of the survey.

Description.—Plainfield fine sand consists of a loose, light-brown fine sand, 6 inches deep. It is underlain by a loose, yellow fine sand, which is stratified. The soil contains little organic matter.

Topography and drainage.—The surface is flat to gently undulating, and the drainage is excessive. Crops frequently suffer from drought, especially during the late summer.

Origin.—Plainfield fine sand is derived from glacial material which has been deposited as outwash plains or as small terraces by streams coming from beneath the ice sheet.

While this material comes from a glaciated limestone region it has been acted upon by water to such an extent that the lime carbonate content is very low, and the soil acid. On account of this condition the soil is classed as Plainfield rather than Fox.

Native vegetation.—The original timber growth consisted chiefly of scrubby oak. Most of this has been removed, and the growth which remains has no merchantable value.

*Present agricultural development.**—Most of the type is under cultivation, and general farming and dairying are practiced. Owing to its small extent, no farms are found exclusively on it. Oats, corn, rye, and some hay are grown. It is difficult to get a good stand of clover. Yields of all the crops are low.

PLAINFIELD SAND†

Extent and distribution.—This type is inextensive, the largest areas lying in the vicinity of Oak Hill. A few smaller areas occur, chiefly in Sullivan Township.

Description.—The surface soil of Plainfield sand consists of 6 inches of light-brown medium sand, which is loose and porous and contains but little organic matter. It is underlain by a loose, brownish-yellow medium sand, which in many places becomes finer with depth. At 20 to 24 inches the material may be slightly sticky, but at 30 to 36 inches a bed of stratified sand is found. In one place stratified gravel was reached at 2 feet.

* For chemical composition and improvement of Plainfield fine sand see page 44.
† For chemical composition and improvement of Plainfield sand see page 44.
Because of its limited extent and close relation to the fine sands this type has been included with the fine sand group.

Topography and drainage.—The surface is level to gently undulating, and the natural drainage is excessive. The loose, open structure of the material permits the rain water to escape rapidly, and crops suffer from drought, except during seasons of excessive rainfall.

Origin.—The type is derived from glacial material laid down as outwash plains or as terraces above the present flood flow. While this material is found in a glaciated limestone region the lime has been leached out and the soil is now in an acid condition. On account of this acid condition it is classed as Plainfield rather than as Fox.

Native vegetation.—The original forests consisted chiefly or red and white oak, though the growth was somewhat scrubby and scattered.

Present agricultural development.—About 90 per cent of the Plainfield sand is under cultivation. The area of the type is so small that no farms and but few fields are located entirely on this one soil. It is difficult, therefore, to get accurate records of yields. General farming and dairying are practiced, and corn, rye, oats, and a little clover are the chief crops grown. All yields are low.

Below are given the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Plainfield sand.

Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Soil	0.3	13.0	40.4	29.0	2.5	9.0	5.0
Subsoil	.5	14.2	32.5	35.1	4.2	7.2	6.1

RODMAN FINE SAND

Extent and distribution.—The type is also of small extent, occupying 2.8 square miles. It occurs associated with the Kettle Moraine in Palmyra Township in the southeastern part of the county.

Description.—The surface soil of Rodman fine sand consists of 6 inches of light-brown fine sand, of loose, open structure and low organic-matter content. The subsoil is a loose, open yellow fine sand, showing stratification at lower depths.

Topography and drainage.—The surface is rough and hummocky, the result in part of drifting. Several sand dunes 30 feet in height were seen on the type. The natural drainage is excessive and the type is droughty.

Origin.—Rodman fine sand is composed of glacial material which appears to have been deposited beneath the ice sheet. While most of the gravel and stones present are limestone, the material has been leached so that the surface soil is in an acid condition and sorrel was seen growing in all of the fields.

Native vegetation.—The native forest growth was scattering and consisted chiefly of scrub oak.

*Present agricultural development.**—About 50 per cent of the type is under cultivation, approximately 10 per cent is in forest of scrubby oak, and the remainder is cleared, but not cultivated, because of its low productiveness. General farming is practiced, but the yields are small. Corn, oats, and rye are the chief crops. Clover is difficult to seed and but little is grown, as during dry years the yields are very low and the crops sometimes an entire failure. Of the special crops grown, cucumbers, melons, and potatoes may be mentioned. With an abundance of rain in August and September cucumbers are usually a profitable crop, provided the field has been well fertilized. Melons and potatoes of good quality are grown, but the acreage is very small.

RODMAN GRAVELLY SANDY LOAM

Extent and distribution.—A little more than 4 square miles of this soil is found in the county. It occurs in the southeastern part associated with the Kettle Moraine, and in the western part, chiefly in Oakland Township.

Description.—The surface soil of Rodman gravelly sandy loam consists of a light-brown medium sandy loam, about 8 inches deep, containing a considerable quantity of gravel and only a little organic matter. The subsoil is a reddish-brown, sticky, rather compact gravelly sandy loam, with a depth of 18 inches, resting on stratified gravel. Where the type occurs within the sandy regions of the county the lower slopes are sandy and the surface soil is deeper than typical. Within the silty areas the lower slopes contain considerable silt and are better farm lands. These variations were of too small extent to be shown as separate types on the map.

Topography and drainage.—The surface is gently to steeply rolling and the natural drainage excessive.

Origin.—The type consists chiefly of kame and esker material. The stratified material contains a large proportion of limestone gravel, but the surface soil is frequently in an acid condition.

* For chemical composition and improvement of Rodman fine sand see page 44.

Native vegetation.—As on the Rodman types the original timber growth was scattering. It consisted chiefly of scrub oak, which had but little value.

*Present agricultural development.**—About 35 per cent of the type is under cultivation and the remainder is in forest and pasture land. The chief crops are corn, oats, and rye, but the yields are so small that the type has a low agricultural value. The pasturage is fair during the early summer, but later in the season the grasses wither and dry and furnish but little grazing. It is difficult to get a good stand of clover and but little is grown.

RODMAN GRAVEL†

Extent and distribution.—The type occupies a total area of 6.5 square miles and occurs chiefly in the southeastern part of the county in Palmyra Township, where it forms a part of the Kettle Moraine. It also occurs in the western tier of townships and in a few scattered areas throughout the county.

Description.—Rodman gravel to a depth of 1 to 3 inches consists of a dark-brown medium sandy loam containing varying amounts of gravel and a considerable quanitty of organic matter, underlain by stratified material consisting of coarse sand, gravel, stones, and bowlders. The structure of the subsoil is very loose and open and there are but few particles smaller than coarse sand. Road cuts show this material to extend to a depth of 50 feet.

Within the Kettle Moraine the depressions in the type are sandy and the soil is considerably deeper than on the hilltops. In the western part of the county the soil in many of the depressions is silty at the surface, and here the type has some agricultural value. These variations, however, were too small to be indicated on the map.

Topography and drainage.—The type is very irregular, occurring as rounded hills and knolls, as long, narrow ridges, and as rough regions dotted with kettle holes from 50 to 100 feet deep. The natural drainage is excessive.

Origin.—Rodman gravel is of glacial origin and consists of water-laid material, chiefly in the form of kames and eskers. In the southeastern part of the county about 95 per cent of the gravel and bowlders consists of limestone, while in the western part there is a considerable admixture of Baraboo quartzite.

Native vegetation.—The native forest growth consisted of scrubby oak, with some hickory.

* For chemical composition and improvement see page 44.
† For a typical view of this type of soil see page 44.

Present agricultural development.—On account of the uneven topography, the loose, open structure of the material, and its extremely droughty condition, the Rodman gravel may be considered nonagricultural. Practically all of the type is in forest, but as the growth is scattering some grazing is afforded, and this is the only use that is made of the type so far as agriculture is concerned. In the early spring, when there is plenty of rain, there is a good growth of grass, but later in the summer this dries up and is of no value for grazing.

CHEMICAL COMPOSITION AND IMPROVEMENT OF FINE SANDS AND GRAVELLY SOILS

As is generally true with sandy soils the types of this group are low in their content of all of the essential plant food elements. The total amount of phosphorus in the surface 8 inches is about 900 pounds; of potassium between 25,000 and 30.000 pounds and of nitrogen approximately 1650 pounds. There is but little lime carbonate in the soil to a depth of 3 feet, except that which is in the form of coarse sand or gravel, and hence of relatively little value in preventing the development of acidity in the soil. The Rodman gravel is made up almost entirely of limestone gravel, and is of little value for agricultural purposes.

In order that the fertility of these soils may be maintained or increased it will be necessary to increase the nitrogen and organic matter by applying stable manure, peat, or by the growth of legumes, or by green manuring. For the growth of these legumes, as for other crops, available plant food containing both potassium and phosphorus must be used. By neutralizing the soil acidity with ground limetsone, and by the use of moderate amounts of fertilizers good crops of legumes such as clover, or the annual legumes—cowpeas, soybeans, and yellow lupines—may be grown so as to greatly increase the organic matter. When a good supply of active organic matter has thus been developed, the need for applications of potash fertilizer will largely disappear, though the need of phosphate will doubtless continue. Most of these types are well adapted to the raising of truck crops, and where the location and marketing facilities are adequate this industry could well be extended. Potatoes, strawberries, cucumbers, melons, tomatoes, and the like could be profitably grown to a much greater extent than they are at the present time.

CHAPTER V.

SOILS OF THE PRAIRIE REGION.

CARRINGTON SILT LOAM

Extent and distribution.—This type is developed only to a small extent in this survey, less than a square mile being mapped, and it is not as typical as where it occurs in extensive tracts, as in Dane County to the west and Dodge County to the north. The small areas in Jefferson and Sumner Townships form the main portion of the Carrington silt loam as found in Jefferson County.

