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Soil Survey
of
Vermillion County, Indiana
Description and Soil Classification

By
W. H. BUCKHANNAN
United States Department of Agriculture, in Charge
and
J. S. JAMES
Purdue University Agricultural Experiment Station

The Management of Vermillion County Soils

By
A. T. WIANCKO and S. D. CONNER
Purdue University Agricultural Experiment Station

Bureau of Chemistry and Soils
In cooperation with the
Purdue University Agricultural Experiment Station

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SOIL SURVEY OF VERMILLION COUNTY, IND.

By W. H. BUCKHANNAN, United States Department of Agriculture, in Charge, and J. S. JAMES, Purdue University Agricultural Experiment Station

DESCRIPTION AND SOIL CLASSIFICATION

COUNTY SURVEYED

Vermillion County lies along the western boundary of Indiana, midway between the northern and southern boundaries (fig. 1). It is a long, narrow county, its east-west dimension ranging from 5 to 9 miles and its north-south dimension averaging about 38 miles. Wabash River forms the eastern boundary. Newport, the county seat, is about 60 miles west of Indianapolis, the State capital. The county includes a total area of 256 square miles, or 163,840 acres.

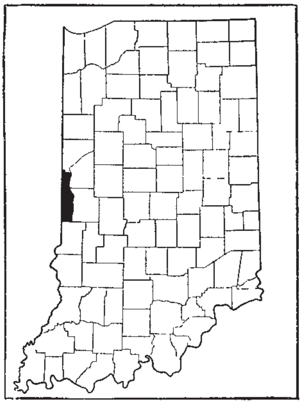

FIGURE 1.—Sketch map showing location of Vermillion County, Ind.

Vermillion County lies within the region of early Wisconsin glacial drift. The surface relief is that of a smooth plain crossed by a few shallow, but rather broad, stream valleys. The upland is a remnant of an original till plain and has the typical irregularities of such a feature, but the basins are dominantly shallow, and the ridges are low. Bordering the valleys of Wabash River and the other large streams, where considerable dissection has occurred, hilly or somewhat rolling areas prevail.

The elevation[1] at Hillsdale, on the river terrace, is 486 feet above sea level and at Dana, on the upland about 6 miles west of Hillsdale, is 642 feet.

In the southern and central parts of the county, where the upland plain breaks to the Wabash Valley, the difference in elevation between the upland and the stream terraces or bottom land is about 100 feet, and here the escarpment is very steep. In the northern part of the county the difference in elevation between the high stream terrace and the upland is less, and the slope between the two divisions is not steep, the extensive Wabash River terrace sloping gently to the east. The river terrace here is a somewhat flat plain, with slight undulations and a succession of swells and sags irregularly disposed, which extends from the lower edge of the upland to the very crest of the slope bordering the first bottoms of Wabash River. The difference in elevation between the river terrace and the first-bottom land throughout the county is about 30 feet, and steep slopes separate these two physiographic divisions. The recent-alluvial plain along Wabash River ranges considerably in width, from

[1] GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. U.S. Geol. Survey Bull. 274, Ed. 4, 1072 pp. 1906.

a few hundred yards immediately north of Hillsdale to 1½ miles elsewhere. The surface of the plain is very nearly level, and, with the exception of a few isolated gravelly knolls and old abandoned stream channels, is unbroken by any change in relief.

The watershed of the county slopes to the east toward Wabash River. Three large streams flow across the county from west to east—Little Vermillion River in the middle of the county, Vermillion River a few miles to the north, and Brouilletts Creek in the southern part. The upland areas south and north of the two Vermillion Rivers have a dendritic drainage system, as shown in plate 1, but over most of the flat upland, drainage is insufficient to adequately remove all surplus water. The natural drainage is effected by intermittent streams which flow in shallow troughlike valleys, and drainage of the flat areas, especially the isolated depressions, has been aided by ditching. With the exception of the large streams that traverse the terrace from the upland toward Wabash River, very few drainage ways are on the terrace or outwash plain, but the plain is excessively drained owing principally to the porous gravelly subsoil. With the exception of the small isolated areas bordering the terrace and the old abandoned river channels, the first bottoms are effectively drained because of their gentle slope and good internal drainage.

The vegetation of Vermillion County belongs in part to the oak-hickory forest association and in part to the tall-grass prairie association. The original tree growth consisted principally of red oak, shellbark hickory, linden, black walnut, sugar maple, and black ash. Tree growth is now confined almost entirely to wood lots and the rougher parts of the county. Shrubs and vines, such as sumac, blackberry, hazel brush, wild cherry, bittersweet, wild grape, and hackberry, grow on the cut-over land and bottom land. Post oak, papaw, sycamore, and elm grow in poorly drained upland and bottom-land areas. The grass vegetation consists almost entirely of bluegrass, which is an introduced species. The original grass vegetation consisted principally of big bluestem and Indian grass in the better-drained areas, and sedges, rushes, and coarse grasses, such as bluejoint, reed canary grass, and a marsh grass in the poorly drained areas.

The earliest history of white men in Vermillion County dates back to about 1670, when French missionaries visited the Kickapoo and Pottawattomie Indians, but permanent settlement did not begin until 1818. Newport, the county seat, was established in 1824. According to the 1930 census, the population of the county is 23,238, of which 15,302 persons are classed as rural. Of the rural population, 4,547 are classed as rural farm and 10,755 as rural nonfarm. The population is most dense in Clinton Township, in which Clinton, the largest town in the county, with a population of 7,936, is located. The coal-mining industry is responsible for the large rural-nonfarm population, most of which is confined to small settlements and unincorporated towns. Clinton and Cayuga are the most important local markets for surplus farm products.

Transportation facilities are good. The main line of the Chicago & Eastern Illinois Railroad extends along the Wabash Valley from Clinton north to Perrysville and leaves the county in the northwestern part near Danville, Ill. A line of the Chicago, Milwaukee, St. Paul & Pacific Railroad enters the western part at Quaker, fol-

An air view taken west of Perrysville in sec. 8, T. 18 N., R. 10 W., showing the flat plain bordered by an area occupied by shallow troughlike drains forming a part of the dendritic drainage system of the county.

lows within a mile of the State line and parallel to it, and leaves the southern part south of Blanford. Two railroads cross the county from east to west, the Baltimore & Ohio passing through Hillsdale and Dana and the New York, Chicago & St. Louis passing through Cayuga. Sidings and spur tracks are numerous, which aid in shipping the locally mined coal and in distributing and marketing farm products and supplies.

The public-road system is well developed and is being improved. United States Highway No. 36, a concrete-surfaced highway, crosses the central part of the county from east to west. All the county roads are well graded and gravel surfaced, and many of the roads in the southern part are paved. Telephone service and rural delivery of mail reach all sections.

Coal mining is the most important nonagricultural industry. It is, in part, closely associated with agriculture, as many of the miners farm on a small scale.

CLIMATE

The climate of Vermillion County is humid and temperate. It is characterized by wide variations in temperature and rainfall. Periods of drought, which materially decrease crop yields, especially corn, occur in some years. Changes of temperature are sudden and frequent. During the corn-growing season, temperatures are uniformly high and the rate of evaporation is comparatively high.

Damage to crops from early and late frosts sometimes occurs, but such frosts are not sufficiently frequent to be of serious consequence. The average dates of the earliest and latest killing frosts at Rockville, Parke County, are October 11 and April 25, respectively, giving an average frost-free season of 169 days. Frosts have been recorded at this station as early as September 13 and as late as May 28.

No Weather Bureau station is in Vermillion County, but the records of the station at Rockville, Parke County, a few miles east of Vermillion County, are considered representative of climatic conditions in this county. The more important climatic data are set forth in table 1.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Rockville, Parke County, Ind.*

[Elevation, 722 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1927)	Snow, average depth
	° F.	° F.	° F.	*Inches*	*Inches*	*Inches*	*Inches*
December	31.4	76	−15	2.78	2.95	4.01	3.8
January	28.4	69	−20	2.64	2.29	2.58	5.2
February	29.6	69	−22	2.12	2.95	1.49	4.4
Winter	29.8	76	−22	7.54	8.19	8.08	13.4
March	40.6	85	−3	3.84	3.73	5.34	3.1
April	52.3	88	19	3.63	2.66	5.61	.3
May	62.2	96	28	3.93	3.34	6.52	(1)
Spring	51.7	96	−3	11.40	9.73	17.47	3.4

1 Trace.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Rockville, Parke County, Ind.*—Continued

[Elevation, 722 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1927)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
June	71.6	102	34	3.92	2.00	3.34	0
July	75.3	105	43	3.42	1.40	2.11	0
August	73.5	106	39	3.21	2.23	7.67	0
Summer	73.5	106	34	10.55	5.63	13.12	0
September	67.4	103	26	3.20	2.47	7.63	(1)
October	55.0	92	18	2.85	.75	3.40	.1
November	42.4	77	2	3.21	2.76	4.90	.5
Fall	54.9	103	2	9.26	5.98	15.93	.6
Year	52.5	106	−22	38.75	29.53	54.60	17.4

1 Trace.

AGRICULTURE

Agriculture has always been the primary interest of the people of Vermillion County, and farming was first developed in the forested part, where fuel and building material were plentiful. The first settlement was on the river terrace near Cayuga. The prairie section was settled slowly, as most of the land was poorly drained, but about 1885 artificial drainage was established, which improved the land considerably, and the prairie section became the leading agricultural section.

In the early agricultural period the forest land gave favorable crop returns, as the fertility of the virgin land was comparatively high, and in addition forest products were an important item in the wealth of the county. The sales of maple sirup and of lumber were important sources of revenue. Corn and wheat were the principal farm crops, but such products as broomcorn, tobacco, dry beans, and maple sirup aided in maintaining a system of diversified farming.

Since 1890 a gradual change in the type of agriculture practiced has been made necessary by changes in prices of certain products, together with decreasing yields. These factors have resulted in a gradual decrease in the acreage of corn and wheat and an increase in the acreage of legume hays. The production of fruits and vegetables has increased since 1910, as favorable markets for these products have been provided by improvements in transportation facilities and the location of a large canning factory at Cayuga.

There has been a gradual increase in the average size of farms in the last 30 years, from 104 acres in 1900 to 130.4 acres in 1930. Labor-saving farm equipment and the opening of the prairie section have been largely responsible for this change. In the prairie section improved implements are particularly adapted to large-scale farming.

Table 2 gives the acreage and production of the principal farm crops in Vermillion County as reported by the Federal census.

TABLE 2.—*Acreage and production of principal crops in Vermillion County, Ind. in stated years*

Crop	1879		1889		1899		1909		1919		1929	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bus'ls*
Corn	36, 523	1, 348, 321	37, 751	1, 271, 975	44, 865	1, 812, 490	44, 934	1, 739, 274	34, 574	1,067,589	[1] 28,863	899, 672
Wheat	31, 611	666, 854	19, 131	237, 238	14, 637	123, 600	12, 242	238, 455	13, 595	209,713	9, 251	165, 570
Oats	3, 791	101, 820	8, 799	240, 099	10, 358	410, 530	18, 857	598, 964	18, 640	567,850	15, 623	419, 124
Rye	39	948	1, 351	16, 575	214	2, 520	257	3, 772	3, 538	46,067	1, 288	15, 160
Barley	------	---------	140	3, 069	------	---------	20	240	53	685	59	695
Potatoes	------	35, 516	510	42, 683	317	23, 603	361	34, 508	257	9,721	113	9, 059
		Tons		*Tons*		*Tons*		*Tons*		*Tons*		*Tons*
All hay	7, 416	8, 386	11, 817	15, 534	11, 279	14, 806	11, 262	14, 265	9, 776	10,578	10, 095	13, 876
Clover	------	---------	------	---------	3, 706	5, 029	1, 534	1, 730	1, 896	1,935	2, 731	4, 068
Timothy	------	---------	------	---------	------	---------	7, 364	9, 179	6, 074	6,467	------	------
Alfalfa	------	---------	------	---------	------	---------	39	93	297	582	909	1, 766

[1] In addition to corn harvested for grain, corn from 767 acres was cut for silage, yielding 4,027 tons; from 283 acres was cut for fodder; and from 1,135 acres was hogged off.

NOTE.—The soybean acreage for 1930 was 10,000 acres (estimated by county agent).

SOILS AND CROPS

The agriculture practiced in Vermillion County consists principally of general farming, with corn, clover, soybeans, wheat, and oats as the principal crops. The climate and the dark-colored soils are particularly favorable to corn. Most of the soils are not well adapted to wheat because of their somewhat excessive moisture. The high rainfall is also unfavorable to wheat. The temperature is often too high during the early part of the summer for best results with oats. Types of farming, however, vary considerably in different parts of the county as a result of the different conditions under which the farms are operated. The character of the soils is the controlling factor, and the type, or kind, of soil, which takes into account the main variable characteristics of the soil, very largely determines the kinds and acreage of crops grown.

In Vermillion County 21 types and 2 phases of soils are favorable for the production of the agricultural crops of the region and 1 type and 3 phases are unfavorable for ordinary agricultural use. Soils favorable for agricultural use are designated as agricultural soils, and soils less favorable or unsuited are called nonagricultural soils. The agricultural soils comprise about 85 percent of the area of the county, and the nonagricultural soils comprise the remainder. With the exception of a few areas occupied by woodlands or wood lots, all the areas of agricultural soils are used as pasture land or as crop land. Most of the land occupied by the nonagricultural soils is unfavorable for tillage operations because of steepness of slope, because of permanently wet conditions, or because the soil is shallow and low in fertility. With the exception of a few swampy areas, nearly all the areas of nonagricultural soils are forested.

