UNIVERSITY OF ILLINOIS

Agricultural Experiment Station

SOIL REPORT No. 31

ROCK ISLAND COUNTY SOILS

By R. S. SMITH, O. I. ELLIS, E. E. DeTURK, F. C. BAUER,
and L. H. SMITH

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The Soil Survey of Illinois was organized under the general supervision of Professor Cyril G. Hopkins, with Professor Jeremiah G. Mosier directly in charge of soil classification and mapping. After working in association on this undertaking for eighteen years, Professor Hopkins died and Professor Mosier followed two years later. The work of these two men enters so intimately into the whole project of the Illinois Soil Survey that it is impossible to disassociate their names from the individual county reports. Therefore recognition is hereby accorded Professors Hopkins and Mosier for their contribution to the work resulting in this publication.

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INTRODUCTORY NOTE

It is a matter of common observation that soils vary tremendously in their productive power, depending upon their physical condition, their chemical composition, and their biological activities. For any comprehensive plan of soil improvement looking toward the permanent maintenance of our agricultural lands, a definite knowledge of the various existing kinds or types of soil is a first essential. It is the purpose of a soil survey to classify the various kinds of soil of a given area in such a manner as to permit definite characterization for description and for mapping. With the information that such a survey affords, every farmer or landowner of the surveyed area has at hand the basis for a rational system of improvement of his land. At the same time the Experiment Station is furnished an inventory of the soils of the state, upon which intelligently to base plans for those fundamental investigations so necessary for solving the problems of practical soil improvement.

This county soil report is one of a series reporting the results of the soil survey which, when completed, will cover the state of Illinois. Each county report is intended to be as nearly complete in itself as it is practicable to make it, even at the expense of some repetition. There is presented in the form of an Appendix a general discussion of the important principles of soil fertility, in order to help the farmer and landowner to understand the significance of the data furnished by the soil survey and to make intelligent application of the same in the maintenance and improvement of the land. In many cases it will be of advantage to study the Appendix in advance of the soil report proper.

Data from experiment fields representing the more extensive types of soil, and furnishing valuable information regarding effective practices in soil management, are embodied in the form of a Supplement. This Supplement should be referred to in connection with the descriptions of the respective soil types found in the body of the report.

While the authors must assume the responsibility for the presentation of this report, it should be understood that the material for the report represents the contribution of a considerable number of the present and former members of the Agronomy Department working in their respective lines of soil mapping, soil analysis, and experiment field investigation. In this connection special recognition is due the late Professor J. G. Mosier, under whose direction the soil survey of Rock Island county was conducted, and Mr. S. V. Holt who, as leader of the field party, was in direct charge of the mapping.

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ROCK ISLAND COUNTY SOILS

By R. S. SMITH, O. I. ELLIS, E. E. De TURK, F. C. BAUER, and L. H. SMITH[1]

LOCATION AND CLIMATE OF ROCK ISLAND COUNTY

Rock Island county is situated in the northwestern part of the state, extending along the Mississippi river for about 50 miles. It is about 428 square miles in area and is divided into almost equal parts by Rock river.

Since there are no Weather Bureau records for Rock Island county for a long-continued period, the data collected at Aledo, Mercer county, are used to represent the climatic conditions in this area. The greatest range in temperature during any one year from 1902 to 1923 was 125 degrees in 1905, 1916, and 1918. The lowest temperature recorded during this period was – 30°, the highest, 104°. The average date of the last killing frost in spring is April 28, the earliest in fall is October 15, giving a growing season of about 169 days.

The average annual rainfall for the period 1902 to 1922 was 33.09 inches. The rainfall by months for this period was as follows: January, 1.59 inches; February, 1.27; March, 2.13; April, 3.15; May, 4.50; June, 3.94; July, 3.54; August, 3.11; September, 4.50; October, 2.32; November, 1.93; and December, 1.31.

AGRICULTURAL PRODUCTION

Diversified farming is the rule in Rock Island county. Twenty-nine percent of the area of the county is rough enough to be subject to serious erosion. This fact emphasizes the necessity of keeping a relatively large acreage in pasture or of using special methods to lessen erosion if the land is cultivated.

In 1919, according to the Fourteenth Census, there were 2,045 farms in Rock Island county. The average size of these farms was 119.2 acres, 87.3 acres of which were improved. Only 38.7 percent of the farms were operated by tenants, which is a slight increase over the two preceding decades.

The following figures show the acreage and production of the principal crops grown in the county. In considering these figures it should be remembered that they are for a single year only, that of 1919.

Crops	*Acreage*	*Production*	*Yield per acre*
Corn	58,508	2,529,024 bu.	43.2 bu.
Oats	22,337	663,366 bu.	29.7 bu.
Wheat	10,745	224,598 bu.	20.9 bu.
Barley	2,653	49,862 bu.	18.8 bu.
Rye	5,557	79,534 bu.	14.3 bu.
Timothy	5,781	8,309 tons	1.44 tons
Timothy and clover mixed	16,412	23,225 tons	1.42 tons
Clover	3,377	5,078 tons	1.50 tons
Alfalfa	719	2,118 tons	2.95 tons
Silage crops	2,214	19,391 tons	8.76 tons
Corn for forage	3,465	7,962 tons	2.30 tons

[1] R. S. Smith, in charge of soil survey mapping; O. I. Ellis, Assistant Chief in soil survey mapping; E. E. DeTurk, in charge of soil analysis; F. C. Bauer, in charge of experiment fields; L. H. Smith, in charge of publications.

The total value of all crops for 1919 was estimated at $6,738,106. The acreage devoted to pasture is not recorded in the Census, but a conservative estimate seems to be that 15 percent of the area of the county, or about 41,000 acres, was used for this purpose in 1923.

Livestock farming is an important industry in this county, as shown by the following figures taken from this same Census report.

Animals and Animal Products	*Number*	*Value*
Horses	10,954	$1,009,737
Mules	429	48,415
Beef cattle	15,756	927,115
Dairy cattle	15,354	1,097,107
Sheep	4,946	59,578
Swine	59,213	1,392,323
Poultry	220,082	238,695
Eggs and chickens	.....	674,746
Dairy products	.....	666,144
Wool	26,080 lbs.	13,594

The total value of livestock and livestock products was, as shown by these figures, over six million dollars in 1919.

Market gardening and dairying are highly developed near the cities. The sandy soils in the vicinity of the cities of Rock Island and Moline are well adapted to gardening and the market is good for garden products.

Fruit growing also is of considerable importance in this county. In 1919 there were about 245,000 quarts of small fruits produced and 8,900 bushels of orchard fruits. The excellent markets, together with soils adapted to fruit growing, would seem to indicate that this industry might be further developed with profit.

SOIL FORMATION

GEOLOGICAL HISTORY

One of the most important periods in the geological history of the county, from the standpoint of soil formation, was the Glacial period, during which and immediately following, the material that later formed the mineral portion of the soils was being deposited. At that time, snow and ice accumulated in the region of Labrador and to the west of Hudson Bay to such an amount that the mass pushed outward from these centers, chiefly southward, until a point was reached where the ice melted as rapidly as it advanced. In moving across the country from the far north, the ice gathered up all sorts and sizes of material, including clay, silt, sand, gravel, boulders, and even immense masses of rock. Some of these materials were carried for hundreds of miles and rubbed against surface rocks and against each other until largely ground into powder. When the limit of advance of the ice sheet was reached, the rock material carried by the ice accumulated along the front of the glacier in a broad, undulating ridge or moraine. When the ice melted more rapidly than the glacier advanced, the terminus of the glacier receded, and the material was deposited somewhat irregularly over the area previously covered. The mixture of materials deposited by the glacier is known as boulder clay, till,

glacial drift, or simply drift. The average depth of this deposit over the state of Illinois is estimated as 115 feet.

During the Glacial period at least six distinct ice advances occurred that were separated by long periods of time. They are described as follows, in the order of their occurrence:

(1) The Nebraskan, which did not touch Illinois; (2) the Kansan, which covered the western parts of Hancock and Adams counties; (3) the Illinoisan, which covered all of the state of Illinois except the northwest county (Jo Daviess), the southern part of Calhoun county, and the seven southernmost counties; (4) the Iowan, which covered a part of northern Illinois, the exact area, however, being difficult to determine because of the effect of the subsequent glaciations; (5) the early Wisconsin, which covered the northeastern part of the state as far west as Peoria and as far south as Shelbyville; (6) the late Wisconsin, which extended to the west line of McHenry county and south to the town of Milford in Iroquois county.

Previous to the ice invasion, this region generally was not well suited to agriculture because of its rough and hilly character, as is shown by borings which indicate many preglacial valleys that later were filled with drift. The general effect of the glaciers was to change the surface from hilly to gently undulating.

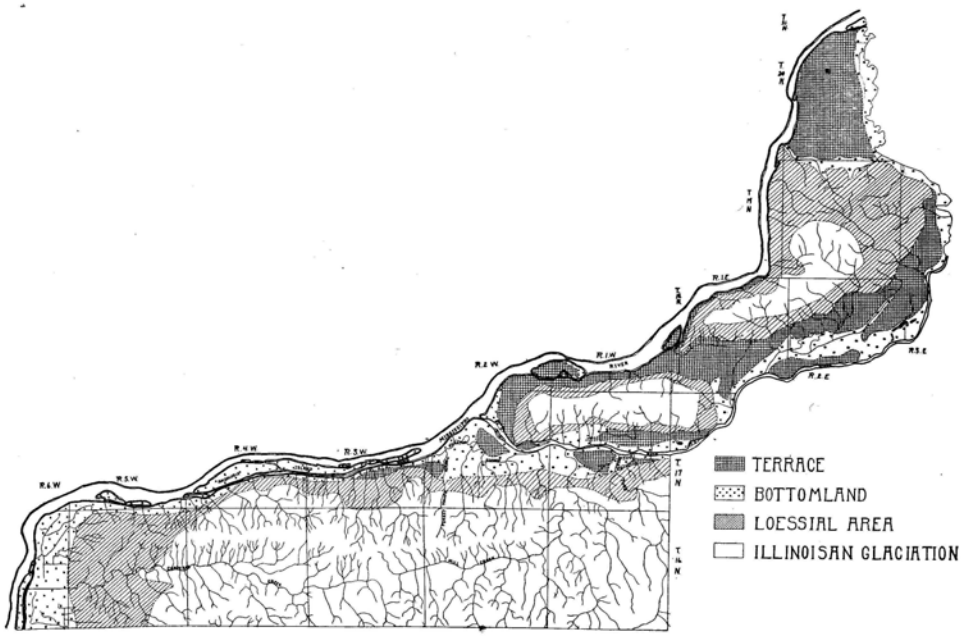
Rock Island county was covered by the Illinoisan glaciation, which partially leveled the region by rubbing down the hills and filling the valleys. No moraines were formed in this county. A later ice sheet, known as the Iowan glaciation, probably did not cover any portion of Rock Island county. It played an important role, however, in the formation of the soils of the county because the water from the melting ice carried large quantities of sediment and deposited it on the extensive bottom lands and terraces. Later much of this material in the form of fine sand and silt was blown on to the upland. This wind-blown deposit varies from 5 to 40 feet in thickness and is known as loess.

CHANGES IN THE RIVER SYSTEMS

The Mississippi river changed its course several times during the Glacial period. At one time, the channel was diverted to the west into Iowa near Fulton, and re-entered its present channel near Keokuk, Iowa. Later, the river followed the present valley of Meredosia slough to Rock river and thence in an eastward direction thru Henry and Bureau counties to the Illinois river. Probably, a third course of the Mississippi river was in its present channel to about Watertown, and thence east thru what is now known as Pleasant Valley.

Presumably the Rock river did not follow any of the preglacial courses of the Mississippi river, but formed a new valley leading to the present channel of the Mississippi river, thus forming the island of upland extending from Carbon Cliff to the city of Rock Island. This area is covered by a deposit of loess 40 feet in thickness at the west end, and 25 feet in thickness at the east end. The glacial drift occurs as a relatively thin sheet, the limestone bed rock being reached at a depth of 50 to 75 feet.

The island-like upland from Hampton to Meredosia slough is covered by a deposit of loess to a depth of 30 to 40 feet, beneath which there is a deposit



MAP SHOWING DRAINAGE SYSTEMS OF ROCK ISLAND COUNTY

of blue till extending to limestone rock at a depth of about 100 feet. The area of upland south of Rock river has a loess cap of 25 to 40 feet in thickness on the borders of the Rock and Mississippi rivers, and decreases to 15 feet in thickness at the Mercer county line. The depth to the rock varies from 50 feet at the Rock river bluffs to 150 feet at the Mercer county line.

PHYSIOGRAPHY AND DRAINAGE

The topography of Rock Island county varies from flat to undulating and rolling. In the bottom lands, the topography varies from flat to slightly undulating, the latter being due to the presence of sand ridges. Most of the terraces are undulating, altho only slightly undulating and even flat areas occur. Where the wind has opportunity to drift the sand, the topography is undulating. The upland in the prairie south and west of Rock river varies from undulating between Taylor Ridge and Edgington, to rolling in the remainder of the area where erosion has been active. In the timber areas, the topography varies from rolling to rough and broken, the slopes becoming steep near the Mississippi river. The topography of the island extending from Rock Island to Carbon Cliff varies from undulating in the Yellow-Gray Silt Loam area to rough and broken near the bluff line, with a drop of 150 or 175 feet to the terrace. The area north of Pleasant Valley in the vicinity of Port Byron varies from undulating to rolling and broken.

Practically all of the county is drained by the Mississippi and Rock rivers. There are two secondary streams, namely Copperas and Mill creeks, in the south part of the county. Nearly all the bottom land has been drained by

open dredge ditches. Levees have been built along the Mississippi river and pumping stations established so as to keep down the excess water and to lower the water-table level. The Meredosia slough in the north part of the county is a sluggish stream, but has a fairly good channel. During periods of high water it serves as an overflow stream or cut-off between the Mississippi and Rock rivers. Some of the small intermittent streams in the upland disappear when they reach the terrace or bottom land. They spread over a wide expanse of area and find their way to the larger streams thru the underdrainage. Very few open ditches are required to drain readily the sandy terrace areas of excess water. The water table is usually deep enough not to hinder the growth of the crops. Some of the depressions without any outlets are poorly drained.

The altitudes of several of the more important towns of the county are as follows: Hillsdale, 577 feet; Moline, 580; Port Byron, 579; Reynolds, 800; Rock Island, 563; Taylor Ridge, 786.

SOIL GROUPS

The soils of Rock Island county are divided into five groups, as follows:

(a) *Upland Prairie Soils,* usually rich in organic matter. These areas originally were covered with wild prairie grasses, the partially decayed roots of which have been the chief source of organic matter. The upland prairie soils include some areas of recent timber growth, where certain kinds of trees have spread over the prairie, but this forestation has not been of sufficient duration to produce the characteristic timber soils. These areas of greater or less width are found along the border of most timber tracts, so that the timber actually extended a little farther than the soil would indicate.

(b) *Upland Timber Soils,* including those zones along stream courses over which forests grew for a long period of time. Timber soil contains less organic matter than prairie soil because the large roots of dead trees and the surface accumulation of leaves, twigs, and fallen trees suffered almost complete decay or were burned by forest fires. The timbered soils are divided into two groups, the undulating and the eroded.

(c) *Deep Loess,* including those soils which are sufficiently near the origin of the wind-blown material to contain considerable amounts of fine sand.

(d) *Terrace Soils,* formed by deposits from flooded streams overloaded with sediment, perhaps at the time of the melting of the glacier. Finer deposits which were later made upon the coarser material now constitutes the soil. Large quantities of sand deposited and reworked by the wind form the sand dunes.

(e) *Swamp and Bottom Lands,* which include the flood plains along the streams and some poorly drained muck and peat areas.

Table 1 gives the list of soil types in Rock Island county, the area of each in square miles, and in acres, and also the percentage of the total area. The accompanying map, shown in 4 sections, gives the location and boundary of each soil type which has been mapped in the county.

For explanations concerning the classification of soils and the interpretation of the map and tables, the reader is referred to the first part of the Appendix.

TABLE 1.—SOIL TYPES OF ROCK ISLAND COUNTY, ILLINOIS

Soil type No.	Name of type	Area in square miles	Area in acres	Percent of total area
	(a) Upland Prairie Soils (500, 800)			
526	Brown Silt Loam	65.74	42,074	15.32
841	Brown Fine Sandy Silt Loam	5.83	3,731	1.37
871	Brown Fine Sandy Loam	.94	601	.22
528	Brown-Gray Silt Loam On Tight Clay	.10	64	.02
		72.61	46,470	16.93
	(b) Upland Timber Soils (500, 800)			
534	Yellow-Gray Silt Loam	43.64	27,930	10.18
535	Yellow Silt Loam	77.55	49,632	18.08
845	Yellow Fine Sandy Silt Loam	24.88	15,923	5.80
844	Yellow-Gray Fine Sandy Silt Loam	14.38	9,203	3.35
874	Yellow-Gray Fine Sandy Loam	25.80	16,512	6.02
875	Yellow Fine Sandy Loam	22.78	14,579	5.31
876	Mixed Sand and Loess	1.08	691	.25
		210.11	134,470	48.99
	(c) Residual Soils (000)			
098	Stony Loam	.11	70	.03
099	Rock Outcrop	.01	6	.002
		.12	76	.032
	(d) Terrace Soils (1500)			
1526	Brown Silt Loam	8.71	5,575	2.03
1526.1	Brown Silt Loam On Clay	.10	64	.02
1528	Brown-Gray Silt Loam On Tight Clay	.09	58	.02
1560	Brown Sandy Loam	29.85	19,104	6.96
1571	Brown Fine Sandy Loam	6.35	4,064	1.48
1560.4	Brown Sandy Loam On Gravel	2.47	1,581	.58
1560.5	Brown Sandy Loam On Rock	.93	595	.22
1568	Brown-Gray Sandy Loam On Tight Clay	.20	128	.05
1564	Yellow-Gray Sandy Loam	2.33	1,491	.54
1564.1	Yellow-Gray Sandy Loam On Clay	.05	32	.01
1580	River Sand	10.36	6,630	2.42
1581	Dune Sand	1.27	813	.30
1590	Gravelly Loam	.06	38	.01
		62.77	40,173	14.64
	(e) Swamp and Botton-Land Soils (1300, 1400)			
1426	Deep Brown Silt Loam	17.51	11,207	4.08
1354, 1454	Mixed Loam	31.26	20,006	7.29
1460	Brown Sandy Loam	5.17	3,309	1.21
1344, 1444	Yellow-Gray Fine Sandy Silt Loam	6.42	4,109	1.49
1461	Black Sandy Loam	.20	128	.05
1480	River Sand	.07	45	.02
1420	Black Clay Loam	1.46	934	.34
1415	Drab Clay	1.24	794	.29
1421	Drab Clay Loam	1.27	813	.30
1450	Black Mixed Loam	11.86	7,591	2.77
1450.5	Black Mixed Loam On Rock	.53	339	.12
1401	Deep Peat	2.61	1,670	.61
1413	Clayey Muck	.03	19	.006
		79.63	50,964	18.57
	(f) Miscellaneous			
	Water	3.14	2,010	.73
	Swamp	.27	173	.06
	Gravel Pits	.23	147	.05
		3.64	2,330	.84
	Total	428.88	274,483	100.00

INVOICE OF THE ELEMENTS OF PLANT FOOD IN ROCK ISLAND COUNTY SOILS

In order to obtain a knowledge of its chemical composition, each soil type is sampled in the manner described below and subjected to chemical analysis for its important plant-food elements. For this purpose samples are taken usually in sets of three to represent different strata in the top 40 inches of soil; namely, an upper stratum (0 to 6⅔ inches), a middle stratum (6⅔ to 20 inches), and a lower stratum (20 to 40 inches). These sampling strata correspond approximately in the common kinds of soil to 2,000,000 pounds per acre of dry soil in the upper stratum, to two times this quantity in the middle stratum, and to three times in the lower stratum. This, of course, is a purely arbitrary division of the soil section, very useful in arriving at a knowledge of the quantity and distribution of the elements of plant food in the soil, but it should be borne in mind that these strata seldom coincide with the natural strata as they actually exist in the soil and which are referred to in describing the soil types as surface, subsurface, and subsoil. By this system of sampling we have represented separately three zones for plant feeding. The upper, or surface layer, includes at least as much soil as is ordinarily turned with the plow, and this is the part with which the farm manure, limestone, phosphate, or other fertilizing material is incorporated.

The chemical analysis of a soil, obtained by the methods here employed, gives the invoice of the total stock of the several plant-food materials actually present in the soil strata sampled and analyzed. It should be understood, however, that the rate of liberation from their insoluble forms, a matter of at least equal importance, is governed by many factors, and is therefore not necessarily proportional to the total amounts present.

For convenience in making application of the chemical analyses, the results as presented here have been translated from the percentage basis and are given in the accompanying tables in terms of pounds per acre. In this the assumption is made that for ordinary types an acre of soil to a depth of 6⅔ inches weighs, when dry, 2,000,000 pounds, exceptions being made of certain soils very high in organic matter, such as the peats and the mucks. It is understood, of course, that this value is only an approximation, but with this understanding it is believed that it will suffice for the purpose intended. It is, of course, a simple matter to convert these figures back to the percentage basis in case one desires to consider the information in that form.

THE UPPER SAMPLING STRATUM

In Table 2 are reported the amounts of organic carbon (which serves as a measure of the total organic matter), and the total quantities of nitrogen, phosphorus, sulfur, potassium, magnesium, and calcium in 2 million pounds of the surface soil of each type in Rock Island county.

Because of the extreme variations frequently found within a given soil type with respect to the presence of limestone and acidity in different strata, no attempt is made to include in the tabulated results figures purporting to represents their averages in the respective types. In examining each soil type in the

field, however, numerous qualitative tests are made which furnish general information regarding the soil reaction, and in the discussion of the individual soil types which follow, recommendations based upon these tests are given concerning the lime requirement of the respective types. Such recommendations cannot be made specific in all cases because local variations exist, and because the lime requirement may change from time to time, especially under cropping and soil treatment. Therefore, it is often desirable to determine the lime requirement for a given field and in this connection the reader is referred to the section in the Appendix dealing with the application of limestone (see page 36).

In connection with Table 2, attention is called to the variation among the soil types with respect to their content of the different plant-food elements. It will be seen from the analyses that variations in the organic-carbon content of the different soils are accompanied by similar variations in the nitrogen content. The organic-carbon content is usually from 10 to 12 times that of the total nitrogen. This close relationship is explained by the well established facts that all soil organic matter contains nitrogen, and that most of the soil nitrogen (usually 98 percent or more) is present in a state of organic combination. This close relationship is also maintained in the middle and lower sampling strata. The organic matter with its nitrogen varies widely in various soils of the county. The largest amounts are found in the swamp and bottom-land soils, especially those which are peaty. Clayey Muck contains 165,075 pounds an acre of organic carbon, the largest amount found in any soil type in the county. Its corresponding nitrogen content is 14,410 pounds. The upland prairie soils are much higher in these constituents than are the timber soils, the average for the former being 51,260 pounds an acre of organic carbon, and 4,210 pounds of nitrogen, as compared to only 21,920 pounds and 2,010 pounds of the two elements, respectively, in the latter group. The relative deficiency of the timber soils in these important constituents serves to emphasize the necessity of giving particular attention to the return of organic materials to soils of this group in planning cropping systems.

Other elements are not so closely associated with each other as organic matter and nitrogen. However, there is some degree of correlation between sulfur and organic carbon. This is because a considerable, tho varying, proportion of the sulfur in the soil exists in the organic form, that is, as a constituent of the organic matter.

The potassium content is always low in peat and muck soils, the minimum for Rock Island county being 13,150 pounds an acre in Deep Peat. With the exception of Deep Peat and Clayey Muck, the potassium does not vary widely from about 30,000 pounds. The maximum amount, as shown in the analyses, is 40,340 pounds an acre in Brown Silt Loam On Clay, Terrace.

