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WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

W. O. HOTCHKISS, Director and State Geologist
A. R. WHITSON, In Charge Division of Soils

SOIL SURVEY IN COOPERATION WITH THE COLLEGE OF AGRICULTURE
H. L. RUSSELL, Dean
University of Wisconsin

BULLETIN NO. 61D SOIL SERIES NO. 42

SOIL SURVEY

OF

ADAMS COUNTY

WISCONSIN

BY

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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 cooperation 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 conditins 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 dunes 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 Between 20–50% 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 a "soil series." It corresponds to the family which is made up of different individuals having the same parentage. The Miami series, for

example, 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 with heavy type predominating. The Plainfield series includes light colored soils in regions where no limestone is present, and where the material occurs as outwashed plains or stream terraces. The soils in this series also have a wide range in texture but sandy types predominate. 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.

SOIL SURVEY OF ADAMS COUNTY, WISCONSIN

CHAPTER I.

DESCRIPTION OF THE AREA

Location.—Adams County is situated a little south of the center of Wisconsin and borders the east side of the Wisconsin River.

The county comprises an area of 670 square miles or 428,800 acres; it is elongated in shape, being about 42 miles in length from north to south and varying in width from 10–20 miles east and west.

Topography.—The general topography or lay of the land in this county may be briefly described as being a plain with sandstone mounds projecting above the general level. A strip six or seven miles wide along the east side in the south half of the county is undulating to rolling. The southeastern corner of the county is set off by a glacial moraine or low ridge known as the "divide." The land to the eastward is undulating to hilly and the streams flow east and southeastward. Westward form this divide the topography is essentially an extensive level sandy plain interspersed with marshes and occasional sandstone mounds projecting from 100 to 300 feet above the plain.

Besides the mounds, the level surface is varied by the stream bottoms which cross it and by the action of the wind on parts of the sandy soil, producing a dune-like or hilly topography especially in parts of Townships 19 and 20 North, Ranges 5 and 6 East, in the Northwest part of the county. Several terrace levels in the northwest corner near the Wisconsin River having differences of level of 20 to 80 feet, break up the level character of the plain. The terrace slopes are abrupt and steep and give the impression of a range of hills in places.

Bordering the river are level bottom lands, from one half to two miles in width which are subject to flooding in spring and fall. Sloughs, marshes, channels, and a few lakes are found and numerous springs issue from the edge of the highland and supply small streams flowing across the bottom lands.

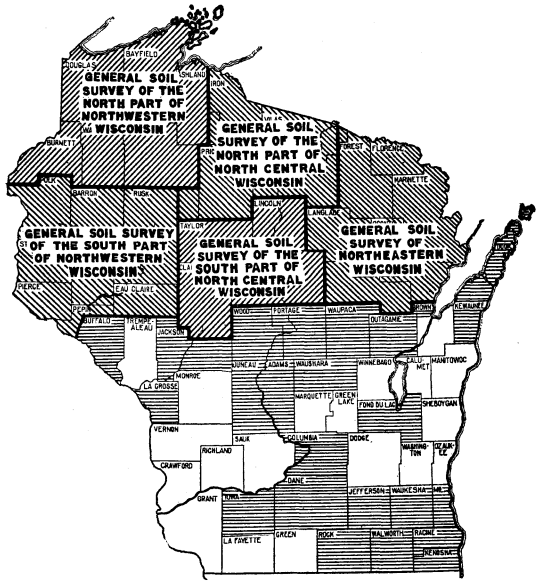

FIG. 1. SKETCH MAP SHOWING AREAS SURVEYED IN THE STATE.

Elevations.—The highest elevations are in the north end of the county and the lowest in the south end. Railroad elevations at various places near the borders or in the county are as follows:

North End	Central	South End
Nekoosa----------975 feet Plainfield----------1108 feet	Arkdale--------919 feet Adams---------956 feet Grand Marsh--1010 feet	Brooks----------954 feet Kilbourn---------893 feet

Thus the general slope is about 1.3 ft. per mile from north to south along the river, about 10 or 15 feet per mile east and southward from the moraine and 7 to 8 feet per mile westward from the divide moraine in the southeastern part of the county.

Regional Drainage.—The drainage of Adams county is controlled by the Wisconsin river on the west side and its tributary creeks flowing mainly from east to west across the area. Four-

teen mile Creek in the north end, Big and Little Roche-a-Cri creeks in the central part, and White Creek and Neenah Creek in the southern and eastern parts are the main tributaries. The largest areas of undrained lands are found in the northeast corner of the county and back of the moraine along the east side of the county. Water power is developed on the Wisconsin River at Nekoosa near the north end, and at Kilbourn near the south end of Adams county. There are feed mills and power plants on some of the tributary streams also; namely at Friendship, White Creek, Easton, Briggsville, Arkdale, and New Rome.

Settlement.—Adams county was organized in 1858 from a part of Portage County. The first settlement was a post or store for the accommodation of travelers and to furnish supplies to lumber camps in the vicinity. The post called Walsworth Tavern, was located two miles from Big Springs. The first land was farmed in 1844 and 1845. Friendship, the county seat, was first settled in 1856 by people from a town of the same name in New York state. Most of the settlers were from eastern states and many of their descendants are still residents. People of Irish, Norwegian and German descent are found in various parts of the county. A settlement of Bohemians is located in the Northwest part in the town of Rome. Norwegians are found in Strongs Prairie Township and around Niebull in Big Flats township.

The most thickly populated parts of the county are along the east edge, in the southwest corner, and on the west side bordering the river in the regions of the best soils. The total population of the county was 8,604 in 1910 and in 1920 it was 9,287. Friendship, the county seat, had less than 500 people in 1920. Large areas of the interior of the county are practically undeveloped or very sparsely settled so that the average population per square mile (12.6) is small.

Towns.—The county seat is Friendship with a population of 442 in 1920. Adams, a new town on the C. & N. W. R. R. one mile south of Friendship has a population of 1,119. Other small inland towns having a population of 100 or less are Plainville, Easton, White Creek, Arkdale, Monroe Center, and Davis Corners. Grand Marsh and Brooks are located on the railroad in the eastern part of the county.

Transportation.—Adams county has but one railroad line, the so-called short line of the C. & N. W. Railway between Milwau-

kee and La Crosse. This railroad crosses the south half of the county in a northwest-southeast direction. The county is in the main well supplied with roads, even in the undeveloped sections. The majority of the roads are made from the material at hand—sand and shale and clay. Several highways of the State Trunk Highway system cross parts of the county and these roads are regularly patrolled and improved to a higher degree than the average. Many of the sand roads remain fairly good all season but where there is much travel in dry weather these unsurfaced roads become difficult.

Highway No. 13 from Kilbourn to Nekoosa passes through Friendship and traverses the entire length of the county north and south. Highway No. 29 crosses part of the south end of the county east and west; No. 21 crosses the center, and No. 73 crosses the north end. Telephone service is maintained in nearly all developed parts of the county.

Markets.—Before the entrance of the railroad, a few years ago, all the products of Adams county were marketed through towns in the adjoining counties. Dairy products and stock are shipped from Kilbourn, Necedah, Adams, Grand Marsh, Brooks and Hancock to Chicago and other points. Potatoes are shipped from Arkdale, Kilbourn and Necedah. Most of the grain and hay are fed to stock and but little grain except rye is shipped.

SOILS

In a Geological division of the soils of Adams County, based on the underlying rocks, there would be but one division, since this county is underlaid by but one kind of rock, namely, sandstone. But the soils have been subject to so many influences other than the processes of weathering which produce soils from the rocks which they overlie, that perhaps very little of the present soil was formed in the place it now occupies, and much of the soil came from other sources than that of the Potsdam Sandstone which underlies it.

A brief summary of these influences in their approximate order of occurrence is as follows:

At one time the general surface of the county was at a much higher elevation than now. This surface was worn down from a level as high or higher than the top of Friendship Mound, 310 feet, by processes of weathering and erosion, the softer products

View from moraine north of Coloma looking west across Adams County.

being carried away by streams, and the present mounds are remnants of the former level, protected by more resistant layers in the sandstone. Subsequently, during the glacial period, the Green Bay lobe of the continental glacier advanced to the eastern edge of Adams county. The drainage waters were intercepted by the ice sheet and for a period part of the county was covered by glacial Lake Wisconsin, on the bed of which sediments were deposited among which is a reddish calcareous clay. This is thought to underlie much of the county since beds of it are revealed in some gullies which streams have cut in the former lake bed. Many well records also show this clay to be present but the depth is often so great as to be of no practical agricultural significance.

Great quantities of sands and gravel were deposited also by streams from the melting ice, forming a wide, level sandy plain interspersed with marshes and covering most of the county from the moraine on the east to the Wisconsin River on the west. Later the sand was drifted and piled by winds and fine dust soils were drifted into the southwestern part of the county by the same agency. Peat, and black soil of the Dunning series accumulated in the undrained parts of the old lake bed and formed the extensive marshes found there.

The series or families of soils which have been mapped in Adams County include the following:

The Coloma series includes the light-colored timbered soils within the glaciated region where the soil material has been derived largely from sandstone and contains so little limestone that it has little or no appreciable influence on the agricultural value of the soil. The sandy members of the family are most extensive and the heavy members limited in extent. Both soil and subsoil are usually acid.

The Plainfield series includes the light-colored, timbered soils occurring as sandy plains of outwash material, or terraces of level soil deposited by rivers or lakes, where the material contains not enough limestone to affect the agricultural value of the soils. The sandy members of this series also are much the most extensive and the heavier members are found on the terraces where water has mixed in slight amounts of silt or clay. Both surface and subsoil are generally acid.

The Superior series includes lacustrine (water deposited) material. The clay composing the subsoil is reddish or pink in

color and calcareous. The surface material on the clay has been blown on by wind, washed over by water or mixed in by the ice. The soils are level except where glacial ice has over-run them, where they are generally undulating to gently rolling.

The Knox series includes light-colored timbered soils in the unglaciated region where the surface soil material has been deposited by wind. The deep subsoil is largely residual. The surface may be nearly level, rolling, or hilly, depending on the topography of the land over which the soil has been spread. The surface soil is usually slightly acid.

The Boone series includes light-colored timbered soils where the material is derived from the weathering of sandstone. In places, this has been mixed slightly with wind blown material. Soil and subsoil are acid.

The Genesee series includes light-colored timbered soils of alluvial (water laid) origin and is confined to the present flood plain of the streams along which they occur. It includes such material in both glaciated and unglaciated regions.

The Poygan series includes the dark colored poorly drained soils associated with the Superior series and usually having a red clay subsoil. Heavy soil predominates.

The Dunning series includes dark-colored low-lying soils in the non-limestone regions. The soils occupy old lake beds and marsh borders and are acid. The sandy types are most extensive. Where heavy soils of this nature occur they are classed with the Whitman series.

The Waukesha series includes dark-colored soils, usually prairie, occurring as outwash (water-laid) plains, stream terraces or filled valleys. The subsoil consists of layers of sand and gravel and the soils are well drained, and usually strongly acid.

Peat includes organic soil derived from moisture loving plants in various stages of decomposition. The proportion of mineral matter in the peat varies from less than ten up to fifty per cent. It is poorly drained land, and the peat layer varies from one to ten feet or more in depth.

MECHANICAL ANALYSIS OF A FEW ADAMS COUNTY SOILS

No.	Type	Fine Gravel	Coarse Sand	Med. Sand	Fine Sand	Very Fine Sand	Silt	Clay
		%	%	%	%	%	%	%
1436A*	Plainfield	.02	3.7	17.7	57.6	12.1	5.2	3.6
B	(Fine) Sand	.08	3.9	19.6	58.2	10.7	3.8	3.3
C		.09	4.8	21.5	57.6	9.8	3.0	2.9
1432A	Coloma	.08	4.7	14.6	63.0	10.0	3.8	3.6
B	(Fine) Sand	.2	5.9	16.2	61.6	9.4	3.1	3.4
C		.1	5.2	17.9	68.4	6.8	.7	1.2
1422A	Superior	.1	1.3	1.7	5.7	11.4	52.0	27.3
B	Silt Loam	.0	.4	.6	3.4	11.1	32.5	52.5
C		.0	.1	.4	4.4	13.4	29.3	53.2
1424A	Superior	.3	5.2	7.9	17.7	17.2	36.2	14.9
B	Clay Loam	.4	6.6	9.5	19.5	14.4	25.2	24.3
C		.1	2.0	3.0	5.8	7.3	37.7	44.4
1434A	Superior	.09	3.0	7.2	14.0	50.6	18.3	5.4
B	Sandy	.00	1.0	2.8	7.6	60.4	20.8	6.4
C	Loam	.00	1.3	3.7	11.0	65.8	12.2	5.7
1435A	Waukesha	.3	13.5	28.9	36.3	8.7	6.0	5.8
B	Sand	.4	12.7	25.5	39.2	8.5	6.5	5.3
C		.8	16.7	34.6	35.1	5.4	4.4	3.1

*A— 0— 8 inches surface.
B— 8—24 inches subsurface.
C—24—48 inches subsoil.

The following table shows the area of different soils in Adams County.

SOIL TYPES OF ADAMS COUNTY.

GROUP OF HEAVY SOILS

	Area in acres	%
Knox silt loam	2,496	.6
Superior silt loam	5,632	1.3
Miama silt loam	1,344	.3

GROUP OF FINE SANDY LOAMS

Superior sandy loam	10,196	2.4
Coloma fine sandy loam	7,360	1.9
Gravelly phase	576	
Boone fine sandy loam	1,216	0.3
Waukesha fine sandy loam	2,816	0.6

SOIL TYPES OF ADAMS COUNTY—Continued

GROUP OF SANDY SOILS

	Area in acres	%
Waukesha sand	6,784	1.6
Coloma fine sand	35,776	8.4
Boone fine sand	8,192	1.9
Plainfield sandy loam	9,024	2.1
Plainfield sand	205,312	47.9
Plainfield sand, rolling phase	32,832	7.6

GROUP OF POORLY DRAINED SOILS

Dunning sandy loam	42,880	9.9
Genesee fine sandy loam	16,640	3.9
Poygan clay loam	3,136	0.7
Peat	28,480)	7.8
Peat, shallow phase	4,672)	
Rough stony land	3,456	0.8
Total	428,800	

CHAPTER II.

GROUP OF HEAVY SOILS

Superior Silt Loam

Description. The Superior silt loam consists of grayish or yellowish brown silt loam eight to sixteen inches deep overlying pink or red heavy clay. This type of soil is found chiefly in the southeastern part of the county about Mason and Jordan lakes.

Topography. It occupies nearly level to gently rolling topography. Much of it occurs on gently undulating slopes midway between the Coloma soils of the hills and knolls, and the level or low-lying Poygan soils of the lower slopes, stream margins, and flats.

Drainage. The drainage of this soil is generally good on account of its undulating surface and is more easily worked than a clay loam because of the more silty character of the surface soil. Where nearly level, places are sometimes insufficiently drained, the drainage as a whole is very fair on this type despite its heavy subsoil.

*Present Agricultural Development.** While this soil covers only a few square miles in area, it is one of the best types in the county. The greater proportion of it is under cultivation, the small wooded areas consisting of large trees including oak, hickory, elm, and a few maple and basswood.

The important crops grown on this soil are hay, clover, oats, corn, barley, and some wheat. Dairying is the prevailing type of farming, and this soil is well fitted for dairying because it produces good pasture, clover, grains, and corn. Alfalfa can also be grown successfully.

Yields of corn are 50 to 60 bushels per acre; oats, 40 to 50 bushels; wheat, 25 to 30 bushels. Good barley is also grown. Red clover and alsike clover particularly do well. This soil is better grain and hay land than the adjacent Coloma fine sandy loam, but not quite such good corn land. The silt loam is also

* For a discussion of methods of improvement, see page 24.

earlier and more easily worked soil than the heavy phases in the same locality. The best farms bring $75 to $125 per acre.

Superior Silt Loam,* Heavy Phase

This soil is a grayish brown silty clay loam 2 to 4 inches deep overlying reddish silty clay loam with red clay at 8 or 9 inches. This red clay extends below four feet, some well records showing that it extends to depths of 16 to 50 feet or more.

The Superior silt loam, heavy phase, is found only in the southeastern corner of the county in the towns of New Haven and Jackson. This type of soil covers a total area of two or three square miles. It occurs as level or flat to very gently sloping areas bordering Mason Lake and a number of the tributary streams and valleys which drain into it. The topography being level or nearly so, and because the very heavy compact subsoil prevents the rapid downward movement of water, the drainage is frequently deficient.

A large part of the soil is used for pasture or is timber land, and its value could be greatly increased by tile draining portions of it. However, a large part also is cultivated and good crops of oats, clover, alsike, timothy, wheat, barley, and corn are produced.

Numerous springs issue at the upper edges of this type where it joins the more rolling topography and streams of fine spring water cross the farms in this vicinity. Dairying and general farming are practiced. Yields of hay, 2 tons; oats, 40 to 60 bushels; wheat, 30 bushels; barley, 35 to 40 bushels, are reported on this soil. The flat portions are somewhat late and cold and do not produce as good corn, potatoes, or barley as where the land is better drained. Farms in this vicinity sell for $75 to $125 per acre.

Knox Silt Loam

Description. The surface soil to a depth of 7 or 8 inches is a grayish brown friable silt loam on light yellowish brown compact silt loam which changes to compact yellowish brown silty clay loam at 30 to 36 inches. In the level phase of this soil the heavy subsoil continues below four feet, but in the more rolling

* Because of its small extent, this soil has been combined with the Superior silt loam on the soil map.

areas, more or less fine sand and sandstone fragments are found below two to three feet. In some rolling areas, small sandstone fragments occur also on the surface.