Each soil type has certain definite characteristics by which it can be separated from all the other soils. Similarities, however, exist between certain soils, which allow all the agricultural soils to be placed into groups, with all the soils of each group presenting a certain general adaptation to crops.

In the following pages the soils of Vermillion County are described in groups and in detail, and their agricultural importance is discussed. Their distribution in the county is shown on the accompanying soil map, and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Acreage and proportionate extent of soils mapped in Vermillion County, Ind.*

Type of soil	Acres	Per-cent	Type of soil	Acres	Per-cent
Fincastle silt loam	25,536	15.6	Fox gravelly loam	384	0.2
Fincastle loam	448	.3	Fox silt loam	7,296	4.4
Russell silt loam	22,912	13.9	Genesee silt loam	7,808	4.8
Russell loam	1,472	.9	Genesee fine sandy loam	12,544	7.6
Rush silt loam	768	.5	Genesee fine sandy loam, high-bottom phase	1,152	.7
Delmar silt loam	768	.5	Genesee clay loam	2,368	1.4
Conover silt loam	704	.4	Eel silty clay loam	1,152	.7
Helt silt loam	1,792	1.1	Russell silt loam, slope phase	18,112	11.0
Dana silt loam	8,000	4.9	Lordstown loam	512	.3
Carrington silt loam	832	.5	Lordstown loam, slope phase	576	.4
Toronto silt loam	4,544	2.8	Eel silty clay loam, dark-colored phase	576	.4
Brookston silty clay loam	11,264	6.9	Mine pits and mine dumps	512	.3
Brookston silty clay loam, prairie phase	12,736	7.8			
Clyde clay	5,056	3.1	Total	163,840	
Warsaw sandy loam	9,856	6.0			
Fox loam	4,160	2.6			

AGRICULTURAL SOILS

The agricultural soils of the county can be divided on a physiographic basis, which also has an agricultural significance, into two main divisions as follows: (1) Soils of the uplands and (2) soils of the terraces and bottom lands.

The crops grown and the type of agricultural industry prevailing in the county are determined by Nation-wide and even world-wide economic and geographic relationships. The local soil character is a relatively minor factor in the matter. However, it is an important factor in yields obtained and costs of production. It is more important in this respect than it would be if conditions allowed greater freedom in selecting crops favorable to soil character.

Another factor which limits the farmers' freedom in fitting his crop to his soil is the occurrence of widely different soils in such small and intermixed areas that fields cannot be fitted to them.

SOILS OF THE UPLANDS

General farming predominates in the area occupied by the upland soils, with corn occupying an important place as a cash crop and as feed for livestock. With the exception of an area occupied by one of the groups of soils, the farms on the upland soils, in general, just about use the feed crops produced. The cropping systems in general use include corn, oats, soybeans, clover, timothy, and other hay crops.

All the upland soils may be considered in four main soil groups, each named for a dominant or characteristic soil of the group. These are the Russell group, the Delmar group, the Dana group, and the Brookston group. With the exception of the soils of the Dana group, the soils in all other groups are intimately associated. The soils of the Dana group are geographically associated only with the soils of the Brookston group.

SOILS OF THE RUSSELL GROUP

The Russell group includes five types of soils, namely, Russell silt loam, Russell loam, Fincastle silt loam, Fincastle loam, and Rush silt loam. In their virgin condition these soils were covered principally with red oak, shagbark hickory, sugar maple, and walnut. The predominant characteristics which these soils have in common are the light-colored 6-inch surface soil which is comparatively low in organic matter, the heavy-textured subsoil that is capable of holding a large amount of water, and the similarity in depth to which the soils have weathered. They are productive for corn, clover, soybeans, oats, and wheat, with corn occupying the greater part of the crop acreage.

The soils of the Russell group are intimately associated with the soils of the Brookston and Delmar groups. With the exception of the area occupied by the soils of the Dana and Brookston groups, the soils of the Russell group are well distributed over the upland. The surface relief of the areas occupied by these soils is sufficiently undulating to afford adequate surface drainage. Although natural underdrainage is not everywhere sufficient for crops, tiling has not been considered necessary.

The soils of the Russell group produce comparatively well if care is taken in the system of farming to maintain the fertility of the soil. The acreage of soybeans seems likely to increase on these soils, particularly in fields where small areas of the Brookston soils occur. Where a large quantity of hay crops has been grown, fertility is being maintained, and the keeping of livestock for utilization of the hay has taken the place of the more strictly grain farming formerly practiced. The general system of farming has been very largely determined by the quantity of corn that can be grown and still maintain the productivity of the soil.

Fincastle silt loam.—Fincastle silt loam, under cultivation, has a friable mottled yellow and light-gray silt loam surface soil about 6 inches thick. The subsurface layer, between depths of 6 and 12 inches, consists of gray and yellow material in which the gray material predominates. It is very friable and allows easy penetration of roots and moisture. The upper subsoil layer, between depths of 12 and 30 inches, consists of silty clay which becomes lighter textured with depth. Below a depth of 36 inches, the subsoil consists of silty clay loam which extends to a depth of 60 inches. Free lime carbonate occurs in the subsoil at a depth of about 60 inches.

The surface soil is relatively low in organic matter, but clover and soybeans add to the nitrogen supply, and it is comparatively easy to obtain a stand of these legumes if lime is applied to the land. When the rainfall is not too abundant and not so rapid as to pack the soil material, tillage is comparatively easy and a favorable seed bed can be obtained. The heavy-textured material in the subsoil makes conditions favorable for holding large quantities of water for crops over a long period of drought, but in rainy seasons the subsoil becomes water-logged, owing to poor internal drainage.

General farming practices on this soil differ very little from those practiced on the other soils of this group, and there is very little difference between crop distribution on this soil and that on the other soils of the group. With proper management, the application of lime, and a crop rotation including clover and soybeans, an acre yield of about 45 bushels of corn can be obtained, but when such practices are neglected this soil becomes less productive and corn yields may be as low as 15 or 20 bushels an acre.

Fincastle loam.—Fincastle loam occurs only in the northern part of the county. It differs from Fincastle silt loam chiefly in its lower percentage of silt and higher percentage of fine sand. The yields on this soil and the management of it are similar to those on Fincastle silt loam. The surface soil of Fincastle loam is light in color, and it has less structure and cohesiveness than the corresponding layer of Fincastle silt loam.

Russell silt loam.—Russell silt loam occupies undulating or very gently rolling land. Small areas of this soil occur on low mounds and flat ridges. Most of it, however, is confined to small strips of land near the streams and to rolling well-drained areas between the deeply incised streams. The difference in the characteristics of the subsoil of Russell silt loam from those of the subsoil of Fincastle silt loam increases with increasing degree of slope. Away from drains, where the plain is almost flat, this soil grades into Fincastle silt loam, the transition from one soil to the other being indistinct. Without examining their subsoils, a difference in elevation is usually the only indication of the extent of the area in which each of these soils occurs, as their surface soils, except in plowed fields where erosion has taken place, have similar characteristics. In the better-drained areas the subsoil of Russell silt loam differs from that of Fincastle silt loam in that it is browner and lighter textured. The yellow-brown color of the subsoil of Russell silt loam indicates good internal drainage, but the soil is sufficiently heavy textured to hold large quantities of water which will maintain crops over long periods of drought. Russell silt loam is more favorable than Fincastle silt loam to all crops commonly grown on the soils of this group, and yields of corn will average about 5 bushels more an acre than on Fincastle silt loam.

Russell loam.—Russell loam differs from Russell silt loam in the higher percentage of fine sand in the upper layers. It occurs chiefly in the northern part of the county, and areas of it are intimately associated with areas of Fincastle loam. A few isolated bodies lie in the central-southern part of the county. The agricultural practices on this soil are similar to those on other soils of this group.

Rush silt loam.—Rush silt loam occupies bench-land areas along some of the larger streams. The areas of this soil are closely associated with those of Russell silt loam, and the methods of management and cropping on the two soils differ very little. To a depth of about 54 inches the characteristics of the soils are similar, but below that depth the soil material of Rush silt loam is gravelly and sandy. The gravelly material influences the productivity of the soil very little, and the yields of all crops are very nearly the same as on Russell silt loam.

SOILS OF THE DELMAR GROUP

The soils included in the Delmar group are Delmar silt loam, Helt silt loam, and Conover silt loam. These soils occupy small, somewhat flat areas, and their surface soils and subsoils are poorly drained. The drainage of Helt silt loam differs to some extent from that of the other soils of the group, as some of the land is very slightly undulating. The soils of this group occur entirely within the area occupied by soils of the Russell group, and most of them lie between bodies of the Fincastle soils and soils of the Brookston group. Management of crops and tillage practices differ very little from those employed on soils of the Russell group, except where the soils of the Delmar group occur in large areas. Except in years of normal temperature and well-distributed rainfall, corn yields are considerably less than on Fincastle silt loam. The heavy, more or less compact, poorly drained and poorly aerated subsoils render these soils unfavorable for crops during periods of excessive rainfall. The characteristics of the surface layers of these soils are comparable, but their subsoils differ in acidity, color, and structure. In cultivated areas, the surface soils are highly acid but the subsoils range from very acid to alkaline. Very nearly all of Helt silt loam occurs in the southern half of the county, Delmar silt loam occurs chiefly in the central and northern parts, and Conover silt loam is mapped principally in the southern part.

Delmar silt loam.—Delmar silt loam is commonly called "buckshot land." It is the least productive soil of this group, and yields on it are low during droughty seasons as well as during wet seasons. The surface soil, to a depth of 8 inches, is loose floury very light gray silt loam. This material is extremely low in organic matter and contains a large number of small dark-brown pellets from which the soil received the name, buckshot land. A favorable seed bed can be obtained, provided heavy rains do not pack the surface soil. The subsoil, to an average depth of 38 inches, is heavy plastic clay loam highly mottled with gray and yellow. The material in this layer is highly acid, but the underlying material is neutral, and the texture becomes lighter. Free calcium carbonate occurs at a depth of about 60 inches. During periods of heavy rains the subsoil becomes water-logged and unfavorable for the growth of roots. Wheat does not do well on this soil, and corn, except in years of normal temperature and well-distributed rainfall, yields from 5 to 15 bushels less than on Fincastle silt loam. In some areas the floury silty surface soil is so impoverished of plant nutrients and the subsoil is so water-logged that the land is practically valueless for farming. Although there is a great difference in the growth of crops on Delmar silt loam and on Fincastle silt loam, a much greater difference exists between those grown on Delmar silt loam and on Brookston silty clay loam. Crop growth changes on these two soils as abruptly as the soil changes. Some farmers give the Delmar soil special attention to make it more productive, but wherever possible it is used as forest and pasture land. Special treatment given this soil consists principally in the application of manure.

Conover silt loam.—A dark-brown heavy clay loam subsoil is a characteristic feature of this soil. The subsoil is overlain by gray silty material similar to the surface soil of Delmar silt loam. The cultivated soil is somewhat darker and is higher in organic matter than that of the Delmar soil. The light-colored surface layer varies considerably in thickness, but it extends to an average depth of 12 inches, and its transition into the material below is in most places very abrupt. Between depths of 12 and 26 inches, the subsoil is very dark brown heavy clay loam with a prismatic structure. Below a depth of 26 inches, the material changes to a grayish-yellow color, and it is slightly lighter in texture. Free calcium carbonate occurs at a depth of about 50 inches. The subsoil is so heavy that it is nearly impervious to water, and during heavy rains water collects on the surface where surface drainage is insufficient to remove it. The subsoil, however, is not too compact for penetration of roots, and root growth is aided by the large supply of nitrogen in the upper part of the subsoil. Crop adaptations and yields are similar to those on Delmar silt loam.

Helt silt loam.—Helt silt loam is the most productive soil of this group. Its surface soil is similar to that of the other soils of the Delmar group. At a depth of 12 inches the material changes abruptly to heavy yellow clay loam, with gray mottling in the upper 3 or 4 inches of the layer. The pronounced characteristic of the subsoil is the very heavy yellow clay loam which occurs at a depth of 15 or 18 inches. Depth to neutral or only slightly acid material varies somewhat, but in most places such material occurs at a depth of about 18 inches.

No fields are occupied entirely by this soil, most of which occurs as irregularly disposed small areas in association with Brookston silty clay loam. Surface drainage in most places is slightly better than on Delmar silt loam, and the soil responds more quickly to fertilization and proper crop rotation than the other soils of this group.

SOILS OF THE DANA GROUP

The three soils comprising the Dana soil group are Dana silt loam, Carrington silt loam, and Toronto silt loam. These soils occur only in the two sections of the county commonly called prairies. These prairies are the eastern extensions of a large region, known as the Illinois prairie, in which the soils support a grass vegetation, have very dark or black surface soils, and are comparatively high in organic matter and productivity. In Vermillion County, one of the prairies lies south of the central-western part of the county and the other occupies the northwestern part.

With the exception of the part of the area occupied by Toronto silt loam, these soils were covered with grasses when the county was settled. The soils of the prairies have not been farmed so long as have other soils of the county, because lack of timber resources and poor drainage made these areas unfavorable for settlement. When artificial drainage was established and transportation facilities provided, the land was quickly settled and it became a cash corn-producing section.

Although a large part of the prairie land was naturally poorly drained, the soils of the Dana group are moderately well drained, and the agriculture practiced on them has been influenced by the poorly drained Brookston soils with which they are closely associated.