Description.—Carrington silt loam consists of about 12 inches of dark-brown to nearly black, friable silt loam, containing a considerable quantity of organic matter, underlain by a yellowish-brown, heavy silt loam, which at about 24 inches grades into a compact silty clay loam. The unassorted glacial till is found at 3 to 4 feet and the underlying rock varies from 10 to 20 feet below the surface.

Topography and drainage.—The surface is undulating to gently rolling and the natural drainage is fairly good.

Origin.—The soil has been derived from glacial till material. Loessial material may possible form a part of the soil. The dark color is due to the growth and decay of vegetation, chiefly grasses, under poor conditions of drainage. The surface material is in a slightly acid condition and sorrel was found growing in some of the fields.

Native vegetation.—Carrington silt loam is typically a prairie soil, but as found here it supported a scattering growth of oak and was locally called "oak openings."

*Present agricultural development.**—Practically all of the type is under cultivation and it is a very good general farming soil. Corn, oats, clover, and timothy are the chief general farm crops, and very satisfactory yields are secured. The methods of cultivation and fertilization are practically the same as are followed on the Miami silt loam.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

* For chemical composition and improvement see page 47.

Mechanical analyses of Carrington silt loam.

Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Soil	0.0	0.8	1.6	2.8	3.7	73.1	17.8
Subsoil	.0	.3	1.0	2.2	4.4	74.1	17.9

CARRINGTON LOAM*

The surface soil of Carrington loam consists of a black, friable loam, about 12 inches deep, containing a considerable amount of organic matter. Beneath this occurs a yellowish-brown, gritty clay loam, gradually becoming lighter in color and in texture with increase in depth. At 30 inches there is considerable limestone gravel in the subsoil, and at about 40 inches the typical glacial till is encountered. Bedrock is reached from 2 to 10 feet below the surface.

The type covers an area of only 448 acres. It occurs in Cold Spring Township and extends south into Walworth County, and has a value of $135 to $150 an acre. Its small extent makes it unimportant locally, though in other parts of the State it is a valuable asset.

CARRINGTON FINE SANDY LOAM†

The Carrington fine sandy loam has a small area, comprising less than a square mile in Sumner Township.

The surface soil of Carrington fine sandy loam consists of about 10 inches of dark-brown to black fine sandy loam. On the tops of the knolls the color is lighter than usual, the soil is shallow, and there is a sprinkling of gravel. The subsoil is a brownish-yellow, sticky fine sandy loam to a depth of 30 inches, where a yellow fine sand is reached. Gravel in the subsoil is quite common.

The surface is gently rolling and the natural drainage is very good, though the type is apt to suffer from drought during dry seasons.

The soil has been derived from the ground moraine, and the dark color is due to the presence of relatively large quantities of organic matter. While the subsoil contains considerable limestone material, the surface has been leached, and the soil is now in an acid condition. It was formerly "oak openings."

* For chemical composition and improvement see page 47.
† For chemical composition and improvement of this type see page 47.

About 90 per cent of the type is under cultivation, the remainder being in woodlots. General farming is carried on, though tobacco is one of the important crops grown, and yields from 1,000 to 1,200 pounds per acre. Land of this character sells for $70 to $90 per acre.

WAUKESHA LOAM

Extent and distribution.—Less than a square mile of this soil is found in Jefferson County. It is confined to the northeastern part of Palmyra Township, in sections 1 and 12.

Description.—Waukesha loam consists of 10 inches of dark-brown to black, friable loam, underlain by a brownish, rather compact gritty clay loam to a depth of 20 to 24 inches, where stratified beds of gravel are encountered. The type is similar to the Fox loam differing only in color and in content of organic matter, which is larger in the Waukesha loam.

Topography and drainage.—The surface is level to gently undulating, and on account of the underlying gravel the natural drainage is good. The type suffers from drought, especially during the late summer.

Origin.—The type here occurs as a terrace formation, though it may also occur as, or be derived from, outwash plain materials. In any event it is composed of glacial material deposited by streams flowing from beneath the ice sheet. The gravel contains a large percentage of limestone, but the surface soil is in an acid condition.

Native vegetation.—A much larger area of this soil is found in Waukesha County, where it is a prairie soil. In Jefferson County there was a scattering growth of bur oak on the areas, and they were known as "openings."

Present agricultural development.—Practically all of the type is under cultivation and is devoted to general farming and dairying. As it is of small extent, no farms are located entirely upon it. The usual crops are corn, rye, oats, and hay, and fair yields are obtained. Owing to the acid condition of the soil it is difficult to get a good stand of clover. No special crops are grown, except a few potatoes and a little garden truck for home use.

CHEMICAL COMPOSITION AND IMPROVEMENT OF SOILS OF THE PRAIRIE REGION

The soils included in this group are all of very limited extent in Jefferson County, the total area of the entire group being approximately 1200 acres. The content of phosphorus is considerable higher than in the light colored soils of the same texture. In the

Waukesha loam, Carrington loam, and silt loam, the amount is approximately 1600 pounds per acre for the surface 8 inches, while in the Carrington fine sandy loam the amount is somewhat lower. The larger amount of organic matter characterizing this group is probably the cause of the accumulation of somewhat larger amounts of phosphorus than are found in other types of soil having less humus.

The content of potassium in this group of soils is sufficiently high to meet the demands made upon it by crops for an almost indefinite period, the amount being approximately 40,000 pounds per acre in the surface 8 inches. The problem in connection with potassium supply is to keep in the soil a sufficient amount of active organic matter which will assist in making the potassium available to growing plants.

The amount of organic matter and nitrogen is much higher than in the light colored soils of the area, as would be suspected from the dark color. The total supply of nitrogen is approximately 4800 pounds. Where fields have been under cultivation for a long period of years, however, the humus is often of a resistant character which does not decompose readily, and therefore does not serve the purpose of fresh vegetable matter.

All of the soils of this group are in an acid condition, and this should be corrected by the application of ground limestone. The amount required will range from 2000 to 4000 pounds per acre, depending upon the degree of acidity.

In the improvement of these soils the use of ground rock phosphate will be found profitable. About 600 pounds per acre will be found sufficient for the first application. Smaller amounts may then be applied once during each succeeding rotation.

As the humus is in a resistant form the organic matter supply of these soils should be supplemented by fresh vegetable matter in the form of green manuring crops, of which legumes are best. Green manuring crops may be used to supplement the supply of stable manure, and this combination along with rock phosphate will materially increase the productivity of the soils of this group.

CHAPTER VI.

DARK COLORED, POORLY DRAINED SOILS.

CLYDE CLAY LOAM

Extent and distribution.—This type occupies an area of 20.1 square miles, and is confined entirely to the southern part of the county. It lies parallel with and mostly on the south side of Scuppernong and Bark Rivers between Palmyra and Fort Atkinson. It is associated with other low-lying areas of Clyde loam, some Clyde silt loam, and extensive areas of Peat.

Description.—The surface soil of Clyde clay loam to an average depth of 12 to 14 inches consists of a black silty clay loam containing a high percentage of organic matter. The material is quite stiff and compact, but the organic matter present tends to make it more loamy than the light-colored soils containing the same amount of silt and clay.

The subsoil consists of a light-gray or bluish, heavy, plastic, calcareous silty clay, which is somewhat mottled with yellow, especially in the lower depths. With depth the material becomes heavier and more compact, and at 2 to 3 feet it is a compact, impervious, putty-like clay. Some lime concretions and iron stains are commonly found in the deep subsoil. The type as a whole is very uniform.

Topography and drainage.—The surface of the type is flat to very gently undulating and drainage is defective. The rain water drains off fairly well from most of the soil, but there are some depressions and narrow strips along streams where the surface is flooded at times. In addition, the material composing the type is so heavy and compact that the internal movement of water is slow. A number of open ditches and some tile drains have been installed on portions of this soil.

Origin.—The type occupies what is probably an old preglacial valley which was a lake for a time after the retreat of the last ice sheet. The soil thus is of lacustrine origin, the materials of which it is composed having been eroded from higher glacial débris and laid down in quiet waters. To this has been added a large quantity of vegetable matter, which is responsible for the black color of this soil.

Native vegetation.—The original forest growth consisted chiefly of elm, some bur oak, and willow. Where the drainage was the most defective the tree growth was light, but there was in such places a dense growth of wild grasses.

*Present agricultural development.**—At the present time about 75 per cent of the type is under cultivation, the remainder being chiefly in permanent pasture. Dairying in conjunction with general farming is the type of agriculture chiefly followed. From 15 to 25 cows and from 25 to 60 hogs are kept on each 100 acres of land. The leading crops are corn, oats, barley, and hay. Corn does very well, except in wet years, and is the most important crop. Yields range from 35 to 50 bushels per acre, the higher returns being obtained on well-drained areas. Oats average about 45 bushels per acre, with reported yields as high as 75 bushels. Some barley is grown, with an average yield of 35 bushels per acre. The growth of straw in the case of all small grains is apt to be too rank and there is danger of lodging. The quality of the grain is not equal to that grown on the upland soils. Where the type is well drained clover gives very good returns, but the acreage devoted to this crop is small, owing to the fact that there is considerable permanent pasture on the type made up of wild grasses, which are frequently cut for hay. Timothy also does well on this soil.