The sandy soils furnish examples of the lowest amounts of phosphorus in the county as well as of calcium and magnesium. Dune Sand contains but 740 pounds of phosphorus, while River Sand contains only 5,200 pounds of calcium and 2,640 pounds of magnesium an acre. The comparatively small amounts of the mineral elements in the sandy soils may be due in part to the open texture which permits more rapid leaching, but is also undoubtedly due in part to the chemical composition of the parent material out of which the soil has been

formed. The texture of the sandy soil encourages deep penetration by the roots of crop plants and the resultant increase in the scope of the feeding zone offsets to some extent the lower concentration of the elements above mentioned in these soils.

The largest amounts of phosphorus, calcium, and magnesium are all to be found in Stony Loam, a soil occupying but 78 acres in the county, and of no great agricultural importance. These amounts are: phosphorus, 2,360 pounds, calcium, 51,180 pounds, and magnesium 29,960 pounds an acre.

THE MIDDLE AND LOWER SAMPLING STRATA

In Tables 3 and 4 are recorded in a similar manner the amounts of the plant-food elements in the middle and lower sampling strata. In comparing these strata with the upper one, it will be noted that the majority of the soil types diminish rather rapidly in organic matter and nitrogen with increasing depth, while the percentages of the other elements for the most part remain about the same and in some cases increase slightly in the lower strata. In making these comparisons, it is necessary to bear in mind that the data as given for the middle and lower sampling strata are on the basis of 4 million and 6 million pounds of soil, and should therefore be divided by two and three, respectively, thus converting them to a uniform basis of 2 million pounds, before comparing them with each other or with the data for the upper stratum.

It is frequently of interest to know the total supply of a plant-food element accessible to the growing crops. While it is impossible to obtain this information exactly, especially for the deeper-rooted crops, it seems probable that practically all the feeding range of the roots of most of our common field crops is included in the upper 40 inches of soil. By adding together for a given soil type, the corresponding figures in Tables 2, 3, and 4, the total amounts of the respective plant-food elements to a depth of 40 inches may be ascertained.

A wide range of variation with respect to composition is found to occur in the sub-layers as well as in the top layers of the various soil types. The tables reveal further that there is not only this wide diversity among the different soils with respect to a given plant-food element, but that there is also a great variation with respect to the relative abundance of the various elements within a given soil type as measured by crop requirements. We may compare in this way, the two most extensive soil types in the county, namely Brown Silt Loam and Yellow Silt Loam, both upland types. The respective amounts of nitrogen in the two soils to a depth of 40 inches are 15,950 and 5,680 pounds an acre, equivalent to the nitrogen contained in the same number of bushels of corn, since a bushel of corn contains approximately a pound of nitrogen. The Brown Silt Loam thus contains nearly three times as much of this element as the Yellow Silt Loam. With regard to the phosphorus and potassium content of the two soil types, there is no significant difference. The former contains 6,210 pounds of phosphorus, which is equivalent to 36,600 bushels of corn, as compared to 5,790 pounds in the latter, equivalent to 34,100 bushels of corn. The total amounts of potassium in the two soil types, respectively, are 206,210 and 201,160 pounds, equivalent to approximately 1,085,000 bushels of corn.

TABLE 2.—PLANT-FOOD ELEMENTS IN THE SOILS OF ROCK ISLAND COUNTY, ILLINOIS
UPPER SAMPLING STRATUM: ABOUT 0 TO 6⅔ INCHES

Average pounds per acre in 2 million pounds of soil

Soil type No.	Soil type	Total organic carbon	Total nitrogen	Total phosphorus	Total sulfur	Total potassium	Total magnesium	Total calcium
	Upland Prairie Soils (500, 800)							
526	Brown Silt Loam	64 380	5 070	1 330	950	34 000	7 870	9 840
841	Brown Fine Sandy Silt Loam	43 340	3 720	1 260	860	32 700	6 560	9 020
871	Brown Fine Sandy Loam	46 420	4 060	1 280	760	32 080	14 520	9 220
528	Brown-Gray Silt Loam On Tight Clay	50 900	3 980	1 020	740	32 020	7 440	12 100
	Upland Timber Soils (500, 800)							
534	Yellow-Gray Silt Loam	25 790	2 330	920	630	35 330	5 090	7 640
535	Yellow Silt Loam	20 770	1 950	940	500	32 700	8 100	7 720
844	Yellow-Gray Fine Sandy Silt Loam	29 540	2 520	1 260	540	34 780	6 900	10 700
845	Yellow Fine Sandy Silt Loam	15 860	1 660	870	470	33 570	6 270	8 390
874	Yellow-Gray Fine Sandy Loam	32 510	2 850	1 000	860	32 810	5 450	8 570
875	Yellow Fine Sandy Loam	14 720	1 500	870	460	32 350	12 260	22 310
876	Mixed Sand and Loess	14 240	1 240	740	780	25 700	3 940	12 260
	Residual Soils (000)							
098	Stony Loam	85 240	7 760	2 360	1 640	22 180	29 960	51 180
099	Rock Outcrop[1]	.....	.....	.....	.....	.....	.....	.....
	Terrace Soils (1500)							
1526	Brown Silt Loam	71 520	6 060	1 580	1 540	30 300	8 960	18 180
1526.1	Brown Silt Loam On Clay	42 520	3 540	1 340	840	40 340	8 640	11 540
1528	Brown-Gray Silt Loam On Tight Clay[1]	.....	.....	.....	.....	.....	.....	.....
1560	Brown Sandy Loam	38 520	3 260	1 150	670	28 290	5 570	10 150
1571	Brown Fine Sandy Loam	37 100	2 940	1 100	900	32 540	4 860	7 320
1560.4	Brown Sandy Loam On Gravel	28 320	2 140	1 060	720	23 640	4 520	8 480
1560.5	Brown Sandy Loam On Rock	66 600	5 660	1 460	940	26 280	4 680	9 080
1568	Brown-Gray Sandy Loam On Tight Clay	49 600	4 540	1 260	980	27 600	4 040	6 340
1564	Yellow-Gray Sandy Loam	14 340	1 060	800	380	29 140	2 880	6 060
1564.1	Yellow-Gray Sandy Loam On Clay	26 780	2 240	900	480	34 800	4 900	10 380
1580	River Sand	14 880	1 160	800	720	25 220	2 640	5 200
1581	Dune Sand	14 200	920	740	700	24 160	2 860	7 560
1590	Gravelly Loam	31 040	2 540	1 060	920	24 920	5 760	9 800
	Swamp and Bottom-Land Soils (1400)							
1426	Deep Brown Silt Loam	55 390	4 700	1 450	980	30 990	8 250	13 620
1454	Mixed Loam[2]	.....	.....	.....	.....	.....	.....	.....
1460	Brown Sandy Loam	33 810	3 110	1 370	830	27 930	5 530	11 910
1444	Yellow-Gray Fine Sandy Silt Loam	27 430	2 540	1 140	780	33 350	10 870	20 900
1461	Black Sandy Loam	60 700	5 740	1 220	920	24 620	6 340	10 020
1480	River Sand[1]	.....	.....	.....	.....	.....	.....	.....
1420	Black Clay Loam[1]	.....	.....	.....	.....	.....	.....	.....
1415	Drab Clay	51 000	4 780	1 380	960	34 160	13 060	14 220
1450	Black Mixed Loam[2]	.....	.....	.....	.....	.....	.....	.....
1421	Drab Clay Loam	67 990	5 620	2 050	1 040	35 190	11 080	15 530
1450.5	Black Mixed Loam On Rock[2]	.....	.....	.....	.....	.....	.....	.....
1401	Deep Peat[3]	106 640	8 870	1 360	1 460	13 150	7 160	12 830
1413	Clayey Muck[4]	165 075	14 410	1 090	2 910	18 750	5 400	10 450

LIMESTONE and SOIL ACIDITY.—In connection with these tabulated data, it should be explained that the figures for limestone content and soil acidity are omitted not because of any lack of importance of these factors, but rather because of the peculiar difficulty of presenting in the form of numerical averages reliable information concerning the limestone requirement for a given soil type. A general statement, however, will be found concerning the lime requirement of the respective soil types in connection with the discussions which follow.

[1]Not analyzed.

[2]On account of the heterogeneous character of the Mixed Loams, chemical analyses are not included for these types.

[3]Amounts reported are for 1 million pounds of Deep Peat.

[4]Amounrs reported are for 1½ million pounds of Clayey Muck.

TABLE 3.—PLANT-FOOD ELEMENTS IN THE SOILS OF ROCK ISLAND COUNTY, ILLINOIS
MIDDLE SAMPLING STRATUM: ABOUT 6⅔ TO 20 INCHES

Average pounds per acre in 4 million pounds of soil

Soil type No.	Soil type	Total organic carbon	Total nitrogen	Total phosphorus	Total sulfur	Total potassium	Total magnesium	Total calcium
	Upland Prairie Soils (500, 800)							
526	Brown Silt Loam	86 480	6 920	2 200	1 370	69 800	19 760	19 770
841	Brown Fine Sandy Silt Loam	54 360	5 000	2 440	1 240	65 680	18 880	18 280
871	Brown Fine Sandy Loam	53 280	5 160	1 960	1 200	65 560	16 840	18 160
528	Brown-Gray Silt Loam On Tight Clay	42 800	3 880	1 440	800	66 000	18 880	20 200
	Upland Timber Soils (500, 800)							
534	Yellow-Gray Silt Loam	17 520	2 190	1 700	780	71 060	16 700	14 940
535	Yellow Silt Loam	14 660	1 810	1 730	680	66 380	19 420	21 570
844	Yellow-Gray Fine Sandy Silt Loam	22 840	2 320	2 320	880	71 640	15 320	15 160
845	Yellow Fine Sandy Silt Loam	13 760	1 620	2 160	800	68 100	15 080	20 460
874	Yellow-Gray Fine Sandy Loam	29 380	2 800	1 620	1 100	68 860	15 800	17 020
875	Yellow Fine Sandy Loam	12 160	1 700	1 880	520	62 520	28 540	62 840
876	Mixed Sand and Loess	19 400	1 680	1 320	1 400	54 320	8 840	20 360
	Residual Soils (000)							
098	Stony Loam[1]	.....	.....	.....	.....	.....	.....	.....
099	Rock Outcrop[1]	.....	.....	.....	.....	.....	.....	.....
	Terrace Soils (1500)							
1526	Brown Silt Loam	85 240	7 160	2 560	2 120	62 160	17 040	28 680
1526.1	Brown Silt Loam On Clay	72 960	5 840	1 960	1 480	82 000	19 600	23 880
1528	Brown-Gray Silt Loam On Tight Clay[1]	.....	.....	.....	.....	.....	.....	.....
1560	Brown Sandy Loam	41 330	3 250	1 730	1 080	57 930	10 580	15 730
1571	Brown Fine Sandy Soil	48 360	3 880	1 920	1 080	66 480	11 000	17 760
1560.4	Brown Sandy Loam On Gravel	42 880	3 720	2 160	1 640	50 600	10 440	19 040
1560.5	Brown Sandy Loam On Rock	83 080	6 680	2 240	1 560	51 920	10 920	20 440
1568	Brown-Gray Sandy Loam On Tight Clay	25 040	2 400	1 760	1 000	64 080	9 200	12 520
1564	Yellow-Gray Sandy Loam	12 320	1 120	1 640	400	63 160	7 160	10 720
1564.1	Yellow-Gray Sandy Loam On Clay	18 040	1 840	1 520	480	73 240	12 160	14 920
1580	River Sand	26 040	1 960	1 640	1 000	48 960	6 040	12 000
1581	Dune Sand	12 160	760	1 240	1 080	45 000	5 240	14 520
1590	Gravelly Loam[1]	.....	.....	.....	.....	.....	.....	.....
	Swamp and Bottom-Land Soils (1400)							
1426	Deep Brown Silt Loam	56 780	4 720	1 980	1 400	63 220	16 600	25 560
1454	Mixed Loam[2]	.....	.....	.....	.....	.....	.....	.....
1460	Brown Sandy Loam	36 660	3 340	2 260	1 120	51 900	10 280	24 080
1444	Yellow-Gray Fine Sandy Silt Loam	41 740	3 560	2 260	1 400	66 020	19 900	49 960
1461	Black Sandy Loam	45 280	3 520	1 480	920	48 480	15 240	19 760
1480	River Sand[1]	.....	.....	.....	.....	.....	.....	.....
1420	Black Clay Loam[1]	.....	.....	.....	.....	.....	.....	.....
1415	Drab Clay	58 160	5 760	2 000	1 440	64 040	22 360	27 720
1450	Black Mixed Loam[2]	.....	.....	.....	.....	.....	.....	.....
1421	Drab Clay Loam	86 000	7 240	3 100	1 680	68 460	21 540	31 640
1450.5	Black Mixed Loam On Rock[1]	.....	.....	.....	.....	.....	.....	.....
1401	Deep Peat[3]	206 880	16 600	1 940	2 400	24 680	14 780	26 540
1413	Clayey Muck	209 600	17 280	1 480	3 360	47 680	9 520	20 080

LIMESTONE and SOIL ACIDITY.—See note in Table 2.

[1]Not analyzed.

[2]On account of the heterogeneous character of the Mixed Loams, chemical analyses are not included for these types.

[3]Amounts reported are for 2 million pounds of Deep Peat.

TABLE 4.—PLANT-FOOD ELEMENTS IN THE SOILS OF ROCK ISLAND COUNTY, ILLINOIS
LOWER SAMPLING STRATUM: ABOUT 20 TO 40 INCHES

Average pounds per acre in 6 million pounds of soil

Soil type No.	Soil type	Total organic carbon	Total nitrogen	Total phosphorus	Total sulfur	Total potassium	Total magnesium	Total calcium
	Upland Prairie Soils (500, 800)							
526	Brown Silt Loam	28 860	3 960	2 680	1 020	102 410	42 140	29 700
841	Brown Fine Sandy Silt Loam	28 980	3 180	3 120	1 260	97 560	34 260	36 480
871	Brown Fine Sandy Loam	29 940	3 420	2 520	1 440	102 540	30 780	26 760
528	Brown-Gray Silt Loam On Tight Clay	22 260	2 700	3 000	1 380	97 500	40 920	38 100
	Upland Timber Soils (500, 800)							
534	Yellow-Gray Silt Loam	15 610	2 140	3 400	920	102 080	35 220	27 660
535	Yelow Silt Loam	13 040	1 920	3 120	900	102 080	46 920	64 120
844	Yellow-Gray Fine Sandy Silt Loam	21 900	2 400	3 380	1 140	103 140	28 080	32 640
845	Yellow Fine Sandy Silt Loam	10 650	1 320	3 660	840	99 840	45 780	89 160
874	Yellow-Gray Fine Sandy Loam	18 300	2 270	2 970	1 470	104 280	27 120	31 080
875	Yellow Fine Sandy Loam	10 560	1 500	3 060	750	93 900	36 990	76 890
876	Mixed Sand and Loess	16 860	1 320	1 920	1 140	84 540	13 680	35 220
	Residual Soils (000)							
098	Stony Loam[1]	.....	.....	.....	.....	.....	.....	.....
099	Rock Outcrop[1]	.....	.....	.....	.....	.....	.....	.....
	Terrace Soils (1500)							
1526	Brown Silt Loam	22 560	3 060	3 540	1 680	93 420	60 720	100 680
1526.1	Brown Silt Loam On Clay	41 100	4 440	2 940	1 200	131 640	51 000	40 440
1528	Brown-Gray Silt Loam On Tight Clay[1]	.....	.....	.....	.....	.....	.....	.....
1560	Brown Sandy Loam	23 100	2 200	1 980	1 080	96 420	18 700	25 420
1571	Brown Fine Sandy Loam	28 200	2 880	2 640	1 020	100 320	18 540	26 820
1560.4	Brown Sandy Loam On Gravel[1]	.....	.....	.....	.....	.....	.....	.....
1560.5	Brown Sandy Loam On Rock[1]	.....	.....	.....	.....	.....	.....	.....
1568	Brown-Gray Sandy Loam On Tight Clay	15 360	1 380	3 000	1 320	75 540	16 500	18 960
1564	Yellow-Gray Sandy Loam	13 740	1 320	2 460	660	91 260	15 480	15 960
1564.1	Yellow-Gray Sandy Loam On Clay	19 860	2 700	3 660	900	114 060	28 140	28 380
1580	River Sand	15 300	1 500	1 800	540	72 780	10 020	20 040
1581	Dune Sand	18 180	720	1 620	1 380	68 280	9 300	26 160
1590	Gravelly Loam[1]	.....	.....	.....	.....	.....	.....	.....
	Swamp and Bottom-Land Soils (1400)							
1426	Deep Brown Silt Loam	29 610	3 060	2 610	990	99 060	28 680	38 040
1454	Mixed Loam[2]	.....	.....	.....	.....	.....	.....	.....
1460	Brown Sandy Loam	28 230	2 190	2 820	1 230	75 660	14 610	30 990
1444	Yellow-Gray Fine Sandy Silt Loam	76 620	6 510	4 170	1 500	96 840	36 060	82 080
1461	Black Sandy Loam	35 460	2 580	1 620	1 080	73 200	24 720	28 500
1480	River Sand[1]	.....	.....	.....	.....	.....	.....	.....
1420	Black Clay Loam[1]	.....	.....	.....	.....	.....	.....	.....
1415	Drab Clay	50 040	4 920	2 940	780	96 000	33 240	39 060
1450	Black Mixed Loam[2]	.....	.....	.....	.....	.....	.....	.....
1421	Drab Clay Loam	61 740	4 800	4 230	1 980	103 230	30 600	39 750
1450.5	Black Mixed Loam On Rock[1]	.....	.....	.....	.....	.....	.....	.....
1401	Deep Peat[3]	154 350	10 020	1 680	2 160	13 830	26 640	32 640
1413	Clayey Muck	29 970	2 520	1 080	1 560	67 200	11 160	19 020

LIMESTONE and SOIL ACIDITY.—See note in Table 2.

[1]Not analyzed.

[2]On account of the heterogeneous character of the Mixed Loams, chemical analyses are not included for these types.

[3]Amounts reported are for 3 million pounds of Deep Peat.

These two soil types vary widely in calcium content, the amounts contained to a depth of 40 inches being 59,310 pounds in Brown Silt Loam and 93,410 pounds in Yellow Silt Loam. The relative amount of calcium is not of so great importance directly in connection with the corn crop as it is with respect to legumes. Since a ton of red clover hay contains approximately 29 pounds of calcium, these two soils contain as much calcium as would be removed in 2,040 and 3,220 tons of red clover, respectively. Three other soil types contain exceptionally large quantities of calcium. In all cases it is due to the presence of calcium carbonate (limestone) in the subsoil, the third sampling stratum being the only stratum exhibiting a high calcium content. These types are Yellow Fine Sandy Loam, Yellow Fine Sandy Silt Loam, and Brown Silt Loam, Terrace. In each case only one of the samples collected for the type contains calcium carbonate and then only in the lower stratum sampled. The other areas no doubt contain calcium carbonate, but it occurs below the 40-inch depth reached in sampling, and is therefore of no very great value to growing crops.

These statements are not intended to imply that it is possible to predict how long it might be before a certain soil would become exhausted under a given system of cropping. Neither do the figures necessarily indicate the immediate procedure to be followed in the improvement of a soil, for other factors enter into consideration, aside from merely the amount of plant-food elements present in the soil. Much depends upon the nature of the crops to be grown as to their utilization of plant-food materials, and much depends upon the condition of the plant-food substance themselves as to their availability. Finally, in planning the detailed procedure for the improvement of a soil, there enter for consideration all the economic factors involved in any fertilizer treatment. Such figures do, however, furnish an inventory of the total stocks of the plant-food elements that can possibly be drawn upon, and in this way these chemical data contribute fundamental information for the intelligent planning in a broad way of systems of soil management for conserving and improving the fertility of the land.

DESCRIPTION OF SOIL TYPES

(a) UPLAND PRAIRIE SOILS

The upland prairie soils of Rock Island county occupy 72.61 square miles, or 16.91 percent of the area of the county. Most of the prairie soils are found south of Rock river. However, small areas of prairie soils are found on the island-like tract of upland between Meredosia slough and Hampton, and a few areas on the upland between Rock Island and Carbon Cliff. The dark color of the prairie soils is due to the accumulation of organic matter which is derived, very largely, from the fibrous roots of the prairie grasses. The network of grass roots was protected from rapid and complete decay because of the exclusion of oxygen by the covering of fine moist soil and mats of vegetative material of old grass and leaves. On the native prairies, the stems and leaves were usually burned in part by prairie fires or disappeared in part by decay. This surface accumulation, which was constantly renewed, added but little organic matter to the soil directly, but the decay of the prairie-grass roots was retarded considerably by it.

Brown Silt Loam (526)

Brown Silt Loam covers an area of 65.74 square miles, or 15.32 percent of the county. In topography, it varies from undulating to rolling. The undulating areas occur south of Rock river from the vicinity of Edgington to Taylor Ridge. In portions of the Brown Silt Loam area, erosion has been so active as to remove the surface soil and expose the subsoil. These areas were mapped as Yellow Silt Loam. It is a common practice to leave small gullies and places which erode easily in permanent grass, thus controlling the difficulty. The Brown Silt Loam in the north part of the county, east of Port Byron, has an appreciable amount of fine sand in the surface soil, owing to its nearness to the sandy areas to the west.

The surface soil, which is about 8 inches in depth, is a silt loam varying in color from brown to grayish brown and in some cases an appreciable amount of fine sand is found. The subsurface, extending from 8 to 19 or 20 inches in depth, varies from a drabbish brown to a yellowish brown silt loam, the former occurring where the surface has a gray cast. The upper portion of the subsoil, 19 to 32 inches, varies from a plastic, compact, drabbish gray or drabbish yellow, silty clay loam to a yellow silt loam, splotched with bright yellow iron concretions. The lower part, below 32 inches, is usually a friable, mottled, yellow silt loam, splotched with bright yellowish red iron concretions.

Management.—The tests made indicate that this type is not strongly acid. Much of it will grow red clover fairly well without the addition of limestone, but the successful growth of alfalfa or sweet clover usually requires the application of 2 or 3 tons of limestone an acre. The need for limestone and the amount required should be determined in detail for each field, either with the assistance of the county farm adviser or thru correspondence with the Experiment Station.

The successful management of this type requires that adequate provision be made for the maintenance of the nitrogen and organic matter thru the use of farm manure, crop residues, and clover, preferably sweet clover. The first step in carrying out this program is the application of limestone, if needed.

The portions of this type which have a gray cast are very similar to the soil upon which the Aledo experiment field is located. A discussion of the results from this field will be found in the Supplement to this Report (see page 54). It will be noted that comparisons are being made in the phosphate experiments between acid phosphate, steamed bone meal, basic slag, and rock phosphate, both with and without lime.

While the information available regarding the phosphate fertilization of soil similar to that upon which the Aledo field is located is not so conclusive as we would wish, yet all of the information available indicates that if the nitrogen and organic matter are maintained by the use of clovers, manure, and crop residues, rock phosphate and basic slag may be used at a good profit.

The reader is referred to the Supplement to this Report for the results of field experiments on Brown Silt Loam at Kewanee, Galesburg, and Urbana, and asked to give the problem of phosphate fertilization careful study, since it is much easier to maintain the crop-producing power of a soil than it is to restore it after the yields have begun to decline.

Brown Fine Sandy Silt Loam (841)

Brown Fine Sandy Silt Loam covers an area of about six square miles, or 1.37 percent of the county. This is one of the loess soils and is found in the north part of the county between Meredosia slough and the Mississippi river. A few areas occur also in the southwestern part of the county. The undulating to rolling topography of this type was caused by the action of the wind in the formation of sand ridges.