Extent and Distribution. The Knox silt loam occurs in isolated patches forming a more or less continuous strip along the Wisconsin River from White Creek southward for about 15 miles to the south boundary of the county.

Topography. The major part of this soil is nearly level in topography, about 200 acres only having undulating to rolling surface.

Drainage. Although nearly level, the drainage of this soil is usually good. The rolling areas are somewhat subject to erosion so that more of this phase is timbered (oak, poplar, and pine), while practically all the level and undulating portions are under cultivation.

Origin. Some of this soil is of wind origin, consisting of fine dust deposits brought in from the southwest by winds which spread the blanket of dust over sandstone hills and level older alluvial deposits alike. In Section 13, T. 15, R. 5, the silt lies but 10 to 15 feet above the river bottoms and may be of more directly alluvial origin, but since there is such a small amount of the silt thus located, it is correlated with the Knox soil since its agricultural character is the same. Some of the Knox silt loam is situated on elevated level areas above the river and is doubtless underlaid by old lake bottom and terraces, at least in part. The sandy portion of the deep subsoil doubtless came from the underlying sandstone rock and some of the silt may have been derived from a shale phase of sandstone.

*Present Agricultural Development.** The Knox silt loam is not extensive, since it totals not more than five square miles of areas, but it is one of the best soils in the county. Good grain, hay, clover, and corn are grown. Pasture is good and alfalfa can be grown with the aid of lime. Dairying is practiced and a few excellent well bred herds are maintained. Some smaller farms are run in connection with the hotels and summer resorts at the Dells along the river, supplying them with farm products.

Where too rolling, the soil is subject to erosion and where the silty deposit is thin, the soil dries out rather easily. However, these conditions do not represent any very large part of the soil

* For a discussion of the chemical composition and improvement of this soil see page 24.

in this county. Yields of oats, 40 to 50 bushels; corn, 30 to 50 bushels; and wheat, 25 to 30 bushels; are reported.

Barnyard manure is the only fertilizer in general use, and except for a few experiments with lime and phosphorus, commercial feltilizers are not in use. The best farms on this soil are held as high as $125 to $150 per acre.

Miama Silt Loam

This soil is a light brown or grayish friable silt loam six or eight inches deep over a compact yellowish brown silt loam containing a few gravel stones. The subsoil becomes a dark yellowish brown silty clay loam at 20 to 24 inches which extends to a sandy gravelly loam at 30 to 36 inches or below the reach of a 40-inch auger. Scattered bowlders and small stones are found on the surface.

The silt loam is found in one single area lying mainly in Sections 28, 29, and 33, T. 14N., R. 7E., in the southeastern corner of the county.

It is gently undulating land with just sufficient surface variation so that the drainage is good.

It is practically all farm land and highly valuable. Its extent is not great, totaling about one square mile in area. The original timber growth was heavy, consisting of large white, red, and black oak, and a few hickory and maple.

Dairying is practiced in this section. Cream is sold in Kilbourn and Briggsville. Hay, corn, small grain, and potatoes are grown.

Yields of oats, 60 bushels; barley, 40 bushels; corn, 50 bushels; and potatoes, 150 bushels, per acre are reported.

Land in this vicinity sells for $100 to $150 per acre (improved farms).

Chemical Composition and Improvement of the Heavy Soils

The heavy soils have a good supply of plant food, the Miami and Superior soils having somewhat greater supplies of potassium and also of calcium (lime) than the Knox soils. The average amount of phosphorus is quite uniform in all these

heavy soils. Nitrogen supply is somewhat greater in the Miami and Superior than in the Knox soils also.

Average Composition of the Silt Loam Soils in Pounds per Acre

	Calcium	Nitrogen	Phosphorus	Potassium
Knox silt loam	1,980	2,400	1,020	35,600
Superior silt loam	52,060	2,960	1,040	49,000
Miami Silt Loam	9,940	2,940	1,120	43,200

Nitrogen and Organic Matter. The light colored soils always have less amounts of these elements of plant food than the dark colored ones. They can best be added to any soil by growing and plowing under green crops of clover, alfalfa, soybeans, or even rye. Organic matter added to soil helps to prevent erosion on slopes, increases the water-holding capacity, thus giving crops more moisture, and enlarges the leaf and stem growth of plants, giving larger straw on the grain crops and improved yields of silage and corn.

Acidity and Liming. While the Miami and Superior soils were originally well supplied with calcium or lime, in places this calcium has been removed from the surface soil by leaching and cropping and it is much harder to grow clover or alfalfa now than when the soil was new. The use of two tons of ground limestone or four tons of marl to the acre will add the necessary lime.

Phosphorus. The supply of phosphorus is medium to fair in these soils but these being the heavier soils on the farms in the south end of the county, have been cropped to grain more heavily than the lighter soils and in many fields these soils do not produce as good grain as formerly.

Small applications of phosphate fertilizer with the manure will pay where the grain is not doing well. Lodged grain or light yield may be due to lack of mineral plant food or to an unbalanced ratio of the food elements and addition of lime and small amounts of phosphorus often helps to remedy these conditions. Of course if the crop conditions are due to drought or lack of drainage, the addition of plant food could not be expected to remedy the situation.

Potassium. These soils are well supplied with this element of plant food and in most cases staple crops probably would not show any results from the application of potash fertilizers.

Crops. The Knox silt loam is best adapted to grain and pasture crops and fairly so to corn. The Superior soils, while more difficult to cultivate, are also strong grain, especially wheat and barley soils and good hay and pasture soils. Good grain, corn, and clover crops are grown on the Miami silt loam.

Apples, berries and many fruits do well on the Knox silt loam. Apples also like the limey Superior soils, but good orchard sites are less numerous than on the Knox soils.

CHAPTER III

GROUP OF FINE SANDY LOAM SOILS

Superior Sandy Loam†

Description. This type includes land with a sandy or loamy surface soil underlaid at three feet or less by a sticky clay subsoil. The soil consists of eight or ten inches of brown or grayish brown sand or fine sand to fine sandy loam over yellowish brown sand with compact sticky, red or mottled clay subsoil at from 24 to 30 inches below the surface. This clay subsoil extends below the reach of a four foot auger.

Extent and Distribution. The Superior Sandy Loam is found mainly in the townships of Strongs Prairie and Monroe, and in the southeastern part of the county. It occurs as level to flat areas interspersed with low winding wooded sandy ridges and knolls heaped up by the wind in the vicinity of Monroe Center, Arkdale, and Holmesville, to the west and northwest of Friendship. A few small areas are found near Easton to the south of Friendship also. This soil is not a very extensive one, the areas of it being scattered and irregular.

*Agricultural Development.** This is one of the more valued types of soil in the county. While the topography is level the drainage is generally good because of the open sandy surface soil. A few wet spots occur where the clay lies nearest the surface. It is one of the best potato and oats soils because of its warmth and workability and water-holding capacity. Corn, hay, clover, rye, and wheat also do well where the soil is well formed. Stock is more easily maintained and more manure is available where this soil abounds.

Yields of potatoes, 125 to 200 bushels; corn, 40 to 50 bushels; oats, 40 to 50 bushels; and wheat, 20 bushels per acre; were reported. While the surrounding sandy soils without a heavy sub-

† Because of its clay subsoil this sandy loam is grouped with the fine sandy loam soils.

* For a discussion of the chemical composition and methods of improvement of this soil see page 31.

soil are subject to drought, the presence of the clay subsoil layer is distinguishable by the larger plants and the greener color of the foliage in these parts of the fields.

On some farms, potatoes are not grown as extensively as formerly because of decreased yields and increasing trouble in securing good stands of clover. On such farms where not enough stock is kept, commercial fertilizers could be used to advantage. Small amounts are already used on some farms.

Coloma Fine Sandy Loam

Description. This soil is a light brown to grayish brown fine sandy loam, eight to ten inches deep, overlying a yellowish brown sticky loam or sandy clay loam at 8 to 10 inches below the surface. In places, the surface soil is a darker brown loam. This heavy subsoil may become a gravelly sandy loam or yellowish sand at 24 to 40 inches or may extend below the reach of a four-foot auger.

Scattered boulders are found on the surface, these being more numerous where the topography is rolling. (See Rolling Phase) but seldom sufficiently numerous to entirely prevent cultivation. This soil is confined to the eastern portion of the south half of the county on east side of the "Divide."

Topography. The topography is gently undulating to nearly level, the soil frequently occupying gentle slopes or saucer shaped flats while the surrounding crests of the knolls with more rolling surface are different soil. This soil is generally well drained, and most of it is cultivated and highly developed farm land. A small portion of this area includes knolls and ridges with rolling topography, which because of its small extent is shown with the same color on the map.

*Agricultural Development.** The timbered portions are covered with large white and black oak with some poplar, birch, and elm, or brush. The main crops grown are hay, small grain, corn, and some potatoes and wheat. Dairying and general farming are practiced. Milk, cream, potatoes, and some grain are sold in Kilbourn and Briggsville. Most of the corn and grain are fed on the farms, and a number of hogs and young stock are fattened. Timothy and clover do well and pasture can be maintained on this soil, which adapts it to these lines of farming.

* For a discussion of the chemical composition and methods of improvement see page 31.

Yields of potatoes, 100 to 150 bushels; rye, 15 to 20 bushels; corn, 35 to 40 bushels; oats, 40 to 50 bushels; and barley, 30 to 40 bushels, are reported. As compared with the Superior soils in this locality, it is reported that oats, potatoes, and barley do best on the fine sandy loam, while wheat and corn do better on the heavier soils.

Coloma Fine Sandy Loam

(Gravelly Phase)

This type of soil includes the rough, hilly, or very gravelly and stony land in the glaciated southeastern section of the county. The soil is variable in character, including fine sand and fine sandy loam, the major part being sandy. This land usually consists of sharp knolls, gravel ridges, or steep stony slopes of such a character that it cannot be cultivated and is used mainly for pasture and wood lot, most of the soil being covered with black and white oak timber and brush.

Besides its steep topography, the soil is generally sandy and subject to drought so that its general agricultural value is low. Very little of the land is or can be cultivated, but as it occurs in some of the best soil areas of the county, it affords a small amount of pasture. These gravelly knolls and ridges are not extensive, including a total area of only about one square mile.

Because of the small extent these areas are not given a separate color but are separated by means of gravel symbols over the Coloma fine sandy loam color on the map.

Waukesha Fine Sandy Loam

Description. This soil is a dark grayish brown to black fine sandy loam to loam. Eight to 12 inches deep on yellowish brown sandy loam, becoming yellowish brown sand at 16 to 30 inches and containing scattered gravel stones. The deeper subsoil is all sandy or gravelly. The surface layer is quite variable in texture, ranging from loamy fine sand to sandy loam and heavy fine sandy loam in very short distances.

Extent and Distribution. The Waukesha fine sandy loam is found on the terraces and outwash areas in the southeastern and the northwestern parts of the county. It is not an extensive soil, covering a total area of perhaps three square miles. It is found mainly in Dell Prairie and Strongs Prairie townships.

Topography. The topography is level with slight flats and knolls due to wind or water action. Because of the open subsoil, the drainage is generally good, although small flat spots occur where water stands after hard rains.

*Agricultural Development.** This soil is all under cultivation and there is practically no timber as the original vegetation was mainly prairie grass. A few oaks are found around the margin. The crops grown are mainly corn, rye, potatoes, clover, and oats. Yields of corn, 15 to 40 bushels; rye, 10 to 15 bushels; oats, 25 to 35 bushels; and potatoes, 80 to 140 bushels were reported. This soil responds to good care and the organic matter in it should be maintained by frequent seeding. This also aids greatly in its waterholding capacity since crops sometimes suffer for lack of moisture in dry seasons where this soil is run down.

Farms sell for from $25 to $75 per acre in the localities where this soil occurs.

Waukesha Fine Sandy Loam†

(Heavy Phase)

This soil consists of 12 to 14 inches of dark brown to black heavy loam on yellowish brown or chocolate heavy loam subsoil, which becomes a sandy gravelly loam in a few borings. The deeper subsoil becomes a gravelly sandy loam at 24 to 36 inches, which extends below four feet.

This soil is inextensive, the largest area of ½ square mile being located in Dell Prairie township on a part of the outwash area west of the glacial moraine or divide. The topography is level, the soil occupying slight flats or depressions which receive the surface water from surrounding land. Despite this, the soil is fairly well drained because of its open gravelly subsoil. It is fairly fertile soil and gives good yields. Yields of corn, 40 to 50 bushels; oats, 40 to 70 bushels; barley, 30 to 40 bushels; and good clover and timothy hay are reported.

Boone Fine Sandy Loam

This soil is not extensive. The surface soil consists of a brown to grayish brown fine sandy loam 8 to 10 inches in depth

* For a discussion of chemical composition and improvement see page 31.
† Because of its small extent this soil is combined with the Waukesha fine sandy loam and shown by the same color on the map.

on lighter yellowish brown fine sandy loam which grades into yellowish fine sand in the deeper subsoil. This soil is confined to the southwest part of the county where the wind blown silt has been spread over the sandstone or over the residual sandy soils. The fine sandy loam occupied an intermediate position between the residual fine sand and the windblown Knox silt loam.

The topography is generally undulating to rolling, including ridges and slopes. An exception to this is in Sections 30 and 31, T. 15 N., R. 6 E., where the surface is nearly level, the surface soil slightly darker than typical, and the drainage impeded to some extent by a subsoil layer of sticky mottled sandy clay loam overlying sandstone at 18 to 30 inches. Slight sandy knolls and flat wet spots with a considerable mixture of shaly sandstone slabs on the surface are found. This area should properly have been mapped as Vesper fine sandy loam and corresponds to that soil as described in other counties, but because of its small extent in this county, is combined with the Boone soils. Except for this area, the Boone fine sandy loam is well drained, the soil is practically all under cultivation, and fair crops of corn, oats, rye, hay, and potatoes are grown.

Composition and Improvement of the Fine Sandy Loam Soils

These soils lie midway between the heavy soils and the sandy soils in their fertility and agricultural value. Excepting in Dell Prairie and New Haven where there is a block of about 15 sq. miles of the medium soils, the fine sandy loams and loams cover only small scattered patches in the east and southern parts of the county.

These soils are lighter and more easily worked than the silt loams and while somewhat more subject to drought, are much better than the sandy soils because of their greater water-holding capacity and natural fertility. These soils average about 900 to 1,000 pounds of phosphorus, 1,500 to 2,000 lbs. of nitrogen, and 30,000 lbs, of potassium per acre 8 inches deep. The Waukesha fine sandy loam is darker colored than the other medium soils and has larger amounts of nitrogen and phosphorus than the others. The Superior fine sandy loam has a heavy clay subsoil which helps in retaining moisture so that these latter three are probably slightly the best soils of the group.

Owing to the ease with which they are cultivated and their open structure allowing the easy passage of air and water, these soils tend to lose their stores of organic matter and lime more rapidly than the heavier soils. Stable manure and plowing under green crops are important in keeping up fertility and the use of marl or ground limestone will help to restore the ability of the soils to produce clover and alfalfa.

The phosphorus content of these soils also is lower than that of the heavier soils and where the supply of manure is too limited, or where grain does not fill well, phosphorus fertilizer should be used to supplement the manure. Two to three hundred pounds per acre of acid phosphate are usually used on general crops and can be applied by hand, by means of a manure spreader or by a grain drill with fertilizer hopper or a corn planter with fertilizer attachment. Deposits of marl have been discovered in the southeastern part of Adams county where most of these soils are located.

CHAPTER IV.

GROUP OF SANDY SOILS

Waukesha Sand

Description. This soil consists of 12 to 14 inches of dark brown medium loamy sand on yellowish brown or chocolate brown sand. The subsoil is a yellow sand at 24 to 30 inches with considerable fine gravel at depths varying from 20 to 36 inches.

Extent and Distribution. The Waukesha sand occurs in places on the outwash plains bordering the glacial moraine or divide in the southeastern part of the county and on parts of the Wisconsin River terraces on the western border of the county in the towns of Quincy, Strongs Prairie, and Monroe. It is water deposited soil, laid down during overflow or lake-like conditions produced by the advance of the glacial ice and its subsequent melting and recession.

Topography. The topography is level with very little variation except where stream channels have cut across the terraces making shallow draws or ravines.

Drainage. Because of the open character of the subsoil and the sandy texture of the surface, this soil is always well drained and unless rains occur at regular intervals during the growing season, crops are liable to suffer because of lack of sufficient moisture.

Agricultural Development. The Waukesha sand is not an extensive soil occupying a total area of approximately 7 square miles. Most of the soil is cultivated although portions lie fallow nearly every season because not sufficient manure is produced to maintain fertility and profitable crops are often obtained only by fallowing the land. Very little of the soil has timber on it, the original vegetation having been mainly grass with scattered clumps of oaks and Jack pines. The most important crops grown are rye, corn, potatoes, and buckwheat.

Dairying is practiced by those farmers who have bottom lands

or marsh pasture land to supplement the sand in summer for pasture. Rye, potatoes, corn, and cream are the products sold. In Strongs Prairie potatoes were formerly grown even more extensively than at present. Potatoes are spoken of as being hard on the soil and are grown mainly on the newer pieces of land. Some of this land has been badly run down and the organic matter so depleted that the soil has begun to blow quite badly. Lanes or hedges of jack pines have been planted for protection from wind on a few farms.

But little fertilizer outside of a little barn manure is used. Some farmers seed down the land about two years out of five. Clover does fairly well and soy beans are being grown on a number of farms. Yields of rye, 7 to 10 bushels; corn, 25 to 40 bushels; potatoes, 80 to 150 bushels; buckwheat, 20 bushels; and oats on new ground, 25 to 30 bushels; are reported.*

Plainfield Sandy Loam

Description. This soil is very variable in texture, the surface soil changing from loamy sand to sandy loam or fine sandy loam within short distances. The grayish brown surface soil is from 6 to 10 inches deep over a yellowish sand or fine sand subsoil. In places a yellow, grayish, or mottled sticky layer 2 to 6 inches deep is found at 24 to 40 inches.