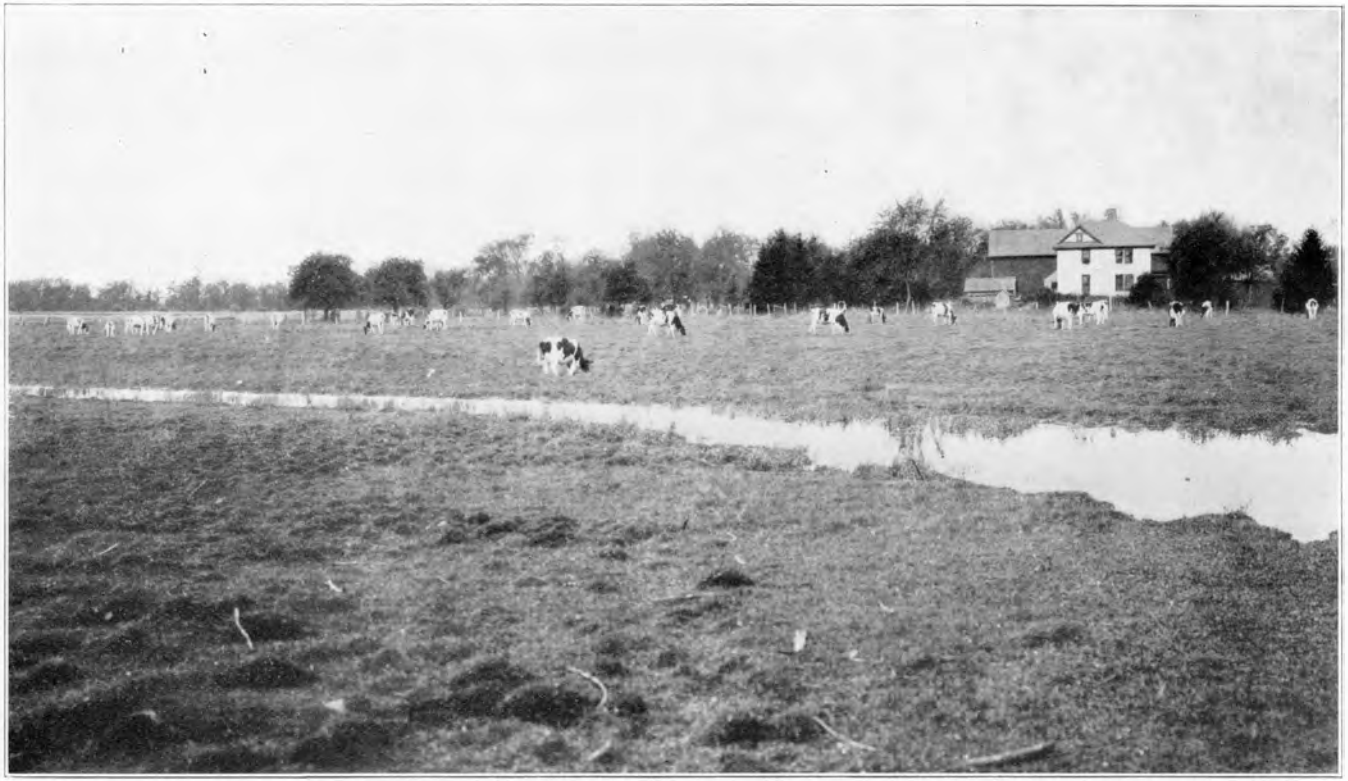
No special crops are grown upon Clyde clay loam, except a few potatoes and garden vegetables for home use. The potatoes yield well, but are of poor quality, being rather watery and frequently large and hollow.

On this type the most common rotation consists of two years corn, one year oats or barley, followed by clover or timothy. Fall plowing is quite general, owing to the wet conditions which usually prevail during the spring months. Manure is usually applied to sod which is to be plowed for corn. Twelve loads per acre every 4 or 5 years is about the usual application. This type is one of the most difficult to cultivate in the county.

CLYDE SILT LOAM

Extent and distribution.—Clyde silt loam is one of the extensive and important agricultural soils of the county. The largest area occurs along the Crawfish River, extending north from Favilles Grove past Hubbleton and north into Dodge County. This region is usually spoken of as "prairie." Other areas, several square miles in extent, are found north of Lake Koshkonong in Sumner Town-

* For chemical composition and improvement of Clyde clay loam see page 55.



VIEW OF CLYDE SILT LOAM SEVEN MILES WEST OF WATERTOWN.

The Clyde loam, silt loam, and clay loam combined cover over 20 per cent of the county. These types are low, level, and deficient in drainage. When drained they are very fertile, productive soils. The improvement of this class of land is of great economic importance to Jefferson County.

ship and to the west and southwest of Fort Atkinson in Koshkonong Township. Other smaller tracts, containing from a few acres to 2 square miles, are scattered throughout the county. They occur most frequently in the regions where the upland soil is Miami loam or Miami silt loam. Many areas consist of long, narrow strips between tracts of higher land.

Description.—The surface soil of Clyde silt loam as found in Jefferson County consists of a black, friable silt loam extending to a depth of 12 to 15 inches. The soil contains a high percentage of organic matter and silt, which gives it the smooth feel characteristic of the type.

The subsoil consists of a light-gray, heavy silt loam or silty clay loam to 24 inches, where a compact silty clay loam is reached. This material becomes very stiff and tenacious at 30 to 36 inches. The subsoil is frequently mottled and streaked with iron stains and contains considerable lime, some of which is in the form of concretions and crusts. In a few cases seams of fine to medium sand are found in the subsoil and in local areas the surface may be covered with 2 to 4 inches of Peat.

A lighter phase occurs south of Hubbleton, in sections 4, 5, 8, 9, 16, 20, and 21 east of Crawfish River and sections 6, 7, 17, and 18 west of Crawfish River, in Milford Township. Here the subsoil is a light-gray or almost white silty clay loam to a depth of 24 to 40 inches, where a very fine light-gray sand is encountered. In some places this bed of sand can not be reached by the auger, but it is thought to underlie the area in Milford Township at some depth. A similar condition is found in sections 20, 30, and 31, Palmyra Township.

The type somewhat resembles Clyde clay loam, but contains considerably less clay, which makes it an easier soil to handle and more desirable for farming.

Topography and drainage.—Areas of this type are flat, or have only a gentle slope toward the streams along which they occur. The natural drainage is defective, except over a portion of the type along Crawfish River where there is enough slope to give the surface fairly good drainage. The under-drainage of the whole type is defective.

Origin.—Where typically developed Clyde silt loam consists of glacial material which has been washed from the uplands and laid down as a lacustrine deposit in quiet waters. The dark color is due to the slow decomposition of vegetation in the presence of moisture. The portion of the type which occurs along small streams, or as narrow strips between regions of higher land, may be partly alluvial in origin and there may also be some colluvial material mixed with

the soil in places. From the standpoint of texture, color, and agricultural value, however, the differences are not sufficient to warrant a separate classification. The soil is not acid and there is a high percentage of lime in the subsoil.

Native vegetation.—The native forest growth consisted chiefly of elm, some oak, hickory, soft maple, ash, and willow. Along the Crawfish River there was but little forest, and a rank growth of marsh grass covered the lowlands of that section.

*Present agricultural development.**—Only about 10 to 15 per cent of the Clyde silt loam is under cultivation at the present time, about 5 per cent is still in forest and the remainder mostly in pasture and hay lots. In only a few instances have tile drains been installed, though most of the type has been sufficiently supplied with open ditches to be used for pasture and hay. Directly east of Favilles Grove about 300 acres have been tile drained. There are a few other smaller tracts in various parts of the county which have been similarly reclaimed. In sections 6, 8, 9, 17, and 18, Milford Township, about half of the type is drained sufficiently to permit the raising of general farm crops.

General farming in connection with dairying is the chief type of agriculture, with corn, oats, and hay as the principal crops. Of these corn is the most important. The soil is well adapted to this crop, the average yield being about 45 bushels per acre, with yields of 60 bushels frequently reported. Oats do well, though the growth of straw is apt to be so heavy as to cause lodging. The average yield is about 45 bushels per acre. Where the type is well drained clover yields from 2 to 3 tons per acre. Timothy also does well, though not grown extensively. As the type is usually associated with highly improved upland soils, the undrained portions are used chiefly for hay and pasture. Marsh hay yields from 1 to 2 tons per acre. Special crops are not grown to any extent on this type at present, though some peas and a small amount of corn for canning are produced southwest of Fort Atkinson. Both crops give satisfactory yields. As a rule no definite crops rotation is practiced on this type, as so small a portion of it is under cultivation on any farm.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

* For chemical composition and improvement of Clyde silt loam see page 55.

Mechanical analyses of Clyde silt loam.

Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Soil	0.1	1.0	0.8	3.5	5.3	72.2	17.2
Subsoil	.7	1.1	.5	1.2	3.1	74.5	18.8

CLYDE LOAM

Extent and distribution.—Clyde loam is of smaller extent than the silt loam. It occurs only in small patches and is confined largely to Sullivan, Palmyra, Hebron, Cold Spring, Koshkonong, Sumner, and Oakland Townships, though a few small areas occur in the northern part of the county.

Description.—The surface soil of Clyde loam consists of 14 inches of black mellow loam containing a high percentage of organic matter. In a number of places the surface is covered with a few inches of Peat or Muck, but this mantle is never so thick as to prevent the plow turning up the underlying soil. The subsoil consists of a light gray, gritty clay loam, usually mottled with iron stains. This extends to a depth of 3 feet or more, but it may contain seams of sand at almost any depth.

Practically all of the type as found in Palmyra Township is lighter than typical and consists of a black loam from 18 to 20 inches deep, containing a relatively large quantity of fine sand. This is underlain by a yellowish mottled very fine sand. Scattered throughout the type are small patches of Clyde very fine sandy loam too small to map.