The surface soil, which is about 8 inches in depth, is a brown, fine sandy silt loam. The subsurface to a depth of 20 inches is a yellowish brown, fine sandy silt loam. The upper 14 inches of the subsoil is a friable, yellow, fine sandy silt loam, while below 34 inches, it is a light reddish yellow, fine sandy loam.

Management.—Brown Fine Sandy Silt Loam is well adapted to the growth of alfalfa, but since no carbonates occur within 40 inches of the surface, it is very necessary to apply limestone before seeding either alfalfa or sweet clover. The assistance of the county farm adviser or Experiment Station should be secured in determining the proper amount of limestone to use. The friable nature of this type favors deep root penetration and it seems unlikely that phosphate fertilization will pay unless it be in the case of wheat. After adequate provision has been made for supplying nitrogen and organic matter by the growth of clovers and use of farm manure and crop residues, the trial of rock phosphate at the rate of about 1,000 pounds an acre, acid phosphate at the rate of about 300 pounds per acre, or basic slag at the rate of about 500 pounds an acre for wheat is advised. The rock phosphate should be applied prior to plowing for wheat and the other materials after plowing and worked into the soil as the seed bed is being prepared.

Brown Fine Sandy Loam (871)

Brown Fine Sandy Loam occupies 601 acres, or .22 percent of the county. Nearly all the areas are in the western part of the county in the timbered deep loess area. The type is of a rolling topography owing to the action of the wind that has deposited the fine sandy loam in dune-like formation. Most of this land has been left in permanent pasture.

The surface soil, which is about 8 inches in depth, is a brown fine sandy loam, mealy in texture. The subsurface, 8 to 21 inches, is a brownish yellow, fine sandy loam. The subsoil in the upper 14 or 15 inches is a rather heavy, fairly compact, yellow, sandy silt loam, and in the lower part, a yellow silt loam with an appreciable amount of fine sand.

Management.—The recommendations made for the management of the preceding type, Brown Fine Sandy Silt Loam, apply also to this type.

Brown-Gray Silt Loam On Tight Clay (528)

There are only about 64 acres of Brown-Gray Silt Loam On Tight Clay, Upland, mapped in Rock Island county.

The surface soil, extending to a depth of 7 or 8 inches, is a brown silt loam with a gray cast. From a depth of 8 inches to 16 or 18 inches, the subsurface is a floury to gritty, gray silt loam mottled with brown. The upper part of the

subsoil is a drab to grayish drab clay, tough and plastic, and very impervious to the penetration of water. The lower part of the subsoil, below 32 inches, is a somewhat friable, sandy, drabbish yellow, clay loam to silty clay loam.

Management.—This type is strongly acid and is not well supplied with nitrogen and organic matter. Because of the impervious subsoil, surface drainage must be depended on for the removal of excess water.

(b) UPLAND TIMBER SOILS

The upland timber soils are found well distributed thruout the county, adjacent to the streams. Usually, they are characterized by a yellow or yellowish gray color, owing to the low organic-matter content. This lack of organic matter has been caused by the long-continued growth of forest trees. As the forests invaded the prairies, the following effects were produced: the shading of the trees prevented the growth of grasses, the roots of which are mainly responsible for the large amount of organic matter in the prairie soils; and the trees themselves added very little organic matter to the soil, for the leaves and branches either decayed or were destroyed by forest fires. The timbered soils cover about 210 square miles, or practically half the area of the county.

Yellow-Gray Silt Loam (534)

Yellow-Gray Silt Loam occupies the flat to undulating areas of timber soil near the streams. It will be noted on the map that near the headwaters of the small streams Brown Silt Loam occurs adjacent to the Yellow Silt Loam. This is an unusual condition, probably brought about by the circumstance that headwater erosion has been so rapid that there has not been time for the usual timber growth. This type occupies 43.64 square miles, or 10.18 percent of the area of the county.

The surface soil, which is about 5 inches in depth, varies from a brownish yellow to either a brownish or a yellowish gray, silt loam. The texture of this type is coarser near the deep loess, owing to the action of the wind in distributing fine sand over it. The subsurface, which extends to a depth of 18 or 19 inches, varies from a mottled, light yellow to yellow, silt loam. The upper stratum of the subsoil is about 10 inches thick and varies from a compact, mottled, light yellow silt loam to a compact, mottled, yellow, silty clay loam. The lower stratum of the subsoil varies from a mottled, light to golden yellow, friable silt loam and contains many yellow and red iron concretions.

Management.—This type is usually acid in the surface, tho not strongly so, and is nearly always more acid in the subsurface and subsoil than in the surface. The degree of acidity indicates that an application of 2 or 3 tons of limestone an acre is necessary for the growth of alfalfa or sweet clover. Red clover can be grown on portions of the type without the addition of limestone. Before applying limestone, the assistance of the county farm adviser or of the Experiment Station should be secured to determine the exact rate of application.

This soil is very low in organic matter and runs together badly after rains. The first step in its improvement is the application of the right amount of limestone, and the second, the growth of clover, preferably sweet clover. It is an

excellent plan to pasture the sweet clover the fall of the first year and turn it under for corn the spring of the second year. The phosphorus content of this soil is not high. It is suggested, therefore, that after the nitrogen and organic-matter deficiency has been met, at least in part, trial be made of the various phosphates.

Yellow Silt Loam (535)

Yellow Silt Loam covers 77.55 square miles, or about 18 percent of the area of the county. As mapped, it is the eroded portion of the timber soils from which much or all of the surface soil has been removed by washing. The topography of the type varies from strongly undulating to rough and broken. The slopes are longer and steeper near the river bluffs than they are farther back. The timber has been removed from practically the entire area. Portions of it have been allowed to grow up in underbrush and are of no value as sources of timber and of little value as pasture. Other portions are being farmed, frequently with disastrous results because of washing. In places where grass has been allowed to grow for some time, a shallow, yellowish brown, surface soil has been developed.

The exact character of this type varies greatly because of differences in vegetation and amount of washing. The surface to a depth of 4 or 5 inches is usually a grayish yellow or brownish yellow silt loam. The subsurface to a depth of 8 to 15 inches is a yellow silt loam. The subsoil is usually a somewhat plastic, yellow, silty clay loam. Till usually occurs at a depth of 4 to 10 feet and a stratum of yellowish red, sandy silt loam from 10 to 14 inches in thickness frequently occurs on top of the till.

Management.—This type should, for the most part, be used for pasture, orcharding, or timber production. The less steep slopes may be farmed successfully if special precautions are taken to prevent washing. This may be done by keeping some vegetation on the land as much of the time as possible, practicing contour tillage, terracing, and seeding the land to grass for a few years as soon as a tendency to wash becomes pronounced.

This soil is but slightly acid and carbonates commonly, tho not always, occur within one or two feet below the surface of the till. In no instances were carbonates found above the till. Alfalfa can be grown successfully on the less steep slopes of this type after a moderate application of limestone has been made. The exact rate of application of limestone should be determined with the assistance of the county farm adviser or thru correspondence with the Experiment Station. Good use may be made of much of this land as sweet clover pasture after limestone has been applied. No treatment other than the application of limestone and the provision for increasing the nitrogen and organic-matter contents of the soil is advised. (See account of Vienna field experiments, page 62.)

Yellow Fine Sandy Silt Loam (845)

Yellow Fine Sandy Silt Loam covers an area of 22.78 square miles, or 5.31 percent of the area of the county. Most of the timber has been removed and cultivated crops have been grown on the eroded hillsides until some of the areas have been abandoned because of erosion, or are producing very little. In some places

on this type, particularly in the western part of the county, wind action has been effective in forming sand dunes.

The surface soil, which is about 4 inches in depth, varies from a brownish yellow or yellowish gray to a yellow fine sandy silt loam. The subsurface and subsoil are a yellow fine sandy silt loam. In a few instances, glacial till was found 10 to 12 feet below the surface.

Management.—This type should ordinarily not be used for growing the grain crops. The more gentle slopes may be so used if proper precautions are taken to prevent erosion. Much of the area contains carbonates and, when such is the case no limestone is needed to grow alfalfa or sweet clover; in fact the latter is found growing wild on some portions of the area. Good use may be made of much of the type by growing alfalfa on the less steep slopes and sweet clover on those which are of intermediate steepness. Portions of the area may be used for orcharding and other portions should be used for timber production.

Yellow-Gray Fine Sandy Silt Loam (844)

Yellow-Gray Fine Sandy Silt Loam covers an area of 14.38 square miles, or 3.35 percent of the area of the county. This type is found on the upland immediately adjoining the bottom land. In topography it is the same as Yellow-Gray Silt Loam described on page 16.

The surface soil, which is about 6 inches in depth, varies from a brownish yellow to a yellowish gray, fine sandy silt loam. The subsurface, extending to a depth of about 18 inches, is a mottled, yellow, fine sandy silt loam. The subsoil occurs in two strata. The upper, to a depth of about 32 inches, is fairly compact and varies from a mottled, yellow, fine sandy silt loam to a yellow, silty clay loam splotched with bright red concretions. The lower part, below 32 inches, is strongly mottled and varies from a light yellow to golden yellow, fine sandy silt loam, and contains bright yellowish red iron concretions.

Management.—This type is very similar to Yellow-Gray Silt Loam (534) excepting that it does not run together so badly after rains, is somewhat easier to work, and is usually slightly less acid. It is very low in organic matter, however, and requires the same management as suggested for Yellow-Gray Silt Loam to increase its productivity (see page 16).

Yellow-Gray Fine Sandy Loam (874)

Yellow-Gray Fine Sandy Loam is one of the loessial soils found adjacent to the Mississippi bottoms. It is undulating in topography and occupies the same relative position with respect to adjoining soil types as does Yellow-Gray Silt Loam. It covers 25.80 square miles, or about 6 percent of the area of the county.

The surface, which is about 6 or 8 inches in depth, varies from a brownish yellow to a yellowish gray, fine sandy loam. The subsurface, extending to a depth of about 19 inches, varies from a friable, yellowish brown to golden yellow, fine sandy loam. The upper 12 to 15 inches of the subsoil varies from a some-

what compact, yellow silt loam to a yellow sandy silt loam. The lower part varies from a mottled, yellow, fine sandy silt loam to a mottled, yellow, fine sandy loam.

Management.—This type is more open in structure than Yellow-Gray Silt Loam (534) and runs together less after rains. Its limestone requirement is about the same as that of Yellow-Gray Silt Loam, and it should be managed in the same way. It is an excellent alfalfa soil because of its open structure and also because carbonates usually occur within 40 or 50 inches of the surface, thus making it unnecessary to add as much limestone as in the case of soils which have been leached to a greater depth.

Yellow Fine Sandy Loam (875)

Yellow Fine Sandy Loam, as mapped, consists of the eroded area of loess near the bluffs. Deep gullies have been formed by long-continued erosion. The timber has been largely cut off and the land farmed until much of it can no longer be used profitably for grain crops. The type occupies 22.48 square miles, or 5.31 percent of the county. There is usually no true surface or subsurface present because for the most part they have been eroded away. A thin surface soil, however, has been developed over small areas where the growth of grass has protected the soil from erosion. The soil to a depth of 40 inches is a yellow, fine sandy loam, open and easily penetrated by roots.

Management.—This type, because of its rough topography, should be used for pasture, orchard, or timber. The depth to carbonates varies greatly. In places, strong effervescence with acid occurs at one foot below the surface, while in others no effervescence occurs to a depth of 25 feet. This soil will grow good alfalfa on the more gentle slopes after limestone has been applied. If either alfalfa or sweet clover is to be grown, the amount of limestone necessary should be determined with the assistance of the county farm adviser or of the Experiment Station.

Mixed Sand and Loess (876)

Small areas occur in the northern and western parts of the county in which the wind has deposited strata of different texture. Erosion has subsequently exposed these strata in places so that a great variety of soils is formed. The areas of the various soils are so small that they cannot be mapped separately and they have therefore been grouped together and called Mixed Sand and Loess. The surface varies from brown to yellow in color and from a fine sandy loam to sand in texture. The subsurface varies in like manner. The subsoil, starting at a depth of about 18 inches, is usually a yellow sand.

Management.—This soil is used chiefly for pasture. The lower brown-colored areas are excellent for gardening or for watermelon production. Probably one of the best uses which can be made of these areas is to apply sufficient lime to grow sweet clover for pasture. After this crop has been grown a few years, alfalfa probably can be successfully grown.

(c) RESIDUAL SOILS

Stony Loam (098)

Stony Loam is found in a few scattering areas lying mainly at the southeast of Cordova. It occupies only 70 acres and is of no agricultural importance.

Rock Outcrop (099)

Rock outcrop occurs as exposures of rock and the character of the rock determines its value. There are several quarries near Moline and one in the eastern part of the county where limestone is being taken out. There are other exposures of shale and cherty limestone, neither of which has any agricultural value.

(d) TERRACE SOILS

Large areas of terrace soils occur in Rock Island county because of the changes which have occurred in the river systems. They were formed by overloaded and flooded streams which deposited an immense amount of material in the old channels. Later as the streams diminished in size or cut their channels deeper, new bottoms were developed, leaving the old flood plains above overflow, thus forming terraces.

These terrace formations which were built up, for the most part, during and immediately following the Glacial period, were later covered to varying depths with wind-blown material from which the present soils were formed.

Brown Silt Loam (1526)

Brown Silt Loam, Terrace, occurs for the most part in Pleasant Valley and along Rock river. In many places, fine sandy outwash from the bluffs has been deposited upon the Brown Silt Loam. The type covers an area of 8.71 square miles, or 2.05 percent of the area of the county. Drainage is usually good altho small areas occur near the bluffs where seepage water causes wet spots. Many small intermittent streams deposit their water over the surface without following any definite channel, causing a temporary water-logged condition.

The surface soil, extending to an average depth of 8 inches, varies from a brown silt loam to a brown, fine sandy silt loam. The subsurface, extending from 8 to 20 inches, varies from a light brown to a yellowish brown, fine sandy silt loam. The subsoil below 20 inches is usually in two parts; the upper, usually 14 or 15 inches in thickness, varies from a yellow, fine sandy silt loam to a somewhat compact, grayish yellow, fine sandy loam; the lower varies from a somewhat plastic, drab clay loam to a yellowish gray, fine sandy silt loam splotched with yellowish red iron concretions.

Management.—A large proportion of this type is not acid and in no case was it found to be more than slightly acid. It is a productive, easily worked soil and is adapted to any of the general farm crops. The more sandy portions near the bluffs are well adapted to trucking. The most important consideration in the management of this type is the provision for maintaining an adequate nitrogen supply. This can be done only by growing clover at regular intervals and plowing down a portion of the total growth. Sweet clover is unexcelled as a source of nitrogen and can be used to good advantage as a combination pasture

and green manure crop by pasturing it the fall of the first year and plowing it in for corn the spring of the second year. No experimental information is available upon which to base recommendations for the fertilizer treatment of this type. It is suggested if any purchased fertilizer is used, that it be used in a limited way until its value or lack of value has been demonstrated. In no case should any fertilizer other than one of the phosphates be used excepting for truck crops.

Brown Silt Loam On Clay (1526.1)

Brown Silt Loam On Clay occurs in a few scattered areas in the northern part of the county and covers a total of only 64 acres.

The surface soil, extending to 8 inches in depth, is a heavy brown silt loam. The subsurface, 8 to 16 inches, is a light brown silt loam mixed with some yellowish red sand. The subsoil in the upper 17 inches is a tough, brick-red clay. In the lower part, it varies from a brick-red sandy clay loam to a sandy silt loam.

Management.—About 2 tons of limestone an acre should be applied to this type and sweet clover grown to be plowed down the spring of the second year for corn. Surface drainage is necessary as the upper stratum of the subsoil is too heavy and impervious to permit tile drainage.

Brown-Gray Silt Loam On Tight Clay (1528)

Brown-Gray Silt Loam On Tight Clay occurs in small isolated areas thruout the terrace. It is located in pockets or depressions that are not well drained. It covers an area of only 54 acres.

The surface soil, which is about 4 inches in depth, is a grayish brown silt loam. The subsurface, extending to 14 inches in depth, is a gray silt loam splotched with a few yellow iron concretions. The subsoil is found in two distinct parts. The upper, extending to a depth of 34 inches, is a very sticky and compact gray clay, having some yellow clay streaks. The lower part, below 34 inches, is a friable, grayish drab clay loam, splotched with some red iron concretions.

Management.—This type is strongly acid and should receive about 4 tons of limestone an acre. Surface drainage must be depended on and sweet clover should be grown frequently.

Brown Sandy Loam (1560)

Brown Sandy Loam, Terrace, occurs in scattered areas thruout the Rock river and Mississippi river terraces, altho most of it is found along Rock river. The type covers 29.85 square miles, or about 7 percent of the area of the county. The sand content of this type varies from place to place. In the vicinity of River Sand (1580), the Brown Sandy Loam is underlain with sand. Near the bluffs, the fine sand content is high, owing to outwash material having been deposited at the base of the slopes.

The surface soil, which is about 8 or 10 inches in depth, is a brown sandy loam, varying from medium to coarse in texture. The subsurface extending to about 18 inches, is a brown sand. The subsoil is a yellow sand.

Management.—This type is somewhat acid, tho not strongly so. It does not stand drouth so well as soils having a less coarse subsoil, and corn is likely to suffer from lack of moisture unless the rainfall is well distributed thruout the growing season. The small grains and soybeans are well adapted to this type. The frequent plowing down of leguminous green manure crops is advised, and also the use of all manure available.

Brown Fine Sandy Loam (1571)

Brown Fine Sandy Loam, Terrace, occurs in small scattered areas thruout the Mississippi and Rock river terraces. Most of the areas seem to have been formed by outwash from the bluffs. The type is not uniform because of the way in which it has been formed. It occupies 6.35 square miles, or 1.48 percent of the area of the county.

The surface soil, extending to about 9 inches in depth, is a light brown to chocolate brown, fine sandy loam. The subsurface is a light brown, fine sandy loam. The upper part of the subsoil is a bright yellow, fine sandy loam, while the lower part below 36 inches is a slightly compact, yellow, sandy silt loam.

Management.—This type is only slightly acid in the surface but frequently shows medium acidity in the subsurface and subsoil. It is a productive, easily-worked soil and the friability of the subsoil favors deep root penetration. The nitrogen supply should be provided for by growing clovers and turning in a portion of the crop. No definite fertilizer treatment is recommended; however, it would be an excellent plan to determine by trial whether one of the phosphates might not be used at a profit for wheat.

Brown Sandy Loam On Gravel (1560.4)

Brown Sandy Loam On Gravel covers only 2.47 square miles, or about .58 percent of the area of the county. It occurs as small areas scattered thruout the terraces. It is slightly undulating in topography and is very sandy for the type. The gravel is usually near enough to the surface to be detrimental because of its interference with the moisture supply for the growing crop.

The surface, to about 8 inches in depth, is a coarse-grained, brown sandy loam. The subsurface, from 8 to 18 inches, is a light brown sandy loam. The subsoil, which on the average is about 6 or 7 inches in thickness, rests on the gravel layer or bed and is a yellow sand. The gravel is composed of well-rounded, small and medium-sized pebbles and stones.

Management.—This type is not adapted to the general farm crops because of its drouthy nature. It is somewhat acid and is not well supplied with organic matter.

Brown Sandy Loam On Rock (1560.5)

Brown Sandy Loam On Rock is a type of little importance. It covers less than one square mile and is found chiefly on Rock and Sylvan islands.

The surface soil, which extends to about 8 inches in depth, is a coarse-grained, brown sandy loam. The subsurface is a coarse-grained, yellowish brown sand and rests on limestone rock, which occurs at a depth of 20 to 22 inches below the surface.

This type is used chiefly for pasture and is suited to nothing else. Efforts have been made to grow clovers but with little success because of the drouthy nature of the soil.

Brown-Gray Sandy Loam On Tight Clay (1568)

Brown-Gray Sandy Loam On Tight Clay covers only about two-tenths of a square mile, or 128 acres. It is flat and usually found at a lower level than the adjacent soil types.

The surface, to a depth of 4 inches, is a grayish brown sandy loam. The subsurface, extending to a depth of about 19 inches, varies from a brownish gray sandy loam to a gray sand. The subsoil is in two distinct strata; the upper stratum, which is 10 or 11 inches in thickness, is a plastic, very compact, gray sandy clay, with a few yellow splotches; the lower is a friable, brick-red, sandy silt loam.

Management.—Provision for good surface drainage, the addition of limestone, and the growing of clovers, preferably sweet clover, are essentials in the management of this type.

Yellow-Gray Sandy Loam (1564)

Yellow-Gray Sandy Loam is undulating in topography and is found in small, scattering areas in the Rock river terrace.

The surface soil, extending to about 5 inches in depth, varies from a brownish yellow sandy loam to a yellowish gray fine sandy loam, the latter occurring near the bluffs. The subsurface, 5 to 22 inches, varies from a yellow sandy silt loam to a yellow sand. The subsoil is in two fairly distinct parts; the upper, which is about 8 inches in thickness, varies from a yellow silt loam to a fairly compact, red sandy clay; the lower part, below 30 inches, varies from a yellow sandy silt loam to a brick-red, coarse-grained sand.

Management.—This type is very similar to Yellow-Gray Fine Sandy Loam (874), except that most of the area is coarser in texture and carbonates do not occur within the 50-inch section. The reader is referred to the discussion of the management of Yellow-Gray Fine Sandy Loam (874) and Yellow-Gray Silt Loam (534) for suggestions regarding the management of this type.

Yellow-Gray Sandy Loam On Clay (1564.1)

Yellow-Gray Sandy Loam On Clay is found in only one area of 32 acres located along the Mississippi river north of Port Byron.

The surface soil, which is about 7 inches in depth, varies from brownish yellow to a grayish yellow sandy loam. The subsurface, extending to about 19 inches in depth, is a grayish red sandy loam. The subsoil is a sticky, compact red clay with some sand and gravelly material mixed with clay making the lower part somewhat gritty. The area is in timber and pasture.

River Sand (1580)

Most of the River Sand, Terrace, is found in the northern part of the county, adjacent to Whiteside county. It occupies 10.36 square miles, or 2.42 percent

of the area of the county. Its tendency to drift has resulted in the formation of a typical dune topography.

The surface soil, to a depth of about 7 inches, is a sharp-grained brown sand. The subsurface to a depth of about 20 inches, is a brownish yellow sand. The subsoil is a sharp, coarse-grained yellow sand. Both the subsurface and subsoil contains some fine gravel.

Management.—Crop yields are low on this type. Wheat and rye are the principal crops grown. Quack grass is abundant. Farming should not be undertaken on it with extravagant expectations of making the soil highly productive by good farming methods and fertilizer treatment. Its productivity, however, can be increased by first applying limestone at the rate of about 2 tons per acre and growing sweet clover as a source of much-needed organic matter and nitrogen. If purchased fertilizers of any kind are used, they should be used experimentally until it is shown that the increase in returns justifies the expenditure. The use of much of this land for timber production is advisable. For results from experiments on sand, see the account of the Oquawka field, page 64.

Dune Sand (1581)

Dune Sand occurs, for the most part, in the northern part of the county in conjunction with River Sand (1580). Small sand dunes and "blowouts" have been formed where the wind has had an opportunity to drift the sand. Very little vegetation grows on this type. Some wire grass and wild vetch are found, and black jack oaks occur in places. The soil is a yellow sand from the surface to 40 inches or more and contains very little organic matter. This type is of little importance because of its small area and because it is of very little agricultural value. Experience has shown that this land may be made valuable by forestation, both as a source of timber and for pasture.

Gravelly Loam (1590)

Gravelly Loam consists of small areas in the northern part of the county and covers a total area of only 38 acres. It is used for pasture and is suited to nothing else.