Extent and Distribution. This soil is confined to scattered strips or flats in the sandy plain where finer material has settled out from water in glacial times or which has been re-worked later by the Wisconsin River.

Topography. The surface is practically level. Slight knolls and flats occur, the soil being slightly more sandy on the knolls and heavier in the flats. Drainage is generally good, although water often stands in the flats in spring.

Agricultural Development.† Most of this soil is under cultivation. Portions lie fallow some years where the soil approaches a medium sand in texture, but crops on most of this soil look very good. Rye, corn, potatoes and hay are grown. On the heavier portions, yields of 30 to 50 bushels of corn; 15 bushels rye, 125 bushels potatoes; and 1½ tons of clover have been reported. The larger area in the town of Monroe is more

* For suggestions on the management of this type see page 40.
† For discussion on chemical composition and improvement of this soil see page 40.

This is a view of Coloma sand which is representative of the sandy moraine in the southeastern portion of Adams County. Where the surface is left bare the soil is often blown about by the wind.

subject to drought than the smaller strips and patches are and average yields are not as great. Pasture is more difficult to maintain also and some of the farms depend upon adjacent bottomland along the Wisconsin River for summer pasture. Fair clover, hay and pasture are produced on the heavier portions of this soil, and farms with a good proportion of this soil have often sold for 40 to 50 dollars per acre.

Coloma Sand

Description. This soil consists of from 8 to 10 inches of brown fine to medium sand on a subsoil of yellowish brown fine sand, which contains a few gravel stones at 24 to 30 inches. The deeper subsoil is generally yellowish fine sand, though white or reddish bands may occur.

Extent and Distinction. The Coloma sand is quite an extensive soil, occupying the major part of the glaciated southeast part of the county. It covers a total area of something over 50 square mile.

Topography. The topography is generally undulating to rolling with small areas which are quite hilly and others nearly level.

Because of the sandy character and undulating surface this soil is always well drained, and in dry seasons crops suffer considerably for want of sufficient moisture.

Agricultural Development. While a considerable part of this soil is cultivated, a large part also is still timbered or lies as fallow or abandoned fields. The timbered areas are large oak with scattered Jack pine or oak brush.

A larger part of the soil is cultivated in the southeast corner of the county where areas of heavier soil are intermixed with the fine sand, than to the north where the sand occurs in larger bodies.

Rye and corn are the chief crops. Potatoes are grown on a number of farms. Clover and oats are also grown on the better farmed places. There is considerable variation in the appearance of the crops and buildings on this soil, due largely to the quality of farming done and partly to slight variations in the value of the soil itself. Large boulders scattered over the land, or large sized oak trees with but few Jack pines are often indi-

cations of slightly better moisture and fertility conditions than average in the fine sand.

Yields of rye vary from 6 to 18 bushels (Average 12 to 14 bushels), oats from 15 to 30 bushels, corn from 11 to 30 bushels and potatoes from 80 to 100 bushels. General farming with but little clover and two or three cows is carried on by some of the farmers while others are able by better methods to have ten or more cows on the same amount of land. There is never enough manure produced so that it should be carefully conserved and applied, and clover should be grown in the rotation. A silo greatly increases the value of the corn crop for winter feed as compared with the too common method of feeding from the shocks which sometimes stand in the field till spring.

The selling price of land of the Coloma sand type varies from fifteen to fifty dollars per acre, depending upon location, improvements, and condition of the land. Undeveloped land may be had for less, while the average partly developed farm brings about $20 to $25 per acre.*

Boone Fine Sand

Description. This soil consists of grayish or light brown fine or medium sand overlying yellowish brown fine sand at six or eight inches. The subsoil, except for occasional sandstone fragments, is uniformly yellowish fine sand to a depth of three feet or more. The soil is found in the vicinity of sandstone outcrops and mounds which have not been overlaid by the deposits of glacial lake Wisconsin and the outwash from the margin of the glacier. While this soil is mainly derived from the decomposition of sandstone rock, in places it was difficult to decide whether the deeper fine sands were of this residual origin or lacustrine and wind blown materials, so that some such materials probably have been included, the agricultural value being practically indentical.

Extend and Distribution. The largest areas of this soil occur in the southwestern part of the county within a mile or two of the Wisconsin River, about the base of such sandstone bluffs as Rattlesnake Mound and Quincy Bluff in the township of Quincy, and on top of the flat-topped sandstone rid-

* For discussion of the management of this type of soil see page 40.

ges in the northeast corner of the town of Springville and the southeast corner of the town of Easton.

Topography. The surface of the soil varies from nearly level or gently undulating to rolling. The rolling topography is confined to the slopes surrounding some of the mounds. The surface and under-drainage of this soil is good, and because of its open character, crops are likely to lack sufficient moisture in dry spells.

Agricultural Development. This soil is not an extensive one totalling perhaps 10 or 12 square miles in area. A large part has never been cleared, especially the undulating to rolling parts which are covered with a thick growth of scrub oak, jack pine or brush. The more level parts are cleared and cultivated or lie fallow. The main crops are rye, corn and oats. Yields of rye, 6 to 10 bushels, corn 15 to 20 bushels, oats 20 bushels and potatoes 50 to 100 bushels are reported. Clover does fairly well on new or manured fields, but it often kills out in winter or in the dry hot weather. This soil needs careful farming to keep it productive. Some of it bordering the river occurs in connection with better soils and for this reason small areas of the fine sand are farmed better, the yields are larger, and the value of the land is held higher than the average. Boone fine sand frequently sells as low as from $5 to $15 per acre. Improved farms have a higher value, depending upon improvements etc.*

Plainfield Sand

Description. The Plainfield sand to an average of 8 to 10 inches consists of a loose medium sand or fine sand. It has a light brown colored surface containing but a small amount of organic matter. Te subsoil is a brown sand gradirg into yellowish brown sand which includes gravelly layers at 24–30 inches. The deeper subsoil is yellowish sand.

About two square miles of this soil along the Little Roche-a-Cri Creek near Friendship seem to have better moisture conditions than most of this soil, which may be due to some clay under it below the reach of a four foot auger.

Extent and Distribution. The Plainfied sand is one of the most extensive kinds of soil in Adams County. Together with

* For discussion of chemical composition and improvement of this soil see page 40.

the marshy soils, it covers most of the county from the moraine on the east to the Wisconsin river on the west.

Topography. The topography consists of a level sandy plain broken by occasional sandstone mounds and ridges and many marshs. A portion of this soil in the northwest part of the county has been blown up into low hills and is separated as the rolling phase.

While this soil is the most extensive type and therefore includes perhaps a greater number of farms than any other type of soil, still the Plainfield sand is not completely or even extensively developed when the total area is considered. The total improved land in Adams County amounts to but slightly over one quarter of its area and much of this improved land is of better kinds of soil so that perhaps not more than one-eighth or one-tenth of the area of this soil is improved farm land.

Large areas are wooded, including oak and Jack pine timber or brushy land. There is also a considerable acreage of fallow and abandoned fields which have formerly been under cultivation.

The most important crops grown on this soil include corn, rye, buckwheat and potatoes. Clover does fairly well on new land and in moist seasons, but often the land is cropped continuously to rye and corn till yields are unprofitable and then after a period of idleness it is again cropped without clover or the return of any plant food in the form of manure or fertilizer. On some of the better managed farms, however, care is taken to keep up the organic matter my growing clover once in three years, manure is carefully conserved and applied, and a rotation of crops is followed. Such methods as shallow plowing and the substitution of harrowing or discing for deep plowing in order to keep the soil compact also are practiced. On such farms yields of rye, 10 to 16 bushels; corn 20 to 35 bushels; and clover or May hay, one to 1½ tons per acre are obtained. Marsh or bottom land for dry weather pasture helps many to maintain a herd of stock, others, by renting cheaply a large acreage in the vicinity are able to maintain some degree of fertility on their own farms at the expense of the rented land.

The census (state) for 1919 shows that the towns of Monroe and Strongs Prairie where this soil is fine sand, produced 456 acres and 1040 acres of potatoes respectively. In the latter

town a large part of this acreage is on heavier soil, associated with the sand. In some instances, a sticky layer in the subsoil beyond reach of a four foot auger, may be present and thus account for better yields on some small areas, although wherever this sticky layer could be detected, the area was mapped separately as Plainfield sandy loam.

Yields of potatoes, 80 to 125 bushels, oats 15 to 30 bushels, and fertility is somewhat easier to maintain than on typical Plainfield sand.

Some of the best managed farms on this type of soil sell for 25 to 35 dollars per acre while large acreages in the remoter and undeveloped sections can be had for 4 to 12 dollars per acrea.*

Plainfield Sand, Rolling Phase

The rolling phase of the Plainfield sand includes all of this type where the surface is distinctly undulating to rolling in character. In the town of Strongs Prairie it includes more or less parallel, narrow, wooded, irregular ridges fifteen to forty feet high, surrounded by level to flat areas of better soil, most of which is cultivated. Lying two miles east of Monroe Center and extending to the northeast is a considerable area of uniformly undulating to rolling, medium fine sand, covering about 12 or 15 square miles. The whole area has a dune-like rolling character and while most of it is covered with oak and Jack pine trees or brush, portions on which cultivation has been attempted, show a marked tendancy to revert to the active, dune character unless very carefully handled.

There are quite a number of abandoned farms and clearings in this section especially on the east side. On the north side of the area in Sections 1 and 35 is a group of farms called the Bohemian Settlement, where quite a little farming is done on this type of soil. Rye, corn and potatoes are the crops generally grown.

Where the undulating sandy soil is not of the finer texture, very little of the soil is cultivated, being mostly covered with brush or oak and jack pine. It is mainly used for pasture and wood lot. In general this type of soil is not suitable for agricultural use. If possible it should be reforested.

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* For a discussion of the chemical composition and improvement see page 40.

CHEMICAL COMPOSITION AND IMPROVEMENT OF SANDY SOILS*

Since so large a part of the soil of Adams County is quite sandy, the problems of its improvement are very important. Very sandy soils have several difficulties to contend with. They have low water-holding capacity, making them subject to drought. They are low in plant food and frequently sour, and they are subject to blowing which injures crops just starting to grow and is detrimental in other respects as well.

As a result of a number of chemical analyses which have been made, it is found that the supply of mineral plant food elements in the Plainfield sand, for example, which is the most extensive type in Adams County, is low. The supply of phosphorus ranges from 500 to 800 pounds to the acre. The supply of potassium will average about 25,000 pounds per acre and the supply of nitrogen, from 1000 to 1400 pounds per acre. These amounts are less than half of what we often find in some of the heavier soils of the state, such as Miami silt loam. Some of the sandy loam types have a higher content of plant foods but all of the sandy lands are inclined to be dificient in the four importand elements of plant food, nitrogen, phosphorus, potash and lime (calcium). The system of farming which should be followed, therefore, in the maintenance and improvement of this land, must provide for supplying these elements in sufficient quantities in manure, straw and fertilizer to meet the demand of the growing crops. The supply of nitrogen is not only low but the organic matter is also limited and any method of improvement should provide for gradually increasing the amount of organic matter in the soil.

On the other hand, sandy soils are easily worked. There is no loss of time after rains before they can be worked and they warm up quickly in the spring. Moreover, they can be purchased at a much lower price per acre than heavier soils so that a farm or a crop represents a much smaller investment of money and labor. One-third or more of the gross return on higher priced lands is taken for interest or rental charges. If the difficulties mentioned are met, these sandy soils can be formed successfully; that is, the farmer will be able to make a good livelihood on them.

* For more information on this subject see Bul. No. 299, Wis. Expt. Sta.

The question then is: To what extent can these difficulties be met, and what average yields can they produce in comparison with heavier soils? The first difficulty mentioned, that of low water-holding capacity, is very hard to overcome to any considerable extent. Some benefit is secured by increasing the organic matter. This can be accomplished best by plowing under green crops, and the use of stable manure also increases the organic matter somewhat, though it should be remembered that, in the feeding of crops, two-thirds to three-fourths of the total organic matter is decomposed in digestion so that only about one-third as much organic matter is returned to the soil in the manure as was contained in the crops which were fed.

In considering the benefits from the addition of organic matter it should be borne in mind that organic matter or humus holds from six to seven times its weight in water, a large portion of which can be withdrawn by crops for their use and this recurs with every good rain, so that the addition of one thousand pounds of humus to the acre will mean that several thousand pounds of water will be made available to the crops growing on it during the season.

Tillage of the land tends to oxidize or decompose the organic matter so that it is easier to accumulate organic matter in the soil under crops which are not tilled. Such as small grains, clover, alfalfa or grasses, and this principle should be kept in mind in planning the rotation. Nevertheless, corn uses water very economically, that is, it requires a smaller amount of water per pound of dry matter produced than practically any other crop, and it grows well on lighter soils when these are sufficiently fertile and it makes the best feed to use in connection with legume hay so that corn should be considered one of the staple crops on lighter soils in all sections where the length of growing season is sufficient. Rye by getting a good root system developed in the fall is able to start growth very quickly in the spring and mature before the period of the year is reached when droughts are liable to occur. Alfalfa, on account of its very deep root system and its consequent ability to withstand long drought, as well as the fact that it will stay on the land two to five years without reseeding, is one of the best crops on these soils. Moreover, its very high protein content and excellence as hay makes it of great value as feed when used in connection with corn or corn silage. Also being a legume, it gathers its

nitrogen from the air and supplies that element for other crops when the manure from its feeding is used.

Clover, though a legume and an excellent hay, has shortcomings on these soils in that, being a biennial, it usually makes but one year's growth after the year in which it is sown, and when sown with rye or other grain as a nurse crop it is apt to be left without sufficient moisture since that is taken by the grain crop. Nor will it produce as heavy hay crops as alfalfa in dry seasons, even after a stand is secured. It seems likely, therefore, that alfalfa can be used to better advantage than clover on these lands. Nevertheless, if the soil is sufficiently moist and in fairly good condition, it may often be worth while to seed clover in the rye or other grain crop to be left the year following if it succeeds in making a good stand and then be plowed under as green manure or used as pasture if it is not absolutely needed as feed. Soybeans is a crop which is able to make fair growth on quite poor soils and offer some return as a cash crop as well as making good legume feed when other crops are not successful.

Corn, rye, alfalfa, soybeans and clover are therefore among the best crops for these soils, but these crops are best used as feed and therefore the line of farming which seems best adapted to such lands is one in which the growing of livestock plays an important part, and so long as dairy products maintain a fair price, dairying should be followed quite generally on these lands.

In seasons having a good amount and a proper distribution of rainfall, potatoes do well on these lands when fertility is maintained. However, they involve so large an expenditure for seed, spraying and labor and the risk of drought is so large that they cannot be considered well adapted to the more sandy soils and should be grown only to a limited extent. A few other cash crops which have done rather well on light soils are: cucumbers, where a pickling station is nearby; navy beans, where water is available and a market at hand; a little buckwheat for chicken-feed; and even watermelons, when their growing is well understood and a market available.

The low plant food naturally existing in these soils must be suplemented. This includes nitrogen,* phosphorus, calcium or lime, and potash. The nitrogen can be maintained through the growth of legumes such as alfalfa, clover and soybeans.

* For a discussion of the use of fertilizers and methods for their application see page —.

Some phosphorus must be added through the use of fertilizers and the calcium supplied either in ground limestone, marl, or other form. If the manure is taken care of, it will return most of the potash in crops to be used over again and will cause more of that in the soil to become available and be added to the revolving fund in the organic matter in the manure. The use of abundant bedding or other absorbent to take up all the urine in which most of the potash occurs, is a matter of the greatest importance on sandy farms. In spite of all precautions, such as the utilization of all straw produced either as bedding or a soil top dressing, the best conservation of the manure, and the feeding of all roughage grown, there will be losses of potash from the farm through crops and leaching, and, since the soil supply was originally limited and has been further depleted by cash cropping and burned or unused straw piles, the use of potash in a commercial form is advisable on special crops and even for alfalfa.

The growing of alfalfa is the starting point in the improvement of such lands. The use of from two to three tons of lime or an equivalent amount of marl which may mean from 3 to 10 yards per acre depending on the quality of the marl, is necessary. Inoculation of all alfalfa and other legume seed is essential. The use of at least a light application of manure is almost a necessity for getting a catch of alfalfa as it contains moisture and readily available plant food for the seedling. To this should be added 300 to 400 pounds per acre of 16 per cent acid phosphate or an equivalent amount of higher grades. For best results lime or marl should be applied 6 to 12 months before sowing the alfalfa and the crops and plowing so managed that the lime is in the surface soil when alfalfa is sown. Manure and the prosphates should be applied late in fall or early in spring and the manure and lime disked into the soil. In general, it is best to sow early in the spring and this may be on a very light stand of rye or without a nurse crop entirely. When seedingly are made very early in spring broadcast seeding afford the best chance for a successful stand, but with later (June and later) seedings, the seed should be drilled in a little deeper than on heavier soils and the use of a corrugated roller which will compress the soil and yet will leave the surface roughened, is very helpful; or a smooth roller followed by a light drag may be used. A small field of alfalfa should be seeded each year

since there is little danger of winter killing on the younger fields than there is on the older.

When success in the growing of alfalfa has been reached, it becomes the source of feed containing much nitrogen and leads to the production of manure of good quality which is available for corn land to be followed by rye. When other crops than alfalfa are grown, smaller amounts of lime may be used. From 1 to 2 tons every 2 to 5 years will probably be sufficient.