Topography and drainage.—The surface of the type is low and flat and the natural drainage is poor.

Origin.—The soil is derived from glacial material occupying old lake beds and occurs along the bottom land bordering streams. A portion of it is lacustrine, but in the small, narrow areas some may be of alluvial and some of colluvial origin. The wet condition prevailing in the past has favored the growth and decay of vegetation, and this accounts for the high organic-matter content and the dark color of the soil. The soil and subsoil contain considerable lime and are not in an acid condition.

Native vegetation.—The native vegetation on Clyde loam was chiefly elm, black ash, willow, and marsh grass.

*Present agricultural development.**—By far the greater proportion

* For chemical composition and improvement of Clyde loam see page 55.

of this type is utilized for pasture and marsh hay. Not more than 5 per cent is under cultivation and probably an equal amount is in forest. Where the type is drained and cultivated, corn and oats are the chief crops. Corn yields from 30 to 50 bushels and oats 30 to 45 bushels per acre. Timothy and alsike clover also do well. Grains are apt to lodge, and the quality of the grain is not so good as that grown on upland soils.

CLYDE FINE SANDY LOAM*

This soil has an area of less than a square mile. It is found chiefly in Palmyra and Sumner Townships, where it is associated with areas of the other Clyde soils and Peat.

Clyde fine sandy loam consists of 12 inches of black fine sandy loam, containing a relatively large quantity of organic matter, underlain by a brown fine sandy loam to a depth of 20 inches and then with yellow fine sand to a depth of more than 3 feet.

The surface of the type is flat and the natural drainage deficient. It has the same origin and supports the same character of forest as the Clyde sandy loam.

About 10 per cent of the type is under cultivation, the remainder being in pasture or hay lots. Where cultivated, it is devoted to general farm crops, chiefly corn, which yields about 30 bushels per acre. Some oats are grown, yielding from 30 to 40 bushels per acre. When drained, the type is easy to cultivate and can be worked under quite a wide range of moisture conditions.

CLYDE SANDY LOAM

Clyde sandy loam is of very small extent. It is found chiefly due north of Oak Hill, in Sullivan Township. Here it occurs between areas of Peat and areas of Miami soils.

The surface soil of Clyde sandy loam consists of about 10 inches of black, loose, open, medium sandy loam, with a high organic-matter content. The subsoil consists of a grayish medium sandy loam, frequently mottled with yellow iron stains. Streaks or thin beds of sandy clay are very common in the subsoil. Around the borders of some of the Peat marshes the type occurs with considerable Peat or Muck mixed with the surface soil. In such places the subsoil is usually a gray medium sand to 36 inches, where sandy clay is reached. The surface of the type is flat and the natural drainage poor.

* For chemical composition and improvement of this type see page 55.

The soil is derived from glacial material deposited in the beds of old lakes, though it may be in part colluvial or alluvial.

Only a small part of the type is cultivated. Conditions of cropping are very much as on the fine sandy loam.

CHEMICAL COMPOSITION AND IMPROVEMENT OF THE DARK COLORED, POORLY DRAINED SOILS

The soils of this group make up 25 per cent of the total area of the county, and their improvement is therefore an important item, as at the present time only a small acreage of these types are under cultivation.

These types of soil are characterized by having relatively large amounts of organic matter, accumulated as a result of poor drainage. As is usually the case, accumulation of organic matter increases the total content of phosphorus, but this does not necessarily mean that this element is readily available. Its availability will depend largely on the rate of decomposition of the vegetable matter.

The total amount of phosphorus in the heavy members of this group will run in excess of 2000 pounds per acre in the surface 8 inches, while in the sandy members the amount averages about 1000 pounds.

It is freqeuntly true that soils of these types are well supplied with available phosphorus for a few years after being reclaimed but it must always be borne in mind that such soils are likely to show a deficiency in the available supplies of this element after a period of cropping unless barnyard manure or other fertilizer is used. The total amount of potassium in these soils is fair in all cases and large in some, but the chief question with reference to this element is not the total amount present, but conditions affecting its availability. While soils well supplied with vegetable matter as these usually are do not need special treatment with refernce to potassium immediately after reclamation, they very generally do show a need of care in this regard within a few years, and patches of these types frequently fail to produce satisfactory crops even immediately after drainage and breaking unless barnyard manure or special potash fertilizer is supplied.

Owing to the fact that these soils receive the drainage from higher surrounding land the subsoil of which contains large amounts of lime, they are as a rule well supplied with this substance and are not acid. Their lack of sufficient drainage limits their use for the growth of alfalfa or medium red clover to which otherwise they would be well adapted. These soils are, of course, usually well sup-

plied with nitrogen—indeed they contain on an average from 3 to 5 times as much of this element as do the upland light colored silt and clay loam soils of this region. They do not therefore need special care with reference to this element and it is frequently more economical to use commercial fertilizers containing potassium and also phosphorus, where these elements are needed on such soils, and permitting the use of all the manure of the farm on the upland light colored soils which require nitrogen as well as the other elements.

In the improvement of these types the first question which should be given consideration is that of drainage.* Only a small proportion of the total area of this group is sufficiently drained. On the heavy types, plowing fields in narrow strips with dead furrows from to 2 4 rods apart, and having these lead into open ditches along the side of the field will greatly assist in carrying off the surface water. In order to make the internal drainage of the soil complete, however, tile drains should be used to supplement the surface drains. From tests made by tile draining such land it has been found that the increased crops will pay for the improvement in the course of a few years.

When the drainage of these soils has been established and the crop yields still seem to be deficient, the question of applying commercial fertilizers should be considered. Ground rock phosphate should be applied at the rate of about 600 pounds per acre for the first application and from 300 to 400 pounds per acre once during each succeeding rotation. Muriate of potash may be applied for general farm crops, at the rate of about 150 pounds per acre. If cabbage or beets are to be grown from 250 to 300 pounds per acre should be applied. When these crops are grown in rotation it may be necessary to use potash fertilizer in seeding down with a cereal crop following a crop on which a heavy application was used the previous year.

Rock phosphate may be applied at any time and should ordinarily be spread broadcast and either plowed in, disked, or harrowed in so as to have it well distributed through the soil. On account of the small bulk of the fertilizer used, it can be applied readily by hand, in seeding grain, or the potash and rock phosphate may be mixed and applied in the spring in one of the many fertilizer distributers on the market. Before using these commercial fertilizers over large tracts, however, it would be well to make tests on small plots to determine the need of the soil over any specific area, since there may be considerable variation due to drainage, the condition of the organic matter, etc.

* See Bulletin 339 Wisconsin Experiment Station—"The Right Drain for the Right Place".

Care must be exercised in the cultivation of the heavy soils, and they should be plowed only when the moisture conditions are the most favorable. Because of the large amount of organic matter present they are not as difficult to cultivate as light colored soils of the same texture.

When these soils are thoroughly drained alfalfa and the clovers may be grown successfully, and the acreage devoted to these crops should be increased. Such crops as cabbage and sugar beets can be grown successfully, but the heavy soils are too heavy for growing potatoes or the ordinary truck crops on a commercial scale. Such soils are best adapted to general farming and dairying, and these are the lines along which the greatest development is now being made.

CHAPTER VII.

MARSH SOILS.

PEAT

(With included areas of Muck)

Extent and distribution.—Peat (with included areas of Muck) is one of the most extensive soils in Jefferson County, being found in every township. The largest area lies southwest of Oak Hill, in Palmyra and Cold Spring Townships, along Scuppernong River. Other large tracts are found in Jefferson, Hebron, Sullivan, Concrod, Waterloo, and Lake Mills Townships.

Description.—The material mapped as Peat (with included areas of Muck) in Jefferson County consists of vegetable matter in varying stages of decomposition, to which has been added, in some cases, a small amount of mineral matter. Where the Peat is only partially decomposed, as is the case over most of the type, the material has a brown color and is very fibrous. Where a more advanced state of decomposition has been reached the fibrous structure has largely disappeared, and the material is black and has a smooth feel. Around the margin of the large marshes, and over a considerable proportion of many of the small ones, varying amounts of mineral matter have been washed down from the surrounding uplands and mixed with the Peat. While this is seldom sufficient to warrant the establishing of a Muck type, there are here and there a few areas of typical Muck. These were not separated, on account of their small extent. In the larger marshes the Peat soil extends to a depth of 5 to 15 feet; in the smaller ones the depth varies from 2 to 5 feet. The underlying material is usually a light-gray or bluish, plastic silty clay, which is generally mottled.

In sections 13, 14, 33, and 34, Sullivan Township, and in the areas in Palmyra Township which are associated with sandy upland types, the Peat is underlain by a light-gray sand of medium to fine texture or by a light mottled sandy clay. A shallow phase occurs in section 1, Concord Township, and in sections 4 and 9, Milford Township, and extending into section 3, Watertown Township; the surface here consists of 12 to 20 inches of black, mucky Peat. Considerable

mineral matter is mingled with the organic material, but it is hardly sufficient to warrant classing the soil as Muck. The soil is underlain usually by a light-gray mottled clay and in local spots by grayish sand. Deposits of marl occur under some of the Peat marshes.

Topography and drainage.—By far the greater proportion of the surface of the Peat is flat. There are, however, a number of places where the areas lie on gentle slopes or where the surface is gently undulating. The drainage of the Peat is naturally very defective, and only a small proportion of it can be farmed without first installing some sort of a drainage system.

Origin.—Peat owes its origin to the accumulation of organic matter resulting from the growth and decay of rank water-loving vegetation. Marsh grasses, sedges, and sphagnum moss have added much material, but the leaves, limbs, and roots of trees have also helped to build up the deposits.