(e) SWAMP AND BOTTOM-LAND SOILS

This group includes the bottom lands along the Mississippi and Rock rivers and their tributaries, and swamps and poorly drained lowlands. The soil is an alluvial formation and the land is largely subject to overflow. In former times, these swamps were lakes or part of the preglacial river channels. At the present time, the bottom lands along the Mississippi river in the western part of the county have been leveed, dredge ditches constructed, and pumping stations established, so that most of the area is cultivated. The total area of this group, consisting of thirteen soil types, occupies 7,963 square miles, or 18.57 percent of the area of the county.

Deep Brown Silt Loam (1426)

Deep Brown Silt Loam is the second largest area of overflow land in the county, comprizing an area of 17.51 square miles. Practically all the type is

located along the Mississippi river in the western part of the county and along Rock river.

The surface soil, which is about 8 inches in depth, is a heavy brown silt loam containing an appreciable amount of fine sand. The subsurface, in the upper 8 inches, varies from a light brown sandy loam to a gray or drab sandy silt loam; in the lower part it is a black silt loam. The subsoil, which begins at about 22 inches, varies from a brownish yellow silt loam to a drab silt loam.

Management.—This type is, for the most part, subject to moderate overflow. It needs no treatment other than good tillage.

Mixed Loam (1354, 1454)

Mixed Loam occupies 31.26 square miles, or about 7 percent of the county, and is found along the Mississippi and Rock rivers and also along the tributary streams. This type, as mapped, is made up of a number of distinct types which occur in areas that are too small to be successfully separated; moreover, since much of the type is subject to overflow, it is constantly being changed.

Management.—The overflow portions of this type require nothing more than good tillage. The portions which are no longer subject to overflow are becoming slightly acid and require the addition of light applications of limestone to grow sweet clover. Nitrogen should be supplied by growing clover crops at regular intervals and plowing down a portion of them. Probably no fertilizer treatment will prove profitable for many years.

Brown Sandy Loam (1460)

Brown Sandy Loam, Bottom, occupies an area of 5.17 square miles.

The surface soil, to about 8 inches in depth, is a heavy brown sandy loam, with a rather high percentage of fine sand. The subsurface extending to 18 inches is a yellowish brown sandy loam. The subsoil in the upper 12 or 14 inches consists of a plastic, grayish yellow, silty clay loam with enough sand to make it gritty, while in the lower part it is a gray to yellow sand with splotches of bright red iron concretions.

Management.—This type, as a rule, is not acid. It contains a higher percentage of clay in the three upper strata than is usually the case with this type and it is therefore easier to maintain the organic-matter and nitrogen supply than in a more open soil. The subsoil is not favorable to deep root penetration and for that reason, particular care must be exercised in maintaining a rich surface and subsurface soil. No experimental information is available regarding the fertilization of this soil. It is suggested that the various phosphates be tried and that in making the trials it be borne in mind that wheat usually responds to phosphate better than do other crops.

Yellow-Gray Fine Sandy Silt Loam (1344, 1444)

Yellow-Gray Fine Sandy Silt Loam, Bottom, covers an area of 6.42 square miles, or 1.49 percent of the area of the county.

The surface soil to a depth of 6 inches, varies from a light brown to a yellowish gray, fine sandy silt loam. The subsurface extending to 20 inches in

depth is a yellowish gray, fine sandy loam. The subsoil in the upper 10 inches is a yellowish gray sandy loam, while in the lower part it varies from a brown, fine sandy loam to a somewhat compact, yellow, clayey sand.

Management.—This type is well supplied with carbonates and is an excellent alfalfa and sweet clover soil. It is not well supplied with nitrogen or organic matter and particular attention should be given to increasing the amount of these constituents by growing clovers. The reader is referred to the discussion of the management of Yellow-Gray Silt Loam (534) for further suggestions regarding the management of this type (see page 16).

Black Sandy Loam (1461)

Black Sandy Loam occurs in a few low, poorly drained areas in the Rock river bottom.

The surface soil, extending to a depth of 8 inches, is a black sandy loam. The subsurface, extending from 8 to 16 inches, varies from a black to a yellowish brown or yellowish drab sandy loam. The subsoil varies from a drab to a yellow sand. Some of the areas have a gravel deposit of several feet in thickness at a depth of about 22 inches below the surface. This type, being poorly drained and also alkaline, is not productive. The area is small, and on the whole the type is of little importance.

River Sand (1480)

Only a few areas of River Sand, Bottom, were mapped in the county. It is similar to River Sand, Terrace (1580), excepting that it is not so well drained and is alkaline.

The surface soil is a brown sand to a depth of 3 or 4 inches, and the subsurface and subsoil are yellow sand.

Black Clay Loam (1420)

Black Clay Loam occurs almost entirely in the Rock river bottom. It covers an area of only 1.46 square miles. The areas of this soil type are usually lower in topography than those adjacent to them.

The surface soil, extending to a depth of 8 inches, is a plastic black clay loam. The subsurface, 8 to 16 inches, is a drabbish black clay loam. The subsoil in the upper 14 inches is a very plastic drab clay containing many snail shells, while below 30 inches, it is a drab clay loam and less plastic.

Management.—This type is alkaline and the alkali salts may be sufficiently concentrated to require the use of potash to overcome their harmful effects. Good underdrainage will gradually lessen the amount of alkali. Particular care should be used in maintaining a good supply of organic matter in order to help maintain a good physical condition and also to help in overcoming the effects of the alkali. No fertilizer treatment other than the use of potash, where necessary, is advised.

Drab Clay (1415)

Drab Clay is found almost exclusively in the Mississippi river bottom. It is flat in topography, but has been fairly well drained thru the construction of levees and dredge ditches. It covers an area of 1.24 square miles, or .29 percent of the area of the county.

The surface soil, to a depth of 7 inches, varies from a heavy, drabbish, silt loam to a plastic, drab, clay loam. The subsurface, 7 to 22 inches, varies from drab clay to mottled drab clay loam. The subsoil below 22 inches is drab clay.

Management.—This type is well supplied with the elements of plant food with the exception of nitrogen, but the soil is hard to work unless the moisture conditions are just right. The type is usually not alkaline, and since being leveed and drained, is gradually becoming acid. It is very necessary to maintain a good supply of fresh organic matter to help overcome the tendency towards poor physical condition and to furnish nitrogen for the growing crops.

Drab Clay Loam (1421)

Drab Clay Loam occurs in association with Drab Clay and often grades into that type. It has been formed where there has been very little current, so that the finest material has been carried in and deposited. The topography is flat. Drainage has been established thru the construction of dredges. Drab Clay Loam is found in the Mississippi river bottoms along the west side of the county. Thru an error, the type name has been omitted from the legend on three sections of the printed soil map.

The surface soil, which is about 6 inches deep, varies from a heavy brown clay loam to a plastic drab clay loam. The subsurface gradually changes from a drab clay loam to a plastic drab clay. The subsoil is a plastic, compact, drab clay.

Management.—The management requirements of this type are the same as for Drab Clay (1415).

Black Mixed Loam (1450)

Black Mixed Loam was formed in low, poorly drained, swampy areas. Within recent years, most of the areas have been drained so that crops can now be grown. Most of the areas are located along Rock river and its former channels. The type covers 11.86 square miles, or 2.77 percent of the area of the county.

The surface soil, to a depth of 7 inches, varies from a black silt loam to a black sandy loam or peaty loam. The subsurface, 7 to 20 inches, is usually a black clay loam with an appreciable amount of sand. The subsoil in the upper 12 inches is a drab clay loam containing considerable sand and gravel, and the lower part is a sticky drab clay.

Management.—This is a productive type of soil when well drained. Alkali is present on some areas in sufficient concentration to necessitate the use of a potash salt, while on others the plowing-down of a good growth of sweet clover in the spring for corn is a sufficient corrective for this condition. No fertilizer

treatment other than the above treatment for alkali, when necessary, is advised. Adequate provision should be made for maintaining the nitrogen and the supply of fresh organic matter by the frequent growth of legumes.

Black Mixed Loam On Rock (1450.5)

Black Mixed Loam On Rock occurs in the Rock river bottom. The underlying limestone rock comes to within less than 30 inches of the surface. The type occupies only .53 square mile.

The surface soil, to a depth of 7 or 8 inches, is a sandy black clay loam. The subsurface, 7 to 17 inches, varies from a black to drabbish, silty clay loam, with the limestone at about 17 inches as a rule. In a few places, where the limestone occurs about 22 to 24 inches below the surface, the subsoil is a plastic yellow clay.

This type is suitable only for pasture.

Deep Peat (1401)

Deep Peat occupies 2.61 square miles, or 1.21 percent of the area of the county. It occurs in areas which have been continuously wet, thus favoring the growth and accumulation of organic matter.

The surface soil, to a depth of about 7 inches, is well-decomposed black peat. The subsurface differs from the surface in that it contains more clay. The subsoil is rather variable in depth and in composition. It is usually peaty material down to about 30 inches and then a clayey muck. In places, the clayey muck occurs at a depth of 25 or 30 inches below the surface.

Management.—The first requirement in the management of this type is good drainage. The type is likely to be alkaline and usually the application of potash is necessary; however, the high percentage of clay near the surface suggests that the use of potash may not be necessary unless alkali is present in harmful amounts. Acid phosphate has been found to give good results on this type in neighboring states; however, it should be used in an experimental way until its value or lack of value has been proved.

Clayey Muck (1413)

Clayey Muck occurs in the northeastern part of the county in Meredosia slough. It covers only .03 square mile, or 19 acres.

APPENDIX

EXPLANATIONS FOR INTERPRETING THE SOIL SURVEY

CLASSIFICATION OF SOILS

In order intelligently to interpret the soil maps, the reader must understand something of the method of soil classification upon which the survey is based. Without going far into details the following paragraphs are intended to furnish a brief explanation of the general plan of classification used.

The type is the unit of classification and each type has definite characteristics. In establishing types, the following factors are taken into account: the character of the horizons composing the soil as to depth and thickness, physical composition, structure, organic-matter content, color, reaction, and carbonate content; the topography; the native vegetation; and the geological origin of the soil.[1]

Not infrequently areas are encountered in which type characters are not distinctly developed or in which they show considerable variation. When these variations are considered to have sufficient significance, type separations are made whenever the areas involved are sufficiently large. Because of the almost infinite variability occurring in soils, one of the exacting tasks of the soil surveyor is to determine the degree of variation which is allowable for any given type.

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[1] Since some of the terms used in designating the factors which are taken into account in establishing soil types are technical in nature, the following explanations are introduced:

Horizon. A layer or stratum of soil which differs discernibly from those adjacent in color, texture, structure, chemical composition, or a combination of these characteristics, is called an horizon.

Depth and Thickness. The horizons or layers which make up the soil profile vary in depth and thickness. These variations are distinguishing features in the separation of soils into types.

Physical Composition. The physical composition, sometimes referred to as "texture," is a most important feature in characterizing a soil. The texture depends upon the relative proportions of the following physical constituents: clay, silt, fine sand, sand, gravel, stones, and organic material.

Structure. The term "structure" has reference to the aggregation of particles within the soil mass and carries such qualifying terms as open, granular, compact.

Organic-Matter Content. The organic matter of soil is derived largely from plant tissue and it exists in a more or less advanced stage of decomposition. Organic matter forms the predominating constituent in certain soils of swampy formation.

Color. Color is determined to a large extent by the proportion of organic matter, but at the same time it is modified by the mineral constituents, especially by iron compounds.

Reaction. The term "reaction" refers to the chemical state of the soil with respect to acid or alkaline condition. It also involves the idea of degree, as strongly acid or strongly alkaline.

Carbonate Content. The carbonate content has reference to the calcium carbonate (limestone) present, which in some cases may be associated with magnesium or other carbonates. The depth at which carbonates are found may become a very important factor in determining the soil type.

Topography. Topography has reference to the lay of the land, as level, rolling, hilly, etc.

Native Vegetation. The vegetation or plant growth before being disturbed by man, as prairie grasses and forest trees, is a feature frequently recognized in determining soil types.

Geological Origin. Geological origin involves the idea of character of rock materials composing the soil as well as the method of formation of the soil.

Classifying Soil Types.—In the system of classification used, the types fall first into four general groups based upon their geological relationships; namely, upland, terrace, swamp and bottom land, and residual. These groups may be subdivided into prairie soils and timber soils, altho as a matter of fact this subdivision is applied in the main only to the upland group. These terms are all explained in the foregoing part of the report in connection with the description of the particular soil types.

Naming and Numbering Soil Types.—In the Illinois soil survey a system of nomenclature is used which is intended to make the type name convey some idea of the nature of the soil. Thus the name "Yellow-Gray Silt Loam" carries in itself a more or less definite description of the type. It should not be assumed, however, that this system of nomenclature makes it possible to devise type names which are adequately descriptive, because the profile of mature soils is usually made up of four or more horizons and it is impossible to describe each horizon in the type name. The color and texture of the surface soil are usually included in the type name and when material such as sand, gravel, or rock lies at a depth of less than 30 inches, the fact is indicated by the word "on," and when its depth exceeds 30 inches, by the word "over"; for example, Brown Silt Loam On Gravel, and Brown Silt Loam Over Gravel.

As a further step in systematizing the listing of the soils of Illinois, recognition is given to the location of the types with respect to the geological areas in which they occur. According to a geological survey made many years ago, the state has been divided into seventeen areas with respect to geological formation and, for the purposes of the soil survey, each of these areas has been assigned an index number. The names of the areas together with their general location and their corresponding index numbers are given in the following list.

000 *Residual,* soils formed in place thru disintegration of rocks, and also rock outcrop
100 *Unglaciated,* comprizing three areas, the largest being in the south end of the state
200 *Illinoisan moraines,* including the moraines of the Illinoisan glaciations
300 *Lower Illinoisan glaciation,* covering nearly the south third of the state
400 *Middle Illinoisan glaciation,* covering about a dozen counties in the west-central part of the state
500 *Upper Illinoisan glaciation,* covering about fourteen counties northwest of the middle Illinoisan glaciation
600 *Pre-Iowan glaciation,* but now believed to be part of the upper Illinoisan
700 *Iowan glaciation,* lying in the central northern end of the state
800 *Deep loess areas,* including a zone a few miles wide along the Wabash, Illinois, and Mississippi rivers
900 *Early Wisconsin moraines,* including the moraines of the early Wisconsin glaciation
1000 *Late Wisconsin moraines,* including the moraines of the late Wisconsin glaciation
1100 *Early Wisconsin glaciation,* covering the greater part of the northeast quarter of the state
1200 *Late Wisconsin glaciation,* lying in the northeast corner of the state
1300 *Old river-bottom and swamp lands,* found in the older or Illinoisan glaciation
1400 *Late river-bottom and swamp lands,* those of the Wisconsin and Iowan glaciations
1500 *Terraces,* bench or second bottom lands, and gravel outwash plains
1600 *Lacustrine deposits,* formed by Lake Chicago, the enlarged glacial Lake Michigan

For further information regarding these geological areas the reader is referred to the general map published in Bulletins 123 and 193.

Another set of index numbers is assigned to the classes of soils as based upon physical composition. The following list contains the names of these classes with their corresponding index numbers.

Index Number Limits	Class Names
0 to 9	Peats
10 to 12	Peaty loams
13 to 14	Mucks
15 to 19	Clays
20 to 24	Clay loams
25 to 49	Silt loams
50 to 59	Loams
60 to 79	Sandy loams
80 to 89	Sands
90 to 94	Gravelly loams
95 to 97	Gravels
98	Stony loams
99	Rock outcrop

As a convenient means of designating types and their location with respect to the geological areas of the state, each type is given a number made up of a combination of the index numbers explained above. This number indicates the type and the geological area in which it occurs. The geological area is always indicated by the digits of the order of hundreds while the balance of the number designates the type. To illustrate: the number 1126 means Brown Silt Loam in the early Wisconsin glaciation, 434 means Yellow-Gray Silt Loam of the middle Illinoisan glaciation. These numbers are especially useful in designating very small areas on the map and as a check in reading the colors.

A complete list of the soil types occurring in each county, along with their corresponding type numbers and the area covered by each type, will be found in the respective county soil reports in connection with the maps.

SOIL SURVEY METHODS

Mapping of Soil Types.—In conducting the soil survey, the county constitutes the unit of working area. The field work is done by parties of two to four men each. The field season extends from early in April to Thanksgiving. During the winter months the men are engaged in preparing a copy of the soil map to be sent to the lithographer, a copy for the use of the county farm adviser until the printed map is available, and a third copy for use in the office in order to preserve the original official map in good condition.

An accurate base map for field use is necessary for soil mapping. These maps are prepared on a scale of one inch to the mile, the official data of the original or subsequent land survey being used as the basis in their construction. Each surveyor is provided with one of these base maps, which he carries with him in the field; and the soil type boundaries, together with the streams, roads, railroads, canals, town sites, and rock and gravel quarries are placed in their proper location upon the map while the mapper is on the area. With the rapid development of road improvement during the past few years, it is almost inevitable that some recently established roads will not appear on the published soil map. Similarly, changes in other artificial features will occasionally occur in the interim between the preparation of the map and its publication. The detail or minimum size of areas which are shown on the map varies somewhat, but in general a soil type if less than five acres in extent is not shown.

A soil auger is carried by each man with which he can examine the soil to a depth of 40 inches. An extension for making the auger 80 inches long is taken

by each party, so that the deeper subsoil may be studied. Each man carries a compass to aid in keeping directions. Distances along roads are measured by a speedometer or other measuring device, while distances in the field away from the roads are measured by pacing.

Sampling for Analysis—After all the soil types of a county have been located and mapped, samples representative of the different types are collected for chemical analysis. The samples for this purpose are usually taken in three depths; namely, 0 to 6⅔ inches, 6⅔ to 20 inches, and 20 to 40 inches, as explained in connection with the discussion of the analytical data on page 7.

PRINCIPLES OF SOIL FERTILITY

Probably no agricultural fact is more generally known by farmers and landowners than that soils differ in productive power. A fact of equal importance, not so generally recognized, is that they also differ in other characteristics such as response to fertilizer treatment and to management.

The soil is a dynamic, ever-changing, exceedingly complex substance made up of organic and inorganic materials and teeming with life in the form of microorganisms. Because of these characteristics, the soil cannot be considered as a reservoir into which a given quantity of an element or elements of plant food can be poured with the assurance that it will respond with a given increase in crop yield. In a similar manner it cannot be expected to respond with perfect uniformity to a given set of management standards. To be productive a soil must be in such condition physically with respect to structure and moisture as to encourage root development; and in such condition chemically that injurious substances are not present in harmful amounts, that a sufficient supply of the elements of plant food become available or usable during the growing season, and that lime materials are present in sufficient abundance favorable for the growth of the higher plants and of the beneficial microorganisms. Good soil management under humid conditions involves the adoption of those tillage, cropping, and fertilizer treatment methods which will result in profitable and permanent crop production on the soil type concerned.

The following paragraphs are intended to state in a brief way some of the principles of soil management and treatment which are fundamental to profitable and continued productivity.

CROP REQUIREMENTS WITH RESPECT TO PLANT-FOOD MATERIALS

Ten different elements of plant food are essential for the growth and formation of every plant. These elements are: *carbon, oxygen, hydrogen, nitrogen, phosphorus, sulfur, potassium, magnesium, calcium, and iron.* Some seasons in central Illinois are sufficiently favorable to allow the production of at least 50 bushels of wheat per acre, 100 bushels of corn, 100 bushels of oats, and 4 tons of clover hay. When such crops, growing under favorable climatic and cultural conditions and uninjured by disease or insect pests, are not produced the failure is due to unfavorable soil conditions, which may result from poor drainage, poor physical condition, or from an actual deficiency in one or more of the elements of plant food.

TABLE 5.—PLANT-FOOD ELEMENTS IN COMMON FARM CROPS[1]

Produce		Nitrogen	Phosphorus	Sulfur	Potassium	Magnesium	Calcium	Iron
Kind	Amount							
		lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
Wheat, grain.....	1 bu.	1.42	.24	.10	.26	.08	.02	.01
Wheat straw	1 ton	10.00	1.60	2.80	18.00	1.60	3.80	.60
Corn, grain.....	1 bu.	1.00	.17	.08	.19	.07	.01	.01
Corn stover.....	1 ton	16.00	2.00	2.42	17.33	3.33	7.00	1.60
Corn cobs.....	1 ton	4.00	.....	.....	4.00	.....	.....	.....
Oats, grain.....	1 bu.	.66	.11	.06	.16	.04	.02	.01
Oat straw.....	1 ton	12.40	2.00	4.14	20.80	2.80	6.00	1.12
Clover seed.....	1 bu.	1.75	.50	.....	.75	.25	.13	.....
Clover hay.....	1 ton	40.00	5.00	3.28	30.00	7.75	29.25	1.00
Soybean seed.....	1 bu.	3.22	.39	.27	1.26	.15	.14	.....
Soybean hay.....	1 ton	43.40	4.74	5.18	35.48	13.84	27.56	.....
Alfalfa hay.....	1 ton	52.08	4.76	5.96	16.64	8.00	22.26	.....

[1] These data are brought together from various sources. Some allowance must be made for the exactness of the figures because samples representing the same kind of crop or the same kind of material frequently exhibit considerable variation.

Table 5 shows the requirements of some of our most common field crops with respect to the seven plant-food elements furnished by the soil. The figures show the weight in pounds of the various elements contained in a bushel or in a ton, as the case may be. From these data the amount of any element removed from an acre of land by a crop of a given yield can easily be computed.

PLANT-FOOD SUPPLY

Of the ten elements of plant food, three (carbon, oxygen, and hydrogen) are secured from air and water, and seven from the soil. Nitrogen, one of these seven elements obtained from the soil by all plants, may also be secured from the air by the class of plants known as legumes, in case the amount liberated from the soil is insufficient; but even these plants, which include only the clovers, peas, beans, and vetches among our common agricultural plants, are dependent upon the soil for the other six elements (phosphorus, potassium, magnesium, calcium, iron, and sulfur), and they also utilize the soil nitrogen so far as it becomes soluble and available during their period of growth.

The vast difference with respect to the supply of these essential plant-food elements in different soils is well brought out in the data of the Illinois soil survey. For example, it has been found that the nitrogen in the surface 6⅔ inches, which represents the plowed stratum, varies in amount from 180 pounds per acre to more than 35,000 pounds. In like manner the phosphorus content varies from about 420 to 4,900 pounds, and the potassium ranges from 1,530 to about 58,000 pounds. Similar variations are found in all of the other essential plant-food elements of the soil.

With these facts in mind it is easy to understand how a deficiency of one of these elements of plant food may become a limiting factor of crop production. When an element becomes so reduced in quantity as to become a limiting factor

TABLE 6.—PLANT-FOOD ELEMENTS IN MANURE, ROUGH FEEDS, AND FERTILIZERS[1]

Material	Pounds of plant food per ton of material		
	Nitrogen	Phosphorus	Potassium
Fresh farm manure	10	2	8
Corn stover	16	2	17
Oat straw	12	2	21
Wheat straw	10	2	18
Clover hay	40	5	30
Cowpea hay	43	5	33
Alfalfa hay	50	4	24
Sweet clover (water-free basis)[2]	80	8	28
Dried blood	280	...	...
Sodium nitrate	310	...	...
Ammonium sulfate	400	...	...
Raw bone meal	80	180	...
Steamed bone meal	20	250	...
Raw rock phosphate	...	250	...
Acid phosphate	...	125	...
Potassium chlorid	...	...	850
Potassium sulfate	...	...	850
Kainit	...	...	200
Wood ashes[3] (unleached)	...	10	100

[1] See footnote to Table 5.
[2] Young second year's growth ready to plow under as green manure.
[3] Wood ashes also contain about 1,000 pounds of lime (calcium carbonate) per ton.

of production, then we must look for some outside source of supply. Table 6 is presented for the purpose of furnishing information regarding the quantity of some of the more important plant-food elements contained in materials most commonly used as sources of supply.