Since artificial drainage has been introduced the prairie land has been the most highly productive part of the county, and within this area agriculture has been more of a cash grain type of farming than elsewhere. Much of the grain, principally corn, oats, and wheat, is sold for cash. Although corn is still the main crop, the acreage of clover and soybeans is increasing, and a gradual change to a type of farming similar to that practiced on soils of the Russell group is indicated. Level land and large regular-shaped fields encourage farming on a large scale, and consequently farms are larger in the prairie section than elsewhere in the county. High organic-matter content and high water-holding capacity of the subsoils of these soils are important characteristics which result in high crop production. The average yield of corn on Dana silt loam is about 40 bushels an acre, and on Carrington silt loam and Toronto silt loam it is somewhat lower. Very good response from fertilizer can be obtained on these soils, but most of the treatment given them is confined to applications of ground limestone. Although nitrogen is still comparatively high in these soils, according to observation of results obtained, legumes grown in rotation with corn may increase crop yields as much as 20 percent. Although these soils are slightly less acid than the soils of the Russell group, their lime requirement is about the same.

Dana silt loam.—Dana silt loam is one of the most productive corn soils in the county, and almost all of it is under cultivation. Areas of this soil are nearly level, and they occur at slightly higher elevations than the soils of the Brookston group. The land is moderately well drained, and tiling is not necessary. This is the predominant soil of the Dana group, and it owes much of its ability to produce high yields of corn to the high organic content of the surface soil which extends to a depth of about 12 inches. The color of the surface soil is very dark brown, and the texture is silt loam. The material is very granular and friable, so that a favorable seed bed is readily obtained. Following heavy rains, however, the soil does not yield to tillage practices so well as do soils of the Russell group. Between depths of 12 and 18 inches the material is slightly heavier, and it breaks into slightly larger particles than that in the layer above. Beginning at a depth of 18 inches is a brown heavy clay loam layer about 20 inches thick, which contains no mottling to indicate poor drainage. This heavy layer is not impervious to water, and conditions seem to be favorable to root penetration. At a depth of 38 inches the material changes to silty clay loam which becomes lighter in texture and more friable as depth increases. Free lime carbonate occurs at a depth of about 60 inches.

Carrington silt loam.—Carrington silt loam occurs on undulating or gently rolling upland, giving place to Dana silt loam on the more nearly level areas. These two soils are comparable in their general characteristics. The dark surface layer of Carrington silt loam, however, contains less organic matter and does not extend to so great a depth as that of Dana silt loam. The subsoil of Carrington silt loam is characterized by friable brown silty clay loam material which has a water-holding capacity sufficient to enable crops to withstand long periods of drought. Free lime carbonate occurs at a depth of about 60 inches, and the material below a depth of 36 inches in places carries considerable sand and gravel. The crops grown and crop rotations differ very little from those on Dana silt loam. A larger acreage of Carrington silt loam is used for pasture, but very little of it is in permanent bluegrass pasture.

Toronto silt loam.—Toronto silt loam is commonly called "hazel-brush land." The surface soil is similar to that of Carrington silt loam, and the subsoil is similar to that of Fincastle silt loam; that is, a mottled gray and yellow silty clay loam. The color of the surface soil, however, is lighter in some areas where it grades into the soils of the Russell group. The gray mottling in the subsoil decreases with depth, and below a depth of about 36 inches the soil characteristics are very similar to those of Carrington silt loam at corresponding depths.

Toronto silt loam occurs in areas lying between the prairie section and the section occupied by soils of the Russell group. The type of agriculture practiced on this soil is similar to that practiced on the other soils of this group, but crop yields are lower. Corn yields about 10 bushels an acre less than on the adjoining Carrington silt loam, especially in areas in which the surface is nearly flat and the soil grades into Fincastle silt loam.

SOILS OF THE BROOKSTON GROUP

Soils of the Brookston group are excellent corn-producing soils. They are also highly productive of wheat, soybeans, clover, and oats, but the high organic content of the surface soils, their heavy texture, and their large water-holding capacity make them especially favorable for corn. This group includes three soils—Brookston silty clay loam, Brookston silty clay loam, prairie phase, and Clyde clay. They are commonly called gumbo soils, black soils, and jack-wax soils. Brookston silty clay loam occurs chiefly in association with soils of the Russell group, whereas Brookston silty clay loam, prairie phase, and Clyde clay are associated with soils of the Dana group. The Brookston soils occupy the sags, sinuous depressions, and other poorly drained parts of the upland. In most places tile drainage is necessary before these soils can be farmed.

With the exception of small areas associated with soils of the Russell group, very nearly all the area occupied by Brookston silty clay loam and its prairie phase is farmed. Clyde clay, which occupies the most poorly drained situations within areas of Brookston silty clay loam, prairie phase, is so difficult to drain in most places that much of it remains in a swampy condition. The low position of the areas of these soils and the heavy texture of the subsoils result in the maintenance of a high water table and the retention of a large amount of water, enabling crops to withstand longer periods of drought than on the better-drained soils of the upland. Where the soils of the Brookston group are fairly well drained, however, crop injury, because of wet conditions, rarely occurs. These soils warm up slowly in the spring, and the growth of early planted crops is retarded. The tendency of the ground to heave during freezing and thawing is injurious to wheat and makes these soils unfavorable for that crop. Oats largely take the place of wheat in the rotation, especially in places where nearly all the field is occupied by soils of the Brookston group. Although these soils apparently are high in plant foods, favorable returns are obtained by the application of commercial fertilizers. Nitrogen, however, can be omitted from the fertilizer, because the soil contains a comparatively large amount of organic matter and because of only slight acidity it is favorable to the growth of legumes which will supply nitrogen and organic matter by the plowing under of the green vegetal growth.

Brookston silty clay loam.—The surface layer of Brookston silty clay loam is very dark grayish-brown or nearly black silty clay loam, about 15 inches thick, which grades into yellowish-gray sticky plastic tough clay. Although the material to a depth of 15 inches is heavy textured it is comparatively friable because of its granular structure, which is an aid in maintaining good tilth. The high organic-matter content of the surface soil, the nearly neutral reaction, and the high water-holding capacity of the subsoil are important factors in making this soil highly productive. The subsoil is so heavy, however, that it may become water-logged during rainy periods unless the land is properly drained. Such a condition is usually reflected in the crops and is indicated by the presence of yellow spots and stripes in the lower leaves of corn. Approximately 90 percent of this soil is under cultivation.

Brookston silty clay loam, prairie phase.—The prairie phase of Brookston silty clay loam occupies the rather broad flats or slight depressions in the western part of the county where the prairie land prevailed. Under natural conditions drainage was imperfect. The dark-colored surface layer is similar to that of typical Brookston silty clay loam, being very dark gray rather than black. It ranges from 12 to 15 inches in thickness. The subsoil and substratum materials are like those of the typical Brookston soil of the timbered section. The original vegetation of the prairie phase, as the name indicates, was prairie grasses, rather than trees; therefore the organic matter in the natural condition was somewhat more thoroughly mixed with the mineral material of the surface soil and probably extended to a greater average depth than in the Brookston soils lying farther east.

The areas occupied by Brookston silty clay loam, prairie phase, have been practically all brought under cultivation and constitute some of the best farm land of the county. They are probably the most productive soils of the Brookston group.

Clyde clay.—Clyde clay, where adequately drained, is more productive of corn than Brookston silty clay loam, to which it is similar in its characteristics and crop adaptations. It occupies the lower and wetter parts of the larger upland depressions, and it also occurs in shallow stream channels and narrow strips intermingled with areas of Brookston silty clay loam, prairie phase. In some places this soil constitutes the larger part of 40-acre fields. Clyde clay differs from Brookston silty clay loam in having a heavier-textured surface soil, a grayer subsoil, and in that the surface soil is neutral or nearly neutral in reaction. The water table is comparatively high at all times. After heavy rains the surface soil becomes very hard as a result of packing, and large cracks 2 or 3 inches wide and 10 inches deep occur during periods of drought.

Soils of the Terraces and Bottom Lands

Soils of the terraces and bottom lands may be divided into two groups, the Fox group and the Genesee group. Soils of the Fox group occupy the high gravelly terrace along Wabash River, and soils of the Genesee group occur in the large Wabash River bottoms and in the small stream bottoms. Conditions in the area occupied by the soils of these two groups are unfavorable for the type of agriculture practiced on the upland. Soils of the Fox group are unfavorable for corn because the excessively drained subsoils hold only a small amount of water. Drought injury to corn occurs in the latter part of summer at the time that large quantities of water are necessary to sustain crop growth. The bottom lands, however, which are occupied by soils of the Genesee group, are almost entirely limited to the production of corn, especially in the Wabash River bottoms. Although these soils are comparatively high in the plant foods necessary to produce the crops of the region, periodic overflows occur in the winter and spring seasons and, to a great extent, limit the utilization of these soils to the production of corn and to pasture.

SOILS OF THE FOX GROUP

Soils of the Fox group are commonly called sandy soils. They occur almost entirely on the high terrace along Wabash River, but a few small areas are along Brouilletts Creek and Little Vermillion River. The soils of this group are Warsaw sandy loam, Fox silt loam, Fox loam, and Fox gravelly loam. In most places the terraces are sufficiently large that the agriculture practiced on the farm is determined almost entirely by characteristics of the terrace soils. The characteristics of these soils, as previously stated, make it necessary to eliminate corn as much as possible from the crop rotation, but the light texture of the surface soils makes the soils favorable for wheat, as it prevents winter injury caused by heaving of the surface soil during freezing and thawing, such as occurs in the heavier-textured soils. Although the soils are droughty, wheat usually escapes injury because it matures before the period of summer drought begins. Soybeans are comparatively well suited to these soils because of their ability to withstand droughty periods. Aside from the droughty condition of the soils, deep-rooted legumes, such as alfalfa, red clover, and sweetclover, find these soils favorable because the soils are neutral at a comparatively slight depth, and in some areas, especially in the gravelly areas, even the surface soil is only slightly acid.

Although the agriculture on the terrace lands is confined to a system of cash farming, a number of farmers have found it profitable to raise beef cattle and practice dairying because hay can be produced cheaply on the comparatively low priced land. In certain localities on the terrace, particularly near Cayuga, large quantities of vegetables, principally tomatoes and cabbage, are produced. Sweet corn also is grown profitably, and, together with tomatoes and cabbage, is marketed at the canning factory in Cayuga. These crops ordinarily give favorable returns as they are produced on cheap land, and they aid in maintaining a system of diversified farming. The soils respond very well to fertilization, but aside from the application of lime, which began to be practiced a few years ago, very little soil amendment has been practiced. Most of the supply of nitrogen is obtained by growing legumes, and practically no attention is given to applying phosphorus and potash through commercial fertilizers.

Warsaw sandy loam.—Warsaw sandy loam is the darkest-colored soil on the terraces. According to the early settlers, the natural vegetation on the part of the terrace occupied by this soil was prairie grass. Three large areas of this soil occur in Vermillion County, one in the southern half of the county, in the vicinity of Summit Grove, and the other two in the northern half. These areas are separated by the light-colored Fox soils which occur along Vermillion River, and on the outer limits of the areas of Warsaw sandy loam the soil grades into the lighter-colored Fox soils.

The cultivated surface soil of Warsaw sandy loam, to a depth of about 6 inches, is very dark brown or black loose sandy loam. Between depths of 6 and 15 inches the material is sandy loam, which is lighter brown than the material in the layer above. The texture of the material above a depth of 15 inches in some places is heavier than sandy loam, and in many places the surface soil contains considerable gravel. Areas of this soil having a gravelly surface soil are too small and irregular in shape to be mapped separately. They occur almost entirely within the large area of Warsaw sandy loam in the vicinity of Summit Grove. Between depths of 15 and 40 inches the subsoil consists of reddish-brown sandy gravelly material containing sufficient clay to render it coherent. This material is underlain by light-colored highly calcareous unweathered dry sand and gravel. In most places the material between depths of 30 and 40 inches is considerably heavier than in the upper part of the subsoil, and it is darker. Although this heavy-textured material retains a fair amount of water for crops, the water-holding capacity is very small because of the thinness of the heavy layer and the porous gravelly material below. This soil is comparatively low in available phosphorus, but its low water-holding capacity is the limiting factor in crop production.

Fox loam.—Fox loam consists of light-colored loam or fine sandy loam to a depth of about 15 inches. This layer is underlain by a subsoil having similar characteristics to those of the subsoil of Warsaw sandy loam. In places the surface soil is gravelly. This soil, as a whole, is less productive than Warsaw sandy loam because of the lower organic-matter content of the surface soil and the more numerous gravelly areas too small and irregular to be mapped. Except in the area occupied by Warsaw sandy loam, Fox loam is well distributed over the terraces. Most farmers consider it a less productive soil than Warsaw sandy loam.

Fox gravelly loam.—Fox gravelly loam is very droughty and comparatively unproductive. Although some areas of this soil are large enough to comprise the greater part of a 40-acre field, most of them are small and occupy swells and ridges slightly elevated above the surrounding areas of Fox loam. The gravelly surface soil, the shallowness of the underlying dry unweathered gravel, and the thin light-textured reddish-brown subsoil are unfavorable for the retention of moisture. In many of the areas, especially in the southern part of the county, the soil is neutral in reaction within a few inches of the surface, and the soil in these areas is somewhat more favorable for the production of alfalfa than for other crops. As yields of grain are very low, most of the land is used for the production of hay.