Native vegetation.—About 15 to 20 per cent of the Peat is timbered with tamarack, and the remainder as covered with coarse marsh grass.

Present agricultural development.—Only a very few small areas of the Peat are under cultivation at present. The marsh grass yields large quantities of hay, which can be readily cut during dry seasons. In wet seasons, however, the ground is too soft to support a team. As a rule the marshes are cut into small tracts and owned by the farmers on the surrounding upland, who depend on the marshes for hay in dry seasons, when the upland crop is apt to be a failure. A few patches of corn were seen growing on the Peat, though most of this was where mineral matter had been washed in from the upland and mixed with the Peat. On some of the gentle slopes where the Peat was quite fibrous and only partially decomposed this crop was also grown.

CHEMICAL COMPOSITION AND IMPROVEMENT OF PEAT

Nineteen per cent of Jefferson County consists of Peat land, and only a very small proportion of it has been drained. Since most of this land can be drained and profitably farmed, its improvement is of great economic imporatnce.

Peat has been largely formed by the accumulation of vegetable matter, particularly spahgnum moss and certain sedges and grasses. It is very low in earthly matter, running from 80 to 95 per cent of organic matter. The amount of the mineral elements is consequently low, the total weight of phosphorus being approximately 600 pounds per acre to a depth of 8 inches, and of potassium, 700 pounds. It

will be seen, on comparison of these statements with those made on the composition of such soils as Miami silt loam and Fox silt loam, that the total amount of potassum, in particular, is extremely small, the amount in Peat often being less than 2 per cent of that found in the upland silt loam soils. While the total amount is small, a large proportion of it is available to plants, epsecially if the surface has been burnt over, and the supply may be sufficient for from 1 to 3 crops. It is to be expected, therefore, that profitable cropping is possible over a long period of years, only by the use of some form of potassium fertilizer, either barnyard manure, wood ashes, or the usual commercial fertilizers containing this element. The total supply of phosphorus is rather low, though the difference between the amounts present in Peat and upland soils is very much less than in the case of potassium. In view of the enormous quantity of nitrogen contained in these soils, the average amount of which is over 15,000 pounds per acre 8 inches, it is unnecessary to use stable manure, the most valuable element of which is the nitrogen, so that, on farms including both Peat or Muck land and upland soils, the stable manure should be used on the upland, and commercial fertilizers containing phosphorus and potash, if needed, on the lower land, unless, indeed, there is sufficient manure for the entire farm, which is rarely the case. These marsh soils are rarely acid on account of the percolation of lime-containing water from higher lands, though occasionally patches of acid Peat are found on the larger marshes. This acidity, however, is not so detrimental in the case of marsh lands as in the case of sand and clay soils, since the chief objection to acidity is that it interferes with the growth of those legumes, such as clover and alfalfa, which are needed on the higher lands to secure nitrogen, but which are not needed on the marsh soils for this purpose, and to the growth of which, indeed, the marsh soils are not so well adapted physically.

In the improvement of Peat the question of drainage* is the first step to be considered. Both open ditches and tile drains can be utilized in reclaiming the marshy tracts. The major portion of the Peat areas in Jefferson county can be profitably drained and improved. When properly handled the Peat will produce profitable crops of corn, alsike clover, timothy, and a number of other general farm crops, as well as special crops such as peppermint, celery, etc.

* For special information concerning drainage, write the Soils Department of the Wisconsin Experiment Station.

CHAPTER VIII.

GENERAL AGRICULTURE OF JEFFERSON COUNTY.

The agriculture of Jefferson County dates back to about 1836, when the first settlement was made. The chief crops grown by the pioneers were wheat, corn, oats, and hay. Wheat early became the most important product of the farms and continued to be the cash crop for many years. There was a gradual increase in the acreage devoted to this crop until about 1862, when the invasion of the chinch bug did considerable damage to the crop and caused a reduction in the acreage. The decline in interest in wheat was only temporary, however, and in 1865 over a quarter of a million bushels were produced. In 1877 the crop amounted to 409,172 bushels. Since 1880 there has been a gradual reduction in the acreage, the census of 1910 reporting only 3,191 acres of wheat in Jefferson County. The average yield at that time was slightly over 20 bushels per acre.

Hops were grown very extensively in this county at one time. In 1860 the industry was in its infancy, but by 1868 it had assumed great proportions. In 1877 the yield was over half a million pounds. This rapid growth was due to the failure of the crop in the east and to the resulting high prices. Many of those who went into the industry first were very successful and it was not uncommon for a single crop to pay for the land and equipment. Nearly every farmer finally took up the production of this crop, and while the average acreage for each farm was about 4 or 5 acres, there were many fields of 10 to 15 acres. Large quantities of hops were also grown in other sections of the State and over-production resulted. Prices went so low that many failures followed and by 1885 the industry was entirely abandoned.

Corn was grown in the county as early as wheat, but was fed to the stock on the farms. By 1877 the yield of corn was greater than that of wheat and since that time it has remained the more important crop.

The raising of barley began about 1867 and reached its greatest proportions between 1880 and 1890. The average yields declined

about that time, owing chiefly to continued cropping on the same fields and to the use of inferior seed.

Oats were grown with corn and wheat in the early days, though to a smaller extent than the two latter crops. During later years, however, it has come to be more extensively grown than any other cereal crop in the county.

During the early history of the county the methods of cultivation were rather crude and but little, if any, attention was given to the rotation of crops, thorough tillage, the selection of seed, or the adaptation of crops to certain kinds of soil. Land was plentiful and wasteful methods were common. Continued cropping of fields to the same crop, together with inferior methods of cultivation, had a tendency to lower the productiveness of the lands. When the cause for the reduction in yields became apparent a gradual change took place in the agricultural practices followed and improved methods were introduced. The system of agriculture which is being followed at the present time is far in advance of the old methods.

Before the coming of the railroad the marketing of farm produce was difficult and expensive. Most of the grain was hauled by teams over plank roads to Milwaukee. The first plank road was built from Watertown to Milwaukee in 1836. A few years later one was completed from Milwaukee to Whitewater, which lies just outside of the county to the south. The coming of the railroads reduced these long hauls, opened up new markets, and did much to encourage the development of agriculture. The Prairie du Chien Division of the Chicago, Milwaukee & St. Paul Railroad was completed through the county in 1851, and the La Cross Division in 1855.

The chief type of agriculture followed at the present time consists of general farming in conjunction with dairying and stock raising. This system of farming is followed throughout the county, though in the southeastern corner in Oakland and Sumner Townships it is not as important as elsewhere, because in this region some tobacco is grown. Special lines of farming, such as trucking, fruit growing, etc., are developed only to a very small extent.

The general farm crops grown in the county, in order of the acreage devoted to each, are hay, oats, corn, barley, rye, wheat, potatoes, tobacco, peas, sugar beets, beans, and a few truck crops. The figures given below in connection with the various crops, etc., are taken from the censns of 1910 and give a fairly accurate idea of the relative importance of the agricultural products of the county.

The acreage of hay is greater than that of any other crop. From 67,189 acres a production of 112,058 tons, or about 1.7 tons per acre, was secured. Of this acreage 28,015 acres was wild hay grown in

marshes and other low, poorly drained areas. The average yield of such hay was 1.3 tons per acre. From 14,640 acres of timothy and clover mixed an average yield of 1.6 tons per acre was secured. Timothy was grown alone on 12,606 acres and gave an average yield of 1.6 tons per acre. Clover alone covered only 2,824 acres, with an average yield of 1.8 tons per acre. The acreage of alfalfa was 2,251 acres, with a yield of 2.2 tons per acre. Other kinds of hay grown to a small extent are oats and peas cut green and cured, alsike clover, and a small quantity of millet.

Clover and timothy are usually seeded with a nurse crop consisting of wheat, oats, barley, or rye. Some difficulty has been experienced in getting a good stand, especially on the lighter soils, which are usually in an acid condition and contain only a small amount of organic matter. The hot, dry weather of late summer freqeuntly kills some of the clover and the period immediately following the removal of the nurse crop is also a critical stage in the growth of the clover plant. Clover does better on the Miami silt loam and loam and Fox silt loam types than on the other soils of the county. The Miami gravelly sandy loam also produced good clover. Clover seed is produced to a considerable extent, especially in the vicinity of Waterloo. Some alsike clover is grown, especially on the more poorly drained types, such as the Clyde silt loam. It does better under such conditions than any of the other legumes. Yields of 1½ to 2½ tons per acre are secured.

Alfalfa has become an important crop in the county. On a considerable number of dairy farms it is considered the most important crop that can be produced, since it yields a larger amount of valuable feed per acre than any other crop adapted to this region. While the average yield given by the census for 1910 is but 2.2 tons per acre, returns much larger than this are secured when the crop is properly handled. Yields of 4 tons per acre are quite common and 6 tons per acre have been secured on the most highly improved farms. The possibilities of this crop for Jefferson County are thus shown to be very great.

Alfalfa is grown most extensively on the Miami silt loam, Miami gravelly sandy loam, and Fox silt loam. About 20 pounds of seed per acre is the amount sown.

There is a larger acreage devoted to oats than to any other grain crop in the county. From 45,469 acres in 1909 the total production was 1,688,972 bushels, or an average of approximately 37 bushels per acre. Sweedish Select is probably the most common variety grown. In some portions of the county pure-bred oats are being raised for the seed market. A part of the crop is sold. Oats are most exten-

sively grown on the Miami silt loam, loam, gravelly sandy loam, fine sandy loam, and Fox silt loam. On the Clyde soils the growth of straw is apt to be too heavy and the crop is likely to lodge. The quality of the grain is also inferior to that grown on the light-colored upland soils.