LIBERATION OF PLANT FOOD

The chemical analysis of the soil gives the invoice of plant-food elements actually present in the soil strata sampled and analyzed, but the rate of liberation is governed by many factors, some of which may be controlled by the farmer, while others are largely beyond his control. Chief among the important controllable factors which influence the liberation of plant food are the choice of crops to be grown, the use of limestone, and the incorporation of organic matter. Tillage, especially plowing, also has a considerable effect in this connection.

Feeding Power of Plants.—Different species of plants exhibit a very great diversity in their ability to obtain plant food directly from the insoluble minerals of the soil. As a class, the legumes—especially such biennial and perennial legumes as red clover, sweet clover, and alfalfa—are endowed with unusual power to assimilate from mineral sources such elements as calcium and phosphorus, converting them into available forms for the crops that follow. For this reason it is especially advantageous to employ such legumes in connection with the application of limestone and rock phosphate. Thru their growth and subsequent decay large quantities of the mineral elements are liberated for

the benefit of the cereal crops which follow in the rotation. Moreover, as an effect of the deep-rooting habit of these legumes, mineral plant-food elements are brought up and rendered available from the vast reservoirs of the lower subsoil.

Effect of Limestone.—Limestone corrects the acidity of the soil and supplies calcium, thus encouraging the development not only of the nitrogen-gathering bacteria which live in the nodules on the roots of clover, cowpeas, and other legumes, but also the nitrifying bacteria, which have power to transform the unavailable organic nitrogen into available nitrate nitrogen. At the same time, the products of this decomposition have power to dissolve the minerals contained in the soil, such as potassium and magnesium compounds.

Organic Matter and Biological Action.—Organic matter may be supplied thru animal manures, consisting of the excreta of animals and usually accompanied by more or less stable litter; and by plant manures, including green-manure crops and cover crops plowed under, and also crop residues such as stalks, straw, and chaff. The rate of decay of organic matter depends largely upon its age, condition, and origin, and it may be hastened by tillage. The chemical analysis shows correctly the total organic carbon, which constitutes, as a rule, but little more than half the organic matter; so that 20,000 pounds of organic carbon in the plowed soil of an acre corresponds to nearly 20 tons of organic matter. But this organic matter consists largely of the old organic residues that have accumulated during the past centuries because they were resistant to decay, and 2 tons of clover or cowpeas plowed under may have greater power to liberate plant-food materials than 20 tons of old, inactive organic matter. The history of the individual farm or field must be depended upon for information concerning recent additions of active organic matter, whether in applications of farm manure, in legume crops, or in sods of old pastures.

The condition of the organic matter of the soil is indicated to some extent by the ratio of carbon to nitrogen. Fresh organic matter recently incorporated with the soil contains a very much higher proportion of carbon to nitrogen than do the old resistant organic residues of the soil. The proportion of carbon to nitrogen is higher in the surface soil than in the corresponding subsoil, and in general this ratio is wider in highly productive soils well charged with active organic matter than in very old, worn soils badly in need of active organic matter.

The organic matter furnishes food for bacteria, and as it decays certain decomposition products are formed, including much carbonic acid, some nitrous acid, and various organic acids, and these acting upon the soil have the power to dissolve the essential mineral plant foods, thus furnishing available phosphates, nitrates, and other salts of potassium, magnesium, calcium, etc., for the use of the growing crop.

Effect of Tillage.—Tillage, or cultivation, also hastens the liberation of plant-food elements by permitting the air to enter the soil. It should be remembered, however, that tillage is wholly destructive, in that it adds nothing whatever to the soil, but always leaves it poorer, so far as plant-food materials are concerned. Tillage should be practiced so far as is necessary to prepare a suitable seed bed for root development and also for the purpose of killing weeds, but more than

this is unnecessary and unprofitable; and it is much better actually to enrich the soil by proper applications of limestone, organic matter, and other fertilizing materials, and thus promote soil conditions favorable for vigorous plant growth, than to depend upon excessive cultivation to accomplish the same object at the expense of the soil.

PERMANENT SOIL IMPROVEMENT

According to the kind of soil involved, any comprehensive plan contemplating a permanent system of agriculture will need to take into account some of the following considerations.

The Application of Limestone

The Function of Limestone.—In considering the application of limestone to land it should be understood that this material functions in several different ways, and that a beneficial result may therefore be attributable to quite diverse causes. Limestone provides calcium, of which certain crops are strong feeders. It corrects acidity of the soil, thus making for some crops a much more favorable environment as well as establishing conditions absolutely required for some of the beneficial legume bacteria. It accelerates nitrification and nitrogen fixation. It promotes sanitation of the soil by inhibiting the growth of certain fungous diseases, such as corn-root rot. Experience indicates that it modifies either directly or indirectly the physical structure of fine-textured soils, frequently to their great improvement.

Thus, working in one or more of these different ways, limestone often becomes the key to the improvement of worn lands. Remarkable success has been experienced with limestone used in conjunction with sweet clover in the reclamation of abandoned hill land which has been ruined thru erosion.

Amounts to Apply.—If the soil is acid, limestone should be applied, the initial treatment being at the rate of 2 to 6 tons an acre, according to the degree of acidity. Continue to apply limestone from time to time according to the requirement of the soil as indicated by the tests described below, or until the most favorable conditions are established for the growth of legumes, using preferably at times magnesian limestone ($CaCO_3MgCO_3$), which contains both calcium and magnesium and has slightly greater power to correct soil acidity, ton for ton, than the ordinary calcium limestone ($CaCO_3$). On strongly acid soils, or on land being prepared for alfalfa, 4 or 5 tons per acre of ground limestone may well be used for the first application.

How to Ascertain the Need for Limestone.—One of the most reliable indications as to whether a soil needs limestone is the character of the growth of certain legumes, particularly sweet clover and alfalfa. These crops do not thrive in acid soils. Their successful growth, therefore, indicates the lack of sufficient acidity in the soil to be harmful. In case of their failure to grow the soil should be tested for acidity as described below. A very valuable test for ascertaining the need of a soil for limestone is found in the potassium thiocyanate test for soil acidity. It is desirable to make the test for carbonates along with the acidity test. Limestone is calcium carbonate, while dolomite is the combined carbonate of calcium and magnesium. The natural occurrence of these carbonates in the

soil is sufficient assurance that no limestone is needed, and the acidity test will be negative. On lands which have been treated with limestone, however, the surface soil may give a positive test for carbonates, owing to the presence of undecomposed pieces of limestone, and at the same time a positive test for acidity may be secured. Such a result means either that insufficient limestone has been added to neutralize the acidity, or that it has not been in the soil long enough to entirely correct the acidity. In making these tests, it is desirable to examine samples of soil from different depths, since carbonates may be present, even in abundance, below a surface stratum that is acid. Following are the directions for making the tests:

The Potassium Thiocyanate Test for Acidity. This test is made with a 4-percent solution of potassium thiocyanate in alcohol—4 grams of potassium thiocyanate in 100 cubic centimeters of 95-percent alcohol.[1] When a small quantity of soil shaken up in a test tube with this solution gives a red color the soil is acid and limestone should be applied. If the solution remains colorless the soil is not acid. An excess of water interferes with the reaction. The sample when tested, therefore, should be at least as dry as when the soil is in good tillable condition. For a prompt reaction the temperature of the soil and solution should be not lower than that of comfortable working conditions (60° to 75° Fahrenheit).

The Hydrochloric Acid Test for Carbonates. Make a shallow cup of a ball of soil and pour into it a few drops of hydrochloric (muriatic) acid, prepared by diluting the concentrated acid with an equal volume of water. The presence of limestone or some other carbonates will be shown by the appearance of gas bubbles within 2 or 3 minutes, producing foaming or effervescence. The absence of carbonates in a soil is not in itself evidence that the soil is acid or that limestone should be applied, but it indicates that the confirmatory potassium thiocyanate test should be carried out.

The Nitrogen Problem

Nitrogen presents the greatest practical soil problem in American agriculture. Four important reasons for this are: its increasing deficiency in most soils; its cost when purchased on the open market; its removal in large amounts by crops; and its loss from soils thru leaching. Nitrogen usually costs from four to five times as much per pound as phosphorus. A 100-bushel crop of corn requires 150 pounds of nitrogen for its growth, but only 23 pounds of phosphorus. The loss of nitrogen from soils may vary from a few pounds to over one hundred pounds per acre, depending upon the treatment of the soil, the distribution of rainfall, and the protection afforded by growing crops.

An inexhaustible supply of nitrogen is present in the air. Above each acre of the earth's surface there are about sixty-nine million pounds of atmospheric nitrogen. The nitrogen above one square mile weighs twenty million tons, an amount sufficient to supply the entire world for four or five decades. This large supply of nitrogen in the air is the one to which the world must eventually turn.

There are two methods of collecting the inert nitrogen gas of the air and combining it into compounds that will furnish products for plant growth. These are the chemical and the biological fixation of the atmospheric nitrogen. Farmers have at their command one of these methods. By growing inoculated legumes, nitrogen may be obtained from the air, and by plowing under more than the roots of those legumes, nitrogen may be added to the soil.

[1] Since undenatured alcohol is difficult to obtain, some of the denatured alcohols have been tested for making this solution. Completely denatured alcohol made over U. S. Formulas No. 1 and No. 4_1 have been found satisfactory. Some commercial firms are also offering similar preparations which are satisfactory.

Inasmuch as legumes are worth growing for purposes other than the fixation of atmospheric nitrogen, a considerable portion of the nitrogen thus gained may be considered a by-product. Because of that fact, it is questionable whether the chemical fixation of nitrogen will ever be able to replace the simple method of obtaining atmospheric nitrogen by growing inoculated legumes in the production of our great grain and forage crops.

It may well be kept in mind that the following amounts of nitrogen are required for the produce named:

1 bushel of oats (grain and straw) requires 1 pound of nitrogen.
1 bushel of corn (grain and stalks) requires 1½ pounds of nitrogen.
1 bushel of wheat (grain and straw) requires 2 pounds of nitrogen.
1 ton of timothy contains 24 pounds of nitrogen.
1 ton of clover contains 40 pounds of nitrogen.
1 ton of cowpea hay contains 43 pounds of nitrogen.
1 ton of alfalfa contains 50 pounds of nitrogen.
1 ton of average manure contains 10 pounds of nitrogen.
1 ton of young sweet clover, at about the stage of growth when it is plowed under as green manure, contains, on water-free basis, 80 pounds of nitrogen.

The roots of clover contain about half as much nitrogen as the tops, and the roots of cowpeas contain about one-tenth as much as the tops. Soils of moderate productive power will furnish as much nitrogen to clover (and two or three times as much to cowpeas) as will be left in the roots and stubble. In grain crops, such as wheat, corn, and oats, about two-thirds of the nitrogen is contained in the grain and one-third in the straw or stalks.

The Phosphorus Problem

The element phosphorus is an indispensable constituent of every living cell. It is intimately connected with the life processes of both plants and animals, the nuclear material of the cells being especially rich in this element.

The phosphorus content of the soil is dependent upon the origin of the soil. The removal of phosphorus by continuous cropping slowly reduces the amount of this element in the soil available for crop use, unless its addition is provided for by natural means, such as overflow, or by agricultural practices, such as the addition of phosphatic fertilizers and rotations in which deep-rooting, leguminous crops are frequently grown.

It should be borne in mind in connection with the application of phosphate, or of any other fertilizing material, to the soil, that no benefit can result until the need for it has become a limiting factor in plant growth. For example, if there is already present in the soil sufficient available phosphorus to produce a forty-bushel crop, and the nitrogen supply or the moisture supply is sufficient for only forty bushels, or less, then extra phosphorus added to the soil cannot increase the yield beyond this forty-bushel limit.

There are several different materials containing phosphorus which are applied to land as fertilizer. The more important of these are bone meal, acid phosphate, natural raw rock phosphate, and basic slag. Obviously that carrier of phosphorus which gives the most economical returns, as considered from all standpoints, is the most suitable one to use. Altho this matter has been the subject of much discussion and investigation the question still remains unsettled. Probably there is no single carrier of phosphorus that will prove to be

the most economical one to use under all circumstances because so much depends upon soil conditions, crops grown, length of haul, and market conditions.

Bone meal, prepared from the bones of animals, appears on the market in two different forms, raw and steamed. Raw bone meal contains, besides the phosphorus, a considerable percentage of nitrogen which adds a useless expense if the material is purchased only for the sake of the phosphorus. As a source of phosphorus, steamed bone meal is preferable to raw bone meal. Steamed bone meal is prepared by extracting most of the nitrogenous and fatty matter from the bones, thus producing a more nearly pure form of calcium phosphate containing about 10 to 12 percent of the element phosphorus.

Acid phosphate is produced by treating rock phosphate with sulfuric acid. The two are mixed in about equal amounts; the product therefore contains about one-half as much phosphorus as the rock phosphate itself. Besides phosphorus, acid phosphate also contains sulfur, which is likewise an element of plant food. The phosphorus in acid phosphate is more readily available for absorption by plants than that of raw rock phosphate. Acid phosphate of good quality should contain 6 percent or more of the element phosphorus.

Rock phosphate, sometimes called floats, is a mineral substance found in vast deposits in certain regions. The phosphorus in this mineral exists chemically as tri-calcium phosphate and a good grade of the rock should contain 12½ percent, or more, of the element phosphorus. The rock should be ground to a powder, fine enough to pass thru a 100-mesh sieve, or even finer.

The relative cheapness of raw rock phosphate, as compared with the treated or acidulated material, makes it possible to apply for equal money expenditure considerably more phosphorus per acre in this form than in the form of acid phosphate, the ratio being, under the market conditions of the past several years, about 4 to 1. That is to say, under these market conditions, a dollar will purchase about four times as much of the element phosphorus in the form of rock phosphate as in the form of acid phosphate, which is an important consideration if one is interested in building up a phosphorus reserve in the soil. As explained above, more very carefully conducted comparisons on various soil types under various cropping systems are needed before definite statements can be given as to which form of phosphate is most economical to use under any given set of conditions.

Basic slag, known also as Thomas phosphate, is another carrier of phosphorus that might be mentioned because of its considerable usage in Europe and eastern United States. Basic slag phosphate is a by-product in the manufacture of steel. It contains a considerable proportion of basic material and therefore it tends to influence the soil reaction.

Rock phosphate may be applied at any time during a rotation, but it is applied to the best advantage either preceding a crop of clover, which plant seems to possess an unusual power for assimilating the phosphorus from raw phosphate, or else at a time when it can be plowed under with some form of organic matter such as animal manure or green manure, the decay of which serves to liberate the phosphorus from its insoluble condition in the rock. It is important that the finely ground rock phosphate be intimately mixed with the organic material as it is plowed under.

In using acid phosphate or bone meal in a cropping system which includes wheat, it is a common practice to apply the material in the preparation of the wheat ground. It may be advantageous, however, to divide the total amount to be used and apply a portion to the other crops of the rotation, particularly to corn and to clover.

The Potassium Problem

Our most common soils, which are silt loams and clay loams, are well stocked with potassium, altho it exists largely in a slowly soluble form. Such soils as sands and peats, however, are likely to be low in this element. On such soils this deficiency may be remedied by the application of some potassium salt, such as potassium sulfate, potassium chlorid, kainit, or other potassium compound, and in many instances this is done at great profit.

From all the facts at hand it seems, so far as our great areas of common soils are concerned, that, with a few exceptions, the potassium problem is not one of addition but of liberation. The Rothamsted records, which represent the oldest soil experiment fields in the world, show that for many years other soluble salts have had practically the same power as potassium salts to increase crop yields in the absence of sufficient decaying organic matter. Whether this action relates to supplying or liberating potassium for its own sake, or to the power of the soluble salt to increase the availability of phosphorus or other elements, is not known, but where much potassium is removed, as in the entire crops at Rothamsted, with no return of organic residues, probably the soluble salt functions in both ways.

Further evidence on this matter is furnished by the Illinois experiment field at Fairfield, where potassium sulfate has been compared with kainit both with and without the addition of organic matter in the form of stable manure. Both sulfate and kainit produced a substantial increase in the yield of corn, but the cheaper salt—kainit—was just as effective as the potassium sulfate, and returned some financial profit. Manure alone gave an increase similar to that produced by the potassium salts, but the salts added to the manure gave very little increase over that produced by the manure alone. This is explained in part, perhaps, by the fact that the potassium removed in the crops is mostly returned in manure properly cared for, and perhaps in larger part by the fact that decaying organic matter helps to liberate and hold in solution other plant-food elements, especially phosphorus.

In laboratory experiments at the Illinois Experiment Station, it has been shown that potassium salts and most other soluble salts increase the solubility of the phosphorus in soil and in rock phosphate; also that the addition of glucose with rock phosphate in pot-culture experiments increases the availability of the phosphorus, as measured by plant growth, altho the glucose consists only of carbon, hydrogen, and oxygen, and thus contains no limiting element of plant food.

In considering the conservation of potassium on the farm it should be remembered that in average live-stock farming the animals destroy two-thirds of the organic matter and retain one-fourth of the nitrogen and phosphorus from the food they consume, but that they retain less than one-tenth of the potassium; so that the actual loss of potassium in the products sold from the farm, either

in grain farming or in livestock farming, is negligible on land containing 25,000 pounds or more of potassium in the surface 6⅔ inches.

The Calcium and Magnesium Problem

When measured by crop removals of the plant-food elements, calcium is often more limited in Illinois soils than is potassium, while magnesium may be occasionally. In the case of calcium, however, the deficiency is likely to develop more rapidly and become much more marked because this element is leached out of the soil in drainage water to a far greater extent than is either magnesium or potassium.

The annual loss of limestone from the soil depends, of course, upon a number of factors aside from those which have to do with climatic conditions. Among these factors may be mentioned the character of the soil, the kind of limestone, its condition of fineness, the amount present, and the sort of farming practiced. Because of this variation in the loss of lime materials from the soil, it is impossible to prescribe a fixed practice in their renewal that will apply universally. The tests for acidity and carbonates described above, together with the behavior of such lime-loving legumes as alfalfa and sweet clover, will serve as general indicators for the frequency of applying limestone and the amount to use on a given field.

Limestone has a positive value on some soils for the plant food which it supplies, in addition to its value in correcting soil acidity and in improving the physical condition of the soil. Ordinary limestone (abundant in the southern and western parts of the state) contains nearly 800 pounds of calcium per ton; while a good grade of dolomitic limestone (the more common limestone of northern Illinois) contains about 400 pounds of calcium and 300 pounds of magnesium per ton. Both of these elements are furnished in readily available form in ground dolomitic limestone.

The Sulfur Question

In considering the relation of sulfur in a permanent system of soil fertility it is important to understand something of the cycle of transformations that this element undergoes in nature. Briefly stated this is as follows:

Sulfur exists in the soil in both organic and inorganic forms, the former being gradually converted to the latter form thru bacterial action. In this inorganic form sulfur is taken up by plants which in their physiological processes change it once more into an organic form as a constituent of protein. When these plant proteins are consumed by animals, the sulfur becomes a part of the animal protein. When these plant and animal proteins are decomposed, either thru bacterial action, or thru combustion, as in the burning of coal, the sulfur passes into the atmosphere or into the soil solution in the form of sulfur dioxid gas. This gas unites with oxygen and water to form sulfuric acid, which is readily washed back into the soil by the rain, thus completing the cycle, from soil—to plants and animals—to air—to soil.

In this way sulfur becomes largely a self-renewing element of the soil, altho there is a considerable loss from the soil by leaching. Observations taken at the Illinois Agricultural Experiment Station show that 40 pounds of sulfur per

acre are brought into the soil thru the annual rainfall. With a fair stock of sulfur, such as exists in our common types of soil, and with an annual return, which of itself would more than suffice for the needs of maximum crops, the maintenance of an adequate sulfur supply presents little reason at present for serious concern. There are regions, however, where the natural stock of sulfur in the soil is not nearly so high and where the amount returned thru rainfall is small. Under such circumstances sulfur soon becomes a limiting element of crop production, and it will be necessary sooner or later to introduce this substance from some outside source. Investigation is now under way to determine to what extent this situation may apply to conditions in Illinois.

Physical Improvement of Soils

In the management of most soil types, one very important matter, aside from proper fertilization, tillage, and drainage, is to keep the soil in good physical condition, or good tilth. The constituent most important for this purpose is organic matter. Organic matter in producing good tilth helps to control washing of soil on rolling land, raises the temperature of drained soil, increases the moisture-holding capacity of the soil, slightly retards capillary rise and consequently loss of moisture by surface evaporation, and helps to overcome the tendency of some soils to run together badly.

The physical effect of organic matter is to produce a granulation or mellowness, by cementing the fine soil particles into crumbs or grains about as large as grains of sand, which produces a condition very favorable for tillage, percolation of rainfall, and the development of plant roots.

Organic matter is undergoing destruction during a large part of the year and the nitrates produced in its decomposition are used for plant growth. Altho this decomposition is necessary, it nevertheless reduces the amount of organic matter, and provision must therefore be made for maintaining the supply. The practical way to do this is to turn under the farm manure, straw, cornstalks, weeds, and all or part of the legumes produced on the farm. The amount of legumes needed depends upon the character of the soil. There are farms, especially grain farms, in nearly every community where all legumes could be turned under for several years to good advantage.

Manure should be spread upon the land as soon as possible after it is produced, for if it is allowed to lie in the barnyard several months as is so often the case, from one-third to two-thirds of the organic matter will be lost.

Straw and cornstalks should be turned under, and not burned. There is considerable evidence indicating that on some soils undecomposed straw applied in excessive amount may be detrimental. Probably the best practice is to apply the straw as a constituent of well-rotted stable manure. Perhaps no form of organic matter acts more beneficially in producing good tilth than cornstalks. It is true, they decay rather slowly, but it is also true that their durability in the soil is exactly what is needed in the production of good tilth. Furthermore, the nitrogen in a ton of cornstalks is one and one-half times that of a ton of manure, and a ton of dry cornstalks incorporated in the soil will ultimately furnish as much humus as four tons of average farm manure. When burned, however, both the humus-making material and the nitrogen are lost to the soil.

It is a common practice in the corn belt to pasture the cornstalks during the winter and often rather late in the spring after the frost is out of the ground. This trampling by stock sometimes puts the soil in bad condition for working. It becomes partially puddled and will be cloddy as a result. If tramped too late in the spring, the natural agencies of freezing and thawing and wetting and drying, with the aid of ordinary tillage, fail to produce good tilth before the crop is planted. Whether the crop is corn or oats, it necessarily suffers, and if the season is dry, much damage may be done. If the field is put in corn, a poor stand is likely to result, and if put in oats, the soil is so compact as to be unfavorable for their growth. Sometimes the soil is worked when too wet. This also produces a partial puddling which is unfavorable to physical, chemical, and biological processes. The effect becomes worse if cropping has reduced the organic matter below the amount necessary to maintain good tilth.

Systems of Crop Rotations

In a program of permanent soil improvement one should adopt at the outset a good rotation of crops, including, for the reasons discussed above, a liberal use of legumes. No one can say in advance for every particular case what will prove to be the best rotation of crops, because of variation in farms and farmers and in prices for produce.

Following are a few suggested rotations, applicable to the corn belt, which may serve as models or outlines to be modified according to special circumstances.

Six-Year Rotations

First year —Corn
Second year —Corn
Third year —Wheat or oats (with clover, or clover and grass)
Fourth year —Clover, or clover and grass
Fifth Year —Wheat (with clover), or grass and clover
Sixth year —Clover, or clover and grass

Of course there should be as many fields as there are years in the rotation. In grain farming, with small grain grown the third and fifth years, most of the unsalable products should be returned to the soil, and the clover may be clipped and left on the land or returned after threshing out the seed (only the clover seed being sold the fourth and sixth years); or, in livestock farming, the field may be used three years for timothy and clover pasture and meadow if desired. The system may be reduced to a five-year rotation by cutting out either the second or the sixth year, and to a four-year system by omitting the fifth and sixth years, as indicated below.