Fox silt loam.—Fox silt loam is considered by most farmers to be the most productive soil of the Fox group. This soil is characterized by a brown silt loam surface soil and a yellowish-brown silty clay loam subsoil extending to a depth of about 30 inches and overlying reddish-brown sandy clay which, in turn, is underlain by sand and dry gravel. The characteristics of this soil to a depth of 30 inches are very similar to those of Russell silt loam to the same depth. The comparatively heavy textured surface soil makes it more favorable for corn and clover than the other soils of this group. Corn yields about 10 bushels more an acre than on any other soil of the group, and the yield of clover nearly equals that obtained on Russell silt loam under similar conditions. The system of farming is similar to that practiced on the soils of the Russell group. Most of this soil occurs on the high terrace west of Newport, north of Cayuga, and north and south of Clinton.

SOILS OF THE GENESEE GROUP

The soils of this group include Genesee silt loam, Genesee fine sandy loam, Genesee fine sandy loam, high-bottom phase, Genesee clay loam, and Eel silty clay loam. All these soils, with the exception of Genesee fine sandy loam, high-bottom phase, are subject to periodic overflow and are neutral in reaction from the surface downward.

The agriculture of the area occupied by the soils of the Genesee group is almost entirely a one-crop system of farming. Periodic flooding is the principal factor in limiting the area occupied by these soils to the production of one crop. Corn, the principal crop of the county, is best adapted to conditions on these soils because it can be grown during the summer and early fall, which avoids crop injury by flooding during the late fall, winter, and spring months. Wheat and oats produce well, but practically none of these crops is grown except in the Brouilletts Creek bottom, where flooding is less frequent than in the Wabash River bottom. In some of the areas along Brouilletts Creek, Vermillion River, and Little Vermillion River, alfalfa and clover can be grown.

During overflow these soils receive comparatively rich sediments and hence require very little fertilizer.

Genesee silt loam.—Genesee silt loam is a good corn-producing soil, but flooding at times reduces the yields. With the exception of the bottoms along small creeks, this soil occurs in all bottom lands of the county. Its characteristics vary somewhat, but wherever mapped it consists of dark-brown friable silt loam to a depth of about 10 inches. This layer is underlain by friable brown silt loam extending to a depth of about 36 inches. In most places the material below a depth of 36 inches consists of layers of sand and silt. In some areas considerable very fine sand occurs between depths of 10 and 36 inches.

Genesee fine sandy loam.—Genesee fine sandy loam is the most variable soil of the Genesee group, as it is mapped to include all Genesee soils having a coarser texture than silt loam, thereby including gravel, sand, and very fine sandy loam. This soil occupies small creek bottoms and those parts of the larger bottoms where the swifter currents of the water, flowing out of the channel during high water, drop their coarser sediments. The soil is very droughty in the areas occurring in small stream bottoms and immediately adjacent to the channel of Wabash River where they form a natural levee. The color of the surface soil tends to be lighter and the subsoil is a clearer brown than is characteristic of the other soils of this group. The content of organic matter is lower than in Genesee silt loam.

In the wetter seasons fairly good yields of corn can be obtained on nearly all areas of this soil. In most phases the bodies of Genesee fine sandy loam are the last to be flooded, as they are higher than other first-bottom lands. They are therefore used to a great extent as sites for farm buildings.

Genesee fine sandy loam, high-bottom phase.—In general, Genesee fine sandy loam, high-bottom phase, occurs in small areas adjoining upland slopes. With the exceptions that it occurs at a slightly higher elevation than the overflow land and has an acid reaction, it is similar in nearly every respect to Genesee fine sandy loam. It is usually farmed in the same way as the adjoining bottom-land soils. No attempt has been made to apply fertilizers, because the areas are small and the land is droughty.

Genesee clay loam.—Nearly all the Genesee clay loam mapped occurs in the large bottom along Wabash River, in comparatively large areas which are isolated from the channel of the river or any stream flowing into the river. This soil differs from Genesee silt loam in having a heavy-textured surface soil and subsoil. The subsoil is definitely heavy, and internal drainage is slow. In most places the surface relief is smooth and flat, with sufficient slope to allow fairly good surface drainage. Fair crop yields are obtained in the drier seasons, but in wet seasons yields are low because of slow drainage during early summer.

Eel silty clay loam.—Eel silty clay loam is of comparatively little agricultural importance, because it occupies only a small total area, and only a small percentage of it is farmed. It occurs in isolated bodies which are less efficiently drained than the adjoining bodies of Genesee silt loam. Most of the bodies occupy slight depressions at the foot of upland slopes and low spots where the average ground water level is somewhat nearer the surface than it is in the adjoining areas.

The surface soil consists of grayish-brown clay loam to a depth of 6 inches. When the surface soil becomes dry large cracks form in the material, and it is cloddy when plowed. Between depths of 6 and 31 inches the material is heavy silty clay loam characterized by brown and gray mottling which indicates poor internal drainage. Below a depth of 31 inches the material is bluish-drab clay loam, and in most places the soil is water-logged. Practically no attempt has been made to artificially drain the land, because of the heaviness of the soil material and its occurrence in low-lying areas.

NONAGRICULTURAL SOILS

Included in the group of nonagricultural soils are Russell silt loam, slope phase, Lordstown loam, Lordstown loam, slope phase, Eel silty clay loam, dark-colored phase, and a miscellaneous classification, mine pits and mine dumps. The slope phases, as indicated by their names, have steep sloping surface relief which renders the soils unsuitable for farming operations. A small part of the area occupied by Russell silt loam, slope phase, is farmed, especially that occurring as narrow strips along the shallower valleys. The total area occupied by the nonagricultural soils is 20,288 acres, and Russell silt loam, slope phase, includes 89 percent of that area. The larger part of these soils occurs in the rougher parts of the county along the larger streams.

Most of the areas occupied by these soils have a forest cover consisting of red oak, hickory, sugar maple, and walnut. Practically none of the original timber remains, and the forest consists of second-growth trees that have not attained sufficient size to be used for lumber.

Russell silt loam, slope phase.—The characteristics of Russell silt loam, slope phase, are similar to those of typical Russell silt loam of the Russell soil group. Its steeply sloping surface relief affords good drainage, and its well-drained condition is evidenced by the uniformly reddish brown subsoil. In addition to having a more uniform reddish-brown color it differs from the typical soil in having a thin surface layer and a shallow subsoil. This soil does not erode easily unless it is under cultivation.

Lordstown loam.—Lordstown loam occurs only in small areas of gentle talus slopes adjoining the upland, but, as mapped, it includes a few flat areas which occupy a benchlike position. It is variable in its characteristics and is mapped to include all soils derived from mixed shale and glacial material. In most places the soil consists of a mixture of shale and glacial material which has a shallow weathered surface soil, particularly on the talus slopes where the material is more or less colluvial. The somewhat flat areas occupying a benchlike position show some indication that weathering has taken place.

The surface material, to a depth of 4 inches, is dark grayish-brown loam which is underlain by light grayish-brown material that is variable in texture. The unaltered shaly material lies at various depths, in many places occurring within a few inches of the surface.

Most of the land occupied by this soil has practically no economic value, as grasses on it are poor, and in most places it is sparsely covered with trees. A few areas, adjoining bottom lands and terraces, are cultivated, especially where the soil is associated with one of the productive soils of the Genesee group.

Lordstown loam, slope phase.—Lordstown loam, slope phase, occurs only on the lower parts of the steep upland slopes where the shale underlying the gravelly material outcrops. This soil occupies a small total area. The slopes on which it occurs are so steep that very little weathered material accumulates, on account of the effects of erosion and gravity.

In addition to its low agricultural value, the land produces very little timber because of the steepness of the slopes. A number of brick and tile manufacturing plants are established along the areas from which shale materials are easily obtained.

Eel silty clay loam, dark-colored phase.—Eel silty clay loam, dark-colored phase, occupies bottom land which is subject to frequent flooding, and water stands on the areas throughout much of the year. Most of the soil occurs in old river channels which were doubtless abandoned by Wabash River in comparatively recent times. Practically none of the land is farmed. With the exception of the wettest areas, it is forested with ash, sycamore, elm, and sugar maple.

This is a variable soil, but in most places it consists of a 12-inch layer of very dark brown or black mucky clay loam underlain by structureless gray silty clay loam.

Mine pits and mine dumps.—About 500 acres in the county are occupied by strip mines, mine dumps, and gravel pits. All the areas occupied by mine dumps and strip mines are in the southern half of the county, and small areas occupied by gravel pits occur in all parts of the county, along stream channels and on the high gravelly terrace along Wabash River. All the larger gravel pits are on the high gravelly terrace, where gravel occurs close to the surface and the deposits are deep. Easy accessibility of the pits and the large quantity of gravel available allow it to be obtained at comparatively low cost. The areas occupied by mine dumps, worked-out strip mines, and gravel pits have very little agricultural value, but some attempts are being made to reforest them.

The areas occupied by strip mines range in size from a few acres to nearly 250 acres. The largest strip mine in the county is about 4 miles west of Clinton. Mine dumps have been made by dumping slag and other refuse from shaft coal mines. Most of the mine dumps occupy small areas of less than 10 acres each, but one, which is 1 mile southeast of Blanford, occupies nearly 20 acres.

SOILS AND THEIR INTERPRETATION

The greater part of Vermillion County lies within the region of gray-brown podzolic soils which are light colored. Part of the county, however, is occupied by two lobes of the Illinois prairie, the natural vegetation of which consisted of tall grasses and the soils of which are dark colored. A large part of the high terrace along Wabash River was also occupied by tall grasses, and it has dark-colored soils. The poorly-drained soils are in general dark colored, owing to an accumulation of organic matter which has been preserved by poor drainage. All the soils may be placed in two large main divisions, namely, the dark-colored soils and the light-colored soils.

The light-colored soils and the dark-colored soils may be arranged in a number of groups, each group including several types of soils, and the name of the dominant soil in each group is used to designate the group in which it occurs. Among both the light-colored soils and the dark-colored soils are groups of soils that have imperfectly developed profiles and those that have well-developed profiles. The light-colored soils having well-developed profiles may be designated as members of the Russell group, the Delmar group, and the Fox group. Two groups of light-colored soils have imperfectly developed profiles. Two groups, the Warsaw group and the Dana group, include dark-colored soils having well-developed soil profiles. The soils of only one group (the Brookston) of the dark-colored soils have imperfectly developed profiles, and these soils occur in both the forest section and the prairie section.

The soils of the Russell group are the predominant soils in that part of the county occupied by the gray-brown podzolic soils. These soils show an upper eluviated layer, which has lost material owing to chemical and physical action, and a lower illuviated layer, which has apparently gained in content of finer-textured materials. The greater part of the areas occupied by these soils has smooth-textured surface soil material and is free of coarse materials, such as sand and gravel, to a depth of about 36 inches. This smooth-textured material is underlain by glacial material, presumably laid down by the early Wisconsin ice sheet. Soluble salts, especially carbonates, have been leached from the surface layers to a depth of about 55 inches.

The soils included in the Russell group are members of the Russell, Rush, and Fincastle series. These soils occupy almost one third of the county. They are intricately associated and occur as nearly level or very slightly undulating areas. The general characteristics of the soils are similar, and their differing characteristics correlate closely with differences in surface relief. In a wooded area, where the trees are northern red oak, sugar maple, and shagbark hickory, one fourth mile east and one eighth mile north of the southwestern corner of sec. 33, T. 17 N., R. 10 W., a typical area of Russell silt loam shows the following profile:

A_0. A 1-inch layer of decomposed and partly decomposed leaves. The pH value is 7.0.[2]

A_1. From 1 to 2 inches, very dark grayish-brown structureless silt loam which has a uniform color and is high in organic matter. Many fine roots are in this layer. The pH value is 6.8.

A_2. From 2 to 4 inches, friable grayish-brown silt loam showing some evidence of lamination. The distribution of the color is uneven, the darker color following the natural lines of cleavage which are feebly expressed. A little gray mottling occurs on the outside of the fine-grained material. The pH value is 6.4.

A_3. From 4 to 12 inches, very light grayish-yellow friable structureless silt loam. The pH value is 4.6.

B_1. From 12 to 14 inches, slightly heavier silt loam than that in the layer above, which breaks into irregular subangular particles ranging from one fourth to one half inch in diameter. The material is light yellowish brown, with small streaks of gray between the structure particles. The pH value is 4.8.

B_2. From 18 to 28 inches, yellowish-brown heavy silty clay loam. This is the heaviest-textured layer in the soil profile. The material crumbles readily to angular fragments ranging from one fourth to three fourths inch in diameter. A coating of gray occurs on the outsides of the structure particles and in the natural lines of breakage. The first appearance of gritty material from the surface downward occurs in this layer. The pH value is 5.4.

B_3. From 28 to 34 inches, darker-brown and slightly lighter textured material than in the layer above. The breakage is distinct, forming fragments ranging from one fourth to 1 inch in diameter. The pH value is 5.8.

B-C.[3] From 34 to 40 inches, material similar to that in the layer above in structure and texture, but having a distinctive color with a somewhat red hue and containing rust-brown and black spots. Small stones or pebbles occur in this layer. The pH value is 6.0. From 40 to 50 inches, the material is similar to that in the layer above except that it is darker brown, contains more black spots, and has fewer distinct natural lines of cleavage. The pH value is 6.6.

C_1. From 50 to 56 inches, friable structureless yellow sandy material containing considerable clay and numerous black spots. The pH value is 7.0.

C_2. From 56 inches downward, material similar to that in the layer above, except that this layer contains free lime carbonate.

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[2] Hydrogen-ion concentrations determined by E. H. Bailey, Bureau of Chemistry and Soils, U.S. Department of Agriculture.

[3] The use of two letters, as B-C, in designating a soil layer, indicates a transitional layer, in this case a layer which is transitional from the B horizon to the C horizon, or parent material.