The acreage of corn is nearly equal to that of oats and it is one of the leading crops of the county. From 40,250 acres a total production of 1,516,137 bushels was secured, or an average of approximately 37 bushels per acre. A large proportion of the crop is used as ensilage. Large quantities of corn are fed to hogs and much is also ground to form a portion of the grain ration for dairy cows. The stalks are often shredded in the fall and stored in the barn, or they may be left in the field in the shock and hauled to the feeding lot as needed during the winter. Leaming and Eureka are two varieties grown to a considerable extent for silage. Wisconsin Nos. 7, 8, and 12 are improved early maturing dent varieties which are gradually coming into more common use. The majority of farmers, however, plant unimproved seed. Corn is grown on practically all of the soils of the county, though well-drained areas of the Clyde silt loam and clay loam are probably best adapted to its culture. It does very well on the Miami silt loam, loam, and Fox silt loam.

Barley, though increasing in favor, is not grown as extensively at present as it was 25 years ago. In 1909 the crop from 10,940 acres amounted to 317,253 bushels, or an average of approximately 28 bushels per acre. The variety most commonly grown is the Oderbrucker. Careful breeding and seed selection have improved the yields and also the quality of the grain. Most of the barley is produced in the northern part of the county on the Miami silt loam and Miami loam.

Rye is grown only to a limited extent and is confined largely to the lighter soils of the county. The crop of 1909 from 3,326 acres amounted to 53,387 bushels, or an average of about 16 bushels per acre. Some of the rye is ground and fed to hogs, a little is used making rye flour for bread, but the greater part of the crop is sold.

The acreage of wheat is even smaller than that of rye. From 3,191 acres the production of 1909 was 62,807 bushels, or an average of approximately 19 bushels per acre. It is grown chiefly on the Miami silt loam and Miami loam types.

Irish potatoes are next in acreage to wheat and the crop of 1909 from 1,771 acres amounted to 193,395 bushels, or approximately 109 bushels per acre. The crop is not grown on a commercial scale except in a very small way, though nearly every farmer produces enough for home use and frequently has some to place upon the

market. The fine sandy loam types are better adapted to potatoes than the heavier soils of the county.

The growing of tobacco is almost entirely confined to the two western tiers of sections of Oakland and Sumner Townships in the southwestern corner of the county. This strip of country forms an intermediate belt between the great tobacco section of Dane County on the west and the dairy country to the east. Tobacco was first introduced into the State about 1858 and at one time was an important crop in this county. It has given way largely to the dairy industry and the acreage in 1909 was only 455 acres, from which the average yield was 1,174 pounds per acre. The acreage is being still further reduced. Tobacco growing is confined largely to the Norwegian settlement. The fields are fertilized very heavily with stable manure and as a rule the productiveness of the farm as a whole is sacrificed for the tobacco patch.

The growing of peas for canning is carried on to a small extent. There is a factory at Waterloo, one at Fort Atkinson, and one at Watertown. There are several viners tributary to the factory at Fort Atkinson. The vines are for the most part preserved in the silo at the viners and the pea silage returned to the farmers and fed to the stock before the corn crop is cut. The crop is planted at intervals so that the harvest may spread over a considerable period of time and permit cutting the entire crop when the peas are in the proper stage. The size of pea fields ranges from 5 to 15 acres and the gross receipts from $30 to $90 per acre. The average gross returns for 1912 were about $49 an acre.

Peas of the best quality are produced on the Miami silt loam, and by far the greater proportion of the crop is grown on this type. Peas are grown to maturity to a considerable extent in parts of the county. Seed men at Waterloo contract for from 16,000 to 20,000 bushels of seed peas yearly at about $2 a bushel. A portion of these are grown in the adjoining counties of Dane and Dodge. Among the varieties of peas grown in Jefferson County are Alaska, Horsford, Market Garden, and Advance. The rotation most commonly followed consists of one year each of peas, corn, and oats, followed by one or two years of clover. The rotation recommended by the factory at Waterloo is one year each of peas, clover, and corn.

In the vicinity of Fort Atkinson sweet corn is grown for canning by the same factory that handles the peas. Several hundred acres are devoted to this crop. The price for 1912 was $8 a ton for snapped ears. The small ears are left on the stalks and either cut and put into the silo or allowed to cure in the shock. The average returns from the snapped ears amounts to about $35 an acre. Most of this

corn is grown on the Miami fine sandy loam. The Miami silt loam produces good sweet corn, but there are no extensive tracts of this soil close to the factory.

Sugar beets are grown in the county only to a very small extent. They are produced chiefly on the Miami silt loam, though a few are grown on the Miami fine sandy loam. The industry has not been extended to the Clyde soils in this county. The light-colored upland types produce beets with a higher sugar content, but the tonnage is usually considerably greater on the well-drained Clyde soils. Most of the beets are shipped to the factory at Janesville.

Beans, buckwheat, sorghum, emmer, and spelt are crops of minor importance in the county.

The trucking industry has not been developed to any extent. Cucumbers are grown in the vicinity of Palmyra and some melons in various parts of the county. Every farm has its garden where all sorts of vegetables are grown for home use, but the market garden has not been developed in this region.

Fruit growing has not been developed on a commercial scale, though on many of the farms there are small orchards of apples, cherries, pears, and plums that supply chiefly the home needs. During favorable seasons a few apples may be sold, since the apple trees are the most numerous. Of the small fruits strawberries, currants, gooseberries, blackberries, and raspberries are grown in small patches, chiefly for home use, though a few are sold in the towns within the county.

Dairying is the most important branch of farming in Jefferson County. In 1913 there were 46 creameries, 9 cheese factories, 5 skimming stations, and 4 condenseries within its limits. The amount of butter produced in 1909 amounted to approximately 5,500,000 pounds, while there was a little over a half million pounds of cheese made. The dairy industry requires the production of a large quantity of hay and corn. In 1909, 18.5 per cent of the improved land in the county was in corn and 30.8 per cent was in hay. For every 100 acres of hay and corn combined there were 26.5 milch cows. For every 100 head of cattle in the county there were 62.6 milch cows.

When the creameries pay for the amount of butter fat the price of cream is usually about 2 cents above Elgin prices, the overrun being kept by the creamery for making the butter. When the actual amount of butter is paid for the price is the Elgin quotation minus two-thirds cent per pound for making the butter. When the milk or cream is hauled by the creamery 10 to 15 cents per hundredweight is charged for such service.

The cheese factories have a considerable range in the price paid for milk. In the summer the price goes as low as 85 cents per hundredweight, and this is increased to about $1.70 during the winter. Brick cheese is the kind most commonly made, though other kinds are also produced. The farmers return the whey to the farm and feed it to the pigs.

When milk is sold to the condenseries the price varies from about $1.40 in summer to $1.70 in winter. The test is not taken into consideration, but if it falls below 3 per cent the milk is rejected. Considerable whole milk is shipped from the county, chiefly to Milwaukee. The Chicago, Milwaukee & St. Paul Railraod runs a milk train from Waterloo to Milwaukee and also one from Janesville to Milwaukee. A car is sent from Palmyra every day. Considerable milk is also collected along the lines of the Chicago & North Western Railroad. The milk is shipped in 8-gallon cans, and the annual average price paid for milk delivered in Milwaukee is about $1.10 per can.

Doubtless the majority of the cattle in the county are of grade stock, though there are probably as many pure breds as in any other county of equal size in the State. It has been estimated that between 80 and 90 per cent of the cattle show some Holstein blood, and there are more pure-bred Holsteins than any other breed. The Guernseys are the second breed of importance from the standpoint of numbers, and stock of excellent quality is being raised. It is considered by many farmers that the Holstein is a more economical producer than any of the other breeds. The Holstein will handle a large amount of roughage and give a large amount of milk, but the milk tests considerably lower than the Guernsey. The calves are large and it it is desired to veal them their good size will insure larger returns than if smaller breeds are used. The Guernsey milk has a rich yellow color, a high butter-fat content, and is often preferred by many people who buy milk. The number of Guernsey cattle is gradually increasing. Guernsey and Holstein breeders' associations have been organized in the county and are doing much to advance the interest of these breeds. Through these organizations much pure-bred stock and also considerable good grade stock is sold to buyers from various parts of this country. Stock has been shipped from here to Mexico, Japan, New Zealand, and other foreign countries.

The conditions in Jefferson County are very favorable for dairying and the average farmer engaged in the business keeps from 15 to 18 cows. Many who make a specialty of it keep from 25 to 30 cows. The silo is in common use; probably over half of the farmers keeping

dairy cows have one. The stave silo is the prevailing type, though cement, brick, and tile are also used in their construction. More are being built each year.

Very few beef cattle are raised in the county, though on a number of farms a few steers are fed each year. Most of the male calves of grade stock from the dairy farms are vealed. The majority of the cattle sold for beef are old milch cows which are no longer profitable milk producers, or animals which do not give promise of becoming profitable producers. In 1909, 24,039 calves were sold or slaughtered in Jefferson County.

Sheep are not raised to any extent in the county, the total number in 1910 being 4,938.

Hogs are raised to a considerable extent in conjunction with dairying, the census of 1910 showing 43,650 in the county. The chief breeds represented are Poland China, Berkshire, Duroc Jersey, and Chester White. A sausage factory at Fort Atkinson uses about 12,000 hogs each year and the packing house at Jefferson also uses quite a number. Milwaukee and Chicago are the outside markets for hogs and other live stock.