Five-Year Rotations

First year —Corn
Second year —Wheat or oats (with clover, or clover and grass)
Third year —Clover, or clover and grass
Fourth year —Wheat (with clover), or clover and grass
Fifth year —Clover, or clover and grass

First year —Corn
Second year —Corn
Third year —Wheat or oats (with clover, or clover and grass)
Fourth year —Clover, or clover and grass
Fifth year —Wheat (with clover)

First year —Corn
Second year —Cowpeas or soybeans
Third year —Wheat (with clover)
Fourth year —Clover
Fifth year —Wheat (with clover)

The last rotation mentioned above allows legumes to be grown four times. Alfalfa may be grown on a sixth field for five or six years in the combination rotation, alternating between two fields every five years, or rotating over all the fields if moved every six years.

Four-Year Rotations

First year —Corn
Second year —Wheat or oats (with clover)
Third year —Clover
Fourth year —Wheat (with clover)

First year —Corn
Second year —Corn
Third year —Wheat or oats (with clover)
Fourth year —Clover

First year —Corn
Second year —Cowpeas or soybeans
Third year —Wheat (with clover)
Fourth year —Clover

First year —Wheat (with clover)
Second year —Clover
Third year —Corn
Fourth year —Oats (with clover)

Alfalfa may be grown on a fifth field for four or eight years, which is to be alternated with one of the four; or the alfalfa may be moved every five years, and thus rotated over all five fields every twenty-five years.

Three-Year Rotations

First year —Corn
Second year —Oats or wheat (with clover)
Third year —Clover

First year —Wheat (with clover)
Second year —Corn
Third year —Cowpeas or soybeans

By allowing the clover, in the last rotation mentioned, to grow in the spring before preparing the land for corn, we have provided a system in which legumes grow on every acre every year. This is likewise true of the following suggested two-year system:

Two-Year Rotations

First year —Oats or wheat (with sweet clover)
Second year —Corn

Altho in this two-year rotation either oats or wheat is suggested, as a matter of fact, by dividing the land devoted to small grain, both of these crops can be grown simultaneously, thus providing a three-crop system in a two-year cycle.

It should be understood that in all of the above suggested cropping systems it may be desirable in some cases to substitute rye for the wheat or oats. Or, in some cases, it may become desirable to divide the acreage of small grain and grow in the same year more than one kind. In all of these proposed rotations the word *clover* is used in a general sense to designate either red clover, alsike clover, or sweet clover. The value of sweet clover, especially as a green manure for building up depleted soils, as well as a pasture and hay-crop, is becoming thoroly established, and its importance in a crop-rotation program may well be emphasized.

SUPPLEMENT: EXPERIMENT FIELD DATA

(Results from Experiment Fields on Soil Types Similar to Those Occurring in Rock Island County)

The University of Illinois has conducted altogether about fifty soil experiment fields in different sections of the state and on various types of soil. Altho some of these fields have been discontinued, the majority are still in operation. It is the present purpose to report the summarized results from certain of these fields located on types of soil described in the accompanying soil report.

A few general explanations at this point, which apply to all the fields, will relieve the necessity of numerous repetitions in the following pages.

Size and Arrangement of Fields

The soil experiment fields vary in size from less than two acres up to 40 acres or more. They are laid off into series of plots, the plots commonly being either one-fifth or one-tenth acre in area. Each series is occupied by one kind of crop. Usually there are several series so that a crop rotation can be carried on with every crop represented every year.

Two Farming Systems Provided

On many of the fields the treatment provides for two distinct systems of farming, livestock farming and grain farming.

In the livestock system, stable manure is used to furnish organic matter and nitrogen. The amount applied to a plot is based upon the amount that can be produced from crops raised on that plot.

In the grain system no animal manure is used. The organic matter and nitrogen are applied in the form of plant manures, including the plant residues produced, such as cornstalks, straw from wheat, oats, clover, etc., along with leguminous catch crops plowed under. It is the plan in this latter system to remove from the land, in the main, only the grain and seed produced, except in the case of alfalfa, that crop being harvested for hay the same as in the livestock system.

Definite Crop Rotations Followed

Crops which are of interest in the respective localities are grown in definite rotations. The most common rotation used is wheat, corn, oats, and clover; and often these crops are accompanied by alfalfa growing on a fifth series. In the grain system a legume catch crop, usually sweet clover, is included, which is seeded on the young wheat in the spring and plowed under in the fall or in the following spring in preparation for corn. If the red clover crop fails, soybeans are substituted.

Standard Soil Treatments Used

The treatment applied to the plots has, for the most part, been standardized according to a rather definite system, altho deviations from this system occur now and then, particularly in the older fields.

Following is a brief explanation of this standard system of treatment.

Animal Manures.—Animal manures, consisting of excreta from animals, with stable litter, are spread upon the respective plots in amounts proportionate to previous crop yields, the applications being made in the preparation for corn.

Plant Manures.—Crop residues produced on the land, such as stalks, straw, and chaff, are returned to the soil, and in addition a green-manure crop of sweet clover is seeded in small grain to be plowed under in preparation for corn. (On plots where limestone is lacking the sweet clover seldom survives.) This practice is designated as the *residues system.*

Mineral Manures.—The yearly acre-rates of application have been: for limestone, 1,000 pounds; for raw rock phosphate, 500 pounds; and for potassium, the equivalent of 200 pounds of kainit. The initial application of limestone has usually been 4 tons per acre.

Explanation of Symbols

0 = Untreated land or check plots
M = Manure (animal)
R = Residues (from crops, and includes legumes used as green manure)
L = Limestone
P = Phosphorus
K = Potassium (usually in the form of kainit)
N = Nitrogen (usually in the form contained in dried blood)
( ) = Parentheses enclosing figures signify tons of hay, as distinguished from bushels of seed

In discussions of this sort of data, financial profits or losses based upon assigned market values are frequently considered. However, in view of the erratic fluctuations in market values—especially in the past few years—it seems futile to attempt to set any prices for this purpose that are at all satisfactory. The yields are therefore presented with the thought that with these figures at hand the financial returns from a given practice can readily be computed upon the basis of any set of market values that the reader may choose to apply.

EXPERIMENTS ON BROWN SILT LOAM

Several experiment fields have been conducted on Brown Silt Loam at various locations in Illinois. Those located at the University have been in operation the longest and they serve well to illustrate the principles involved in the maintenance and improvement of this type of soil.

The Morrow Plots

So far as known, the oldest soil experiment field in the United States is located on Brown Silt Loam of the early Wisconsin glaciation, on the campus of the University of Illinois. This field was started in 1879 by George E. Morrow,

who for many years was Professor of Agriculture, and these plots are known as the Morrow plots.

The Morrow series now consists of three plots divided into halves, and the halves are subdivided into quarters. On one plot, corn is grown continuously; on the second, corn and oats are grown in rotation; and on the third, corn, oats, and clover are rotated. The north half of each plot has had no fertilizing material applied from the beginning of the experiments, while the south half has been treated since 1904. Besides farm manure, phosphorus has been applied in two different forms: rock phosphate to the southwest quarter at the rate of 600 pounds, and steamed bone meal to the southeast quarter at the rate of 200 pounds per acre per year up to 1919, when the rock phosphate was increased sufficiently to bring up the total amount applied to four times the quantity of bone meal applied. In 1925 the phosphates were evened up to a total of 3,300 pounds of bone meal and 13,200 pounds of rock phosphate and their application discontinued. In 1904 ground limestone was applied at the rate of 1,700 pounds per acre to the south half of each plot, and in 1918 a further application was made at the rate of 5 tons per acre. From 1903 until 1920, legumes were seeded in the corn on the south half of each plot. Legumes, chiefly red clover until 1918 and sweet clover since that time, have been seeded in the oats on the south half of Plot 4.

Table 7 gives the yearly records of the crop yields from the Morrow plots, and Table 8 presents the results in summarized form.

Summarizing the data from these Morrow plots into two periods, with the second period beginning in 1904, when the treatment began on the half-plots, some interesting comparisons may be made. In the first place we find in the untreated, continuous corn plot a marked decrease in the second period in the average yield of corn, amounting to one-third of the crop. In the two-year rotation there is a decrease in both corn and oats production, while the averages for the three-year system show an increase in corn yield and decreases in oats and

FIG. 2.—CORN ON THE MORROW PLOTS

TABLE 7.—URBANA FIELD, MORROW PLOTS

Crop Yields in Soil Experiments—Bushels or (tons) per acre

Year	Soil treatment applied	Corn every year	Two-year rotation		Three-year rotation		
		Corn	Corn	Oats	Corn	Oats	Clover
1879–87	None.....	....	....	....	....	....	....
1888	None.....	54.3	49.5	....	....	48.6	....
1889	None.....	43.2	....	37.4	....	....	(4.04)
1890	None.....	48.7	54.3	....	....	....	(1.51)
1891	None.....	28.6	33.2	....	....	....	(1.46)
1892	None.....	33.1	....	37.2	70.2	....	....
1893	None.....	21.7	29.6	....	34.1	....	....
1894	None.....	34.8	....	57.2	....	65.1	....
1895	None.....	42.2	41.6	....	....	22.2	....
1896	None.....	62.3	....	34.5	....	....	....
1897	None.....	40.1	47.0	....	....	....	....
1898	None.....	18.1	....	....	....	....	....
1899	None.....	50.1	44.4	....	53.5	....	....
1900	None.....	48.0	....	41.5	....	....	....
1901	None.....	23.7	33.7	....	34.3	....	....
1902	None.....	60.2	....	56.3	....	54.6	....
1903	None.....	26.0	35.9	....	....	....	(1.11)
1904	None.....	21.5	....	17.5	55.3	....	....
1904	MLP.....	17.1	....	25.3	72.7	....	....
1905	None.....	24.8	50.0	....	....	42.3	....
1905	MLP.....	31.4	44.9	....	....	50.6	....
1906	None.....	27.1	....	34.7	....	....	(1.42)[1]
1906	MLP.....	35.8	....	52.4	....	....	(1.74)[1]
1907	None.....	29.0	47.8	....	80.5	....	....
1907	MLP.....	48.7	87.6	....	93.6	....	....
1908	None.....	13.4	....	32.9	....	40.0	....
1908	MLP.....	28.0	....	45.0	....	44.4	....
1909	None.....	26.6	33.0	....	....	....	(.65)[2]
1909	MLP.....	31.6	64.8	....	....	....	(1.73)[3]
1910	None.....	35.9	....	33.8	58.6	....	....
1910	MLP.....	54.6	....	59.4	83.3	....	....
1911	None.....	21.9	28.6	....	....	20.6	....
1911	MLP.....	31.5	46.3	....	....	38.0	....
1912	None.....	43.2	....	55.0	....	....	16.3[1]
1912	MLP.....	64.2	....	81.0	....	....	20.5[1]
1913	None.....	19.4	29.2	....	33.8	....	....
1913	MLP.....	32.0	25.0	....	47.8	....	....
1914	None.....	31.6	....	33.6	....	39.6	....
1914	MLP.....	39.4	....	58.2	....	60.4	....
1915	None.....	40.0	49.0	....	....	....	24.2[1]
1915	MLP.....	66.0	81.2	....	....	....	27.1[1]
1916	None.....	11.2	....	37.5	27.8	....	....
1916	MLP.....	10.8	....	64.7	40.6	....	....
1917	None.....	40.0	48.4	....	....	68.4	....
1917	MLP.....	67.0	81.4	....	....	86.9	....
1918	None.....	13.6	....	27.2	....	....	(2.58)
1918	MLP.....	32.6	....	59.3	....	....	(4.04)
1919	None.....	24.0	30.8	....	52.2	....	....
1919	MLP.....	43.4	66.2	....	70.8	....	....
1920	None.....	28.2	....	37.2	....	52.2	....
1920	MLP.....	54.4	....	51.6	....	69.7	....
1921	None.....	19.8	30.6	....	....	....	(.26)[4]
1921	MLP.....	42.2	68.4	....	....	....	(1.33)[5]
1922	None.....	24.6	....	39.3	49.2	....	....
1922	MLP.....	39.4	....	55.8	65.3	....	....
1923	None.....	15.0	17.2	....	....	53.4	....
1923	MLP.....	31.4	46.4	....	....	66.6	....
1924	None.....	28.0	....	36.0	....	....	(1.83)
1924	MLP.....	38.0	....	68.5	....	....	(4.42)

[1] Soybeans. [2] In addition to the hay, .64 bushel of seed was harvested. [3] In addition to the hay, 1.17 bushels of seed were harvested. [4] In addition to the hay, .53 bushel of seed was harvested. [5] In addition to the hay, .85 bushel of seed was harvested.

TABLE 8.—URBANA FIELD, MORROW PLOTS: GENERAL SUMMARY

Average Annual Yields—Bushels or (tons) per acre

Years	Soil treatment applied	Corn every year	Two-year rotation		Three-year rotation		
			Corn	Oats	Corn	Oats	Clover
		16 crops	*9 crops*	*6 crops*	*4 crops*	*4 crops*	*4 crops*
1888 to 1903	None.....	39.7	41.0	44.0	48.0	47.6	(2.03)
		21 crops	*10 crops*	*11 crops*	*7 crops*	*7 crops*	*7 crops*[1]
1904 to 1924	None.....	25.7	36.5	35.0	51.1	45.2	(1.71)
	MLP.....	39.9	61.2	56.5	67.7	59.5	(2.86)

[1]Including all legume crops evaluated as clover hay.

clover. Unfortunately the numbers of crops included in these last averages are too small to warrant positive conclusions.

The increase brought about by soil treatment stands out in all cases, showing the possibility not only of restoring but also of greatly improving the productive power of this land that has been so abused by continuous cropping without fertilization.

The Davenport Plots

Another set of plots on the University campus at Urbana, forming a more extensive series than the Morrow plots, but of more recent origin, are the Davenport plots. Here provision is made for each crop in the rotation to be represented every year. These plots were laid out in 1895, but special soil treatment was not begun until 1901. They now comprize five series of ten plots each, and each series constitutes a "field" in a crop rotation system.

From 1901 to 1911 three of the series were in a three-year rotation system of corn, oats, and clover, while the remaining two series rotated in corn and oats. In 1911 these two systems were combined into a five-series field, with a crop rotation of wheat, corn, oats, and clover, with alfalfa on a fifth field. The alfalfa occupies one series during a rotation of the other four crops, shifting to another series in the fifth year, thus completing the cycle of all series in twenty-five years.

The soil treatment applied to these plots has been as follows:

Legume cover crops were seeded in the corn at the last cultivation on Plots 2, 4, 6, and 8, from 1902 to 1919, but the growth was small and the effect, if any, was to decrease the returns from the regular crops. Crop residues (**R**) have been returned to these same plots since 1907. These consist of stalks and straw, and all legumes except alfalfa hay and the seed of clover and soybeans. Beginning in 1918 a modification of the practice was made in that one cutting of the red clover crop is harvested as hay. In conjunction with these residues a catch crop of sweet clover grown with the wheat is plowed under.

Manure (**M**) was applied preceding corn, at the rotation rate of 6 tons per acre in the three-year rotation and 4 tons per acre in the two-year rotation in 1905, 1906, and 1907; subsequently as many tons have been applied as there have been tons of air-dry produce harvested from the respective plots.

Lime (**L**) was applied on Plots 4 to 10 at the rate per acre of 250 pounds of air-slaked lime in 1902, and 600 pounds of limestone in 1903. No further

application was made until 1911, when the system of cropping was changed. Since that time applications of limestone have been made at the yearly rate of one-half ton per acre.

Phosphorus (**P**) was applied on Plots 6 to 9 at the yearly rate of 25 pounds per acre in 200 pounds of steamed bone meal; but beginning with 1908 rock phosphate at the rate of 600 pounds per acre per year was substituted for the bone meal on one-half of each of these plots. These applications continued until 1918, when adjustments were begun, first to make the rate of application of rock phosphate four times that of the bone meal, and finally to reduce the amounts of these materials to 200 pounds of rock phosphate and 50 pounds of bone meal per acre yearly. In 1925 the phosphates were evened up to a total amount applied of 3,300 pounds of bone meal and 13,200 pounds of rock phosphate per acre, after which the applications are to be discontinued. The usual practice has been to apply and plow under at one time all phosphorus and potassium required for the rotation.

Potassium (**K**) has been applied on Plots 8 and 9 in connection with the bone meal and rock phosphate, at the yearly rate of 42 pounds per acre, and mainly as potassium sulfate.

On Plot 10 about five times as much manure and phosphorus are applied as on the other plots, but this "extra heavy" treatment was not begun until 1906, only the usual amounts of lime, phosphorus, and potassium having been applied in previous years. In addition, legumes were seeded in the same manner as on Plots 2, 4, 6, and 8. The purpose of this extra heavy treatment is to try to determine the climatic possibilities in crop yields by removing the limitations of inadequate amounts of the elements of plant food.

It will be observed that the applications described above provide for the two rather distinct systems of farming already described. The *grain system,* in which animal manure is not produced and where the organic matter is provided by the direct return to the soil of crop residues along with legumes, is exemplified in Plots 2, 4, 6, and 8; and the *livestock system,* in which farm manure is utilized for soil enrichment, is represented in the corresponding Plots 3, 5, 7, and 9.

Table 9 shows a summary of the results obtained on the Davenport plots beginning with the year 1911, when the present cropping system was introduced.

When used in conjunction with phosphorus, the crop residues and the manure appear about equally effective; but where phosphorus is not applied, manure has been decidedly more effective than residues, under the conditions of the experiment. It should be observed, however, in this connection, that the plowing under of clover is a very essential feature of the residues system, and that, as a matter of fact during the fourteen years there were five clover failures, when soybeans were substituted. Perhaps with a more reliable biennial legume than red clover, the results would have been more favorable for this system.

By comparing Plots 2 and 3 with Plots 4 and 5, it is found that limestone has had a beneficial effect on all crops. What the financial profit amounts to depends obviously upon the market value of the crops and the cost of the limestone.

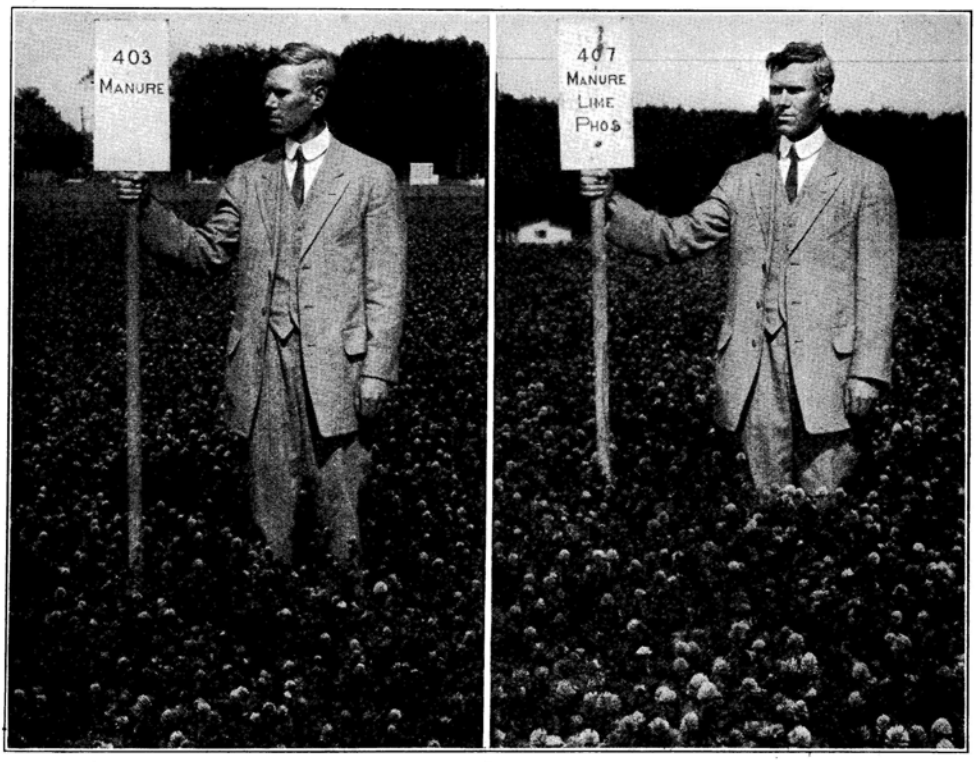
TABLE 9.—URBANA FIELD, DAVENPORT PLOTS

Average Annual Yields 1911-1924—Bushels or (tons) per acre

Plot	Soil treatment applied	Corn *14 crops*	Oats *15 crops*[1]	Wheat *14 crops*	Clover *9 crops*		Soybeans *5 crops*	Alfalfa *12 crops*
1	0	53.1	53.2	26.6	(1.96)	.....	(1.47)	(2.64)
2	R	53.8	54.5	29.3	(.40)	1.23	19.8	(2.76)
3	M	64.3	62.6	29.9	(2.25)	.....	(1.62)	(2.71)
4	RL	62.9	57.8	32.4	(.58)	1.40	20.3	(2.99)
5	ML	69.0	64.8	34.8	(2.78)	.....	(1.67)	(3.24)
6	RLP	69.8	71.3	42.2	(.72)	1.53	23.5	(4.10)
7	MLP	71.2	70.7	41.1	(3.39)	.....	(1.97)	(4.19)
8	RLPK	70.9	73.1	40.0	(.73)	1.20	25.5	(4.30)
9	MLPK	69.0	72.3	40.0	(3.39)	.....	(2.20)	(4.22)
10	Mx5LPx5	65.1	72.0	40.1	(3.11)	.....	(2.22)	(4.26)

[1]Including a nurse crop of oats, grown with alfalfa seeding in 1924.

Comparing Plots 4 and 5 with Plots 6 and 7, respectively, there is found in all cases an increase in crop yield as a result of adding phosphorus. The effect on wheat is especially pronounced. Where limestone and phosphorus



Manure
Yield: 1.43 tons per acre

Manure, limestone, phosphorus
Yield: 2.90 tons per acre

FIG. 3.—CLOVER ON THE DAVENPORT PLOTS

are applied in addition to the crop residues, an increase of 16.7 bushels of wheat, over the yield of the untreated land, has been obtained as a fourteen-year average.

The effect of adding potassium to the treatment is of much interest. Plots 8 and 9 are similar to Plots 6 and 7, respectively, except that potassium has been applied to the former. The small gains appearing in certain cases are counterbalanced by losses in others, and on the whole, potassium treatment has not been profitable on these plots.

No benefit appears as the result of the extra-heavy applications of manure and phosphorus on Plot 10. In fact the corn yields are noticeably less here than on the plots receiving the normal applications of these materials.

The University South Farm

On the University South Farm, at Urbana, several series of plots devoted primarily to variety testing and other crop-production experiments are so laid out as to show the effects of certain soil treatments that have been applied. Several different systems of crop rotation are employed and the crops are so handled as to exemplify the two general systems of farming, grain and livestock.