The profile described is representative of most of Russell silt loam, but in many places variations occur in the lower layers. The depth to carbonates differs appreciably without any correlation with surface relief, but apparently there is some correlation of the depth to carbonates with the texture of the underlying material, as the depth to carbonates increases as the material becomes more sandy or gravelly. The number and character of the B-C transitional layers vary considerably, usually in the depth to carbonates and in the texture of the material. In this soil the first four layers have a smooth texture, and in few places is there any material coarser than very fine sand.

The soils comprising the Delmar group are Delmar silt loam and Helt silt loam. Delmar silt loam occupies areas having poor surface drainage. This soil has a heavy subsoil, and internal drainage is poor. The general sequence of layers and the depths of horizons of eluviation and illuviation are similar to those of the Fincastle soils.

The upper soil layers of Delmar silt loam are comparable to those of Fincastle silt loam, but Delmar silt loam has small iron concretions on the surface and in the upper soil layers. The A_3 layer is thicker, and it has a more floury and ash-gray appearance than the corresponding layer of Fincastle silt loam. This layer is underlain by a heavy highly mottled gray and yellow and highly acid subsoil. The layers below the B_3 horizon are similar to the corresponding layers in the Fincastle soils. Delmar silt loam occurs in small areas irregularly disposed and is confined to flat lands bordering the soils of the Brookston group or to areas at the heads of drains. This soil has developed under the same kind of forest vegetation as have the soils of the Fincastle series.

Helt silt loam has nearly as imperfect drainage as Delmar silt loam. The loose, incoherent, light-gray surface soil is similar to that of Delmar silt loam, but below a depth of 10 inches the layers differ considerably, the greatest difference being in the horizon of illuviation, which lies within a depth of 10 inches, and in places in cultivated fields it is within the normal depth of cultivation. The transition between the eluviated and illuviated horizons is sharp and distinct. The illuviated horizon is distinctly less acid than the corresponding horizon of Delmar silt loam, has a yellowish-brown color free from mottling, and has a columnar breakage. The material in the upper 3 or 4 inches of this layer contains a sprinkling of gray which occurs only on the outsides of the structure particles. The structure particles average one fourth inch in diameter. The material in the second or third layer of the illuviated horizon is heavy, plastic when wet, and hard when dry. Free lime carbonate is present at about the same depth as in Delmar silt loam.

The Fox group includes three closely related soils, namely, Fox loam, Fox silt loam, and Fox gravelly loam, and one soil, Lordstown loam, which is distinctly different in the substratum material from the Fox soils. The Fox soils occur on well-drained high gravelly terraces along Wabash River, and a few areas of Fox silt loam are mapped along Little Vermillion River and along Brouilletts Creek. All these soils are light colored and have a forest cover of mossycup oak, black oak, and shagbark hickory.

Fox loam is the predominant soil in the group. The material to a depth of 6 inches is structureless light grayish-brown loam or fine sandy loam, and it has only a moderate content of organic matter. Between depths of 6 and 17 inches the material is grayish-brown loam with a fine-granular structure. The structure particles are subangular and average about one sixteenth inch in diameter. Between depths of 16 and 46 inches is the horizon of illuviation, which has two layers. The 11-inch upper layer consists of brown sand and gravel with sufficient clay to bind the material together. There is very little indication of structure, and the color is a distinct brown. The thickness of the lower layer varies considerably, as its contact with the unaltered parent material varies in depth. In some places the material of this layer occurs as tongues extending from 2 to 3 feet into the unaltered parent material. The dark reddish-brown structureless sandy clay loam makes this layer the most striking one of the profile. Some accumulation of clay has taken place, and, although the material contains a large amount of sand, it is slightly plastic and sticky when wet. Apparently, this layer is comparatively high in organic matter or manganese dioxide, as the color is very dark. The parent material, which is composed of dry clean gravel high in limestone material, occurs at a depth of about 46 inches.

Lordstown loam differs considerably from the other soils of this group. In this soil, development has been retarded by the resistance to weathering of the parent material. The horizon of illuviation occurs at a slight depth, between 6 and 18 inches, and the characteristics of an illuviated layer are very feebly expressed. The surface layer is structureless dark grayish-brown loam about 2 inches thick. It is underlain by a 4-inch layer of light grayish-brown very fine sandy loam showing some evidence of granulation. The illuviated layer shows some evidence of accumulation of clay and a breakage characteristic of the illuviated layers in soils of the Russell group. This layer extends to a depth of 18 inches, where it grades into unconsolidated shale containing considerable gritty material. A small quantity of glacial material and fragments of shale occur in the solum.

The light-colored soils with imperfectly developed soil profiles include 5 types of soils and 2 phases, namely, Conover silt loam, Genesee silt loam, Genesee fine sandy loam, Genesee fine sandy loam, high-bottom phase, Genesee clay loam, Eel silty clay loam, and Eel silty clay loam, dark-colored phase.

Conover silt loam differs to a marked degree from the other imperfectly drained light-colored soils. It occurs on the upland, occupies imperfectly drained areas, and is closely associated with the Brookston soils. Its characteristics are intermediate between those of Delmar silt loam and the dark-colored poorly drained soils. The surface layer is distinctly dark colored but is only 4 or 5 inches thick. It is underlain by an eluviated light-colored layer. Below a depth of 10 inches, however, this soil closely resembles Brookston silty clay loam at corresponding depths. The material changes abruptly from loose incoherent structureless light grayish-yellow silt loam to very dark brown heavy clay loam, high in nitrogen, that breaks into large prismatic blocks. Above this transitional layer the reaction is slightly acid, but below, the material is neutral or slightly alkaline. At a depth of 26 inches the material changes to grayish-yellow plastic clay loam. As depth increases the material becomes more yellow, less plastic, and contains less clay, and at a depth of 48 inches it effervesces with acid.

All the rest of the light-colored soils with imperfectly developed profiles, with the exception of Genesee fine sandy loam, high-bottom phase, occupy first-bottom land and are subject to periodic overflow. All of them have developed, however, from recently deposited alluvium, and, as no horizons of eluviation and illuviation have developed, their profiles indicate that very little weathering has taken place. The surface soil of Genesee silt loam to a depth of 6 inches is nearly structureless brown silt loam. Below a depth of 6 inches the material is slightly lighter in texture and color. The sand content increases with increasing depth, and below a depth of 36 inches the material in most places consists entirely of stratified very fine sand. Nearly all the areas of this soil occur in the larger bottoms. Genesee fine sandy loam occurs in the small stream bottoms and in the large Wabash River bottom, where, during overflow, the swifter running water has deposited the coarser materials. Fine sand predominates throughout the profile in this soil, and in places gravel occurs in the subsoil.

The dark-colored soils having well-developed profiles are analogous to the light-colored soils having well-developed profiles and good drainage. This large group of dark-colored soils, as previously stated, is divided into two subgroups, the Dana group, and the Warsaw group. The Dana group includes Dana silt loam, Carrington silt loam, and Toronto silt loam.

Dana silt loam may be considered as having a soil profile characteristic of soils of the dark-colored well-drained group. Its characteristics are clearly expressed, it has developed under conditions of normal rainfall of the region, and its surface relief is sufficiently sloping to allow immediate run-off but not enough so to cause excessive erosion. Internal drainage is moderately good. In a pit one fourth mile north and one tenth mile west of the southeastern corner of sec. 31, T. 16 N., R. 10 W., an area of Dana silt loam shows the following profile:

A_1. From 0 to 1½ inches, loose very dark brown silt loam with single-grain or fine-granular structure. When the material is crushed it becomes very slightly lighter in color. The pH value is 5.37.

A_2. From 1½ to 5 inches, very dark brown silt loam having a slightly platy structure. The platy structure, however, is not dominant, as most of the structure particles occur as rounded granules one sixteenth inch in diameter. The pH value is 5.30.

A_3. From 5 to 11 inches, very fine granular silt loam which is slightly heavier than the material in the layer above. The dark-brown color changes very slightly when the material is crushed. The pH value is 5.59.

B_1. From 11 to 15 inches, silty clay loam which breaks into angular particles averaging one fourth inch in diameter. The dark yellowish-brown color of the structure particles changes to a slightly lighter color when the particles are broken or crushed. This layer contains some organic matter. The pH value is 5.72.

B_2. From 15 to 20 inches, yellowish-brown silty clay which breaks into angular particles from one half to 1 inch in diameter. The breakage into these structure particles is very distinct, and the particles change considerably when they are broken apart or are crushed. The dark-brown color indicates that some organic matter penetrates into this layer. The pH value is 6.07.

B_3. From 20 to 34 inches. This layer differs from the layer above in having a lighter texture and color and in being less compact. The pH value is 6.79.

C_1. From 34 to 42 inches, friable yellow silt loam containing slight gray mottlings. A few pebbles occur in this layer, but nearly all the material is of smooth silty texture. The breakage is irregular and forms large bodies. The pH value is 7.87.

C_2. From 42 to 54 inches, material similar to that in the layer above, except that more stones and pebbles occur in this layer. The pH value is 7.99.

C_3. From 54 inches downward, material similar to that in the two layers above, except that it shows less evidence of weathering and contains considerable quantities of free lime carbonate. The pH value is 8.49.

Carrington silt loam is closely associated with Dana silt loam, and the two soils are similar in their general profile characteristics. Carrington silt loam occupies the more undulating areas and everywhere occurs in higher positions than do the adjoining areas of Dana silt loam. It has a more friable and lighter yellowish-brown subsoil. The very dark surface soil is thinner and the organic-matter content is lower. Carbonates occur at about the same depth in both soils.

Toronto silt loam has some characteristics of both the light-colored and the dark-colored well-drained soils of the county. This soil shows evidence of having had a prairie cover for a period of time, followed by a forest cover for a time. It occurs in areas within the typical forest region adjoining the prairie, in the typical prairie regions adjoining the forest, or in areas covered by hazel brush lying between the two regions. This soil is almost entirely confined to moderately well drained areas lying between drains that project into the prairie region. The surface soil to a depth of 7 inches is very similar to that of Carrington silt loam at the corresponding depths, but a thin layer, in which a small quantity of light-gray silty material is present, is in the lower part of the organic horizon. Beneath the very dark brown horizon the general sequence of layers and their characteristics are very similar to those of the corresponding layers of Russell silt loam.

Warsaw sandy loam is the only soil weathered from gravel recognized in the group of dark-colored soils with well-developed profiles. The horizon of illuviation and the parent material are very similar to the corresponding layers in soils of the Fox group. The surface layers, or the horizon of eluviation, differ from those of soils of the Fox group in texture and organic content. This soil has developed under a grass cover and in consequence has incorporated in its surface layers enough organic matter to make the material very dark. Some variation occurs in the texture of the surface soil, but in most of the areas mapped it is sandy loam. The reaction of this soil is very similar to that of soils of the Fox group.

The Brookston group of soils, as previously stated, includes soils having imperfectly developed profiles and distinctly dark colored surface soils. These soils are differentiated from soils of the other groups because the horizons of eluviation and illuviation are very feebly expressed. These soils were or are naturally poorly drained, and water, when not artificially removed, often stands on the surface for a long time. Therefore, conditions have been favorable for the accumulation of organic matter. The slough grasses and water sedges have aided the accumulation of considerable organic matter in the soils. The soils in this group are Brookston silty clay loam, Brookston silty clay loam, prairie phase, and Clyde clay.

Brookston silty clay loam, together with its prairie phase, is the predominant soil in the group. The prairie phase, as the name implies, occurs in the prairie section and the typical Brookston soil in the timber section. The profile of the Brookston soil may be divided into three horizons, namely, organic horizon, weathered mineral horizon, and unweathered parent material. The horizon of high organic-matter content extends to a depth ranging from 12 to 15 inches. The surface soil to a depth of 2 inches is very dark brown or black friable silty clay loam of faint fine-granular structure. As the depth increases the material in this horizon changes to clay loam, plasticity increases, and the breakage into structure particles is more pronounced. In most areas the reaction is very slightly acid to a depth of 6 inches. Between depths of 12 and 16 inches is a transitional layer from the organic horizon to the mineral horizon, in which the color is dark brown and considerable organic matter is mixed with the mineral material. Breakage is into sharp angular particles one fourth inch in diameter. All the material below a depth of 6 inches is clay loam, but at a depth of 36 inches it becomes slightly less plastic and lighter in texture. Below a depth of 16 inches the color is dull grayish brown, the amount of brown increasing with depth. The parent material is structureless heavy silty clay loam containing considerable gritty material. It is comparatively high in free lime carbonate.

Clyde clay occurs almost entirely in the prairie section, but a few areas occur in the timber section along wide shallow drains. As a whole, Clyde clay occupies extremely poorly drained areas. Its general profile characteristics are similar to those of Brookston silty clay loam. It differs from that soil in having a neutral or slightly alkaline surface soil, a heavy clay loam material that breaks into sharply angular particles with smooth surfaces, and a gray subsoil, or mineral horizon, containing very little yellow. The thicknesses of the horizons are very nearly the same as of the corresponding horizons in Brookston silty clay loam, except that the organic horizon is somewhat thicker in the Clyde soil. There is practically no indication of horizons of eluviation or illuviation in Clyde clay.

THE MANAGEMENT OF VERMILLION COUNTY SOILS [4]

The farmer should know his soil and have a sound basis for every step in its treatment. Building up the productivity of a soil to a high level, in a profitable way, and then keeping it up is an achievement toward which every farmer should strive. The business of farming should be conducted as intelligently and as carefully as a manufacturing business, in which every process must be understood and regulated in order to be uniformly successful. The farmer's factory is his farm, and a knowlege of the soil is highly important. Different soils present different problems as to treatment, and these must be studied and understood, in order that crops may be produced in the most satisfactory and profitable way.