Horses are not raised very extensively, but most of the farmers raise one or two colts nearly every year and frequently have a team to sell. The sires used are mostly Percheron and the quality of the work stock is gradually being improved. According to the census of 1910 there were 12,162 horses in the county.

The poultry industry has been developed to a considerable extent on many of the farms. Chickens are more numerous than other fowls and in 1909 the production of eggs was 1,435,396 dozen. Turkeys, ducks, and geese are also raised. Geese from the vicinity of Watertown have a national reputation for quality.

The question of the adaptation of crops to certain soils has been given some consideration, and it is recognized that corn, for example, gives better yields as a general rule on well-drained areas of Clyde silt loam or Clyde clay loam than on the light-colored upland soils of various textures. On the other hand, oats and barley of better quality are produced on the light-colored upland soils than on the black, low-lying types. Potatoes do better on the sandy loam types than on the heavy soils of the county. The important question of soil adaptation, however, has not been carefully studied and there is opportunity for experimentation along this line.

In the crop rotations practiced there is considerable variation, due to differences in texture of the soil, drainage conditions, and the types of farming followed. Probably the most common rotation consists of one year corn, one year oats, and two years clover and

timothy. Oats may be grown for two years or barley or rye may be grown one year in addition to the oats. Rye is mostly grown on the lighter types. Where there is no lowland on the farm, which is seldom the case, one year of pasture may follow the cutting of hay. On farms where alfalfa is the chief hay crop the rotation consists of corn one year, oats or barley one year, or both of these crops for one year each, followed by three to five years of alfalfa. Where tobacco is grown the rotation may be one year each of corn and oats or barley, two years clover and timothy, and two to four years of tobacco. The rotation which appears to have given the best results and the one advanced by the most up-to-date farmers consists of corn for two years, oats or barley for one year, and alfalfa for three or four years.

There is considerable variation in the methods of cultivation, as well as in the rotations followed. It is considered desirable to plow sod land in the fall, especially on the heavier soils, and when time will permit stubble land may also be plowed in the fall. Weather conditions and delay in farm work, however, often prevent much of this work in the fall. It is customary to apply manure to sod land which is to be plowed for corn. If the land is plowed in the fall the manure is often hauled out during the winter and scattered over the plowed surface. If the field is not plowed in the fall the manure is plowed under in the spring. When stubble land is plowed in the late summer manure is frequently applied before plowing. Where tobacco is grown practically all of the manure is applied to the tobacco field.

Among the weed pests most troublesome in the county may be mentioned the wild mustard, quack grass, white daisy, and Canada thistle. While none of these are plentiful enough to cause alarm, they should nevertheless be kept down, and efforts made to eradicate them, for unless checked they will spread rapidly and become a great source of annoyance as well as the direct cause of reduction in the yields of various field crops.

The general appearance of the farmsteads throughout the survey is one of thrift and prosperity. As a rule the farm buildings are substantial, painted, and in good repair. Fields are securely fenced, well cultivated, and modern labor-saving machinery is in common use.

On a great many of the farms in the county all of the labor is done by the family. Where hired help is necessary the wages range from $25 to $28 a month for about nine months. This includes board, washing, and usually the keeping of one horse. Where no horse is kept the wages may range from $30 to $35 a month. On

many of the dairy farms the help is retained for the entire year, and the salary then ranges from $300 to $500 a year.

Of all the land in the county, 94.9 per cent is in farms, and of this 64.9 per cent is improved. There are 3,356 farms the average size of which is 100 acres. On the average there are 65 acres of improved land on every farm. Of all farms 79.9 per cent are operated by the owner. Where land is rented the share system and cash rental are about equally represented. The average value of land in the county in 1910 was $65.18 an acre, which is an increase of 35.8 per cent over the value in 1900. Of the total value of all farm property, 63.3 per cent is represented by the land, 22.1 per cent by the buildings, 3.6 per cent by implements and machinery, and 11 per cent by farm animals, including poultry, etc.

While the methods of farming followed, the crops grown, and the types of agriculture practiced are fairly well adapted to present conditions, there are nevertheless a number of lines along which improvement could well be made.

As natural conditions in the county are well suited to dairying, this industry, which is already very important, could well be extended to greater proportions. Some of the soil types will respond very well to applications of rock phosphate. Erosion should be prevented wherever possible and the methods of cropping and cultivation should be altered where necessary to keep the steep portions of fields from washing.

The trucking industry could be extended with profit, especially on the sandy soils of the county. The orchard should be given attention and every farm should have enough of the different kinds of fruit to supply the home. The drainage of low-lying land in the county, including the Peat marshes, would add greatly to the tillable area of productive soils. Many of these tracts could be readily drained at comparatively small cost and when properly managed would prove very profitable.

CHAPTER IX.

CLIMATE.*

"Among the factors which influence the agriculture of a state none is more important than climate. The class of crops which can be grown is largely determined by the length of the growing season, and the amount and distribution of the rainfall." Any one of these factors may determine the type of farming which can be followed to best advantage.

"The distribution of rainfall over Wisconsin is remarkably uniform, the average yearly precipitation having a range of from 28 to 34 inches, while the mean for the state as a whole is 31 inches. This is a slightly heavier rainfall than is received by eastern England, northern France, most of Germany, and Sweden. As compared with other portions of this country, Wisconsin has a total rainfall equaling that of central Oklahoma and Kansas, northern Iowa, Michigan, Northwestern New York, or the Puget Sound Basin of Washington. But owing to its northerly location, the lessened evaporation probably makes the precipitation as effective as that of Arkansas, Illinois, or Virginia."

The local distribution of rainfall varies, however, from year to year, some sections receiving more rain one year, and other sections more in other years. The variation is caused largely by the movement of cyclonic storms. The average rainfall for the entire state during the driest year was 21.4 inches, and for the wettest year 37 inches.

"Of equal importance, in agriculture, to the total rainfall, is its seasonal distribution, and in this respect Wisconsin is unusually fortunate, since about half of the total rainfall comes in May, June, July, and August, and nearly 70% from April to September, inclusive. June has the heaviest rainfall, averaging 4.1 inches, while July averages 4 inches and May 3.9 inches. The precipitation during the winter, on the other hand, is slight; December, January, and February each averaging from 1 to 1.5 inches of rain and melted snow. The average rainfall for the state during winter is 3.9 inches, during spring 8.3 inches, during summer 11.4 inches and during

* This chapter has been taken largely from Wisconsin Bulletin 223 on The Climate of Wisconsin and its Relation to Agriculture. This bulletin should be consulted if more information is desired concerning climate. All quotations indicated are taken from this bulletin.

autumn 7.4 inches. Most of the rainfall occurs just preceding and during the period of plant growth, thus being received by the crop at the most effective time. Wisconsin receives during the growing season, April to September, inclusive, an average of 21 inches of precipitation, which is as much rain as that received during the same months by eastern Texas, Illinois, Ohio, or eastern New York. The small winter precipitation in Wisconsin, mostly in the form of snow, on the other hand, causes virtually no leaching of fertility from the soil, or erosion."

Another phase of rainfall distribution of great importance is its variation within a period of a few weeks. Frequently periods of drought and periods of unusually heavy rainfall occur, continuing for one to four weeks and occasionally longer. Obesrvations taken at Madison by the Weather Bureau over a period of 30 years from 1882 to 1911, inclusive, show that there are on the average three ten day periods during each growing season when the amount of rainfall is so slight that crops on a reasonably heavy soil (Miami silt loam) actually suffer from the lack of mositure. In Jefferson County the conditions are practically the same.

The following table gives the records of the United States Weather Bureau station located at Lake Mills, Jefferson County, the observations covering a period of 19 years. The station has an elevation above sea level of 897 feet. The date may be considered as fairly representative for the county.

Normal, monthly, seasonal, and annual temperature and precipitation at Lake Mills.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for driest year.	Total amount for wettest year.
	F.	*F.*	*F.*	*Inches.*	*Inches.*	*Inches.*
Deecmber	22.6	55	—19	1.73	1.21	1.67
January	18.4	57	—27	1.55	1.09	1.08
February	18.8	59	—24	1.25	.88	1.46
Winter	19.9			4.53	3.18	4.21
March	32.1	78	— 4	2.18	2.75	2.07
April	45.7	87	14	3.06	.71	2.40
May	57.0	90	24	4.15	2.96	6.98
Spring	44.9			9.39	6.42	11.45
June	66.6	99	32	4.14	1.75	5.66
July	71.2	107	41	4.09	1.37	5.53
August	69.2	99	41	3.54	1.02	5.33
Summer	69.0			11.77	4.14	16.52
September	62.4	96	24	3.19	3.49	3.02
October	49.7	90	10	2.17	2.77	4.34
November	34.7	69	— 3	2.11	.78	3.06
Fall	48.9			7.47	7.04	10.42
Year	45.7	107	—27	33.16	20.78	42.60

It will be seen from this table that the mean annual precipitation is 33.16 inches and that the greater proportion of this is normally distributed throughout the growing season, when most needed. During the months of April, May, June, July, August, and September there is over 3 inches each month, and during May, June, July, and August there is a normal rainfall of over 3.5 inches. The period of greatest variation in the rainfall is during June, July, and August. The normal for this period is 11.77 inches, while the amount during the driest year was 4.14 inches and the amount during the wettest year was 16.52 inches. Extremes of this nature seldom occur, but it is quite common to have a dry spell in July or August, or for a part of both months, during which crops suffer from lack of moisture. On account of the uneven topography over a portion of the county and the large amount of gravel and sand in the subsoil, some of the types are naturally droughty, and during dry seasons crops on such soils suffer.