On farms including only sandy soils, one of the difficulties in stock farming is that these lands are poorly adapted to pasture. The true grasses do not do well on such soils so that there is practically no permanent pasture. When a good catch of clover is secured and there is enough alfalfa to produce the hay needed, the clover may be used as pasture. It should not be pastured in the fall of the year when sown as this may kill it out leaving practically no pasture for the next year. When clover is not available, rye may be used for a short pasture season. The white biennial sweet clover sown in the way described for alfalfa, under favorable rainfall makes excellent growth and may be used as pasture or as a soiling crop, but in many cases pasturage must be supplemented by some soiling through the use of sweet clover, alfalfa and early corn or silage.

A considerable portion of the farms of Adams County include some marsh or meadow land as well as the upland sandy soil. On such farms the meadow or marsh land may be used as permanent pasture or hay land. The narrow strips of meadow land along streams usually have a black sandy loam soil, while the larger marshes are composed of peat for the most part. The black sandy loam meadow strips are low in phosphorus and lime and an application of from one to two tons of ground limestone or marl per acre as a top-dressing once in four to six years, will undoubtedly be very helpful not only in promoting better growth and tending to encourage the better grasses, such as blue grass and even clover, but it will also increase the lime content of these grasses which leads to production of better bone in the animals fed. These lands are also very low in phosphate and the practice of applying a top-dressing of about 200 pounds of acid phosphate or ground steamed bone meal every two or three years will greatly improve the pasturage. Lime and phosphorus are both needed to get the best results. On farms containing such meadow land as well as upland sandy soils, the most of

the manure should be used on the sandy land while the use of moderate amounts of lime and phosphate or of a fertilizer containing both phosphate and potash will maintain the fertility of the meadow land which already contains a large amount of nitrogen in the organic matter. Where the marsh land is of a peaty character, its treatment should be that described on page

On such farms it is often practicable to use some of the peat as a top-dressing on the sandy land. Peat which has been dug out of the ditch and allowed to dry a few months and then applied at the rate of 15 to 20 loads to the acre, distributed with a manure spreader, will add a large amount of nitrogen and organic matter needed by the sandy soil and if this is supplemented by the use of 200 pounds of 16 per cent acid phosphate or its equivalent of other form and 50 to 75 pounds of muriate of potash, it makes a very good substitute for barnyard manure and is a great aid in developing the fertility of such land.

In many sections of this county there is still left a fair stand of jack pine with a few Norway pine. On some of these farms protection of such wooded areas from pasturing animals and fire and filling them out with a small amount of re-setting, would lead to development of valuable timber lots in time.

In the improvement of the sandy soils, methods which can be used to prevent the sand from blowing are often necessary. Where the supply of organic matter is low and the soil left exposed, there is danger of considerable damage being done by blowing. A strip of Jack pine or other trees along the road side and fences lines is of considerable aid but probably the most effective plan is to lay out in long narrow fields such lands as are badly subjected to wind action and have crops that cover the ground in the early spring such as clover or rye alternate with cultivated ground. A strip of fall rye planted around each field will be quite effective in preventing blowing. At the Hancock Experiment Farm, which is badly exposed, the use of rye as a cover crop has practically checked drifting sand. Light soils should always have a growing crop on themselves to prevent blowing and leaching and build up humus. The usual crops in summer and during the winter every field on the farm should have either alfalfa, clover, sand vetch, or rye upon it. Sand vetch must be sown before September 1st to winter successfully, but rye may be sown later. Nevertheless, rye should also be sown as soon as the season's crop is removed or earlier.

CHAPTER V.

POORLY DRAINED SOILS

Dunning Sandy Loam

Description. This soil includes the more or less sandy marsh border soil having a surface layer of dark soil from five to eighteen inches in depth overlying a yellowish, mottled or white sand or sandy loam subsoil. Somewhat less than half the area of this soil lying mainly in the Colburn and Leola marshes has a surface layer of 8 to 16 inches of black mucky sand or sandy loam. Most of the rest of this type has but three to five inches of dark surface material which is peaty or mucky organic matter. A few small scattered areas where the soil is a dark fine sandy loam have been included with this type because of their small total extent.

Topography. All of this soil is low lying and lacks good drainage in its natural state. On the margins of the Drainage Districts, some of this soil has been drained sufficiently for cultivation and fair crops of potatoes, rye, corn, buckwheat and oats have been grown.

Agricultural Development. Most of this soil is undeveloped grass marsh of brushy land largely unused at present for agricultural purpose, except perhaps where marsh hay is cut or where cattle are pastured on it. It has better possibilities in many cases than the surrounding sand upland and because of its lower position retains more moisture in dry seasons.

This soil has rather low natural fertility, but when properly drained, limed and treated with stable manure or phosphate and potash fertilizers it can be made to produce good yields of potatoes, corn, oats, rye and clover.

Genesee Fine Sandy Loam

This type of soil includes the lower lying first bottom lands bordering the Wisconsin River and the larger tributary creeks.

Showing the level surface characteristics of the Dunning soils. The crop is potatoes. This is a marsh border soil and requires drainage.

A wire grass marsh where the grass is cut and bound in bundles to be manufactured into grass rugs. Such marshes occur north of Hamilton Mounds in Leola Township and near Rattlesnake Mound in Adams Township. Efficient drainage destroys this crop. The soil here is the Dunning sandy loam.

Along the river this land is subject to periodic overflow whenever the river becomes high enough to overflow its banks, so that the soil is a mixed and variable one. Much of the soil consists of about eight inches of light yellowish brown or chocolate colored fine sandy loam to loam overlying loose open sandy or gravelly subsoil.

Two general variations in the character of the soil are found. The first of these includes the heavier soil mentioned, fine sandy loam to silt loam occupying the flat and lower areas bordering slough channels, small lakes and marshy areas subject to more frequent overflow. The timber consists of thick brush or large trees including, elm, birch, basswood, soft maple, poplar, etc. Large semi-open grassy sod areas are also included which furnish very fair pasture, and marsh hay is cut on several areas in these bottoms. This soil is in places quite dark in color.

The bottoms also include slightly higher lying areas which are sandy and not subject to as frequent overflow. The soil may be a fine sand or a medium to coarse and gravelly sand. Such areas are generally covered with a thick growth of Jack pine or oak brush. A few clearings have been made on some of the higher knolls and cultivation attempted, but nearly all have been abandoned because of the uncertainty of crops. Very little of the timber on the bottoms is of any commercial value except for fence posts and firewood.

The chief value of this land for agricultural purposes is for pasture, a number of farmers on the adjoining terrace lands Pasturing their stock in enclosed areas or on the open bottoms. It cannot well be protected from the river except at an expense probably not waranted by the quality of the soil, so that crops will not likely be grown extensively on this soil for a long time to come.

Poygan Clay Loam

This soil to an average depth of 8 to 10 inches is a black clay or clay loam containing a good deal of organic matter. The subsoil is a bluish sticky clay becoming mottled at 18 to 20 inches. Gravelly sandy and mottled layers are found in the subsoil at 24

to 30 inches. In places the subsoil is a red clay, and this is the typical condition.

The Poygan clay loam occupies level to very gently sloping wet and undrained areas. Most of it is used for pasture, although a few small areas are cultivated. Most of it is open grass sod or boggy land (with some brush) bordering streams or on the borders of marshes. The soil is not an extensive one, covering not much over one square mile, mainly in the town of New Haven in the southeastern corner of the county.

In its present undrained condition this soil is of agricultural use mainly as pasture, only a few higher spots producing some corn. Drainage is the first necessity in the improvement of this soil and by proper tile drainage or surface ditching this soil could be made highly productive land. Good corn, hay, clover and root crops can be grown if drainage is supplied.

PEAT

Including the Shallow Phase

Description. The material classified as peat consists chiefly of decaying vegetable matter in varying stages of decomposition, with which there is mixed a small but varying amount of mineral matter or fine earth. In color the peat varies from a brown to black. The depth of the material forming this type is also extremely variable, and on the soil map has been grouped into two phases. The typical peat is over 18 inches deep and may be as great as 15 feet, although the average would probably be 4 or 5 feet. The shallow phase of peat varies from 6 or 8 inches to 18 inches in depth. Usually the shallow peat is more thoroughly decayed and when this is the case it is of a darker color. The earthy subsoil under most of the peat consists of sand.

The color of the peat and the extent to which the vegetable matter has decayed are also variable, and these variations are of importance, although they have not been indicated upon the soil map, except as they are brought out by the difference in depth of the peaty material. As a whole, the peat of the shallow phase is somewhat more decayed and of a darker color than the deep peat, and in a few places, because of the larger content of fine earth approachese a muck in composition.

As indicated above, the earthy subsoil under the Peat consists

for the most part of a white or grayish sand. There are exceptions to this which are worthy of note.

In the towns of New Haven and Strongs Prairie there are places where the subsoil is a red or blue clay. This is in the region where the Superior soils are found in the upland. It may be said that wherever the Superior soils are found in the uplands the deep subsoil of adjoining Peat areas is apt to be of a clayey nature also, but this statement will not always hold true. This clay is usually quite calcareous and in some places approaches a marl in composition. In another part of this report will be found a discussion of the marl and marly clays found in Adams County.

From the standpoint of area the peat is one of the important types of soil in Adams County. The largest tract of peat is found in the northeastern portion of the county in what is known as the Leola marsh, mostly in Leola township. Other extensive areas, but smaller are found in the towns of Colburn, Richfield, Rome and Quincy. Small patches of peat are found in practically every town in Adams County. The shallow peat is of limited extent and is confined mostly to the borders of the large marshes. It also makes up all of some the small areas shown on the soil map.

Many farms are made up partly of peat and partly of other types of soils. Such farms can usually be better utilized than where all of the land is peat. In such cases the peat land can be utilized for pasture when not yet completely drained, and the upland portion of the farm utilized for cultivated crops.

A study has been made of the relation between the amounts of upland and marsh, and the results are given in the following table:

The following table shows the relation of upland and marsh by quarter sections of land in a number of drainage districts townships of Central Wisconsin.

	Percent of quarter sections made of up upland soils	Percent of quarter sections made up of marsh land	Percent of quarter sections which have from 10 to 150 A. of either marsh or upland soils
Jackson Co.			
T. 21, R. 3W	30%	22%	48%
T. 21N, R. 2W	9%	26%	65%
T. 21N, R. 1W	18%	11%	71%
T. 21N, R. 1E	5%	46%	49%
Adams County			
T. 21N, R. 7E.	5%	36%	59%
T. 19, R. 7E	16%	13%	71%
T. 18, R. 17E	37%	6%	57%
T. 17N, R. 6E	36%	1%	63%
T. 17N, R. 5E	16%	3%	81%
Portage County			
T. 21N, R. 7E	8%	32%	60%
T. 21N, R. 8E	24%	22%	54%
T. 22N, R. 7E	26%	11%	63%
T. 22N, R. 8E	10%	59%	31%
Average	18%	22%	60%

Topography and Drainage. The tracts of peat soil are all relatively low, flat and naturally very poorly drained. On many of the marshes water stands on the surface during the spring and early summer. In this soggy condition the land is often so soft that it will not support the weight of stock. During the late summer, especially during dry seasons the marshes dry out so that farm stock can safely go almost anywhere, and the peat frequently becomes so dry that the danger from fires is something which must be considered. When fire once gets started in the peat it is very difficult to extinguish, and sometimes continues to burn until stopped by the fall rains. Practically all of the material mapped as peat is sufficiently high in organic matter so that it will burn when dry.

A number of large drainage ditches have been extended into and through the large marsh tracts, but these only supply partial outlets and in order to have the land sufficiently drained for the safe cultivation of crops numerous lateral ditches supplemented with tile drains are necessary. From work already done there appears to be sufficient fall so that from an engineering

standpoint it would be possible and profitable to drain all of the peat land in this county.

Native Vegetation. The present timber growth on the peat marshes consists of tamarack, alder, poplar, willows and various other water loving trees. Only a comparatively small proportion of the peat marshes are timbered, most of them being open and treeless or nearly so. The open marshes support a growth of coarse marsh grass, wire grass or sphagnum moss, through which are scattered a small and stunted growth of water loving shrubs. Some of the grass marshes are pastured or cut for hay. The moss and trees are usually found on the wettest parts of the marsh while the grasses are most common on the parts of the marsh land which are better drained. At the present time not much of the peat is cultivated, except that farmed on the Leola marsh, which is confined largely to the border soils and shallower peat. This is partly because the peat is sometimes too wet without any lateral ditches and because cultivated crops, especially corn, have been severely frozen some seasons. Marsh grass and wire grass are cut on parts of the land and in a few instances a good sod of tame grasses has been established on the peat which furnishes a good grade of pasture.

Potatoes, corn, buckwheat, rye, and soybeans are grown, but mostly on the shallower peat or on small island areas of Dunning and Plainfield soils. No fertilizers outside of a little barnyard manure have been used. More complete drainage and proper commercial fertilization are needed to make this soil productive.

On the Leola marsh a number of farms are in operation and are raising the ordinary farm crops common to the region with varying degrees of success.

Frosts on Marsh Land. It is well known that frosts frequently occur on marsh land where there is no frost on higher land. This is partly because the cold air which forms on the surface of all the ground at night tends to flow down and collect in low places, but it is also the result of the fact that the loose spongy soil of peat marshes does not conduct the heat received from the sun during the day downward. In consequence of this, the lower layers of soil do not become warmed in peat marshes as they do in other earthy soils and the little heat left in the surface inch or too of soil is rapidly lost at night by radiation, so that the freezing point is frequently reached on such soil when it would not be on more earthy soils such as sandy loam or clay

loam which would conduct the heat downward better during the day and so keep warm farther into the night.

This difficulty with peat marshes can be overcome to a certain extent by heavy rolling which, by compacting the soil, permits the heat to be conducted downward more rapidly. It will also to a certain extent become less in time, as the peat decomposes and takes on more of the character of muck. Nevertheless, it must always be expected that marsh lands will be more subject to late spring frosts and early fall frosts than high land. It may be stated as a general guide, that the occurrence of killing frosts is as liable on marsh land at any given point as it is on upland soil having a good air drainage about 150 miles farther north; in other words, the marshes of Dane county are as liable to have a frost which will kill corn as early as are the upland regions of Shawano, Marathon or Clark counties. The marsh land regions of Adams county are liable to have frost two weeks or more earlier than the hill tops of the same latitude. This means that corn and potatoes, while safe crops for the upland region, are not safe crops for the marsh land and should not be depended on as the chief crops.

Chemical Composition and Fertility of Peat*

The chief difference between peat soils and upland soils consisting largely of earthy matter, is that they have relatively small amounts of the mineral elements phosphorus, potassium, calcium, and magnesium, and have extremely high amounts of nitrogen in the organic matter. The average per cent of phosphorus in the peats in this region so far analyzed is 0.135 per cent. This means that in an acre of soil to a depth of a foot there is approximately only 675 pounds, or in two feet 1,350 pounds in comparison with upland soils which have approximately twice these amounts. Moreover, the acid condition of these soils renders the phosphorus less available than in a non-acid soil.

The deficiency of potassium in these soils is greater than that of phosphorus. They contain on the average 0.3 per cent of this element, while good upland clay loam soils average two per cent, or over six times as much expressed in percentage. When the greater weight of the upland soils is taken into account

* For more information on the management of Marsh soils see Bul. 300, Wis. Expt. Station.

it will be found that they contain in the upper two feet 120,000 pounds per acre, while the peat soils contain but 3,000 pounds.

A large amount of organic matter in these soils gives them an extraordinary amount of nitrogen. They average 2.5 per cent of this element, while the upland silt loam soils of this region contain but about 0.12 per cent and this only in the surface eight inches—the amount in deeper layers being much less.

As a result of this difference in the chemical composition the peat soils are very unbalanced. Their rational treatment requires the use of fertilizers containing especially the elements phosphorus and potassium. These elements are contained in barnyard manure and good applications of manure will secure good yields of crops on peat soils, but manure contains large amounts of nitrogen not needed by the peat, so that when a farm includes upland soils as well as peat, the manure should be used on the upland soils and commercial fertilizers containing phosphorus and potassium used on the peat land.

The amount of these fertilizers which should be used will depend on the kind of crop to be grown chiefly, and the frequency with which the fertilizers are applied. There is practically no loss of phosphate applied as fertilizers as it remains in the soil until taken up by crops. It is therefore practicable to apply as much phosphate fertilizer at one time as it is necessary for two or more crops. Potash fertilizers, however, are more liable to loss by leaching so that it is usually desirable to apply the potash fertilizer every year or two years at the most. Actual experiments on the peat soils of this county indicate that at present potash is the only element very noticeably lacking, as shown by the growth of crops, but the total amount of phosphorus in the soil is so small that it is almost certain that this element also will have to be added after a few years of cropping unless stable manure is used.

The most commonly used form of potash fertilizer is high grade muriate containing about 50% of potash. For small grains and other crops not making a heavy draft on the soil, an application of 100 pounds of muriate of potash per acre is a good treatment, but if the ground is being seeded to grass for hay following the grain, then an application of 150 pounds should be made and if more than one crop of hay is to be grown a top dressing of 75 to 100 pounds of muriate of potash should be applied for the second hay crop. Such crops as corn and alfalfa which require larger amouns of potash should receive

an application of 150 pounds per acre, and if the alfalfa remains on the ground three or four years it will need later treatments unless manure is used.

When such crops as potatoes, sugar beets, and other root crops, cabbage, or rape are to be grown, applications of 200 pounds per acre or even more should be used.

The lime content of the peat in Adams County is also comparatively low. While applications of lime do not seem to be necessary for the first two or three years after the land is broken and brought under cultivation, it is highly probable that its use will be found profitable a few years later. This will apply particularly for crops that use a good deal of lime such as alfalfa, clover, sugar beets, peas, cabbage, and others, while for such crops as corn, rye, and oats it will probably not be necessary to use lime quite so soon. When the crops are fed and the manure is returned to the soil, some of the lime is brought back in that way and the lime content of the soil is not exhausted so quickly.