The purpose of the following discussion is to call attention to the deficiencies of the several soils of the county and to outline in a general way the treatments most needed and most likely to yield satisfactory results. No system of soil management can be satisfactory unless in the long run it produces profitable returns. Some soil

[4] This section of the report was written by A. T. Wiancko and S. D. Conner, Department of Agronomy, Purdue University Agricultural Experiment Station.

treatments and methods of management may be profitable for a time but ruinous in the end. One-sided or unbalanced soil treatments have been altogether too common in the history of farming in the United States.

CHEMICAL COMPOSITION OF VERMILLION COUNTY SOILS

Table 4 gives the results of chemical analyses of the different types of soil in Vermillion County, expressed in pounds of elements in 2,000,000 pounds of plowed surface soil of an acre.

TABLE 4.—*Quantities of phosphorus, potassium, and nitrogren per acre of surface soil 6 to 7 inches deep in Vermillion County soils*

Soil no.	Soil type	Phosphorus [1]	Potassium [1]	Phosphorus [2]	Potassium [3]	Nitrogen [3]
		Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
52X	Toronto silt loam	60	185	1,485	29,400	2,800
52	Dana silt loam	192	336	1,748	33,400	4,200
53	Carrington silt loam	79	235	1,310	32,600	3,400
41	Delmar silt loam	60	168	1,136	32,500	2,000
42	Fincastle silt loam	44	168	1,223	27,700	2,200
42X	Helt silt loam	52	150	1,310	29,800	1,800
43	Russell silt loam	60	319	1,136	33,600	2,000
43 B	Rush silt loam	60	218	1,310	29,600	2,800
34	Lordstown loam	52	235	1,485	30,400	3,400
48L	Conover silt loam	79	185	1,398	30,400	3,400
48	Brookston silty clay loam	157	286	1,573	33,100	4,600
55	Brookston silty clay loam, prairie phase	105	252	1,398	31,600	4,800
49	Clyde clay (timber covered)	175	269	2,709	32,500	7,000
59	Clyde clay (prairie covered)	219	286	1,835	27,250	7,400
89	Warsaw sandy loam	96	303	1,784	26,050	3,200
84	Fox silt loam	157	286	1,784	24,200	2,600
84S	Fox loam	122	185	1,398	24,000	2,000
73	Eel silty clay loam	157	387	2,359	39,200	3,800
78	Eel silty clay loam, dark-colored phase	140	269	1,748	30,300	8,800
74H	Genesee clay loam	201	662	2,185	44,400	4,400
74	Genesee silt loam	201	1,040	2,272	39,600	4,400
74S	Genesee fine sandy loam	175	218	1,835	27,200	1,400
75	Genesee fine sandy loam, high-bottom phase	70	108	1,835	31,800	2,200

[1] Soluble in weak nitric acid (fifth normal).
[2] Soluble in strong hydrochloric acid (specific gravity 1.115).
[3] Total elements.

The analyses give the pounds of phosphorus and potassium soluble in weak (fifth normal) nitric acid, the pounds of phosphorus soluble in strong hydrochloric acid (specific gravity 1.115), the pounds of total potassium, and the pounds of total nitrogen.

The amount of phosphorus soluble in weak nitric acid is considered by many authorities as a very good indication of the relative availability of this element. Where the weak-acid soluble phosphorus runs less than 100 pounds to the acre, phosphates are usually needed for high crop yields. The more intensive the crop, the greater is the need for large quantities of available phosphorus. Everything else being equal, the more of this soluble phosphorus a soil contains, the less it is apt to need phosphates. The deeper the soil, the less it needs phosphates. Subsoils contain less available phosphorus than surface soils. A soil which has had the surface layer eroded, exposing the subsurface layers, is apt to be in need of phosphates.

The quantity of potassium soluble in weak acid is considered by some authorities as significant of the need of a soil for potash. This determination, however, is not so certain an indicator as is that for phosphorus. In general, however, the lower the soluble potassium, the greater is the need for potash. The potassium of the subsoil is fairly available, and potash is more apt to be needed on flat uneroded land than on sloping eroded soils. Sandy soils and muck soils are more often in need of potash than clay and loam soils. Poorly drained soils and soils with impervious subsoils usually need potash more than well-aerated, deep soils.

The strong-acid soluble phosphorus, the total potassium, and nitrogen are given as an indication of the plant-food content of the soil. The total amounts of phosphorus and potassium are more valuable as an indication of the origin of the soil than they are of the need of the soil for these elements, as much of the phosphorus and potassium in soils is very insoluble and extremely slow in availability. The total content of nitrogen is to a great extent indicative of the nitrogen and organic-matter content of the soil. Soils of low nitrogen content soon wear out, and this and other plant-food elements should be replenished by legumes, manure, and fertilizer. The darker the soil, the higher it is in organic matter and nitrogen and the longer it may be cropped without the use of nitrogenous fertilizer.

No one method of soil analysis will definitely indicate the deficiencies of a soil. For this reason these chemical data are not intended to be the sole guide in determining the needs of the soil. The depth of the soil, the physical character of both surface soil and subsoil, and the previous treatment and management of the soil are all factors of the greatest importance and should be taken into consideration. Pot tests indicate that nitrogen and phosphorus are much less available in the subsurface soils and subsoils than they are in the surface soils. On the other hand, potassium in the subsoil seems to be of relatively high availability. Crop growth depends largely on the amount of available plant food with which the roots may come in contact. If the crop can root deeply, it may be able to make good growth on soils of relatively low analysis. If the roots are shallow, the crop may suffer for lack of food, particularly potash, even on a higher-analysis soil. The better types of soils and those containing large amounts of plant-food elements will endure exhaustive cropping much longer than the soils of low plant-food content.

The nitrogen, phosphorus, and potassium contents of a soil are not the only chemical indications of high or low fertility. One of the most important factors in soil fertility is the degree of acidity. Soils which are very acid will not produce well, even though there be no lack of plant-food elements. Though nitrogen, phosphorus, and potassium are of some value when added to acid soils, they will not produce their full effect where lime is deficient. This is particularly true of phosphorus. Table 5 shows the percentage of nitrogen and the acidity of the various soils in Vermillion County. The acidity is expressed as pH, or intensity of acidity. A soil of pH 7 is neutral and contains just enough lime to neutralize the acidity. If the pH is more than 7, it means that there is some excess of carbonate of lime. From pH 6 to pH 7 indicates slightly acid soils and from pH 5 to pH 6 soils of medium acidity. If the pH runs below 5, the soil is strongly acid. As a rule, the stronger the acidity the more a soil needs lime.

TABLE 5.—*Percentage of nitrogen and acidity of Vermillion County soils*

Soil no.	Type of soil	Depth	Nitrogen	pH	Average depth of acid soil	Indicated lime requirement per acre
		Inches	*Percent*		*Inches*	*Tons*
		0–6	0.14	6.0		
52X	Toronto silt loam	6–18	.08	5.8	46	1–2
		18–36	.04	5.8		
		0–6	.21	5.7		
52	Dana silt loam	6–18	.15	5.8	34	1–2
		18–36	.08	6.0		
		0–6	.17	5.8		
53	Carrington silt loam	6–18	.11	5.5	60	1–2
		18–36	.07	5.3		
		0–6	.10	5.8		
41	Delmar silt loam	6–18	.05	5.2	50	1–2
		18–36	.04	5.1		
		0–6	.11	5.9		
42	Fincastle silt loam	6–18	.05	5.3	50	1–2
		18–36	.04	5.2		
		0–6	.09	6.3		
42X	Helt silt loam	6–18	.06	6.0	20	1–2
		18–36	.04	7.3		
		0–6	.10	5.8		
43	Russell silt loam	6–18	.06	5.3	60	1–2
		18–36	.04	5.2		
		0–6	.14	5.8		
43B	Rush silt loam	6–18	.07	5.6	54	1–2
		18–36	.03	5.3		
		0–6	.17	5.6		
34	Lordstown loam	6–18	.04	5.3	[1]	1–2
		18+	.03	4.7		
		0–6	.17	5.9		
48L	Conover silt loam	6–18	.06	6.2	18	1–2
		18–36	.04	7.5		
		0–6	.23	6.1		
48	Brookston silty clay loam	6–18	.10	7.2	[2]	0–1
		18–36	.04	7.6		
		0–6	.24	6.0		
55	Brookston silty clay loam, prairie phase	6–18	.18	6.4	20	0–1
		18–36	.06	7.5		
		0–6	.35	7.3		
49	Clyde clay (timber covered)	6–18	.16	7.0	0	None
		18–36	.05	7.5		
		0–6	.37	7.4		
59	Clyde clay (prairie covered)	6–18	.28	7.5	0	None
		18–36	.05	7.7		
		0–6	.16	6.2		
89	Warsaw sandy loam	6–18	.10	6.0	36	1–2
		18–36	.08	6.6		
		0–6	.13	6.3		
84	Fox silt loam	6–18	.09	6.2	45	1–2
		18–36	.05	5.4		
		0–6	.10	5.9		
84S	Fox loam	6–18	.06	7.4	[3]	0–1
		18–36	.04	7.5		
		0–6	.19	7.8		
73	Eel silty clay loam	6–18	.19	7.7	0	None
		18–36	.18	7.7		
		0–6	.44	7.2		
78	Eel silty clay loam, dark-colored phase	6–18	.14	7.5	0	None
		18–36	.09	7.6		
		0–6	.22	7.8		
74H	Genesee clay loam	6–18	.20	7.6	0	None
		18–36	.17	7.6		
		0–6	.22	7.8		
74	Genesee silt loam	6–18	.14	[4]	0	None
		18–36	.11	[4]		
		0–6	.07	7.6		
74S	Genesee fine sandy loam	6–18	.11	[4]	0	None
		18–36	.06	[4]		
		0–6	.11	5.5		
75	Genesee fine sandy loam, high-bottom phase	6–18	.06	5.3	50	2–3
		18–36	.05	5.1		

[1] Acid to bedrock.
[2] None or surface soil only.
[3] Surface soil only.
[4] Calcium.

The acidity is reported for the surface soil (0 to 6 inches), for the subsurface soil, and for the deeper subsoil. It is important to know the reaction not only of the surface soil but of the lower layers of the soil as well. Given two soils of the same acidity, the one with the greater acidity in the subsurface layer is in greater need of lime than the other. Furthermore, the more organic matter and nitrogen a soil contains and the greater the depth to which these elements extend, the less will be the need for lime. The slighter the depth of acid soil, the less it is apt to need lime. Therefore, in determining how badly an acid soil may need lime, it is necessary to know the pH, or intensity of acidity, and the amount of nitrogen and organic matter it contains. It is well to remember that sweetclover, alfalfa, and red clover need lime more than other crops. As it is advisable to grow these better soil-improvement legumes in the rotation, it is in many places desirable to lime the land so that sweetclover or alfalfa will grow. A soil ranging from pH 7 to pH 8 is ideal for these legumes. Grain crops do well on slightly acid soils.

In interpreting the soil survey map and soil analyses, it should be borne in mind that a well-farmed, well-drained, well-fertilized, well-manured soil which is naturally low in fertility will produce larger crops than a poorly farmed soil naturally higher in fertility.

SOIL MANAGEMENT

For convenience in discussing the management of the several soils of the county, they have been arranged in groups according to certain important characteristics which indicate that in many respects similar treatment is required. For example, several of the upland silt loams, which have practically the same requirements for their improvement, may be conveniently discussed as a group, thus avoiding the repetition that would be necessary if each were discussed separately. Where different treatments are required, these are specifically pointed out. The reader should study the group, including the soils in which he is particularly interested.

LIGHT-COLORED UPLAND SOILS

The group of light-colored upland soils includes the silt loams of the Conover, Delmar, Fincastle, Helt, Rush, and Russell series and the loams of the Lordstown, Fincastle, and Russell series. Although Rush silt loam is, strictly speaking, a terrace soil, its characteristics are similar to those of Russell silt loam and for practical purposes may best be discussed with the Russell soil. The two loam soils are included in this group because they are cropped and managed much like the other silt loams with which they are associated, and it does not seem worth while to discuss them as a separate group. The Lordstown soils, as mapped in this county, and Russell silt loam, slope phase, are regarded as either untillable or completely nonagricultural and useful only for pasture or woodland. They will not receive further attention here, as this discussion deals particularly with the tillable land. The tillable soils of this group occupy about 34 percent of the total area of the county. The Fincastle and Russell silt loams are most extensive, occupying about 25,500 and 22,900 acres, respectively. The other tillable silt loams, Helt, Rush, Conover, and Delmar, together occupy 4,032 acres. The Russell and Fincastle loams occupy 1,920 acres.

The practical problems in the management of these soils, with the exception of drainage, are more or less similar. All the soils are naturally deficient in phosphorus, nitrogen, and organic matter. They are, in general, low in available potash, especially the Delmar, Fincastle, and Conover soils, and all are more or less in need of lime.