The average snowfall is 32.9 inches, and under normal conditions crops of winter wheat, rye, clover, and alfalfa are well protected by a covering of snow. When the snowfall is light and the surface of the ground is exposed such crops are frequently damaged by freezing and thawing.

The lowest temperature recorded is −27° F. and the highest 107° F., with a mean annual temperature of 45.7° F. Such extremes, however, are infrequent and of short duration. The records at Lake Mills indicate that the average date of the first killing frost in the fall is October 15, and the last in the spring, April 23, with the earliest recorded in the fall, September 20, and the latest in the spring, June 12. This gives a growing season of 175 days. The records at Watertown, Jefferson County, which is but 14 miles northeast of Lake Mills, indicate that the growing season has a length of 168 days. In this connection the following is extracted from Bulletin 223 of the Wisconsin Agricultural Experiment Station on "The Climate of Wisconsin and its Relation to Agriculture." The bulletin divides Wisconsin into 8 climatic divisions and Jefferson County is included in what is called "The Rock River Basin." "This section has the longest growing season in the State, averaging about 170 days, which is as long as that of centeal Illinois, longer than central Indiana or Ohio, and about equal to the valley of Virginia and central Maryland. The annual temperature curves also show here a northward bend and though the winterrs (20°) are cooler than along the lake, the spring (45°) and summers (70°) are warmer. Hence this section is the best corn area in the State. The temperature of the Rock River Basin in summer is similar to that of northern

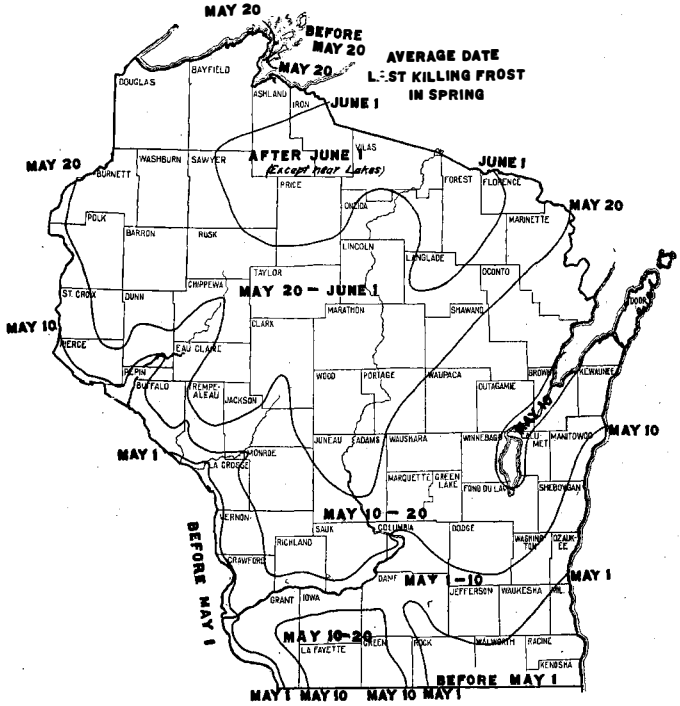


FIGURE 2. LAST KILLING FROST IN SPRING

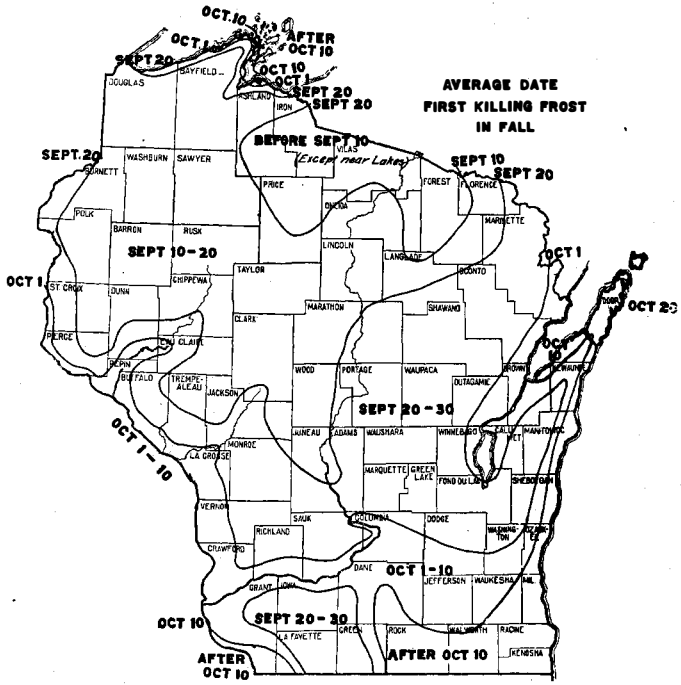


FIGURE 3. FIRST KILLING FROST IN FALL

These maps have been prepared from the original monthly reports of the observers of the U. S. Weather Bureau covering 12 years, supplemented by private records.

Illinois, Indiana, Ohio, and southeastern Pennsylvania, while in winter it resembles southern Vermont, northern Iowa, or southern Montana. During seven summer days, on the average, the thermometer may go as high as 90° and during five winter mornings fall to 10° below or lower."

Figures 2 and 3 show the average dates of the last killing frosts in the spring, and the first killing frosts in the fall. From the data given on these two maps the approximate length of growing season for any portion of the State may be readily determined.

The prevailing winds during the winter are from the west and north and during the summer from the west and south. This region is seldom visited by storms of a destructive character, though high winds are quite common during March. The climate is healthful, and especially delightful during the summer months. The water supply is abundant and of very good quality.

SUMMARY

Jefferson County is located in the southeastern part of Wisconsin and comprises an area of 570 square miles, or 364,800 acres. It lies within the glaciated limestone region and the surface varies from level to rolling and hilly. Peat marshes and other low-lying, poorly drained tracts are numerous. The upland section of the county is well settled, highly improved, and forms a part of the most highly developed agricultural region of Wisconsin.

The area is well supplied with transportation facilities and no point in the county is over 7 miles from a railroad.

The soils of the county are all of glacial or hydroglacial origin. They have been classified into 7 series including 23 soil types and several phases. In addition extensive areas of Peat (with included areas of Muck) have been mapped.

The Miami soils form the most important agricultural sections of the county. They consist of light-colored glacial material with which limestone is associated. The silt loam, loam, and fine sandy loam types are extensive and form good general farming soils. The gravelly sandy loam and fine sand are types of small extent.

The Fox series is of smaller extent and of less importance than the Miami. It includes the light-colored material occupying overwash plains, terraces, and filled-in valleys within the limestone region. The types mapped are the silt loam, loam, and fine sandy loam.

The Plainfield series includes light colored material occupying overwash plains, or stream terraces where there is no limestone present, or only such a small amount as to have no appreciable influence on the agricultural value of the soil. It differs from the Fox series in this one respect. The types mapped are Plainfield sand and fine sand.

The Rodman series includes light-colored assorted glacial material, chiefly in the form of kames and eskers. The soils are inextensive and have a low agriculture value. The types mapped were the gravelly sandy loam, fine sandy loam, fine sand, and gravel.

The Carrington series includes the dark-colored prairie soils in the glaciated limestone region. The series is of very small extent in this survey, though it is extensively developed in bordering counties. The silt loam, loam, and fine sandy loam were recognized.

The Waukesha series includes dark-colored outwash material and is represented by but one type, the loam, which is of very limited extent.

The Clyde series occupies old lake beds and poorly drained depressions and is characterized by a dark color and a high content of organic matter, though not sufficient to form Peat or Muck. When drained the soils make very productive land. The clay loam, silt loam, loam, sandy loam, and fine sandy loam were mapped.

Peat (with included areas of Muck) is composed of vegetable matter in varying stages of decomposition which has accumulated in old lake beds and poorly drained areas. Very large areas occur in this county, though the type has not been improved to any extent. When drained it can be made to yield profitable returns.

The type of agriculture consists of general farming in conjunction with dairying, which is highly developed in the county. The crops grown are hay, oats, corn, alfalfa, barley, rye, with some wheat, buckwheat, potatoes, sugar beets, peas, sweet corn, sorghum, melons, and cucumbers. The fruit industry is not developed on a commercial scale, though there are numerous small orchards which supply the home. Hogs are raised quite extensively in conjunction with dairying, but the raising of beef cattle and sheep is not given very much attention.

Crop rotations differ somewhat in various parts of the county, depending upon the character of the soil, drainage conditions, and the type of farming followed. In general it may be said that the rotations followed and the methods of cultivation practiced are fairly well adapted to present conditions.

Of all of the land in the survey 94.9 per cent is in farms, and of this 94.9 per cent is improved. There are 3,356 farms in the county with an average size of 100 acres. Of all farms 79.9 per cent are operated by the owners.

The mean annual precipitation is 33.16 inches and the mean temperature 45.7°. The length of the growing season ranges from 165 to 175 days, and all crops common to Wisconsin can be grown successfully. There is an average snowfall of 32.9 inches, forming protection for such crops as rye, wheat, clover, and alfalfa during the winter months, when the weather is severe. There is an abundant supply of good water in all parts of the county.

KEEP THE MAP

The Experiment Station will publish bulletins from time to time dealing with the management of the different types mapped, so that some way should be found by each person receiving a copy of this report to keep the map permanently. If the map is folded in such a way as to have the part you are interested in of a convenient size, and then have a simple frame with glass made to hold it, it can be kept indefinitely. Since some of the colors fade after being exposed to strong light for a long time, it would be a good plan to have a protecting flap of dark cloth over the map when not in use.