The summarized results presented in Table 10 represent three different systems of cropping. The first, designated as the Southwest rotation, is to be regarded as a good rotation for general practice, on this type of soil, under Illinois

Residues plowed under
Yield: 35.2 bushels per acre

Residues and rock phosphate
Yield: 50.1 bushels per acre

FIG. 4.—WHEAT ON THE UNIVERSITY SOUTH FARM

TABLE 10.—URBANA FIELD, SOUTH FARM

Average Annual Yields 1908–1919—Bushels or (tons) per acre

Southwest Rotation: Series 100, 200, 400[1]: Wheat, Corn, Oats, Clover[2]					
Soil treatment applied[6]	Corn[3] *9 crops*	Oats[3] *9 crops*	Wheat[3] *8 crops*	Clover[4] *3 crops*	Soybeans *7 crops*
RP	62.3	51.9	41.0	1.05	17.3[5]
R	51.9	46.5	26.9	1.38	16.2[5]
M	59.7	50.2	29.1	(2.28)	(1.25)
MP	64.3	55.4	43.1	(2.86)	(1.51)
RLP	60.5	57.2	41.8	.64	16.4[5]
R	49.7	49.6	25.8	.83	14.7[5]
M	55.5	54.1	27.8	(2.31)	(1.28)
MLP	64.1	59.6	43.9	(2.82)	(1.58)
North-Central Rotation: Series 500, 600, 700[1]: Corn, Corn, Oats, Clover[2]					
Soil treatment applied[6]	Corn 1st year *9 crops*	Corn 2d year *9 crops*	Oats *9 crops*	Clover *5 crops*	Soybeans *4 crops*
RP	56.7	51.1	56.1	.54	16.9
R	51.7	45.2	52.0	.50	16.0
M	54.9	46.7	52.1	(2.29)	(1.60)
MP	56.5	53.4	56.9	(2.73)	(1.74)
South-Central Rotation: Series 500, 600, 700[1]: Corn, Corn, Corn, Soybeans					
Soil treatment applied[6]	Corn 1st year *9 crops*	Corn 2d year *9 crops*	Corn 3d year *9 crops*		Soybeans *9 crops*
RP	51.9	44.0	41.3		20.0
R	45.5	39.9	35.2		19.2
M	50.1	42.1	33.5		(1.59)
MP	54.5	46.7	42.0		(1.66)

[1] Results from Series 300 and 800 are omitted on account of variation in soil type.
[2] Soybeans when clover fails.
[3] Only seven crops with limestone.
[4] Only one crop with limestone.
[5] Average of five crops.
[6] All phosphorus plots received ½ ton per acre of limestone in 1903.

conditions. This is a four-field rotation of wheat, corn, oats, and clover. The second, or North-Central rotation, consisting of corn, corn, oats, and clover, represents a system very commonly practiced; and the third or South-Central rotation, consisting of corn, corn, corn, and soybeans, must be considered as a poor rotation from the standpoint of maintaining the productiveness of the land.

On the whole, the residues have not returned as high yields as those produced by the manure treatment; but, as remarked above in the discussion of the Davenport plots, the residues system has probably been at a disadvantage thru frequent clover failures. On the North-Central rotation, where conditions seem to have been more favorable for clover, there is relatively little difference between the effect of manure and of residues.

Limestone, which has been used in the southwest rotation, appears to have produced no increase of consequence to any of the crops except oats. The comparison may be somewhat impaired, however, by a possible residual effect of the small application of limestone made in 1903 to all the phosphorus plots.

The results obtained from the use of phosphorus are of especial interest because this element has been applied on this field solely in the form of raw rock

TABLE 11.—COMPARING PRODUCTION OF CORN IN THREE DIFFERENT ROTATION SYSTEMS ACRE YIELDS FROM PLOTS ON THE UNIVERSITY SOUTH FARM

Twelve-Year Average (1908–1919)—Bushels per acre

Rotation	Wheat-corn-oats-legume[1]	Corn-corn-oats-legume[2]		Corn-corn-corn-legume[3]		
Treatment	Corn	1st Corn	2d Corn	1st Corn	2d Corn	3d Corn
Organic manures	55.8	53.3	46.0	47.8	41.0	34.3
Organic manures, phosphorus	63.2	56.6	52.3	53.2	45.3	41.6

[1] Clover 3 crops, and soybeans 7 crops.
[2] Clover 5 crops, and soybeans 5 crops.
[3] Soybeans 9 crops.

phosphate. The figures in almost every case show an increase in yield where the phosphate has been applied, and in most cases this increase is very pronounced. The wheat is especially responsive to phosphorus.

The records from this field furnish some interesting comparisons of corn yields produced under different systems of cropping. Table 11 gives a general summary of the corn yields only, in which the results from the residues and manure treatments are averaged together as "organic manures." The highest annual acre-yields are found where corn occurs but once in a rotation. Where corn is grown twice in succession, the annual acre-yields are less; and where corn occurs three times, there is a further reduction. Also, the first crop of corn within a rotation produces more than the second, and the second crop yields more than the third. These are useful facts for consideration in connection with problems of general farm management.

The Aledo Field

An experiment field on Brown Silt Loam is located in Mercer county just west of Aledo. This field has been in operation since 1910. From its physical aspects this field should be well adapted to experimental work, the land being unusually uniform in topography and in soil profile.

There are two general systems of plots and they are designated as the major and the minor systems. The major system comprizes four series (numbered 100, 200, 300, 400) made up of 10 plots each. The plots were handled substantially as described for standard treatment until 1922, when a number of changes were introduced. The rotation practiced was wheat, corn, oats, and clover, until 1923, when the cropping program also was modified.

Table 12 presents a summary of the results showing the average annual yields obtained for the period beginning when complete soil treatment came into sway and ending with the year 1922, after which the crop rotation was changed.

Soybeans have been substituted several times for red clover when the latter failed. For the present purpose only the grain crops are considered in the summary. The lower section of Table 12 gives comparisons in terms of crop increases intended to indicate the effect of the different fertilizing materials applied.

In looking over these results we may observe first the beneficial effect of animal manure on all crops, but especially marked on the corn. This suggests

TABLE 12.—ALEDO FIELD: GENERAL SUMMARY OF THE GRAIN CROPS

Average Annual Yields 1912-1922—Bushels per acre

Serial Plot No.	Soil treatment applied	Wheat *8 crops*	Corn *11 crops*	Oats *10 crops*
1	0	29.9	57.3	59.0
2	M	34.0	68.7	63.8
3	ML	33.4	70.8	65.0
4	MLP	35.5	72.2	64.7
5	0	31.2	59.4	61.2
6	R	31.5	63.2	60.4
7	RL	32.4	69.5	64.5
8	RLP	36.9	70.4	65.2
9	RLPK	35.0	70.8	67.2
10	0	31.1	58.7	56.0
	M over 0	3.3	10.2	5.1
	R over 0	.8	4.7	1.7
	ML over M	−.6	2.1	1.2
	RL over R	.9	6.3	4.1
	MLP over ML	2.1	1.4	−.3
	RLP over RL	4.5	.9	.7
	RLPK over RLP	−1.9	.4	2.0

the advisability of carefully conserving and regularly applying all stable manure. Residues, alone, have as yet shown little effect.

Where limestone has been applied, there is usually a small increase in average yields, the increase becoming particularly marked in the corn crop in the residues system.

Aside from the case of the wheat, the results show little or no effect from adding rock phosphate to the treatment, and at prevailing prices the cost of applying the phosphate would not be covered. However, the economic story has not all been told, for the application of lime and phosphate on these plots is to be discontinued in order to observe the residual effects. The results of the next few years, therefore, will be awaited with great interest.

For the effect of potassium treatment, we may compare Plots 8 and 9. No significant response appears as the result of applying potassium, so far as these common field crops show.

A number of problems have arisen out of the experience on this and other experiment fields which call for some revision of the investigations described above, and accordingly certain changes are to be made in the future conduct of these plots which are intended especially to throw more light upon the problems of liming and applying phosphorus. (See Soil Report No. 29, Mercer County Soils).

Experiments on the Minor Series

The so-called minor system of plots (Series 500, 600, 700, 800) on the Aledo field is given over to a comparison of the effectiveness of different carriers of phosphorus.

In this experiment each series contains four plots. Plot 1 receives residues treatment only; Plot 2 receives residues and phosphorus in one of the forms

under test; Plot 3 receives residues, limestone, and phosphorus; and Plot 4 is similar to Plot 3 with phosphorus omitted. On one series, steamed bone meal (bP) is used as the carrier of phosphorus and is applied at the rate of 200 pounds per acre per year. On another series, acid phosphate (aP) is applied at the yearly rate of 333⅓ pounds per acre. On a third series, rock phosphate (rP) serves as the source of phosphorus, applied at the rate of 666⅔ pounds per acre yearly, and on the last series, basic slag phosphate (sP) is applied at the rate of 250 pounds per acre yearly.

The yields for all crops harvested on these plots during the first nine years are recorded in Table 13. Table 14, which is derived from Table 13, shows differences in crop yields presumed to have resulted from applying the various forms of phosphatic fertilizers for the nine crops harvested since the beginning of the applications up to 1924. In computing these comparisons all residues plots are combined into a single average for the respective crops, as are all lime-residues plots, and these figures stand as checks against the corresponding phosphated plots.

Aside from the soybeans, the figures show without exception more or less crop increase on the phosphorus plots, no matter what the form of carrier employed. The difficulty, however, of arriving at a general conclusion regarding the comparative economy in the use of these different phosphorus materials is obvious, for all depends upon their relative cost, which fluctuates from time to time. Furthermore, the prices received from farm produce likewise fluctuate; and to complicate matters still further, these fluctuations do not necessarily run parallel with those of the fertilizer cost. However, one may readily compute for himself the relative economy of producing these crop increases by applying any set of prices for crops and fertilizers which appear to be most applicable according to prevailing market conditions.

TABLE 13.—ALEDO FIELD: PHOSPHATE EXPERIMENT
Annual Crop Yields—Bushels or (tons) per acre

Plot No.	Soil treatment applied[1]	1916[2] Corn	1917[2] Oats	1918[2] Soy-beans	1919 Wheat	1920 Corn	1921 Oats	1922 Clover hay	1923 Corn	1924 Corn
501	R	53.4	85.5	18.9	32.4	72.8	48.9	(2.88)	83.5	58.2
502	RbP	61.7	91.7	19.0	34.7	86.4	61.9	(3.25)	82.7	66.0
503	RLbP	61.5	90.6	23.2	35.6	87.3	53.3	(3.48)	82.5	66.8
504	RL	55.1	80.5	22.6	32.9	77.7	47.7	(2.61)	88.2	60.3
601	R	55.2	84.7	19.5	33.0	71.2	53.6	(3.17)	84.7	57.3
602	RaP	57.8	87.7	18.7	38.3	87.1	60.9	(3.23)	82.5	65.9
603	RLaP	64.7	83.4	23.1	38.2	88.1	52.3	(3.53)	77.6	64.7
604	RL	51.9	81.7	24.6	32.8	84.9	50.2	(3.06)	84.1	51.9
701	R	54.3	83.1	20.8	34.2	75.6	52.8	(3.41)	82.8	61.2
702	RrP	58.8	83.3	23.3	36.7	80.4	63.0	(3.60)	87.8	69.3
703	RLrP	57.2	81.2	28.1	36.7	80.2	53.3	(3.82)	86.6	70.8
704	RL	52.1	81.7	26.9	34.1	82.0	48.9	(3.15)	84.6	62.5
801	R	57.6	73.8	18.0	33.7	68.1	54.8	(2.62)	74.3	58.8
802	RsP	56.4	87.8	20.6	38.1	81.0	66.2	(3.66)	80.0	69.1
803	RLsP	53.3	78.9	23.7	38.4	83.6	57.0	(3.63)	82.0	70.2
804	RL	51.8	77.5	21.8	33.3	70.4	59.8	(2.99)	82.6	59.9

[1]Bone meal (bP) at the rate of 200 pounds per acre per year.
Acid phosphate (aP) at the rate of 333⅓ pounds per acre per year.
Rock Phosphate (rP) at the rate of 666⅔ pounds per acre per year.
Slag phosphate (sP) at the rate of 250 pounds per acre per year.
All minerals applied once in the rotation ahead of the wheat crop.
[2]No residues.

TABLE 14.—ALEDO FIELD: CROP INCREASES FOR VARIOUS FORMS OF PHOSPHATE BASED UPON RESULTS IN TABLE 13
1916-1924

Comparison of treatments	Wheat *1 crop*	Corn *4 crops*	Oats *2 crops*	Clover *1 crop*	Soybeans *1 crop*
Bone meal and residues over residues	1.4	7.4	9.7	(.23)	−.3
Bone meal, lime, and residues over lime and residues	2.3	5.8	5.9	(.53)	−.8
Acid phosphate and residues over residues	5.0	6.5	7.2	(.21)	−.6
Acid phosphate, lime and residues over lime and residues	4.9	5.0	1.8	(.58)	−.9
Rock phosphate and residues over residues	3.4	7.3	6.0	(.58)	4.0
Rock phosphate, lime and residues over lime and residues	3.4	4.9	1.2	(.87)	4.1
Slag phosphate and residues over residues	4.8	4.8	9.9	(.64)	1.3
Slag phosphate, lime, and residues over lime and residues	5.1	3.5	1.4	(.68)	−.3

For the purpose of furnishing an illustration of such a computation, the following set of arbitrary prices may be assumed as representing approximately average market conditions for the past ten years: wheat, $1.25 per bushel; corn, 75 cents; oats, 45 cents; soybeans, $1.50; and clover, $15 per ton. For the cost of the various phosphatic materials the following estimates are used: bone meal, $40 per ton; acid phosphate, $24; rock phosphate, $12; and slag phosphate, $20. These values seem to be conservative enough. The figures for crop values are all under the average December 1 farm price quotations for the ten-year period 1914-1923. Furthermore, it may be pointed out that the quantities of phosphatic materials employed in these experiments are, with the possible exception of the slag phosphate, greater than ordinarily would be used, or need to be used, in good farm practice.

Figured on the basis of these prices, it appears that both bone meal and acid phosphate, as used on these plots, have been applied at a financial loss, whether accompanied by limestone or not, while rock phosphate and slag phosphate have each yielded a profit. Counting in all crops, the net loss for bone meal was 4 cents per acre per year when applied without limestone, and 41 cents applied with limestone. The use of acid phosphate without limestone resulted in a loss of 17 cents, while with limestone the loss was 66 cents. Rock phosphate produced a profit of $1.14 when used without limestone, but with limestone the profit was reduced to 36 cents. Slag phosphate furnished the most profitable return of any of the phosphorus carriers, producing an average profit of $2.04 an acre yearly when used without limestone and 60 cents used with limestone.

In considering these figures let it be emphasized again that the order of these values might easily be shifted by a relatively small change in commodity prices.

Considering the results from the standpoint of limestone as applied on the plots of the minor series, the following observations are to be made.

Limestone at the rate of 4 tons per acre was applied to Plots 3 and 4 in 1912, when the land was still under alfalfa, and another dressing was added in 1917,

TABLE 15.—ALEDO FIELD: CROP INCREASES FOR LIMESTONE BASED UPON RESULTS IN TABLE 13
1916-1924

Comparison of treatments	Wheat *1 crop*	Corn *4 crops*	Oats *2 crops*	Clover *1 crop*	Soybeans *1 crop*
Residues, limestone over residues	.0	2.0	−1.2	(−.07)	4.7
Residues, limestone, bone meal over residues, bone meal	.9	.3	−4.8	(.23)	4.2
Residues, limestone, acid phosphate over residues, acid phosphate	−.1	.5	−6.4	(.30)	4.4
Residues, limestone, rock phosphate over residues, rock phosphate	.0	−.4	−5.9	(.22)	4.8
Residues, limestone, slag phosphate over residues, slag phosphate	.3	.7	−9.0	(.33)	3.1

after the present experiments were under way. The effect of this limestone, in terms of crop increase, is set forth in Table 15.

Comparing, first, the results from the check plots, which receive no phosphorus, it appears that the limestone used with residues alone has been of benefit to the corn and the soybean crops only.

Considering all treatments as a whole, the soybeans exhibit a consistent gain in yield from the use of limestone, while oats, on the other hand, respond by a consistent loss. Wheat and corn on the whole show a rather indifferent response. If we consider the money value of these crop increases on the same basis as above, we find a gross return for limestone, applied without phosphate, of $1.30 per acre per year. Limestone with bone meal has returned, in gross, 83 cents per acre per year; with acid phosphate, 73 cents; with rock phosphate, 44 cents; and with slag phosphate, 65 cents. It is doubtful, therefore, whether limestone, used with phosphates in the manner described has, up to the present time, paid its cost on these plots. The Aledo field represents one of these borderline cases, so to speak, in which the upper soil is neutral or only slightly acid and the lime requirement, therefore, not yet very marked. As time goes on, however, and cropping continues, the need of lime will develop. It is planned to discontinue liming on these plots until its need becomes manifest, and in so doing the annual cost of the limestone already applied will become automatically reduced, so that net returns which hitherto have represented a loss may sooner or later result in a positive profit.

The Galesburg Field

Another field which should be of interest in this Report, because of its proximity to Rock Island county, is the Galesburg field. This field lay six miles west of Galesburg. It was established in 1904 and was continued until 1918. It was laid out into three series of twenty plots each with treatments as indicated in Table 16. The original rotation was corn, corn, oats, wheat, clover, and timothy, but this was changed in 1909 to corn, corn, oats, clover, wheat, and clover.

All phosphorus was applied in the form of rock phosphate at the rate of 500 pounds per acre per year. At the beginning, a dressing of 1,300 pounds of

TABLE 16.—GALESBURG FIELD: GENERAL SUMMARY OF CROP YIELDS
Average Annual Yields 1908-1918—Bushels or (tons) per acre

Serial plot No.	Soil treatment applied	Corn following clover *6 crops*	Corn following corn *5 crops*	Corn average *11 crops*	Oats *5 crops*	Wheat *4 crops*	Barley *1 crop*	Clover *4 crops*	Soybeans *4 crops*
1	L.....	54.8	45.9	50.8	44.4	21.7	22.5	(2.12)	(1.16)
2	RL.....	65.6	53.1	59.9	47.5	26.6	27.1	.....	13.8
3	ML.....	73.8	61.1	68.0	47.8	28.9	25.5	(2.67)	(1.56)
4	CvML.....	75.1	60.8	68.6	47.4	28.4	25.6	(2.45)	(1.53)
5	L.....	61.6	51.0	56.7	46.8	25.2	21.7	(2.37)	(1.27)
6	LP.....	70.6	58.1	64.9	51.1	33.8	24.2	(2.86)	14.1
7	RLP.....	74.9	58.0	67.2	51.8	36.4	29.8	.....	15.6
8	MLP.....	76.1	65.1	71.1	51.0	32.7	26.8	(2.90)	(1.65)
9	CvMLP ...	74.7	66.1	70.8	50.8	33.3	33.0	(2.91)	(1.62)
10	L.....	59.7	47.3	54.1	45.9	22.2	23.0	(1.94)[1]	12.7
11	LPK.....	68.8	60.9	65.2	49.4	32.7	22.7	(3.03)	15.5
12	RLPK.....	75.1	61.7	69.0	48.2	34.8	38.4	.....	15.9
13	MLPK....	73.8	63.8	69.3	49.8	32.3	29.7	(3.11)	(1.75)
14	CvMLPK..	74.8	67.0	71.3	48.0	33.3	35.1	(3.27)	(1.67)
15	L.....	60.7	46.1	54.0	43.4	19.6	25.5	(2.08)	(1.31)
16	R.....	62.8	49.7	56.8	43.7	24.7	33.3	.....	12.5
17	RP.....	71.1	54.2	63.4	51.9	36.0	31.5	.....	14.2
18	RPK.....	74.3	56.4	66.2	51.9	39.2	32.6	.....	14.3
19	RLNPK...	79.1	60.4	70.6	52.4	36.5	39.1	.....	17.4
20	0.....	59.3	47.6	54.0	43.3	25.8	24.9	(1.82)	(1.14)

[1]Only 2 crops from this plot.

limestone per acre was applied and no more was added until 1913, when an application of 4 tons per acre was made. The potassium was applied in 100 pounds of potassium sulfate per acre. On Plot 19 nitrogen was applied in 200 pounds of dried blood per acre yearly. Some legume cover crops were grown in the corn.

A general summary of the annual crop yields is assembled in Table 16. Following are some of the salient points brought out by a study of the various possible comparisons.

1. Residues without limestone produced very little effect on crop yields, but used with limestone there was a noticeable increase in the residues plots over the non-residues plots.

2. Manure used in the liberal manner of these experiments, along with limestone, produced very beneficial effects. Measured by crop increases, the effect of manure and limestone was about twice that of residues and limestone. It should be borne in mind, however, in this connection that in this system the land received regularly manure at the rate of 3 tons per acre per year, a practice that would be difficult to carry out on many farms.

3. The use of limestone alone, all crops considered, resulted in a financial loss. In combination with residues, however, limestone produced a beneficial effect.

4. Rock phosphate in the residues system produced very pronounced and profitable increases in crop yields, used either with or without limestone. Also, without residues the increases in crop yields were large.

Used with animal manure, however, the increases resulting from phosphate were not nearly so large; in fact, the increases attributable to phosphorus in the manure system are scarcely sufficient to cover the cost of the rock phosphate employed. This is a commonly observed result, explained probably by the fact that the manure itself carries a considerable quantity of phosphorus which supplies directly much of the crops' need for this element of plant food.

5. Potassium in the form of potassium sulfate appears in five different fertilizer combinations on these plots, but the various possible comparisons show no significant effect from potassium. In a large proportion of the cases the figures indicating increase carry the minus sign, and altogether the small differences exhibited are doubtless well within experimental error.

6. Nitrogen, as applied in the form of dried blood and in combination with residues, limestone, phosphorus, and potassium, likewise proved ineffective, resulting in a considerable economic loss thru cost of material.

7. Cover crops, in the three different combinations tried, produced no significant effect so far as crop yields indicate.

The Kewanee Field

Another field in the vicinity of Rock Island county is the Kewanee field, located in Henry county about three miles southwest of Kewanee. This field has been under way since 1915. The crops grown are wheat, corn, oats, and clover. The arrangement of plots and the treatments applied are indicated in Table 17. This table includes the yields of the grain crops, omitting for the present purpose the clover yields.

Summarizing the data in the fashion of Table 17 the following observations may be made.

TABLE 17.—KEWANEE FIELD: GENERAL SUMMARY OF THE GRAIN CROPS
Average Annual Yields 1917-1924—Bushels per acre

Serial Plot No.	Soil treatment applied	Wheat *6 crops*	Corn *8 crops*	Oats *8 crops*
1	0	31.0	54.1	58.8
2	M	32.7	63.5	68.1
3	ML	35.6	67.6	71.3
4	MLP	38.8	67.6	70.1
5	0	32.2	55.1	60.9
6	R	32.9	56.9	58.7
7	RL	33.1	65.7	63.0
8	RLP	38.1	68.8	65.9
9	RLPK	38.2	71.7	67.5
10	0	30.6	50.6	55.3
	M over 0	1.4	10.2	9.8
	R " 0	1.6	3.6	.4
	ML " M	2.9	4.1	3.2
	RL " R	.2	8.8	4.3
	MLP " ML	3.2	0.0	−1.2
	RLP " RL	5.1	3.1	2.9
	RLPK " RLP	.1	2.9	1.6

1. The response to treatment with stable manure stands out clearly in the increase in production.

2. Residues without limestone have not produced a very decided effect on crop yields.

3. The effect of limestone appears to have been beneficial used either with manure or with residues.

4. Phosphorus, as usual, has been more effective applied with residues than with manure. In the residues system the rock phosphate has been applied with profit, while in the manure system the increases in crop yield are not sufficient to cover the cost.

5. Potassium has produced no effect upon the yields of these crops that can be considered significant.

EXPERIMENTS ON BLACK CLAY LOAM

The Hartsburg Field

The results of experiments on the Hartsburg field are introduced as representing the soil type Black Clay Loam. This field is located in Logan county just east of Hartsburg. The work began in 1913. The field was laid off into five series of 10 plots each. The crop rotation up to 1923 was wheat, corn, oats, and clover, with alfalfa growing on a fifth series. The soil treatments are as indicated in Table 18. The table summarizes, by crops, the yields of grain for the period during which the plots have been under full treatment.

The outstanding feature of these results is the large increase in yields produced by residues, which even exceeds the increase brought about by the use of stable manure.