DRAINAGE

Wherever there is a tight subsoil the land should be tiled, as without underdrainage the soil remains wet too long. Tile drainage helps to prevent surface run-off and erosion. Surface run-off carries away large quantities of available plant food which should go into the production of crops. Rain water should be absorbed by the soil, and the surplus should pass away through underdrains. Tile drainage increases the capacity of a soil to absorb water, lessens surface run-off and erosion, and also facilitates soil aeration which helps to render the plant food in the soil available, and it encourages deeper rooting of crops, which enables them to better withstand drought as well as to obtain more plant food. Rush silt loam, Russell silt loam, and Russell loam have fair or good natural drainage. The Conover, Delmar, Helt, and Fincastle soils are naturally poorly drained and are in need of underdrainage by means of tile. Their generally flat surfaces and tight subsoils make natural drainage very slow and difficult. A mottled subsoil is a further indication of insufficient natural drainage. Without tile drainage these soils cannot be managed to the best advantage, and no other beneficial soil treatment can produce its full effect. Results on experiment fields on other soils of similar texture and surface relief indicate that tile lines laid 30 inches deep and about 3 rods apart will give satisfactory results. Where the land is very flat, great care must be exercised in tiling, in order to obtain an even grade and uniform fall. Grade lines should not be established by guess or by rule-of-thumb method. Nothing less accurate than a surveyor's instrument should be used, and the lines should be accurately staked and graded before the ditches are dug, to make sure that all the water will flow to the outlet with no interruption or slackening of the current. The rate of fall may be increased toward the outlet, but it should never be decreased without inserting a silt well, as checking the current may cause the tile to become choked with silt. It is an excellent plan, before filling the ditches, to cover the tile to a depth of a few inches with straw, weeds, or grass. This prevents silt from washing into the tile at the joints while the ground is settling, thus insuring perfect operation of the drains from the beginning.

LIMING

All the soils of this group will respond profitably to liming. Soils of medium or strong acidity will not respond properly to other needed treatments until they have been limed. A strong indication of the need of liming is the failure of clover to do well on land that is otherwise in a fair state of fertility. However, the need for liming is so easily determined that a test should be made in each particular case. If the farmer himself cannot make the test, he should have it made by the county agricultural agent or by the agricultural experiment station at La Fayette. Ground limestone is the most economical form of lime to use in most places. Where liming is needed, the first application should, as a rule, be about 2 tons to the acre. After that a ton to the acre every second or third round of the crop rotation will keep the soil in good condition for most crops. Where alfalfa or sweetclover is to be grown on acid soil, heavier applications of lime may be needed.

Organic Matter and Nitrogen

The soils of this group, except some areas of Conover silt loam, are naturally low in nitrogen and organic matter, and where the land has been cropped for some time without adequate returns matters have been made worse, and in many places the original supplies of organic matter have become so reduced that the soil has lost much of its natural mellowness and easily becomes puddled and baked. This condition, in a large measure, accounts for the more frequent clover failures and the greater difficulty in obtaining proper tilth where the land has been cropped for a long time without adequate returns of organic matter.

Wherever these evidences of lack of organic matter and nitrogen occur, the only practical remedy is to plow under more organic matter than is used in the processes of cropping. Decomposition is constantly going on and is necessary in order to maintain the productivity of the soil. Decomposing organic matter must also apply the bulk of the nitrogen required by crops. For this reason legumes should provide as much as possible of the organic matter to be plowed under. To do this satisfactorily, the land must first be put in condition to grow clover and other legumes. This means liming whereever the soil is acid. Wet lands must also be tile drained. Clover or some other legume should appear in the rotation every 2 or 3 years; as much manure as possible should be made from the produce that can be utilized by livestock; and all produce not fed to livestock, such as cornstalks, straw, and cover crops, should be plowed under directly. It must be remembered that legumes are the only crops that can add appreciable quantities of nitrogen to the soil, and these only in proportion to the amount of top growth that is plowed under, either directly or in the form of manure. Wherever cloverseed crops are harvested, the haulm should be returned to the land and plowed under. Cover crops should be grown wherever possible to supply additional organic material for plowing under. Seeding rye as a cover crop in September on corn land that is to be plowed the following spring is good practice for increasing organic matter and conserving nitrogen. It is important to have some kind of a growing crop on these soils during the winter, in order to take up the soluble nitrogen which would otherwise be lost through leaching. Without living crop roots to take up the nitrates from the soil water, large losses will occur between crop seasons through drainage, and there will also be more soil erosion on slopes and hillsides. Both of these losses may be greatly lessened by a good cover crop of winter rye on all land that would otherwise be bare during the winter. The rye should be run down with a heavy disk and plowed under before heading.

Crop Rotation

With proper fertilization, and liming and tile drainage where needed, these soils will satisfactorily produce all the ordinary crops adapted to the locality. On account of the prevailing shortage of organic matter and nitrogen, every system of cropping should include clover or some other legume to be returned to the land in one form or another. Corn, wheat, and clover constitute the best short rotation for general use on these soils, especially when the corn can be cut and the ground disked and properly prepared for wheat. In this position in the rotation, wheat needs a high-analysis complete fertilizer, and the quantity applied should be sufficient to help the clover also. Oats are used by many farmers as the small-grain crop, but as a rule they are not so well adapted to these soils and climatic conditions in general, as wheat. Corn, soybeans, wheat, and clover constitute an excellent 4-year rotation. The two legumes in the rotation will build up the nitrogen supply. When the soybean is first introduced, the seed should be carefully inoculated with the proper variety of nitrogen-gathering bacteria, and this inoculation should be applied at least 2 years in succession. The soybean straw should be spread on the wheatland in the winter. This will not only help the wheat and lessen winter injury, but it will help to insure a stand of clover. The soybean is not only a good crop in itself, but it also adds some nitrogen to the soil and improves it for the crop that follows. If more corn is wanted, as on livestock farms, the 5-year rotation of corn, corn, soybeans, wheat, and clover may be used satisfactorily where the second corn crop can be given a good dressing of manure. A cover crop of rye, for plowing under the following spring, should be seeded in September on all the cornland. Where, owing to climatic conditions, clover is uncertain in any of these rotations, it has proved to be a good plan to sow a mixture of seeds made up of about 4 pounds of red clover, 3 pounds of alfalfa, 2 pounds of alsike, and 1 pound of timothy to the acre.

Alfalfa and sweetclover may be grown on the better-drained and more friable soils of this group, if the soils are properly inoculated and sufficiently limed to meet the needs of these crops. The brown soils of this group are better adapted to these crops than the gray soils. Alfalfa is preferable for hay, and sweetclover is excellent for pasture and for soil-improvement purposes. Lespedeza is an acid-tolerant legume, especially valuable in pastures. Special literature on the cultural requirements of these crops can be obtained from the Purdue University Agricultural Experiment Station at La Fayette.

Fertilization

All the soils of this group are naturally low in phosphorus, and in most of them the available supplies of this element are so low that the phosphorus required by crops should be wholly supplied in applications of manure and commercial fertilizer. The nitrogen supplies in these light-colored soils are also too low to satisfactorily meet the needs of corn, wheat, and other nonleguminous crops, and provision for adding nitrogen should be an important part of the soil-improvement program. The total quantities of potassium in these soils are large, but the available supplies are low, and in most places the addition of some potash fertilizer would be profitable, especially where little manure is applied.

The problem of supplying nitrogen has been discussed in connection with provisions for supplying organic matter. Legumes and manure are the logical and only really practical means of supplying the greater part of the nitrogen needed by crops, and they should be largely relied on for this purpose. A livestock system of farming, with plenty of legumes in the crop rotation, is, therefore, best for these soils. However, it will generally pay to have some nitrogen in the fertilizer for wheat, regardless of its place in the rotation. Even though wheat follows soybeans or other legumes, it should receive some fertilizer nitrogen at seeding time to properly start the crop, because the nitrogen in the residue of any immediately preceding legume does not become available quickly enough to be of much help to the wheat in the fall. The material must first decay, and that does not take place to any considerable extent until the following spring.

Phosphorus is the mineral plant-food element in which all these soils are most deficient. The only practical way to increase the supply is through the application of purchased phosphatic fertilizers. It will pay well to supply the entire phosphorus needs of crops in this way. In rotations of ordinary crops, producing reasonable yields, it may be counted that 20 pounds of available phosphoric acid to the acre are required each year. It will pay well to supply larger amounts at first, so as to create a little reserve. Enough for the entire rotation may be applied at one time or the application may be divided according to convenience. Where manure is applied, it may be counted that each ton supplies 5 pounds of phosphoric acid, therefore a correspondingly smaller quantity of phosphoric acid need be provided in the form of commercial fertilizer.

The quantity of potash that should be applied as fertilizer depends on the general condition of the soil and the quantity of manure used. The flat poorly drained areas of the gray soils are the ones most likely to be in need of potash fertilizer. On soils that have become run down, any program for their improvement should include potash fertilizer, at least until such time as rather large quantities of manure can be supplied or until the general condition of the soil has materially improved. The availability of the soil potash may be increased by good farm practices, including proper tillage, tile drainage, the growing of deep-rooted legumes, and the plowing under of liberal quantities of organic matter. The better these practices are carried out and the larger the quantity of manure applied, the less potash fertilizer need be purchased.

In the fertilization of these soils, the manure should usually be plowed under for the corn crop, but a part, about 2 tons to the acre, may be applied profitably on wheat as a top dressing during the winter. Such use of a part of the manure not only helps the wheat and lessens winter injury but also helps to insure a stand of clover or other crop seeded in the wheat. As a rule, the manured corn should also receive some available phosphate in the hill or row at a rate ranging from 100 to 150 pounds to the acre. Without manure, a phosphate and potash mixture may be preferable. Wheat should always be given from 200 to 300 pounds to the acre of a high-analysis complete fertilizer, such as a 2-12-6[5] mixture at seeding time. A top dressing ranging from 15 to 20 pounds of soluble nitrogen applied in April when the wheat is 2 or 3 inches high may be expected to cause an increase of 5 or 6 bushels to the acre. Where properly fertilized corn and wheat are included in the rotation, there will be little need for fertilizer on other crops. Oats and soybeans, as a rule, will not give much response to direct applications of fertilizer.

PRAIRIE HIGH GROUND

The group of prairie high ground soils includes the silt loams of the Carrington, Dana, and Toronto series. They occupy 13,376 acres, or 8.2 percent of the total area of the county. The Carrington and Dana are strictly prairie soils, whereas the Toronto occupies the edge of the prairies next to the timber soils and was originally occupied by small trees and shrubs, such as hazel brush.

The practical problems in the management of these prairie soils vary somewhat, owing to differences in natural fertility and drainage. Dana silt loam is the most productive soil of the group, in most places containing good supplies of organic matter and available plant food; Carrington silt loam is not so well supplied with organic matter and is much lower in available phosphorus; and Toronto silt loam has a comparatively limited supply of organic matter and nitrogen and is rather low in available phosphorus and potassium.

Drainage

Carrington silt loam has fair natural drainage and will produce very well without tiling. Toronto silt loam and some of the lower-lying areas of the Dana soil are benefited by artificial drainage. Where more tile drainage is needed, the same procedure should be followed as that suggested for the light-colored upland soils previously discussed.

Liming

These soils are all of medium acidity and will respond profitably to liming at a rate ranging from 1 to 2 tons of ground limestone to the acre.

Organic Matter and Nitrogen

Dana silt loam and Carrington silt loam are naturally fairly well supplied with organic matter and nitrogen and with reasonable care and the growth of some legumes can be kept in satisfactory condition in this respect. Toronto silt loam contains only moderate supplies of organic matter and nitrogen in the surface soil, and the content of these constituents decreases rapidly with depth, so that more attention to maintenance is needed and the use of leugmes is more important than on the other soils of the group. They should all receive some nitrogen in the fertilizer for wheat.

Crop Rotation

These soils are among the best in the county and will produce all the ordinary crops of the region. They are especially well suited to

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[5] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

corn, and this should be the major crop in most places. Among the rotations that may be satisfactorily employed are the following: Corn, wheat or oats, and clover; corn, corn, wheat or oats, and clover; corn, soybeans, wheat or oats, and clover; and corn, corn, soybeans, wheat or oats, and clover. A good seed mixture for hay or pasture in any of these rotations, where clover alone is not dependable, is about 4 pounds of red clover, 3 pounds of alfalfa, 2 pounds of alsike clover, and 1 pound of timothy to the acre. Alfalfa and sweetclover may be grown on Carrington silt loam and on the better-drained areas of the Toronto and Dana soils if properly inoculated and the land sufficiently limed to meet the needs of these crops. Alfalfa is preferable for hay, but sweetclover is excellent for pasture and for soil-improvement purposes. Whenever clover fails, soybeans make a satisfactory substitute crop for legume hay.

Fertilization

Where legumes are included in the crop rotation the Dana and Carrington soils do not need nitrogen in the fertilizer for the ordinary field crops, except wheat. Toronto silt loam is much more limited in its natural supply of nitrogen and should be treated more like the light-colored upland soils previously discussed. Dana silt loam is naturally the most fertile soil of the group. The Toronto and Carrington soils, especially the Toronto, are generally deficient in available phosphorus and to some extent in available potash, and, except where large quantities of manure are used, there is likely to be need of potash in the fertilizer. As a rule, wheat will be the only crop to respond to complete fertilizer, and it should generally receive a mixture at least as good as 2-12-6. Wheat will also generally respond to a top dressing of nitrogen in the spring. Corn, at least on the Toronto and Carrington soils, should receive some phosphate in the hill or row, in addition to manure, or, in the absence of manure, a phosphate and potash mixture at the rate of about 100 pounds to the acre. Oats and soybeans, as a rule, will not respond to direct applications of fertilizer, and where these crops are included in the rotation their needs should be provided for through larger quantities of fertilizer elsewhere in the rotation.

DARK-COLORED UPLAND DEPRESSION SOILS

The group of dark-colored upland depression soils includes Brookston silty clay loam, Brookston silty clay loam, prairie phase, and Clyde clay. They occupy 29,056 acres, or 17.8 percent of the total area of the county. Brookston silty clay loam, prairie phase, is similar to Brookston silt loam mapped in White and Benton Counties, which was also developed under prairie cover, and it is characterized by the high organic-matter content of the subsurface soil. It should be noted also that the Clyde clay on the prairie has more organic matter in the subsurface soil than has this soil in the timber belt of the county.