Some Results at the Coddington Experiment Farm.

An experiment farm on the 40 acre tract, containing some deep peat, some shallow peat, and some peaty sand, has been in operation since 1919. The following table (1) gives the results of different treatments on a rotation of corn, oats, rye, and clover. Owing to failure of the clover, part of the time soy beans have been substituted and as frost has prevented the ripening of the corn all except one year, the weights of that crop are given in the form of fodder.

TABLE I.

YIELDS ON PEAT SOIL FERTILITY PLOTS—1920

Coddington Experiment Farm, Coddington, Wis.

TREATMENT PER ACRE	OAT YIELD PER A. 4 yr. average		RYE YIELD PER A. 2 yr. average		CLOVER 1 yr. average	FODDER CORN YIELD PER A. 4 yr. average
	Grain Bu.	Straw Lbs	Grain Bu.	Straw Lbs.	Hay Lbs.	Average Lbs. D. M.
Corn	18.15	1,222	9.75	1,361	1,799	7,268
8 T. Manure alone	29.43	2,268	19.70	2,576	2,764	12,700
150 lbs. Muriate of Potash only	31.32	1,938	19.84	2,682	2,476	11,816

Cost figures used:

Acid Phosphate	$25.00 per ton
Rock phosphate	20.00 per ton
Muriate of Potash	65.00 per ton
Manure	1.50 per ton
Limestone (Ground)	3.50 per ton

Muriate of potash can now be secured at about $10.00 less.

Farm Produce Values used:

Oats	40 cents per Bu.
Rye	70 cents per Bu.
Clover Hay	$15.00 per ton
Silage	5.00 per Ton
Straw	3.00 per ton

On another portion of this tract most of which is shallow peat though there are some small patches of sand, 400 pounds of an equal mixture of 16% acid phosphate and 48% potash was used while no fertilizer was used on the other part. The following table (II) shows the yields secured:

TABLE II.

Crop	Fertilized	Unfertilized
Oat Hay	5,424	2,595
Oats and Peas	4,715	1,886
Soybeans and Sedan Grass	4,840	1,323
Hungarian Millet	4,760	2,647
Parsnips	14,850	Not worth harvesting
Rural New York Potatoes	151.4	31.6
Sun-flower Silage	27,400	3,960

On the deeper peats which are in a very raw and acid condition the use of lime in some form in addition to the commercial fertilizers will be found profitable. Occasionally a marsh is found on which on account of coldness and high acidity at first nitrification or the chemical change by which the nitrogen in the organic matter becomes available to crops does not take place readily and the use of a light application of composted stable manure to inoculate the soil with the proper organisms is very helpful.

Crops and system of farming on marsh lands:—Since the growth of corn and potatoes to which these marsh lands would otherwise be well adapted, is limited in this section on account of the danger from frost, the best staple crops for this land are grasses for hay and pasture, hardy root crops, and rye, and to a less extent oats. When properly fertilized and limed, clover, alfalfa, and other legumes can also be grown. On fairly well drained marsh land well decomposed good pasture can also be developed. The compacting of the soil resulting from the use of this land as pasture is also a great benefit to it. When peat land is placed under cultivation a heavy roller should be classed along with implements necessary to its successful management.

Where good pasture can be secured and other conditions are the most favorable, selected portions of these marshes can be successfully utilized for dairying or stock raising.

Certain special crops, such as cabbage, onions, buckwheat,

sugar beets, and rape, are adapted to such lands when well drained and properly fertilized.

Tillage and Rotations:—Since peat soil is naturally very loose and porous, it is not desirable that it should be tilled any more than is necessary to properly prepare the surface seed bed, put in the seed, and prevent the growth of weeds. Plowing even, is unnecessary except for the purpose of covering stubble and other vegetation. Rotations of crops should be planned which require as little plowing as possible. When the land is relatively free from weeds, plowing should only be necessary when a sod is to be followed by a cultivated crop. By planning a rotation starting with small grain, such as oats or rye which is used as a nurse crop for grass to be used as hay and later as pasture, the sod may then be plowed for corn or root crops and one or more such crops may follow on land prepared with a disk only and the grain of the next rotation should be sown with the same treatment.

On account of this natural looseness of the soil and its low heat conductivity, the use of a heavy roller for compacting it is beneficial. For this purpose, however, a very heavy roller which may be made of concrete must be used. If a wheel form of tractor is used in plowing and working of the land, that will have the effect of compacting it considerably.

The question of the actual value of marsh land is one which depends on several factors. In the first place, the farmer whose land is largely upland and well drained can use a small amount of marsh land to better advantage than can the farmer whose farm is nearly all marsh land. There are several reasons for this. After heavy rains or in the spring or fall there are times when work can be carried on in the upland, especially sandy upland when the peat soils would be too wet. The upland can utilize the stable manure to better advantage than can the peat marsh, for the marsh does not need the organic matter with which the manure is richly supplied. The upland is more desirable as a site for buildings, stock yards, etc. As a rule the uplands do not require such an expenditure for commercial fertilizers, and the upland is not so much in danger of summer frosts.

Drainage:—Drainage* is necessarily the first improvement in the development of marsh or peat lands. This is usually under-

*See Buls. No. 284 and 351, Wis. Expt. Station.

taken in two stages. First, that of securing the main outlet for each farm which is accomplished by the organization of a drainage district or farm drainage system; and second, the more complete drainage of individual fields thru the use of small lateral ditches or lines of tile. In the Leola district of this county the outlet ditches vary from half a mile to a mile apart but practically all quarter sections are given an outlet. Moreover, since most of the peat is underlaid by sand, a fair degree of drainage for such crops as pasture and hay land is furnished by these main outlets only; but when other crops including small grain and cultivated crops are to be grown, especially on deeper peat, a more adequate drainage system must be installed. This may in some cases consist only of small lateral ditches or it may consist of tile varying from 20 rods apart to from 40 to 60 rods. Depth of placing of the tile is important in deep peats. This is partly because drainage is followed by settling of the peat for a number of years in such a way that the soil over the tile becomes much thinner and if the tile are placed less than three feet below the surface they may be disturbed and not furnish drainage to a sufficient depth. Moreover, tile laid at greater depths will drain a wider strip on each side so that as far as it is possible to get outlets for deeper placing of the tile it is better that they should be from 4 to 5 feet in depth rather than at shallow depths.

The cost of reclaiming and fitting marsh land will, of course, depend largely on the thoroughness of the drainage system installed, though it will also vary with local condition. Assuming a first valuation of from 10 to 20 dollars an acre for the raw land, 10 dollars for the main outlet ditch, and a cost of clearing and breaking of 10 to 15 dollars, the cost of marsh land fitted for growing tame hay will vary from 30 to 45 dollars per acre. If the drainage is made sufficient for the growth of tilled crops, by tiling as above mentioned, the additional cost will run from 15 to 25 dollars per acre making a total cost in this case of 45 to 70 dollars per acre as the value of the land when brought to a point of production, not including buildings and fences.

Considering all the factors which enter into the question of the cultivation and farming of Peat lands, it may be said that the Peat soils which are well drained and fairly well decomposed will have a value equal to approximately two-thirds the value of good upland silt loam where general farming operations are

to be carried on. Where the loocation is good and market conditions are most favorable peat lands frequently have a very high value for trucking purposes. This value in some localities, as for instance the celery fields near Kalamazoo, Michigan, is higher than the value of the adjoining uplands.

Peat Farms in Central Wisconsin.

Probably three-fourths of the land in drainage districts in the central part of the state which includes Adams county, is not farmed at present although the outlet ditches have been installed as long as 10–20 years in some cases. Still there are numbers of farmers who have succeeded and who have worked out the principles of success which will be a benefit and guide to the farmers of the future on these lands.

A recent survey of nearly 100 farms (Bulletin: Drainage District Farms in Central Wisconsin—E. R. Jones, B. G. Packer) on peat, over 1/3 of which have been farmed for 4 to 10 years or more, should be secured and read by all interested in marsh development.

Summarizing the peat situation for the future agricultural development of the peat lands such as are found in Adams county, it may be suggested that before farming on these lands can be permanently successful there are several conditions with which it is necessary to comply.

1. It is absolutely necessary that the land should be sufficiently drained. Large outlet ditches in themselves while necessary are not sufficient, and these must be supplemented with open laterals or tile drains before adequate drainage is insured.

2. This type of land is low in potash, and often phosphorus and lime and these materials must be supplied in proper form and proper amounts before permanent, profitable production can be expected .

3. It must be recognized that the danger from summer frosts make such crops as corn and potatoes uncertain, and the crops to be grown must be those which are not only suited to the soil, but also to the climatic conditions.

4. Those purchasing this type of land must not only see their way clear to pay for the land itself, but they must also provide adequate drainage and fertilization, both of which call for an added investment.

It is suggested for those who desire to undertake the de-

velopment of a Peat farm in any region, but have never had experience with this type of land, that it would be a good plan to rent such a farm for a year or two or possibly serve an apprenticeship on some successful peat farm. This would make possible getting valuable experience without making a large investment.

Rough Stony Land.

Under this heading is included all the rock outcrops, steep sandstone mounds, steep stony slopes bordering the ravines tributary to the Wisconsin River, and all other land which on account of its rough topography and stony condition, is rendered thereby unfit for cultivation.

In places it includes steep wooded slopes fairly covered with soil so that they furnish some pasture, while such rocky and precipitous mounds and bluffs as Friendship Mound and Roche-a-Cri are included also whose steep sides are so sandy or stony that very little grass will grow. The tops of some of the larger mounds are wooded and covered with soil. Where this ridge top includes but a few acres, it also was included with the rough stony land, but where the acreage was larger the ridge top area was separated out as on the flat topped ridge in Section 35, Easton, and Section 11, Springville. Many of the mounds mapped as rough stony land are jagged saw-tooth topped bare rocks without vegetation or soil covering of any kind, and outside of their scenic attractions have little agricultural value.

CHARTER VI.

GENERAL AGRICULTURE AND CLIMATE OF ADAMS COUNTY

Crops, Methods, Equipment, Etc.

Development of Agriculture. Farming in Adams County followed on the heels of the woodsman and timber workers. The first recorded farm was started in 1844 in the southeastern part of the county. This was probably the best white pine timber section of the county. Agriculture also early made its way up along the Wisconsin River in the wake of the lumbermen who floated their logs down the stream. Many of them worked in the camps and on the river in winter and labored on their farms in summer. The chief crops then, as now, were corn, rye, buckwheat, and hay. Up to 1880 wheat was a much more important crop than now on the heavier soils. About 1860, a considerable acreage of hops was produced for a few years. Oats have gradually increased in acreage the last few years.

Dairying and Chief Crops. At present the greatest number of farms are found in the towns of New Haven, Jackson, Springville, Dell Prairie and Strongs Prairie, along the river and in the south end of the county. The greatest number of silos, and the greatest acreages of corn, barley, and oats are found in these towns also. Greatest acreages of rye are found in Lincoln, Springville, New Chester and Jackson, and the most potatoes in Strongs Prairie, Leola, Colburn, and Richfield. The largest acreages of new land brought under cultivation in 1922 are in the towns of Jackson, Rome, Preston, and Quincy.

A portion of the farming in Adams county is now based largely on dairying together with certain special crops, sold for cash. In certain sections where hay and pasture are more difficult to produce in abundance, the special crops take the leading place. Potatoes and rye are the main cash crops, some of the farmers buying sufficient feed to supplement their corn and hay with the proceeds from the sale of rye and potatoes. Cream and butter are the chief forms of dairy products sold. Factories are located at Kilbourn, Briggsville, Friendship, Hancock, Plain-

ville, White Creek, Easton, Davis Corners, Brooks, Grand Marsh, Quincy Township, Arkdale, Monroe Center, and Wisconsin Rapids which obtain all or part of their patronage in Adams County.

In many localities the cream is collected by trucks at a fixed price per can or cwt.

According to the 1911 census, there were 13,774 dairy cattle; 1,567 beef cattle; 1,359 sheep, and 6,422 swine in the county. The value of dairy products totaled $461,857. Reports of the Wisconsin Department of Agriculture show that in 1923 there were in Adams County 8,400 producing dairy cows. In Iowa County for example which is a smaller county there were at the same time 38,100 producing dairy cows. In Adams County these cows during 1923 produced 346,080 cwt. of milk while in Iowa county the production was 1,714,500 cwt. the same, being $1.94 in Adams County and $1.95 in Iowa County. The production per cow in Adams County was 4,120 pounds and in Iowa County it was 4,500 pounds of milk. This difference may have been due in part to differences in the quality of the feed and also in part to differences in the grade of stock. In Adams County the average value of producing cows was $48 while in Iowa County the average value was $55, showing a somewhat better grade of stock in Iowa County than in Adams. It is believed that the basic difference in this dairy showing is a difference in the soils of the two regions. In Adams County sandy soils predominate, while in Iowa County heavy soils predominate. Similar differences are reflected in the production of general farm crops, and in practically all phases of farm opertions.

By following the best methods of soil improvement this difference could be overcome in part, and the farmers of Adams County should look carefully into the possibilities for increasing their annual production through increasing the fertility of their soil. It is also a strong argument for a higher grade of stock.

Of the crops, the cereals have the greatest acreage and value. Corn had in 1919, 21,332 acres; rye 39, 827 acres, and oats 8,850 acres; buckwheat 1,566 and barley less than 1,000 acres.

Of the hay and forage crops, tame hay in 1919 had 10,667 acres and wild grasses with 12,301 acres. The latter is a more or less coarse variety of marsh grass cut in the late summer and fall on the extensive peat marshes. While possessing a low

feeding value, this product is so much needed by sandy land farmers for winter feed for young stock and horses and to mix with better feeds for cattle, that some farmers go as much as ten and fifteen miles to cut and haul the marsh hay.

Wire grass, another variety, is extensively cut and sold for grass rug manufacture.

The following table shows the acreage in various crops in 1919 as compared with several other years.

Crop	1919 Assessors	1918 Assessors	1909 Census	Assessors 1923
Corn for silage and fodder	4,081		All corn	7,445
Corn for grain	19,710	18,662	20,846	20,212
Rye	39,312	34,776	20,079	29,763
Oats	11,478	18,521	11,455	10,130
Barley	801	856	759	459
Spring Wheat	1,658	1,502	282	123
Winter Wheat	31	42	76	68
Clover and Timothy	10,219	10,140	13,345	10,508
Potatoes	7,608	8,228	8,286	4,566
Alfalfa	5		1	164

Special Crops. Potatoes are the only special crop reported, with 6,244 acres produced in 1919. This is a reduction in the acreage, since 10,384 acres of potatoes were reported in 1900. The reduction in acreage is due in part to the increasing difficulty in getting help to do the large amount of hand work necessary with this crop. The potatoes are marketed mainly through Holmsville, Necedah, Grand Marsh, Hancock, and Kilbourn, where numbers of storehouses are located.

Cucumbers are grown to a small extent and pickle stations are located at Brooks and Kilbourn.

Apples are the most common orchard crop, with 7,909 trees reported for 1919. Most of these are grown in the southeastern part of the county where the soils having more or less of a mixture of the calcareous red clay seem to be best adapted to fruits and especially apples.

A small amount of grapes and strawberries also are produced.

Influence of Soil. The kind of soil has a very marked influence on the appearance and kinds of crops grown. The loams

and silt loams of the Superior soils and Knox series have the best water-holding capacity and produce the best pasture and hay as well as the best crops of grain and corn, so that the most highly developed farms and the best dairy farming is found in these localities.

Good dairy farming is much hampered on the sandy soils by lack of good permanent pasture and hay land. This is partly overcome in some cases where the sandy farm included some marsh or low land which supplies pasture when the sandy pastures have dried up. Rye and corn (and potatoes to some extent) are grown on the sandy soils and buckwheat on the lower lying marsh border soils. Some of the best potato lands in Strongs Prairie township consist of sand to fine sandy loam surface soilunderlain by a layer of clay at from ten to thirty-six inches beneath the surface.

Cultural Methods, Equipment, etc. Practices common to most dairy and general farming districts in central Wisconsin are used in much of Adams County. Modern machinery and equipment are common on all the better class of farms. Many of the remote and sandy farms have but a very meagre equipment; and stock is of an inferior quality.

Of the 1,557 farms, only 281 had silos in 1919 and the majority of these are found in the sections of better soils. In 1923 there were 311 silos. Many abandoned sets of buildings are found in the remoter and most sandy parts of the county. In some townships, as many as 20 to 30 such abandoned farms were noted and in addition there are many fields and farms without buildings which were formerly cultivated but now lie idle. At least 15% of the 1,557 farms in the county are abandoned at present, about 239 empty sets of buildings having been recorded by the soil survey.

The census figures indicate that the number of farms in the county has decreased at the rate of 12 to 16 farms per year in the last 20 years, this enumeration including farms which have been absorbed to make larger farms. The average assessed value per farm in 1920 of all property is given as $8,310. Land alone had an average value of $24.86 per acre.

In the sections of better soils, manure spreaders, and seeding and harvesting machinery are common; tractors are used in a few cases, and in the best potato sections, horse-drawn planters, diggers and sprayers are used.

The farmers on heavy soil are inclined to a four-year rotation of clover, timothy, corn, or potatoes, and grain. The sandy land farms more often use a three year rotation of corn, rye, clover; or rye clover, potatoes. A few use a five-year rotation using one or more of these crops twice or introduce one or two years of fallowing.

Some of the run down sandy farms seldom receive manure and but little clover, the crops being rye, corn, or buckwheat, with intervals of fallowing or idleness.