TABLE 18.—HARTSBURG FIELD: GENERAL SUMMARY OF THE GRAIN CROPS

Average Annual Yields 1913-1924—Bushels per acre

Serial Plot No.	Soil treatment applied	Wheat *9 crops*	Corn *12 crops*	Oats *11 crops*
1	0	23.9	44.0	46.6
2	M	29.3	52.6	51.8
3	ML	36.1	59.5	57.8
4	MLP	39.0	58.5	57.7
5	0	31.8	48.3	44.7
6	R	34.3	59.3	54.6
7	RL	32.8	64.0	52.5
8	RLP	36.5	61.9	56.8
9	RLPK	35.4	61.7	56.2
10	0	32.3	49.0	47.9
	M over 0	0.0	5.5	4.4
	R " 0	5.0	12.2	7.2
	ML " M	6.8	6.9	6.0
	RL " R	−1.5	−2.1	4.7
	MLP " ML	2.9	−1.0	− .1
	RLP " RL	3.7	−2.1	4.3
	RLPK " RLP	− .9	− .2	− .6

The behavior of limestone on this field is rather peculiar in that it has been more beneficial where applied with manure than where used with residues. Used with manure, limestone gave a substantial increase in all grain crops, while with residues, the effect on both wheat and corn appears negative.

Altho rock phosphate has given some increases in wheat yield in both manure and residues systems, the results with other crops have been such as to render the use of this material unprofitable on this field.

The addition of potassium appears to have produced a slightly depressing effect upon the yields of all grain crops.

It may be mentioned that new experiments have been recently started on these plots which are designed to answer some of the questions brought out by the foregoing results. For example, the effect of applying phosphorus in other carriers and in different combinations, as well as testing the residual effect of phosphate already applied, will be tried.

EXPERIMENTS ON YELLOW SILT LOAM

Inasmuch as about one-fifth of the area of Rock Island county is made up of Yellow Silt Loam, much of which is subject to erosion, it is believed that an account of some experiments on the Vienna field will be of interest here.

The Vienna Field

In 1906 the University acquired a sixteen-acre tract of badly eroded land characteristic of the region, near Vienna in Johnson county. The whole area with the exception of about three acres had been abandoned because so much of the surface soil had washed away and there were so many gullies as to render further cultivation of this land unprofitable. Experiments were started at once to reclaim this land, the different methods described below being used for this purpose.

The field was divided into five sections. The sections designated as A, B, and C were divided into four plots each, and D into three plots. On section A, which included the steepest part of the area and contained many gullies, the land was built up into terraces at vertical intervals of five feet. Near the edge of each terrace a small ditch was placed so that the water could be carried to a natural outlet without doing much washing.

On section B the so-called embankment method was used. By this method erosion is prevented by plowing up ridges sufficiently high so that on the occasion of a heavy rainfall if the water breaks over it will run over in a broad sheet rather than in narrow channels. At the steepest part of the slope, hillside ditches were made for carrying away the run-off.

Section C was washed badly but contained only small gullies. Here the attempt was made to prevent washing by incorporating organic matter in the soil and practicing deep contour plowing and contour planting. With two exceptions, about eight loads of manure per acre were turned under each year for the corn crop.

The land on section D was washed to about the same extent as that of section C. As a check on the different methods of reducing erosion, the land on

FIG. 5.—VIEW OF AN UNIMPROVED HILLSIDE JUST OVER THE FENCE FROM THE FIELD SHOWN IN FIG. 6

section D was farmed in the most convenient way, without any special effort being made to prevent washing.

Section E was badly eroded and gullied and no attempt was made to crop it other than to fill in the gullies with brush and to seed the land to grass.

Sections A, B, C, and D were not entirely uniform; some parts were washed more than others and portions of the lower-lying land had been affected by soil material washed down from above. When the field was secured, the higher land had a very low producing capacity. On many spots little or nothing would grow.

Limestone was applied to the entire field at the rate of 2 tons per acre. Corn, cowpeas, wheat, and clover were grown in a four-year rotation on each section except D which had but three plots.

FIG. 6.—CORN GROWING ON IMPROVED HILLSIDE OF THE VIENNA EXPERIMENT FIELD. THIS LAND FORMERLY HAD BEEN BADLY ERODED. COMPARE WITH FIG. 5

TABLE 19.—VIENNA FIELD: HANDLING HILLSIDE LAND TO PREVENT EROSION
Average Annual Yields, 1907-1915—Bushels or (tons) per acre

Section	Method	Corn *7 crops*	Wheat *7 crops*	Clover *3 crops*
A	Terrace	31.4	9.0	(0.68)
B	Embankments and hillside ditches	32.4	12.7	(0.97)
C	Organic matter, deep contour plowing, and contour planting	27.9	11.7	(0.80)
D	Check	14.1	4.6	(0.21)

Table 19 contains a summarized statement of the results obtained.

These results indicate something of the possibilities in improving hillside land by protecting it from erosion. The average yield of corn from the protected series (A, B, and C) was 30.6 bushels per acre, as against 14.1 bushels for series D; wheat yielded 11.1 bushels in comparison with 4.6 bushels; and clover .82 ton in comparison with .21 ton.

A comparison of Figs. 5 and 6 will serve to indicate the possibility of improving this type of soil.

EXPERIMENTS ON DUNE SAND

The Oquawka Field

In 1913 the University established an experiment field on Dune Sand, Terrace, in Henderson county, near the Mississippi river. This field is divided into six series of plots. Corn, soybeans, wheat, sweet clover, and rye, with a catch crop of sweet clover seeded in the rye on the residues plots, are grown in rotation on five series, while the sixth series is devoted to alfalfa. When sweet clover seeded in the wheat fails, cowpeas are substituted.

Table 20 indicates the kinds of treatment applied, the amounts of the materials used being in accord with the standard practice, as explained on page 46.

The data make apparent the remarkably beneficial action of limestone on this sand soil. Where limestone has been used in conjunction with crop residues, the yield of corn has been doubled. The limestone has also produced good crops of rye and fair crops of sweet clover and alfalfa.

This land appears to be quite indifferent to treatment with rock phosphate. The analyses show, however, that the stock of phosphorus in this type of soil is not large, and it may develop as time goes on and the supply diminishes along with the production of good-sized crops, that the application of this element will become profitable. It is also quite possible that a more available form of phosphate could be used to advantage on this very sandy soil.

Altho the results show an increase of 3.5 bushels of corn from the use of potassium salts, with ordinary prices this would not be a profitable treatment. The slight increases appearing in the other crops are scarcely significant.

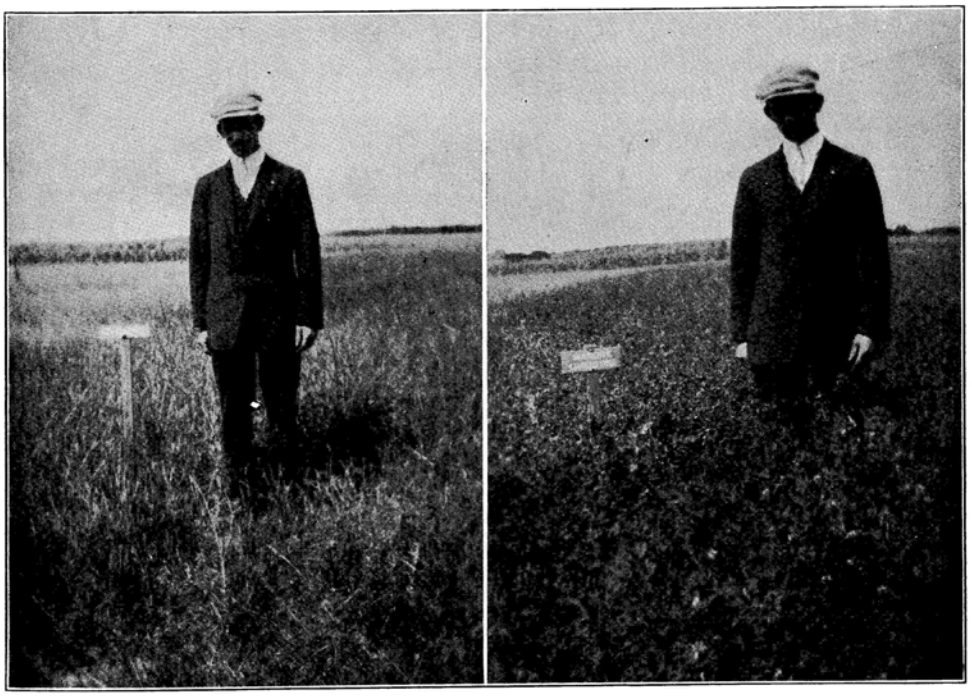
A significant fact which the above summary does not bring out is that improvement under favorable treatment has been progressive as evidenced by a very marked upward trend in production after the first few years. For example,

TABLE 20.—OQUAWKA FIELD: SUMMARY SHOWING AVERAGE ANNUAL YIELDS 1915-1924
Bushels or (tons) per acre

Serial plot No.	Soil treatment applied	Corn *10 crops*	Soybeans *8 crops*		Wheat *10 crops*	Sweet clover[1] *8 crops*		Rye *8 crops*	Alfalfa *7 crops*
			Hay *5 crops*	Seed *4 crops*		Hay *4 crops*	Seed *4 crops*		
1	0.....	17.1	(.89)	8.9	8.4	(.00)	.00	12.2	(.34)
2	M.....	21.6	(1.01)	11.1	11.6	(.00)	.00	13.9	(.55)
3	ML.....	28.1	(1.27)	14.8	15.2	(1.20)	.80	26.4	(2.07)
4	MLP.....	27.0	(1.20)	14.9	15.5	(1.26)	.74	25.1	(2.15)
				Seed *9 crops*		Hay *2 crops*	Seed *6 crops*		
5	0.....	16.8	.....	5.9	10.5	(.00)	.00	12.7	(.06)
6	R.....	19.6	.....	6.4	11.7	(.00)	.00	13.7	(.05)
7	RL.....	33.8	.....	10.3	14.4	(1.47)	1.26	26.5	(1.81)
8	RLP.....	32.7	.....	10.2	14.7	(1.39)	1.21	26.4	(1.77)
9	RLPK.....	36.0	.....	9.6	13.5	(1.53)	1.43	28.5	(1.89)
10	0.....	15.8	(.60)	6.6[2]	9.0	(.00)	.00	10.9	(.05)

[1]In 1918 sweet clover was killed by being cut for hay. Soybeans were seeded on these plots and the following yields obtained: .86, 1.10, 1.93, and 2.00 tons of hay per acre on Plots 1 to 4; 11.1, 9.9, 14.6, 15.8, and 16.6 bushels of seed per acre on Plots 5 to 9; and .62 ton of hay per acre on Plot 10. [2]4 crops.

it may be noted that the yields under the limestone-residues treatment for the entire 10-year period are: corn, 33.8 bushels; soybeans, 10.3 bushels; wheat, 14.4 bushels; and rye, 26.5 bushels per acre, but if we take the average of these



Manure
Yield: Nothing

Manure and limestone
Yield: 4.43 tons per acre

FIG. 7.—ALFALFA ON OQUAWKA FIELD IN 1918

same plots for the last five years the yields are: corn, 42.4 bushels; soybeans, 12.8 bushels; wheat, 19.6 bushels; and rye, 29.7 bushels per acre.

Experience thus far shows rye to be better adapted to this land than wheat, and both alfalfa and sweet clover thrive better than soybeans. With these two legume crops thriving so well under this simple treatment, we have promise of great possibilities for the profitable culture of this land, which hitherto has been considered as practically worthless.

EXPERIMENTS ON DEEP PEAT

The Manito Field

The results secured on the Manito experiment field which was located on Deep Peat and which was in operation during the years 1902 to 1905, inclusive, are presented in Table 21.

There were ten plots receiving the treatments indicated in the table. Where potassium was applied, the yield was from three to four times as large as where nothing was applied. Where approximately equal money values of kainit and potassium chlorid were applied, slightly greater yields were obtained with the potassium chlorid, which, however, supplied about one-third more potassium than the kainit. However, either material furnished more potassium than was required by the crops produced.

The use of 700 pounds of sodium chlorid (common salt) produced no appreciable increase over the best untreated plots, indicating that where potassium is itself actually deficient, salts of other elements cannot take its place.

Applications of 2 tons per acre of ground limestone produced no increase in the corn crops, either when applied alone or in combination with kainit, either the first year or the second.

Reducing the application of kainit from 600 to 300 pounds for each two-year period reduced the total yield of corn from 164.5 to 125.9 bushels. The two applications of 300 pounds of kainit (Plot 9) appear to be insufficient.

TABLE 21.—MANITO FIELD: DEEP PEAT

Annual Corn Yields—Bushels per acre

Plot No.	Soil treatment for 1902	Corn 1902	Corn 1903	Soil treatment for 1904	Corn 1904	Corn 1905
1	None	10.9	8.1	None	17.0	12.0
2	None	10.4	10.4	Limestone, 4000 lbs.	12.0	10.1
3	Kainit, 600 lbs	30.4	32.4	Limestone, 4000 lbs Kainit, 1200 lbs	49.6	47.3
4	Kainit, 600 lbs Acidulated bone, 350 lbs	30.3	33.3	Kainit, 1200 lbs Steamed bone, 395 lbs	53.5	47.6
5	Potassium chlorid, 200 lbs	31.2	33.9	Potassium chlorid, 400 lbs	48.5	52.7
6	Sodium chlorid, 700 lbs	11.1	13.1	None	24.0	22.1
7	Sodium chlorid, 700 lbs	13.3	14.5	Kainit, 1200 lbs	44.5	47.3
8	Kainit, 600 lbs	36.8	37.7	Kainit, 600 lbs	44.0	46.0
9	Kainit, 300 lbs	26.4	25.1	Kainit, 300 lbs	41.5	32.9
10	None	[1]	14.9	None	26.0	13.6

[1] No yield was taken in 1902 because of a misunderstanding.

List of Soil Reports: Published (by counties)

1 Clay, 1911
2 Moultrie, 1911
3 Hardin, 1912
4 Sangamon, 1912
5 LaSalle, 1913
6 Knox, 1913
7 McDonough, 1913
8 Bond, 1913
9 Lake, 1915
10 McLean, 1915
11 Pike, 1915
12 Winnebago, 1916
13 Kankakee, 1916
14 Tazewell, 1916
15 Edgar, 1917
16 DuPage, 1917
17 Kane, 1917
18 Champaign, 1918
19 Peoria, 1921
20 Bureau, 1921
21 McHenry, 1921
22 Iroquois, 1922
23 DeKalb, 1922
24 Adams, 1922
25 Livingston, 1923
26 Grundy, 1924
27 Hancock, 1924
28 Mason, 1924
29 Mercer, 1925
30 Johnson, 1925
31 Rock Island, 1925

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LEGEND

UPLAND SOILS

500 Upper Illinoisan glaciation

800 Deep loess areas

(a) UPLAND PRAIRIE SOILS

- 526 Brown silt loam
- 41 841 Brown fine sandy silt loam
- 71 871 Brown fine sandy loam
- 528 Brown-gray silt loam on tight clay

(b) UPLAND TIMBER SOILS

- 34 534 Yellow-gray silt loam
- 35 535 Yellow silt loam
- 44 844 Yellow-gray fine sandy silt loam
- 45 845 Yellow fine sandy silt loam
- 74 874 Yellow-gray fine sandy loam
- 75 875 Yellow fine sandy loam
- 76 876 Mixed sand and loess areas

(c) RESIDUAL SOILS

- 098 Stony loam
- 099 Rock outcrop
- Small areas of rock outcrop

(d) TERRACE SOILS

- 1526 Brown silt loam
- 26.1 1526.1 Brown silt loam on clay
- 1528 Brown-gray silt loam on tight clay
- 1560 Brown sandy loam
- 1571 Brown fine sandy loam
- 60.4 1560.4 Brown sandy loam on gravel
- 60.5 1560.5 Brown sandy loam on rock
- 68 1568 Brown-gray sandy loam on tight clay
- 64 1564 Yellow-gray sandy loam
- 64.1 1564.1 Yellow-gray sandy loam on clay
- 80 1580 River sand
- 81 1581 Dune sand
- 90 1590 Gravelly loam

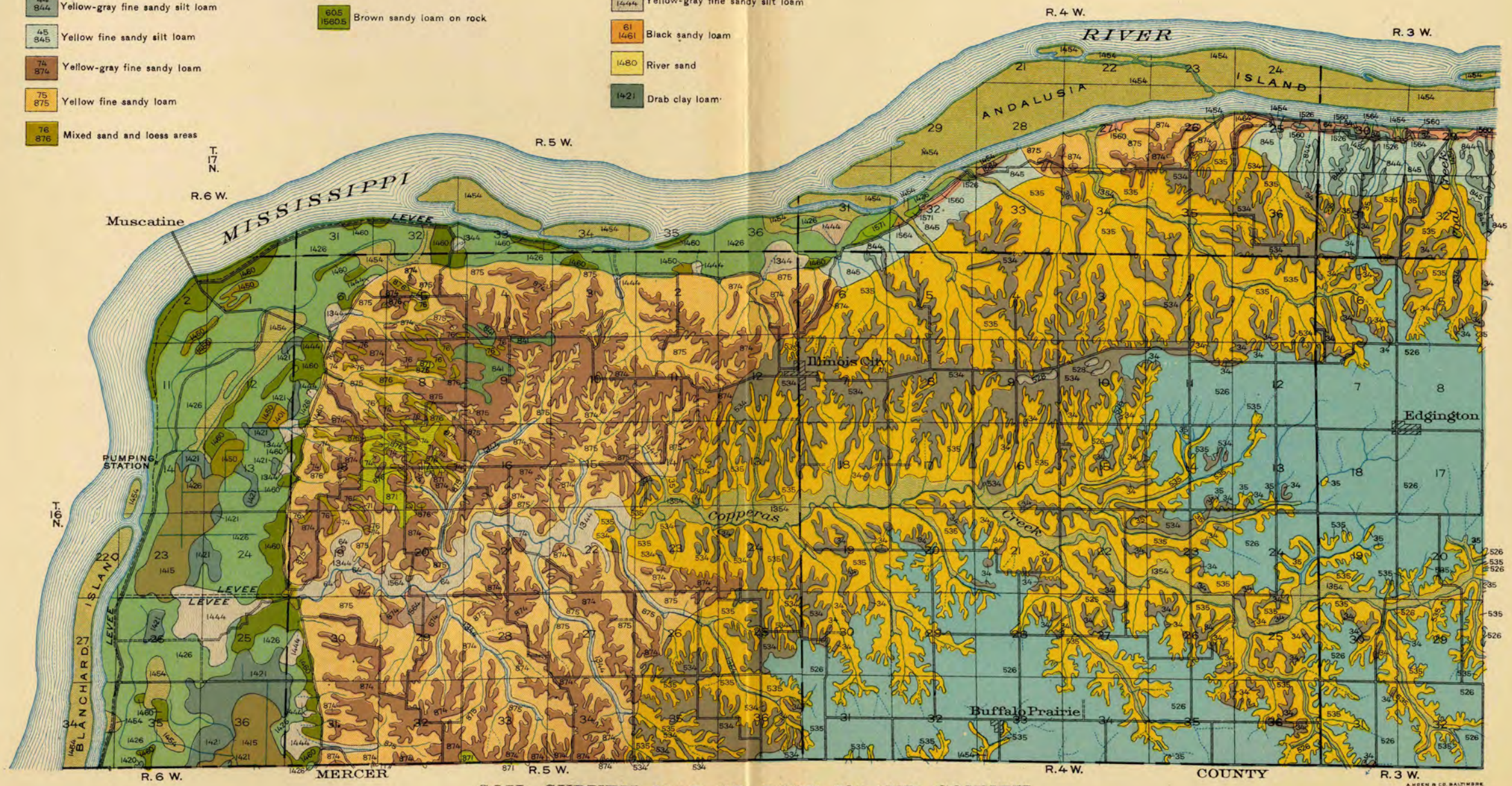
(e) SWAMP AND BOTTOM-LAND SOILS

- 1426 Deep brown silt loam
- 1354 1454 Mixed loam
- 1460 Brown sandy loam
- 1344 1444 Yellow-gray fine sandy silt loam
- 61 1461 Black sandy loam
- 1480 River sand
- 1421 Drab clay loam
- 20 1420 Black clay loam
- 1415 Drab clay
- 50 1450 Black mixed loam
- 50.5 1450.5 Black mixed loam on rock
- 1401 Deep peat
- 13 1413 Clayey muck
- Swamp

1300 Old swamp and Bottom Land Soils.

1400 New swamp and Bottom Land Soils

Scale 0 ¼ ½ 1 2 Miles



SOIL SURVEY MAP OF ROCK ISLAND COUNTY

UNIVERSITY OF ILLINOIS AGRICULTURAL EXPERIMENT STATION

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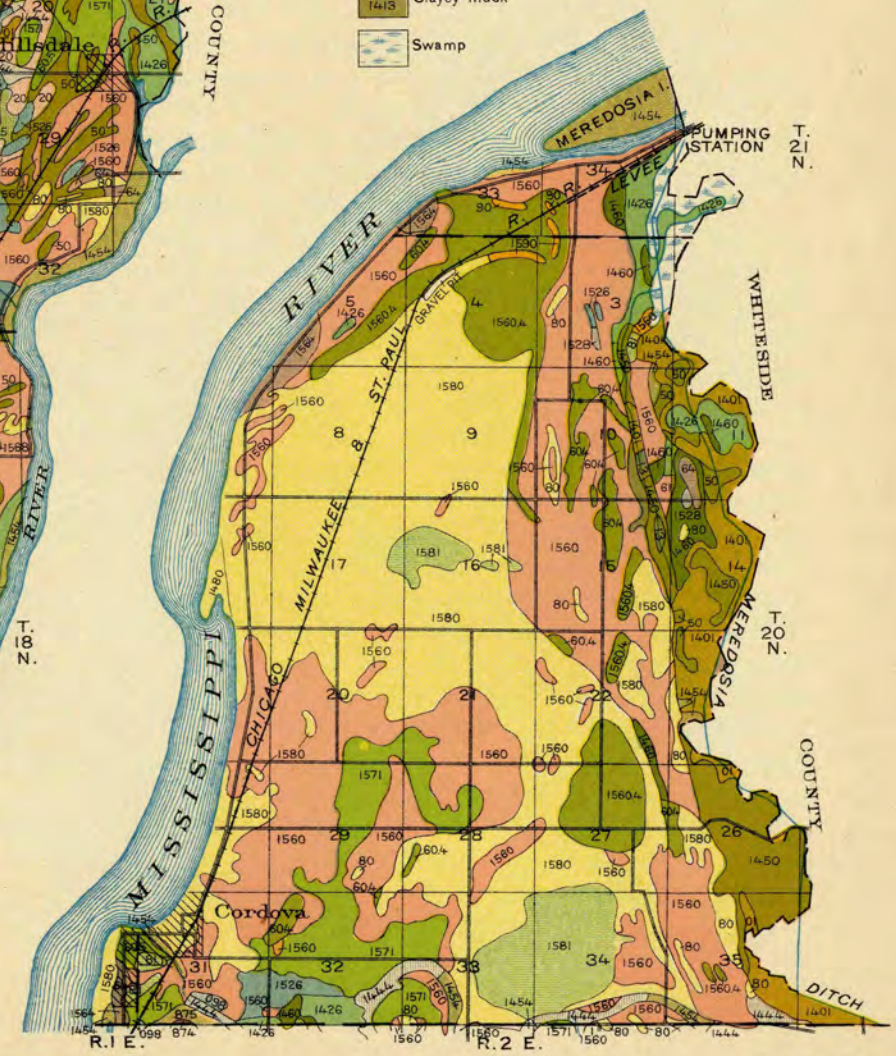

SOIL SURVEY MAP OF ROCK ISLAND COUNTY

UNIVERSITY OF ILLINOIS AGRICULTURAL EXPERIMENT STATION