Drainage

All these soils are more or less in need of artificial drainage. Their dark color indicates a swampy origin where natural drainage was poor. To a large extent artificial drainage has been provided for these soils, and surplus water is fairly well taken care of. In many places, however, there would be good response to more tiling. Where this is needed, the same procedure should be followed as that suggested for the light-colored silt loam upland soils.

Liming

Clyde clay does not show any lime requirement, but Brookston silty clay loam and Brookston silty clay loam, prairie phase, show some acidity in the surface soil and would probably respond to a little liming for sweetclover and similar lime-requiring legumes.

Organic Matter and Nitrogen

These soils are naturally well enough supplied with organic matter and nitrogen to meet the needs of most crops, and, with reasonable care in their management, no special provisions for supplying these constituents will be necessary for a long time. However, if wheat is grown it should receive some readily available nitrogen in the fertilizer. Wheat will also respond to top dressing with nitrogen in the spring, even on these high-nitrogen soils.

Crop Rotation

These dark-colored soils are among the best in the county and will produce all the ordinary crops adapted to the region. They are especially well suited to corn, and this should generally be the major crop. The crop rotations indicated for the prairie high ground apply equally well to these depression soils.

Fertilization

With legumes in the crop rotation, the fertilizer applied to these soils need not contain nitrogen, except for wheat which, as a rule, should receive a good complete fertilizer, such as a 2-12-6, to start it properly in the fall. Where grain farming has been practiced for a long time, corn should probably receive some available phosphate, in the hill or row, and perhaps a phosphate-potash mixture where no manure is used.

SECOND-BOTTOM OR TERRACE SOILS

The group of second-bottom or terrace soils includes the silt loam, loam, and gravelly loam of the Fox series and the sandy loam of the Warsaw series. They occupy 21,696 acres, or 13.2 percent of the total area of the county. Warsaw sandy loam accounts for 6 percent, Fox silt loam 4.4 percent, and Fox loam somewhat more than 2 percent. These terrace soils are generally extensive enough, on the farms where they occur, to require special consideration. They are all more or less droughty, on account of gravelly subsoils and the consequent limited water-holding capacity. All crops, except the deepest-rooted legumes, suffer from lack of moisture during dry spells in the summer.

Liming

As Fox silt loam and Warsaw sandy loam are acid in both surface soil and subsoil, they should receive from 1 to 2 tons of ground limestone to the acre. Fox loam is acid in the surface soil only and requires only a small amount of lime. In places where the gravel extends to the surface, there is no need for liming.

Organic Matter and Nitrogen

The organic-matter and nitrogen requirements of these soils are practically the same as those mentioned for the light-colored terrace soils. The surface soil of Warsaw sandy loam contains a fair supply of organic matter, and if this is conserved and supplemented from time to time, the soil will need no special attention in this respect. The lighter-colored Fox soils, particularly the shallower areas, are especially in need of more organic matter to improve their water-holding capacity and to render them less droughty. Legumes, cover crops, and other special green-manure crops, in addition to manure, should be used as much as possible for plowing under.

Crop Rotation

As a rule, corn does not do well on these terrace soils, on account of the gravelly subsoils which make them droughty in the summertime when corn needs large amounts of moisture. The land is better adapted to the deep-rooted legumes, such as red clover, alfalfa, and sweetclover, which penetrate to deeper levels and have greater power to resist summer droughts. The small grains, especially winter wheat and rye, which mature early in July, usually escape serious injury from drought, but oats and barley do not do so well. Soybeans and lespedeza, because of their acid tolerance and ability to resist drought, are especially well suited to these soils. Grass, as a rule, does not do well.

Fertilization

The light-colored terrace soils should be fertilized in about the same way as the light-colored upland soils. Nitrogen should be supplied largely through legumes and manure. Considerable quantities of available phosphate should be applied for all crops, and, when manure is scarce, some potash fertilizer will generally be beneficial. Wheat should always receive a good complete fertilizer. For alfalfa, a half-and-half phosphate-potash mixture, in addition to lime, will give good results. Where truck crops are grown, special fertilization should be practiced, according to the needs of the particular crop.

BOTTOM LANDS

The group of bottom lands includes the clay loam, silt loam, fine sandy loam, and fine sandy loam, high-bottom phase, of the Genesee series and the silty clay loam of the Eel series. These bottoms occupy 25,024 acres, or 15.2 percent of the total area of the county. Genesee fine sandy loam predominates, accounting for 7.6 percent, and Genesee silt loam accounts for 4.8 percent.

Except on the rather unusual high-bottom phase of Genesee fine sandy loam, which is droughty and acid, the greatest problem in the management of these soils is to provide adequate drainage and to prevent damage from flooding. The heavier areas should be tiled wherever suitable outlets can be provided, in order that surplus water may drain away more readily. With the exception of Genesee fine sandy loam and some areas of Eel silty clay loam, these soils are fairly well supplied with organic matter and nitrogen. On the lighter-colored areas, provision should be made for increasing the organic-matter and nitrogen supplies by applications of manure and by the incorporation of other organic materials, such as crop residues and specially grown cover crops or intercrops.

Liming is not required, except on the high-bottom phase of Genesee fine sandy loam which is acid in both surface soil and subsoil and should receive from 2 to 3 tons of ground limestone to the acre.

Again excepting the high-bottom phase of Genesee fine sandy loam, which is in general poor and droughty, most of this land is best adapted to corn, but wherever excess water is not troublesome some other crop, such as wheat, oats, clover, and soybeans, should occasionally be included in the cropping system. Alfalfa will do well on Genesee fine sandy loam, high-bottom phase, if the land is properly limed and supplied with phosphate and potash.

The true bottoms receive rich sediment from periodic overflows and hence require little fertilizer. The high bottoms, however, will respond to fertilization, such as is recommended for the light-colored upland and terrace soils.

SUMMARY

Vermillion County is in the west-central part of Indiana, adjoining the State of Illinois. It is long and narrow, being about 38 miles from north to south and ranging from 5 to 9 miles from east to west. It comprises an area of 256 square miles, or 163,840 acres.

The climate is humid and temperate and is characterized by wide seasonal variations in temperature and rainfall. The normal frost-free season extends over a period of 169 days.

The elevation of the county ranges from about 500 to about 650 feet above sea level. The watershed slopes toward Wabash River. With the exception of part of the glacial upland, the county has adequate internal and surface drainage. Wabash River, Vermillion River, Little Vermillion River, and Brouilletts Creek form the principal drainage system of the county.

Physiographically, the county consists of glacial upland, outwash terrace, and bottom land. Approximately 21,696 acres are occupied by the outwash terrace, and 23,872 acres by the bottom land.

The soils of the county have been classified, according to their important characteristics, into 22 soil types, and 5 phases of types. With the exception of 1 type and 3 phases all the soils are favorable for agriculture and are called agricultural soils. All the soils unfavorable for agriculture, with the exception of one slightly weathered soil, occupy slopes or poorly drained areas, which are subject to frequent flooding.

The agricultural soils of the county fall into six groups, namely, the Russell, Delmar, Dana, and Brookston groups, which occupy the uplands of the county, and the Fox and Genesee groups, which occur on the terraces and bottom lands. The general adaptability of the soils of these groups to certain crops is reflected in the cropping systems and agricultural practices.

The soils in the Russell group have light-gray surface soils and moderately heavy subsoils. Internal drainage of these soils is fair. Fairly good crop returns can be obtained on these soils, especially when fertilizers are applied and proper crop rotations are practiced. General farming is carried on to a greater extent in the part of the county occupied by the soils of the Russell group than elsewhere. The principal crops grown are corn, wheat, clover, and oats, and the adaptability of these crops to the soils of this group and the necessity of using crops to maintain fertility have been influential in creating a self-sufficing type of agriculture. Although the relative proportion of soils of the different groups on the farms governs agriculture to a considerable extent, and the amount of soils in each group differs somewhat on different farms, the agriculture is determined very largely by the character of the soils of the Russell group.

Soils of the Delmar group are imperfectly drained and occupy small areas intimately associated with soils of the Russell group. These soils differ somewhat in productivity, but for the most part they are the most unproductive soils of the uplands. Their surface layers are light colored, structureless, and low in organic matter. The reaction of their subsoils differs considerably, ranging from very acid to alkaline, and the color ranges from very dark brown to yellow and grayish yellow.

Soils of the Dana group occupy two comparatively large areas in the county. These soils are characterized by dark surface layers overlying yellow moderately heavy subsoils. Soils of this group, in association with soils of the Brookston group, comprise the largest corn-producing areas of the county. General farming, similar to that practiced in the area occupied by the soils of the Russell group, has been gaining in popularity.

Soils of the Brookston group are the most highly productive soils in the county for corn. They occupy poorly drained areas which must be artificially drained. Their subsoils are neutral in reaction, and their surface soils range from slightly acid to neutral. Their surface layers are high in organic matter. The subsoils are gray or yellowish-gray clay, and the depth to the water table varies. Very rarely is any special attempt made to fertilize these soils.

Soils of the Fox group have gravelly subsoils which cause the soils to be droughty, especially where the surface layers are light in texture and the gravelly subsoil occurs within 24 inches of the surface. Wheat is in general more successful on these soils than on other soils of the county. Although clover and soybeans are gaining in popularity, wheat, sweet corn, and tomatoes are still the principal crops grown on these soils. Lime is practically the only fertilizer used.

Soils of the Genesee group are variable in their characteristics, but with the exception of one phase they are all neutral in reaction. They are subject to periodic overflow and require very little fertilization. With the exception of the areas along the narrow bottoms of the smaller streams, these soils are used in the production of corn, especially in the Wabash River bottoms where flooding is common.

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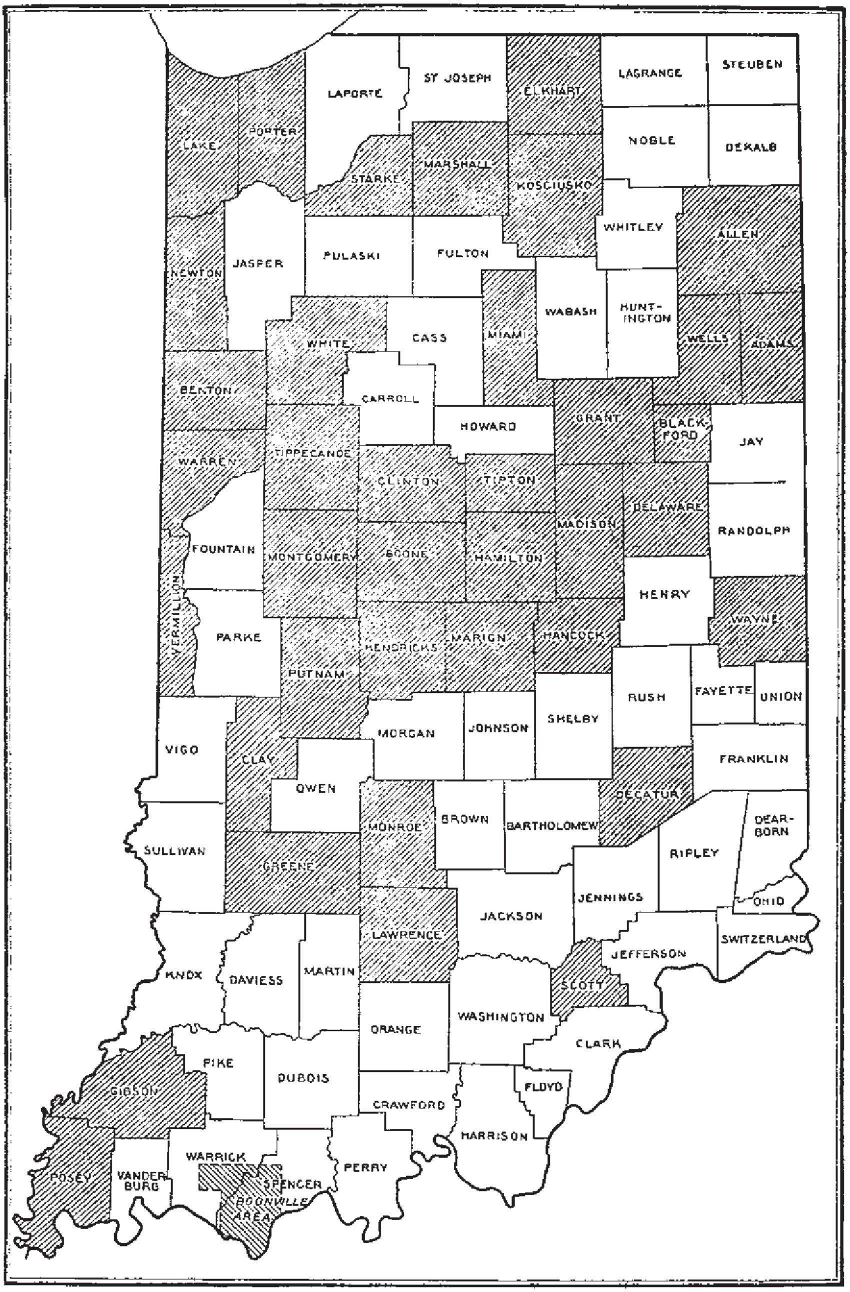

Areas surveyed in Indiana, shown by shading.

Detailed surveys shown by northeast-southwest hatching; reconnaissance surveys shown by northwest-southeast hatching.

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