On sandy land, the rye is quite commonly seeded in the last cultivation of the corn or among the shocks and then fall pastured. This is a slow method since single row cultivators are generally used, but has the advantage of giving some fall pasture and by keeping the soil covered, prevents blowing and keeps the soil more compact than where more plowing and harrowing are done.

Stable manure is the most common fertilizer used and since many sandy farms do not support more than three to ten head of stock, there is never a sufficient supply. Rye and clover are sometimes plowed under, but green manuring is not at all common. Commercial fertilizers have been used in a few cases chiefly in an experimental way. Local deposits of marl are being utilized to some extent. Farm labor is scarce and high in price so that generally the farmer must depend on his own household or neighbors for extra help. The farm help is nearly all local in its origin, and prices paid so variable that no average figure can be given.

Size and Value of Farms. Farms vary in size from 40 to 300 acres or more. The census of 1910 gives the average size of farms as 183 acres, the census of 1920 gives the average size of farms as 195.6 acres; the size of the average farm having gradually increased in the last 20 or 30 years. The great majority of farms are occupied by the owner. Some of the more sandy farms owned by outsiders, are rented. Cash rent for $1.00 to $1.25 per acre or for ⅓ the crop is common on the better sandy farms. The selling price of land varies greatly with its location and the kind of soil. The best farms on heavy types of soil sell for $100 to $125 per acre while remote sandy land may sell as low as $10 or $15. Some sales have been made at even lower figures. Between these limits all gradations in value can be found depending on soil, improvements, location, etc.

The Use of Limestone and Marl*

Relation of Lime to Acidity. Lime is one of the class of substances called bases by the chemist. Bases combine with acids and form salts, a process which is called neutralizing the acidity. Acidity of the soil is caused by insufficient lime or other base to neutralize all the acid portion of the soil. But there may be considerable available lime in the soil even though there is not enough to neutralize all the acidity. On the other hand, soils with little or no acidity also may have very little available lime. It is therefore impossible to determine the amount of available lime by determining the degree of acidity. Some soils are very deficient in available lime even though they are only slightly acid, and other soils are well supplied with available lime in spite of considerable acidity.

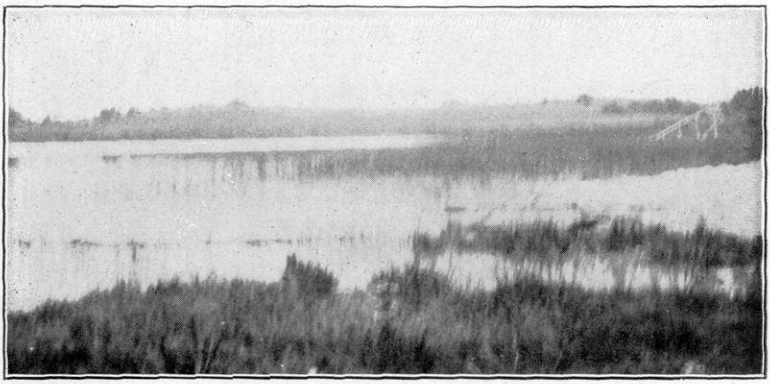
A Simple Test of the Need for Lime. A simple test is made as follows: Slake a bushel of quick lime with water. When it is in a dry powdered condition spread it and work it into a strip of ground a rod wide and four rods long. This should be done after plowing. In place of the bushel of quick lime, two bushels of air slaked lime or commercial limate, or 150 pounds of ground limestone may be used. The strip should be in a field where clover does not do as well as it should. The lime can be applied when preparing the field for corn the year before it will be seeded down or the same year it is being seeded although better results on clover or alfalfa are secured when lime is applied a year before the clover or alfalfa is sown.

Sandy Soils. The sandy soils of Adams County are practically all low in available lime, and will show increased yields with the use of materials for supplying lime to the soil. These sandy soils require from one to two tons of ground limestone or the equivalent amount of marl per acre every 6 to 8 years for staple crops, including corn, rye, and clover.

When seeding down to alfalfa a heavier application should be made and probably 2½ to 3 tons of ground limestone or dry marl is the most profitable rate for the first application. From 1½ to 2 tons may be needed whenever the same field is reseeded to alfalfa thereafter after five years.

The marsh soils of the sandy area are low in lime and while

* For a more complete discussion of this question see Bul. No. 361 of the Wis. Expt. Sta. on The Liming of Wisconsin Soils.



Lakes like the above often hide good marl deposits. This lake is being dredged for marl to be used for agricultural purposes.

Marl will help produce alfalfa fields like this where no alfalfa grew before.

this has not been a disadvantage in many cases so far, it is well to make a trial as suggested above. After such land has been broken and cropped a few years it is quite probable that lime at the rate suggested for the upland will be found profitable.

Heavy Soils. On the heavier soils of Adams county such as Miami silt loam and Superior and Knox silt loam the need for lime is not as great as on the sandy soils. In fact in numerous places these heavy soils do not need lime at all. The Superior soils in particular are rich in lime. The places on these soils where lime is usually needed first is on the highest places where crops have been grown for a number of years, and where there has been the most leaching. The greatest need is when alfalfa is grown. Good drainage is also essential for this crop.

Marl and marly deposits and their use in Adams County. Marl is a form of carbonate of lime that has been deposited from water. Pure marl has a chalky white color but ordinarily marl is blue gray, or grayish in color, intermixed with white or gray colored remains of snail shells, clam shells, or other shell fish. Part of this marl comes from the remains of these shell fish, other parts come from lime washed out of the soil through drainage waters and secreted by plants. This lime is carried to lakes and rivers and creeks and deposited there.

Clay often resembles marl but if hydrochloric acid is added to marl it will bubble or effervesce while with clay no action will be seen. The purity of the sample is determined by the amount of marl that disappears in the acid test. Such impurities as sand or clay will remain. Pure marl will disappear entirely if sufficient acid is added.

Most of the marl deposits in the state are covered with water, peat, or muck soils which means that marl is saturated with water. This fact, together with the difficulty of getting the marl has limited its use up to the present.

Value of Marl. Pure marl is just as valuable as the best limestone on the market, providing both are equally dry. Marl has been used in agriculture both here and in Europe with very good results. Farmers near marl beds have used small quantities on their legume crops with good success; and its use has passed beyond the experimental stage. Marl deposits have been opened in the towns of Lincoln, New Chester, and Jackson in Patrick, McGinnis, Goose, Wolf, Crooked, and Jordan Lakes. Most of this marl occurs in the beds of shallow lakes or in

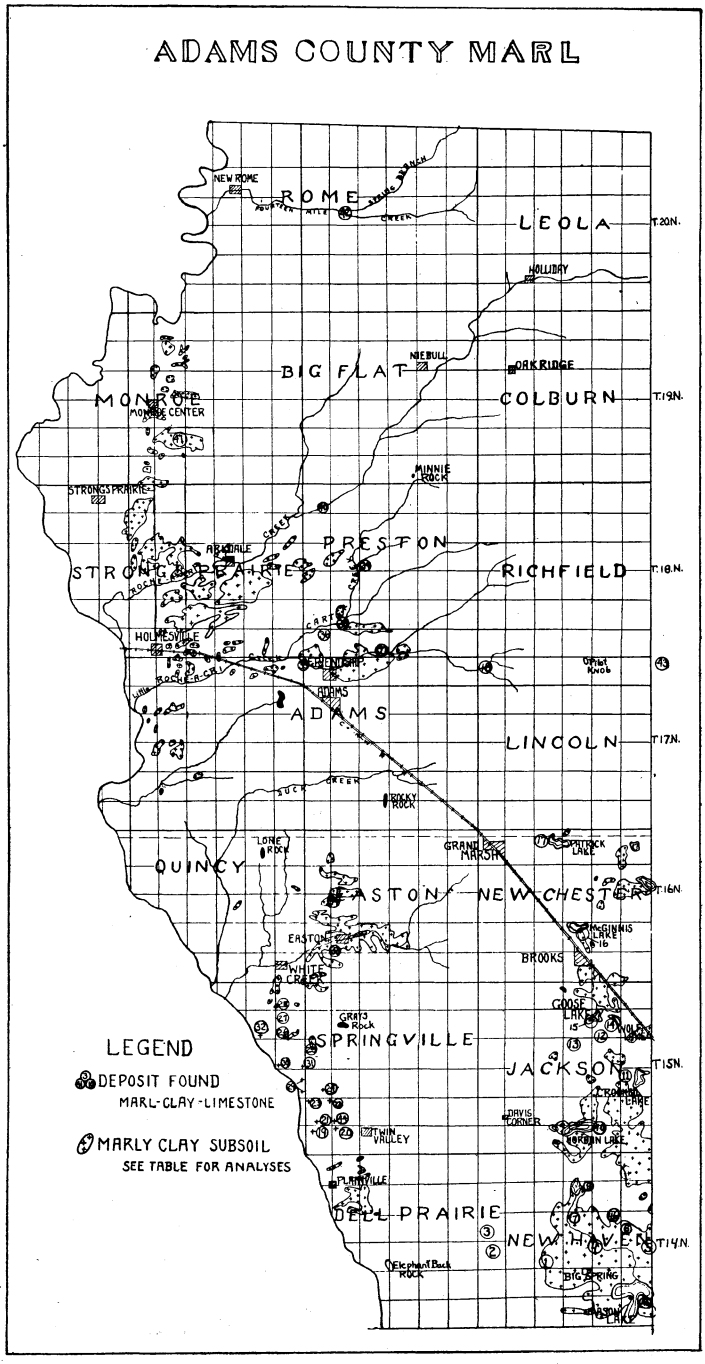


FIG. 2. SKETCH MAP OF ADAMS COUNTY SHOWING LOCATION OF DEPOSITS OF CLAY AND MARL.

marshes and has to be dredged out and allowed to dry. It contains about fifty per cent of water when in condition to spread on the land. It can be obtained for about $1.00 per load and for farms within easy hauling distance, is the cheapest material to use in starting clover or alfalfa on sandy soils.

From 3 to 5 yards of this moist marl will be required for most of the sandy soils of Adams County, the amount used depending upon the purity of the marl and the need for lime. While good stands of alfalfa have been produced on sand at the Experiment station at Hancock and some of the alfalfa has remained good for four to six years without any further applications of ground limestone, it is quite probable that the above mentioned rates of marling will not endure quite as long, because the carbonate of lime in marl is more readily soluble than in ground limestone. This is an advantage while the application is fresh, but a disadvantage after 5 to 6 years.

In the towns of Preston, Monroe, Springville, and Easton also some of the shallow depressions contain a loamy soil mapped as Superior sandy loam or fine sandy loam underlaid by reddish clay. In some places this clay contains 20%—50% of carbonate material useful for supplying lime to soils. While not so valuable as the marl or as ground limestone for getting stands of clover and alfalfa, such material furnishes the needed lime and where it lies within hauling distance of the farm, could be obtained more cheaply than ground limestone.

This red, pinkish, gray or mottled limy clay should be applied in the fall so that the disintegrating action of frost pulverizes it. This material should be used generously (8 to 12 loads per acre) on sandy soils. It not only supplies lime but also small amounts of potash which is present in limited amounts in light soils. In addition to that it helps to make the soil a little heavier and helps it against drought. It is not advisable to use this calcareous clay on heavy soils solely for the sake of its lime, as the labor involved in a ten load application is too high when compared with the cost of 2 tons of ground limestone.

Any one planning to use some of this marly clay or loam to get an alfalfa or clover catch is advised to first send a pint sample of the material to the Soils Department, College of Agriculture, and have it tested to see if there is enough lime in it to do any good.

On page 68 will be found a sketch map of Adams County

showing the location of marl and marly clay deposits so far discovered in this county. Where the deposit is small and does not affect the character of the soil a small black circle marks the location. Where the material has been analyzed, figures giving the per cent of carbonates or lime found are given in a table which accompanies the map.

When and How to Apply Lime

Any form of lime should be applied previous to the crops which give the greatest response to lime. In Wisconsin, lime is used mainly to prepare the soil for the clover and alfalfa crops. Whenever possible it should be applied a year in advance of the time of seeding these crops, that is when preparing the ground for corn. In order to prevent losses from leaching it is advisable to apply it to plowed land and mix it with the soil by harrowing. Fall, winter or spring applications may be made.

Spreading Lime from the Wagon. Any form of lime which is damp enough to prevent blowing can be spread very well with a shovel directly from the wagon. A little skill in handling the shovel will enable the operator to spread it both quickly and evenly.

Fertilizer Distributers and Lime Spreaders. Any form of lime that is dry and pulverized finely enough to pass a one-fourth inch screen can be applied very evenly with a two-wheeled, drill type fertilizer and lime distributor. The machine should be equipped with two agitators. These are necessary to work the material down to the bottom of the hopper so it will feed through evenly and constantly. These machines spread the material very evenly and do fairly good work even when it is quite windy. They will not handle satisfactorily pulverized limestone that has been piled in the field and become wet.

The best machine to use for handling wet pulverized limestone is an end-gate spreader that may be attached to the rear of a wagon box. This machine requires one man to shovel the lime into the hopper from the wagon box and another to drive the team. This machine will not give even distribution of dry fine material on a windy day. With this machine a farmer can equip one rear wheel of two or more wagons with driving sprockets and the machine is light enough so that it may be transferred from one wagon to another. This method saves handling the

Marl and Clay Deposits in Adams County

No.	Material	Location	Owner	Carbonate Analysis
		New Haven		
1	Marl	SW¼ Sec. 21	Geo. Smith	
2	Limestone gravel	NW½ Sec. 19	G. F. Francis	
3	Gravel	SW¼ Sec. 18	John Schweda	
4	Clay	NW¼ Sec. 23	Rob Ramsey	38%
5	Marl	NE¼ Sec. 24	Jno. O'Connor	50%
6	Clay	SW¼ Sec. 13	Geo. Walsh	33%
7	Clay	SE¼ Sec. 10	L. Buckley	17.5%
8	Marly Peat	NE¼ Sec. 10	H. A. Hayes	36%
45	Marl	E ½ Sec. 36	Kimball Bros.	84%
46	Clay	NE¼ Sec. 14	Matt Keogh	35%
		Jackson Twp.		
9	Clay	NE¼ Sec. 33	A. Nemitz	40%
10	Clay	NW¼ Sec. 35	J. Manchester	
11	Clay	NW¼ Sec. 24	F. L. McGowan	
12	Clay	SW¼ Sec. 11	H. L. Mason	
13	Clay	NW¼ Sec. 15	Jno. Rodger	
14	Clay	SE¼ Sec. 11	H. Sorenson	
15	Clay	NW¼ Sec. 11	E. A. Huber	
16	Clay	NE¼ Sec. 27	C. Babcock	
17	Limestone gravel	NW¼ Sec. 9	W. Cavanaugh	
18	Clay	NW¼ Sec. 6	Frank Sarb	28%
		Springville Twp.		
19	Clay	NW¼ Sec. 31	A. D. Billings	
20	Clay	NW¼ Sec. 32	C. Brandenburg	
21	Clay	SW¼ Sec. 30	C. Brandenburg	
22	Clay	NE¼ Sec. 30	F. Stevens	
23	Clay	NW¼ Sec. 30	Jno. Heitman	35%
24	Clay	SE¼ Sec. 19	Wm. Ketcham	
25	Clay	NW¼ Sec. 18	Peter Loftus	28-30%
26	Clay	SW¼ Sec. 7	Geo. Oakes	28%
27	Clay	NW¼ Sec. 7	Wm. Wilson	34%
28	Clay	SW¼ Sec. 6	Earl Schoff	30-34%
29	Clay	NE¼ Sec. 24	E. Douglas	
30	Clay	SW¼ Sec. 15	A. L. Niblow	
31	Clay	SE½ Sec. 13	S. T. Cummings	
32	Clay	SW¼ Sec. 12	Ad. Bacon	
44	Clay	SW¼ Sec. 29	C. F. Eberlein	40%
		Easton Twp.		
33	Marly Clay	SW¼ Sec. 30	P. Goodale	
34	Clay	NE¼ Sec. 19	A. W. Fairfield	32.5%
		Adams Twp.		
35	Clay	NW¼ Sec. 6	R. Kavanaugh	28.5%
		Preston Twp.		
36	Clay	SE¼ Sec. 30	Chas. Souchek	25%
37	Clay	SE¼ Sec. 33	Al. Hodan	32.5%
38	Clay	SW¼ Sec. 19	G. W. Brigham	16%
39	Marly Clay	SW¼ Sec. 16	Jos. Victoria	
40	Marl	SE¼ Sec. 6	C. Friar	78.5%
		Monroe Twp.		
41	Clay	NE¼ Sec. 29	J. H. Thurber	26%
		Rome Twp.		
42	Clay	SE¼ Sec. 18	Mrs. Gnoss	21-23.5%
43	Limestone ledge	NE¼ Sec. 1	Harvey Ayers	95%

lime, for it may be hauled directly from the railroad and spread on the land at once.

Spreading Lime by Using a Manure Spreader. Sometimes a manure spreader may be used to spread lime. The spreader is set at its lowest gear, a few inches of fine manure spread over the bottom of the box to hold the lime in, and the lime distributed evenly on top of this thin layer of manure. If three tons of refuse lime are to be applied per acre, and the machine is set at four loads per acre, as on lowest gear, then each load must contain at least 1500 pounds of lime.

It should be remembered that most acid soils are also deficient in available phosphorus, but applying lime will not add to the total amount of phosphorus in the soil. The need of phosphorus may be so great that but little result will be secured from liming until phosphorus is also added. Frequently the application of phosphorus alone to an acid soil will result in larger increases than the uses of lime alone, and for this reason it is important that both deficiencies should be corrected to secure the most economical production.

THE USE OF FERTILIZERS*

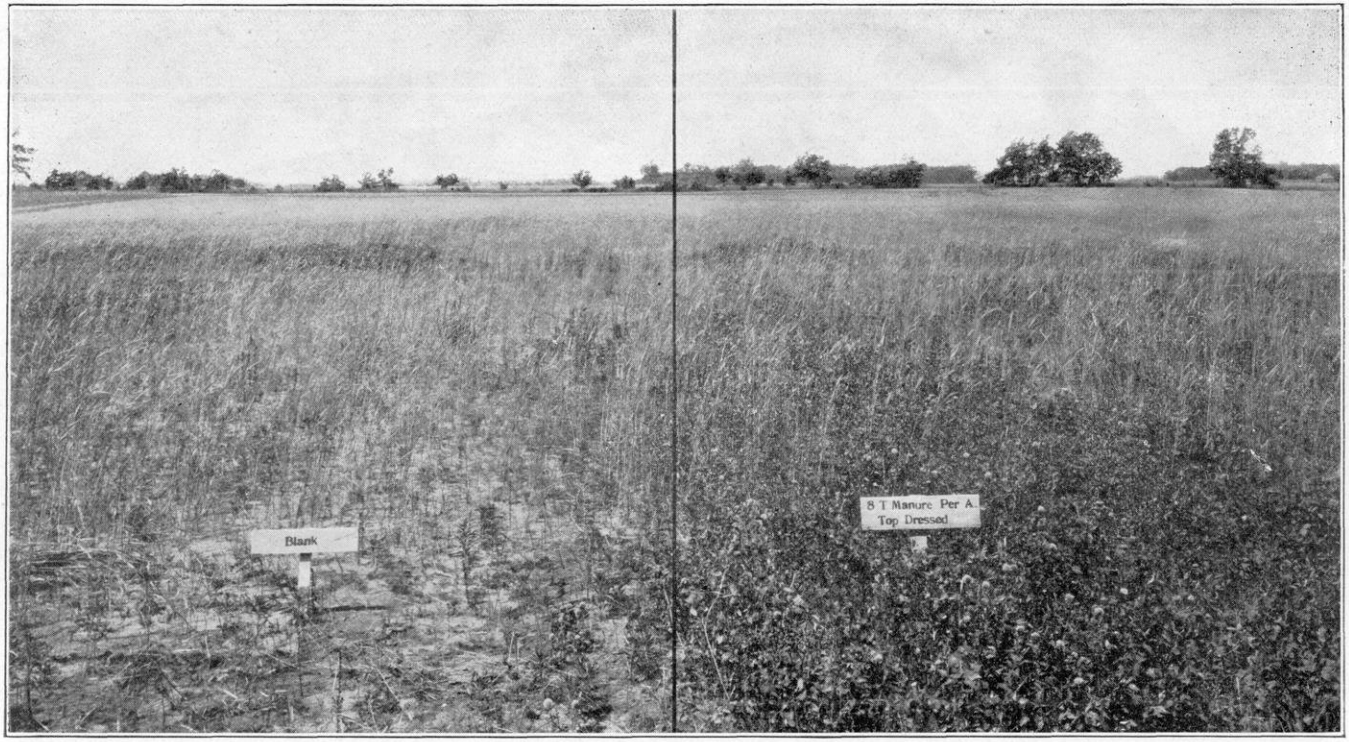
Nitrogen

Nitrogen is chiefly responsible for the dark green, healthy color and rapid growth of corn or other crops on well-manured land. It seems to regulate the general growth of the plant. The amounts of the other elements of plant food used by a crop are determined by the amount of nitrogen within reach of the crop, consequently it is extremely important to have an adequate supply of nitrogen for the crop at all times.

Virgin soils contain large amounts of nitrogen in the vegetable or organic matter, but if they are cropped continuously to such crops as corn, oats and timothy without the addition of fertilizing materials containing nitrogen, the nitrogen supply is gradually exhausted and crop yields are reduced.

Some crops are able to gather nitrogen from the air and add it to the supply in the farm. The clovers, alfalfa, peas and beans have bacteria closely associated with them on their roots that take the free nitrogen from the air and fix it in the plant

* For a more complete discussion of the use of fertilizers see Bulletin 341 of Wis. Experiment Station.



View of Plainfield sand on the Experimental Farm at Hancock in Waushara County. This view shows how clover was grown successfully. On the right there was applied a top dressing of 8 tons of manure, while on the left the land received no treatment.

roots. This is a cheap method of obtaining nitrogen and one which farmers should use to the fullest extent. On the ordinary dairy farm at least one-fourth of the land under cultivation should be seeded to clover or alfalfa. If this is fed to livestock and the manure carefully returned to the land, the nitrogen supply will be gradually increased. If not enough livestock is kept on the farm to require the use of one-fourth of the land in clover, because some land is in cash crops, the legume crop can still be used to add nitrogen to the soil by plowing it under as a green manuring crop. In this case all of the nitrogen in the crop is left in the soil and becomes available to other crops gradually, as they need it.

Phosphate Fertilizers. The chief forms of phosphate fertilizers available to Wisconsin farmers are acid phosphate, treble superphosphate, raw rock phosphate, and bone meal.

Bone meal is an excellent form of phosphate fertilizer, but the supply is very limited. It is obtained from the packing houses and other slaughter houses. It is more available to crops than rock phosphate, but not as quickly available as acid phosphate.

Raw rock phosphate is found in natural deposits in South Carolina, Tennessee, Florida, Idaho, Utah, and Montana. It is prepared for use as a fertilizer by being reduced to fine dust which will pass through a screen having 100 openings to the linear inch. It is a relatively insoluble material and the fine grinding makes it become available more rapidly for the use of plants. When this fertilizer is used in connection with considerable organic matter such as stable manure or on a green manuring crop being plowed under it gives excellent results when the soil is deficient in phosphorus.

Acid phosphate is the form of phosphate fertilizer most extensively used. It is made by treating one ton of raw rock phosphate with one ton of strong sulphuric acid, which has the effect of converting the phosphorus into a much more available and active condition. It usually contains either 16 or 20 per cent of soluble phosphoric acid. More highly concentrated forms are also made. Treble superphosphate is a comparatively new form of phosphate fertilizer. It is similar to the ordinary acid phosphate except that it carries approximately three times as much phosphorus.* This material has not been used in the field very long,

* This means that one ton of treble superphosphate is practically equal in value to three tons of 16% acid phosphate.

but the trials so far indicate that it will give results equal to those produced by acid phosphate. Under present conditions in Wisconsin, acid phosphate and treble superphosphate are probably the two best forms to use.

There is practically no loss of phosphorus from the soil by leaching; so that once a phosphate fertilizer has been worked into the soil, it will remain there until the growing crops exhaust it. It is best, therefore, to put on as much phosphate fertilizer at one time as will be needed in the crop rotation, whether that be three, four, or five years in length; and it makes relatively little difference whether the phosphate is applied to the land the year corn is to be planted, or whether it is put on when oats are being sown. All crops need this element and the benefit from its use is as great in the case of oats as of corn, and its effect on clover or alfalfa is even greater than on corn or oats.

When raw rock phosphate, the insoluble slow-acting form is applied, the applications are generally from 1000 to 2000 pounds an acre. The slow availability is being made up for in quantity. This material must always be applied along with barnyard manure, green manuring crops, or crop residues.

On good upland soil where dairying or general farming is practiced, the use of 200 pounds of 16 per cent acid phosphate or 80 pounds of treble superhosphate to the acre every four years will maintain the phosphate supply. If much grain, potatoes, or other crops are sold, about double these amounts should be used.

On soils relatively low in fertility somewhat more phosphate should be used at first. This is especially true of dark prairie soils which have grown corn or small grains a long time without the use of manure or other fertilizer. While the peat and muck soils of the southern and eastern portions of the state in the limestone region usually do not need phosphate the first few years after they are brought under cultivation, it is practically certain that they will need this element after a number of years of cropping. All of the peat and muck soils in the central and northern part of the state require phosphate from the beginning.

Any farmer who plans to improve or even maintain the fertility of the soils on his farm will want to fertilize all the crops in the rotation. A small amount of phosphate fertilizer applied with a fertilizer attachment on a corn planter will drop it near

the hill and in this way the corn will receive marked benefit, but there is little benefit obtained by the oats or clover following the corn in this method of application. On the other hand, if the phosphate is distributed broadcast in larger quantities and worked into the soil for either corn or oats, the crops following will receive their portion of the benefit. Unquestionably the best practice for the dairy farmer to follow is the broadcast application, though it makes relatively little difference whether the phosphate be applied directly to the corn, oats or other grains.

Acid Phosphate does not make soils acid. It might be supposed that acid phosphate would have a tendency to make the soil acid. But such is not the case. The acidity of the fertilizer is of a kind which entirely disappears, and experience has shown that its use for a long period of years does not make the soil more acid than it would otherwise be.

Potassium. Potassium exists in all upland earthy soils in large amounts, but in relatively unavailable form. On most soils of fairly heavy texture, when live stock is maintained, and the manure carefully used so there is considerable actively decomposing organic matter in the soil, a sufficient amount of potassium will become available from year to year to supply the needs of general farm crops. There are some crops that need relatively large amounts of potassium such as potatoes, tobacco, and cabbage, and they will often be benefited by some addition of potash in fertilizer form.

Mixed Fertilizers. Since certain crops such as tobacco, potatoes, and vegetables are grown in many parts of the country by farmers who do not keep much livestock and who do not rotate these crops with legumes, fertilizers containing nitrogen and potash, as well as phosphorus must be used. Mixed fertilizers containing varying amounts of nitrogen, phosphorus, and potash are therefore manufactured and offered for sale. The composition of these fertilizers is indicated by a formula. A 2-10-4 fertilizer, for instance, is one containing 2 per cent of ammonia, or nearly 2 per cent of nitrogen, 10 per cent of phosphoric acid, and 4 per cent of potash. A 6-12-0 contains 6 per cent of ammonia containing about 5 per cent of nitrogen, 12 per cent of phosphoric acid, and no potash.

One of the chief sources of nitrogen is nitrate of soda; of phosphoric acid, acid phosphate, and of potash, muriate of potash. Nitrate of soda contains about 16 per cent of nitrogen, acid

phosphate about 16 per cent of phosphoric acid, and muriate of potash about 50 per cent of potash; so that 100 pounds of a 2-10-4 fertilizer would contain about the equivalent of 12½ pounds of nitrate of soda, 62½ pounds of acid phosphate, 8 pounds of high-grade muriate of potash, and 17 pounds of filler. These mixed fertilizers cost $5 to $10 a ton more than the plant food in them would cost if bought in the separate forms indicated above. This difference represents the cost of mixing, and profits. Mixed fertilizers should contain not less than a total of 16 per cent of plant food elements.

When nitrogen and potash are to be used as well as phosphoric acid, there is some advantage in using these mixed fertilizers. The filler gives it a good mechanical condition so that it will distribute easily and remain in condition to be used longer than is the case with the substances containing the elements separately. But when the farmer needs to use only a phosphate fertilizer, purchasing a mixed fertilizer means that he is buying not only nitrogen and potash which he does not need, but he is compelled to pay a considerably higher price for the phosphate he gets than is the case when he buys a fertilizer containing phosphate only. While it is quite true that these mixed fertilizers have a very important place in the production of many special crops, their use is not necessary in dairy or stock farming as a rule, and phosphate fertilizers in addition to lime are usually the most profitable.

In the case of sandy soils on which an effort is being made to raise their state of fertility, it may be desirable to use moderate amounts of mixed fertilizer containing both nitrogen and potash as well as phosphorus such as a 4-10-4 fertilizer until clover or other legumes are produced or manure is available. On many muck soils it is necessary to use both potash and phosphorus and here a 0-10-10 fertilizer can be used to advantage. This is true generally of muck or peat soils in the central and northern part of the state. Or the farmer can buy the separate potash and acid phosphate fertilizers and mix them as they are to be used, thus saving the extra cost of the mixed fertilizers.

Method of Applying Fertilizer. Acid or treble superphosphate, as well as other commercial fertilizers, are salts and will injure the seed and prevent germination if they are in immediate contact with them. When the fertilizer is applied in the hill as it sometimes is with corn and other hill crops, there should

be at least one-half inch of soil between the seed and fertilizer. Drills which sow both grain and fertilizer are made so that the grain and fertilizer are not too closely mixed.

The condition of the soil should also be considered in using fertilizers. When the soil is quite dry, fertilizer is more apt to injure the seed than when moist. Three hundred pounds of fertilizer to the acre, applied with grain drill, will not injure the seed even when quite dry, but much larger amounts may. On very sandy soils there is more danger of the fertilizer injuring the seed than on heavier soils because they hold less water in which the fertilizer will dissolve. When applied in the hill for corn, 100 to 125 pounds an acre is all that can safely be used under ordinary conditions. When drilled in for corn, 175 to 200 pounds may be used.

Fertilizer Distributors

Phosphate or other fertilizers or lime should be uniformly distributed, so that some will be near every plant. Ground limestone is applied at the rate of from 2,000 to 4,000 pounds or more an acre, while with phosphates and other fertilizers the amount applied for staple crops is usually from 200 to 400 pounds It is, therefore, very difficult to construct a machine which will satisfactorily distribute both fertilizer and limestone, although excellent machines are on the market for distributing each separately. The fertilizer distributor may be a part of a grain drill or a separate machine.

When a fertilizer distributor is not available the acid phosphate or other fertilizer may be spread evenly over the manure in the manure spreader, and so preceive a very fair distribution. This method will give very good results until such time as a grain drill with fertilizer attachment can be purchased. The amount to be applied on each spreader load must be calculated so the right amount per acre will be applied. An old drill or seeder may be used to distribute the phosphate, going ahead of the grain drill.

Care of Manure

The care and use of the manure produced is the most important thing in the management of dairy and stock farms. The chief advantage of these types of farming is that the proper use

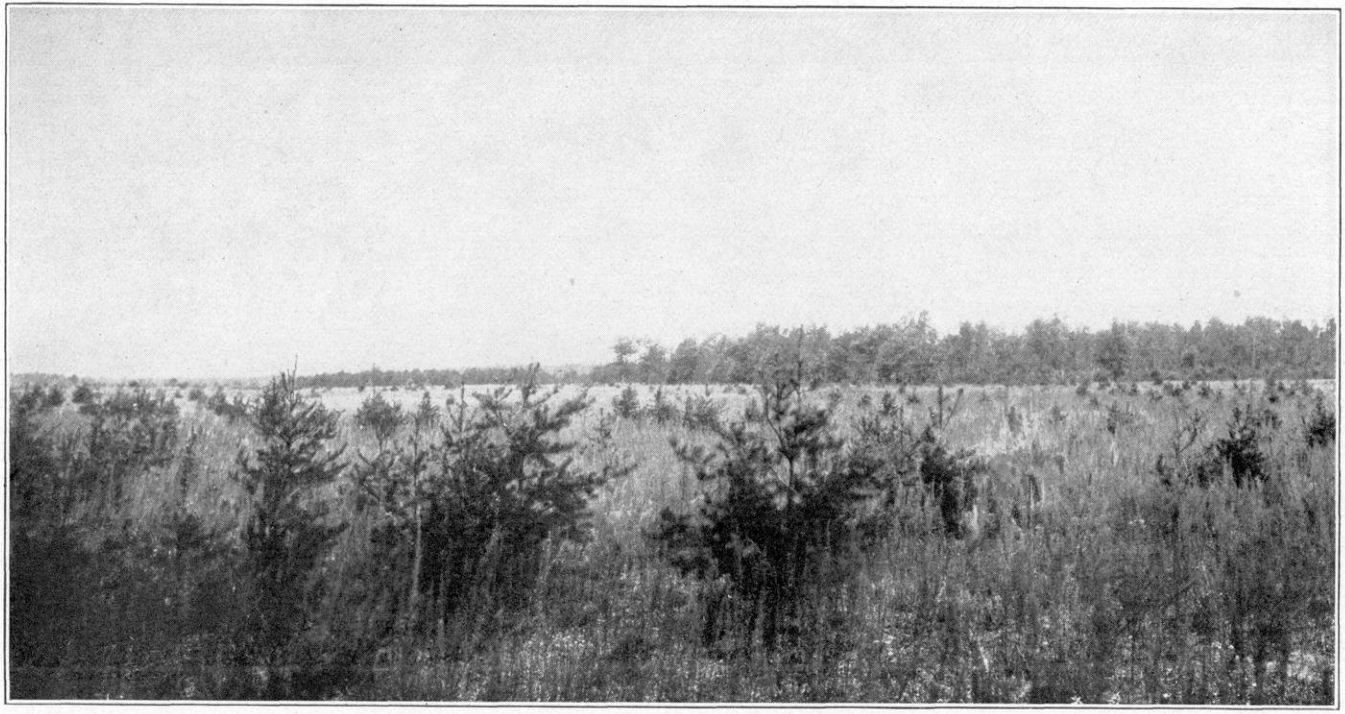
of the manure or other waste products makes it possible to maintain productive yields with comparatively little purchased fertilizer. But it is only when intelligent care is taken that this result is possible. Much of the available plant food in manure is readily soluble in water; so that if the manure is exposed to the rain in flat or shallow piles, a considerable part of its value is lost. This affects nitrogen and potash especially. It is important also to recognize that a large portion of these elements are in the liquid part of the manure and that it is necessary, therefore, to use bedding or absorbents freely to prevent a considerable loss. This is particularly true of potash, about 60 per cent of which is contained in the liquid manure.

If this potash is largely conserved and returned to the soil, it will form a revolving fund to which there are sufficient additions from the soil itself constantly being made to replace unavoidable losses; but if a large part of the potash in the feeds consumed is lost by leaching of the manure, then the soil is not able to supply this element with sufficient rapidity to permit the best growth of crops so that fertilizers containing potash would have to be used.

The use of sufficient absorbents such as oat straw, shredded cornstalks, or even dried peat, is of the utmost importance. Ordinarily the best practice is to haul the manure directly to the field. When this is not practicable the pile should be kept compact, well trodden, and moist as it can be, through the use of a slightly saucer-shaped manure pit, from the outer sides of which the ground slopes away readily; so as to prevent water washing into the pit itself. In this climate the use of shelter is of doubtful importance, though where more rains occur, particularly in the winter, a shed roof is very helpful.

The rate and frequency with which manure is applied depends in part on the character of the soil on the farm. On lighter soils more frequent applications of smaller amounts are desirable than on heavier soils. Five or six loads per acre every third year is desirable on the sandy loams, while eight to twelve or more every fourth or even fifth year may be used to advantage on heavier soils.

Humus. The importance of as large a supply as possible of decomposing vegetable matter in the soil must not be overlooked.



Showing reproduction of Jack Pine in abandoned field near Big Flats, Adams County.

It is through the decomposition of this vegetable matter that chemical reactions are produced which aid in making much of the plant food in the soil available to crops. Also, this organic matter has an important influence in increasing the water holding capacity of the soil, and in the case of heavy soils in improving their tilth or working qualities. All straw and other roughage produced should be worked in with the manure and returned to the soil, and whenever possible the green manuring crops should be grown and plowed under.

Forestry in Adams County

The average farm of Adams County includes about 190 acres. Of this, at present, only about 40 acres is in cultivated crops. A portion of the remainder is in wild pasture and marsh land but there is still a large portion in woodland. It will undoubtedly be necessary to increase the acreage of cultivated land on most farms to make them successful, especially if dairying or other form of livestock raising is followed, which seems the best system under our climate and soil conditions. Nevertheless, there will undoubtedly be a considerable portion of the great majority of farms in the County left in woodland for many years to come.

This being true, the possibility of deriving some revenue from the woodland becomes a matter of importance. While the lighter soils will not support good growth of many of the best timber trees, there are a few kinds which with proper protection will do fairly well. Jack Pine is a native of this section and is coming to have considerable importance, being used as pulp wood for the making of certain grades of paper as well as for box wood and, to a limited extent, for light frame lumber.

The Jack Pine later reproduces itself by seed when adjacent ground is unoccupied and exposed for the germination for such seed. This is well shown by the reseeding of fields left uncultivated adjoining strips of fully developed Jack Pine, as the accompanying illustration shows. With a good stand of Jack Pine, 30 to 40 years of age, a cut of 40 cords of pulp wood per acre is some times secured. With present prices of $8 to $10 per cord, good returns would be secured under favorable conditions.

Some assistance would have to be furnished the farmer by the state to make the introduction of such a system of reforestation practicable. The policy of relief from taxation on the timber

itself until the crop is cut and aid in prevention of fires as well as instruction in methods of reseeding and care of the woodland, would be necessary.

By securing the reseeding of an acre or two each year and then of cutting one or two acres each year when the crop had reached the profitable stage, the farmer would develop a long time rotation which would occupy from 40 to 80 acres in a way which would give him some returns for the use of his land and his labor at a time in the year when he is not otherwise especially busy.

Some other trees, especially of the hardwoods, may be grown chiefly for fire wood. The fuel for farmers' homes of Wisconsin now has a value of probably between ten and fifteen million dollars and is therefore a matter of very considerable importance.

Not only may woodland be developed to a point of having distinct commercial value in itself, but when properly managed is of great help in protecting the fields of lighter soils from damage through the blowing of sand and it also lessens the drifting of snow in the winter which leads to irregular distribution of moisture when it melts. Moreover, the reduction of the rate of melting of snows by protection which woodland furnishes lessens the rapidity with which water resulting from its melting runs off in the spring and so tends to reduce freshets and to maintain more steady flow of streams.

Two thirds of the wood products now produced on farms are used on those farms and only one-third is sold. Forestry could be planned in Adams county so as to help keep the roads open and protect them from drifting snow, protect the fields from wind-drifting of the soil, and give the land owner profitable employment in winter.

In addition to Jack pine, white and Norway pine and several varieties of oaks grow naturally on the heavier soils of the county. A few hemlock are found about the Dells and a few elm and cottonwoods on the lower ground in the south end of the county indicate some of the kinds of trees adapted to this locality. Small patches of tamarack timber are found on some of the peat soils.

It is greatly to be hoped that interest in the methods and possibilities of use of a considerable portion of the farms of this county in woods or forests of some character can be developed and that such legislation as may be necessary will be enacted.

CLIMATE

The climate of Adams County is typical of a large area of Central Wisconsin which has been described in a study of the climate of Wisconsin* as the Wisconsin River Basin. This region appears to be slightly cooler than the Mississippi River

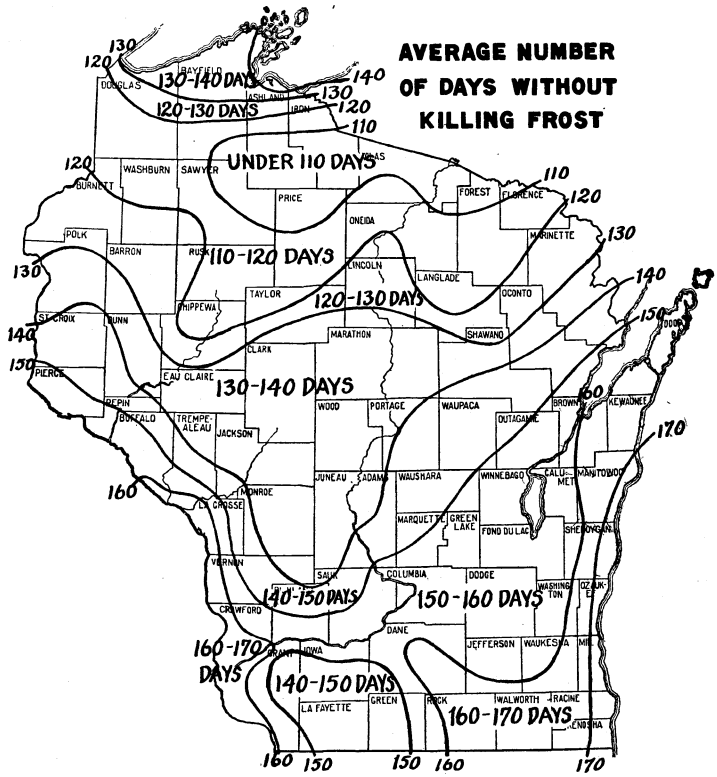


FIG. 3. SKETCH MAP OF WISCONSIN SHOWING THE AVERAGE NUMBER OF DAYS WITHOUT KILLING FROST.

Valley to the West or the Michigan Shore to the east, being cooler than the former in summer and colder than the latter in winter. The Wisconsin River basin averages about 10 days in winter when the temperature drops lower than ten degrees below zero, and thirteen days in summer when the thermometer rises above ninety. The growing season is somewhat shorter, owing probably to the altitude and the sandy soil and marshy condition of much of the land. Mauston, which is the county

seat of Juneau county, has an average season of 130 days between frosts as compared with 160 days at La Crosse to the west, 149 at Oshkosh, and 167 at Sheboygan at the east. Stevens Point has an average growing season of 126 days, and Hancock has about 132 days. From the accompanying chart it will be noted that the growing season of the Wisconsin River Basin averages from 130 to 140 days between killing frosts. There are many places with this basin, however, especially along the marsh land where killing frosts may occur any month during the year.

ADAMS COUNTY, WIS.

NORMAN MONTHLY, SEASONAL, AND ANNUAL TEMPERATURE AND PRECIPITATION.

At Hancock, Waushara Co., Wisconsin.

Month	Temperature			Precipitation			
	Mean	Absolute Maximum	Absolute Minimum	Mean	Total Amt for the dryest year 1985	Total Amt. for the wettest year 1905	Snow Aver. Depth
	°F	°F	°F	Inches	Inches	Inches	Inch
December	20.7	54	—25	1.28	1.75	1.50	
January	14.9	53	—36	----	1.40	1.10	----
February	16.2	53	—36	1.18	1.20	1.20	----
Winter	17.3	54	—36	----	4.35	3.80	----
March	29.8	83	—19	1.72	0.50	1.55	----
April	45.5	86	7	2.55	0.97	1.18	----
May	56.8	93	21	4.36	1.83	6.64	----
Spring	44.0	93	—19	8.63	3.30	9.37	----
June	66.8	102	31	4.25	1.44	10.55	----
July	71.2	103	44	3.98	1.76	4.10	----
August	68.5	100	37	3.32	3.37	6.56	----
Summer	68.8	103	31	11.55	6.57	21.21	----
September	61.2	94	20	3.57	1.44	3.68	----
October	49.0	84	14	2.31	0.40	2.99	----
November	33.2	69	—10	1.47	1.73	1.76	----
Fall	47.8	94	—10	7.35	3.57	8.43	----
Year	44.5	103	—36	----	17.79	42.81	----

The appended table of temperature and rainfall has been compiled from the records of the weather Bureau Station located at Hancock Wisconsin. This place is located just a few miles from the east side of the county. It is within the extensive area of level sandy land which covers much of Adams County and it is thought that these records will apply to Adams County fairly well. They are used since there is no weather bureau Station in Adams County.

From the table given it will be noted that the mean annual

temperature is 44.5 degrees. The highest recorded temperature is 103 and the lowest is –36 degrees. These extremes are seldom experienced, and are of short duration.

The average rainfall is about 31 inches and most of this comes during the growing season when most needed. During the months of April, May, June, July, August and September the rainfall on the average for 17 years is over 2.50 inches. For the months of May, June, July the rainfall on the average is over 3.50. inches. While the records show a fairly good distribution of rainfall it is nevertheless true that during the latter part of the summer some years crops suffer from the lack of moisture. This is especially true on the soils of light texture, which predominate in this county.

As indicated the average length of growing season in Adams County is about 132 to 135 days. While corn does not always mature in this region it can be safely grown as a crop for the silo, and for such use the acreage could be materially extended. Frosts occur on the peat marshes more frequently than on the adjoining upland and in fact light frosts are liable to occur almost any month in the year on the marshlands of the county.

SOIL MAP OF ADAMS COUNTY WISCONSIN

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY
W. O. HOTCHKISS, DIRECTOR — A. R. WHITSON, IN CHARGE OF SOIL SURVEY
IN COOPERATION WITH
THE COLLEGE OF AGRICULTURE, THE UNIVERSITY OF WISCONSIN
H. L. RUSSELL, DEAN
AND
THE U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF SOILS
MILTON WHITNEY, CHIEF

SOILS SURVEYED BY

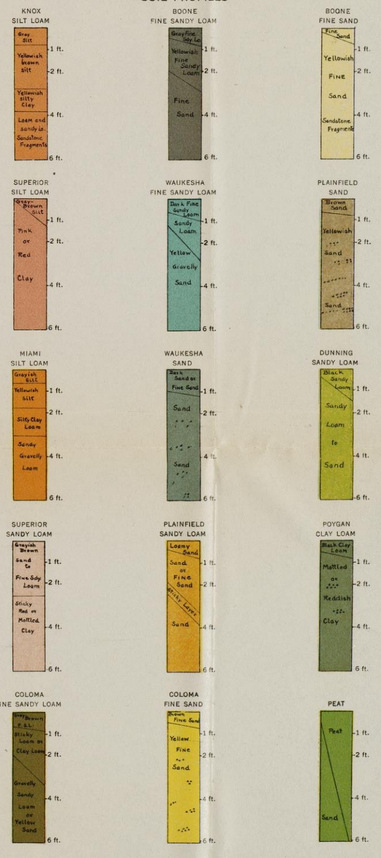
W. J. GEIB, H. W. STEWART, T. J. DUNNEWALD AND OSCAR MAGISTAD
OF THE
Wisconsin Geological and Natural History Survey
AND
JULIUS KUBIER, F. J. O'CONNELL AND J. A. WESLOW
OF THE
U. S. Department of Agriculture, Bureau of Soils

1 ½ 0 1 2 3 4 Miles
Scale 1 inch = 1 mile

KEY TO SOIL MAP

	NAME OF SOIL DESCRIPTION OF SOIL AND SUBSOIL	SURFACE FEATURES AND DRAINAGE	REFERENCE TO ADDITIONAL INFORMATION
GROUP OF HEAVY SOILS	K Knox Silt Loam — *Light brown silt loam with yellowish heavy subsoil. Sandstone or sandy material may be found at 2-5 feet.*	*Level to gently rolling with fair to good drainage.*	*For a more complete description of each soil in this group, and for a statement covering the present development of agriculture, soil fertility and methods for the improvement of these soils, see Chapter II, in the accompanying report, on "GROUP OF HEAVY SOILS."*
	Ss Superior Silt Loam — *Grayish-brown silt loam to clay loam with heavy red clay loam subsoil.*	*Level to gently sloping. Drainage fair to good. Deficient on level and depressed areas.*	
	Ms Miami Silt Loam — *Light-brown, friable silt loam, with yellowish-brown heavy subsoil. Sandy and gravelly at 2-4 feet. Some stones on surface in places.*	*Surface undulating to gently rolling, with good drainage.*	
GROUP OF FINE SANDY LOAMS	S Superior Sandy Loam — *Grayish-brown fine to medium sandy loam grading into sand with red clay 2-3 feet.*	*Level to gently undulating, with good drainage, slightly deficient where clay comes close to surface.*	*For a detailed description of the soils in this group and for a discussion of the present development of agriculture, fertility and methods for the improvement of these soils, see Chapter III in the accompanying report on GROUP OF FINE SANDY LOAMS.*
	Cf Coloma Fine Sandy Loam — *Light-brown fine sandy loam with sandy clay loam subsoil, becoming sandy and gravelly below 2-3 feet. Gravelly on surface in places.*	*Gently rolling to rough and broken. Nearly level in a few places. Drainage good.*	
	B Boone Fine Sandy Loam — *Grayish-brown fine sandy loam with yellow fine sand in deep subsoil.*	*Surface gently rolling. Drainage good.*	
	Wf Waukesha Fine Sandy Loam — *Dark brown to black fine sandy loam or loam grading into yellowish-brown sandy loam with yellow sand at 30-40 in.*	*Surface level. Natural drainage good.*	
GROUP OF SANDY SOILS	W Waukesha Sand — *Dark brown loamy sand to sand becoming chocolate colored below 8 in. Deep subsoil quite sandy with some gravel in places.*	*Surface level to slightly undulating. Sandy material blown into low ridges in places. Drainage good and even excessive in many places.*	*For additional information on the general character of the soils in this group, and for a full discussion of the present development of agriculture, fertility, and methods for the improvement of these soils, see Chapter IV in the accompanying report on GROUP OF SANDY SOILS.*
	Pl Plainfield Sandy Loam — *Light-brown fine to medium sandy loam with yellow sand subsoil. Some gravel in deep subsoil.*		
	C Coloma Sand — *Light-brown fine to medium sand with light colored sand subsoil. Soil and subsoil are gravelly in places. A few stones and boulders on surface.*	*Surface gently rolling to hilly. Drainage good to excessive.*	
	Bs Boone Fine Sand — *Light brown fine to medium sand with yellow sand subsoil.*	*Gently sloping to rolling. Wind blown in places. Drainage good to excessive.*	
	Ps Plainfield Sand — *Light brown fine to medium sand with yellow sandy subsoil.*	*Surface nearly level. Drainage good and often excessive.*	
	Ps Plainfield Sand Rolling Phase	*Surface rolling. Numerous wind blown hills and ridges. Drainage excessive and soil droughty.*	
GROUP OF POORLY DRAINED SOILS	D Dunning Sandy Loam — *Black loamy sand to fine sandy loam, mucky in places, with grayish to nearly white sand subsoil. Heavy subsoil in a very few places.*	*Surface low lying, level or depressed, and natural drainage poor. Usually found as marsh border land.*	*For a detailed description of all soils in this group and for a full discussion of the present development of agriculture, fertility, crop adaption, and methods for the improvement of these soils see Chapter V of the accompanying report on GROUP OF POORLY DRAINED SOILS.*
	G Genesee Fine Sandy Loam — *Dark brown fine sandy loam soil with sandy to silty loam subsoil. Some marshy places quite heavy and dark colored.*	*Surface low, first bottom land, subject to overflow. Drainage deficient.*	
	Pc Poygan Clay Loam — *Black clay loam with sandy spots. Bluish clay subsoil resting on red clay with sandy layers.*	*Surface low, level or depressed. Natural drainage poor. Usually found as marsh border soil.*	
MISCELLANEOUS SOILS	P Peat; P Peat, Shallow Phase — *Dark brown to nearly black partly decayed vegetable matter, with subsoil usually sandy. Typical peat is from 18 inches to over 3 feet deep. Shallow Peat is less than 18 inches deep.*	*Surface level, low lying or depressed and natural drainage poor. All classed as marsh land and very wet part of year.*	
	R Rough Stony Land — *Includes rocky land, sandstone mounds, steep slopes, etc. Soil between rocks quite sandy.*	*Surface so steep or rocky as to be unsuited to cultivated crops. Drainage excessive.*	

SOIL PROFILES



NOTE
The above diagrams show the soil sections to a depth of 6 feet. Horizontal and diagonal cross lines show the varying depths of the soil materials.

CONVENTIONAL SIGNS

- Secondary roads and Trails
- Railroads, Steam and Electric
- School or Church, Cemeteries
- Stony and Gravelly areas
- Soil boundaries

BASE MAP IN PART FROM U.S. GEOLOGICAL SURVEY SHEETS

LITHO. A. HOEN & CO. BALTO. MD