

## SOIL SURVEY OF CLAY COUNTY, ILLINOIS.

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### LOCATION AND BOUNDARIES OF THE AREA.

Clay County lies near the center of the southern part of Illinois, about 100 miles directly east of St. Louis. It is situated between west longitude  $88^{\circ} 17'$  and  $88^{\circ} 43'$  and north latitude  $38^{\circ} 38'$  and  $38^{\circ} 55'$ . About one-half of its eastern boundary is formed by Big Muddy Creek and the Little Wabash River. In shape the county is almost square. Its distance from north to south is 21 miles, and its average width from east to west is about the same. It contains 294,336 acres, or about 460 square miles. (See fig. 13, p. 465.)

### HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

When the first immigrants came to Clay County the appearance of the country was very different from what it is to-day. The surface was about equally divided between forests and prairie. The former grew along the streams, and the latter occupied the level divides between them. The prairies were wet and miry and in the spring were almost impassable. They had a strong sod, which would hold up a wagon and team, but which would shake for rods around. Upon this sod grew a dense, tall prairie grass. Many ponds existed, and the water generally remained upon the surface until removed by evaporation. These prairies were the breeding place of myriads of flies, which were so troublesome in the early days of settlement that the farmers had to plow at night in order to avoid them. This fact, together with the general unhealthfulness of the prairies, led the early immigrants to take up the timber lands and to leave the prairie lands unclaimed and untouched.

Clay County was not one of the first counties of the State to receive the tide of immigration which flowed into the great West. There was not a settlement within the present limits of the county until 1810, when John McCawley erected his log cabin where the present town of Clay City stands. He was forced to flee for his life during the Indian war of 1812, but returned as soon as the Indians were subdued. The next settlement was made near Flora, in 1818. Although the county did not settle up very rapidly, immigrants, principally from Indiana, Ohio, and Kentucky, continued to arrive, and

settlement gradually extended until the greater portion of the county was brought under cultivation.

The lack of a natural outlet for the products of the county greatly retarded its development. The Little Wabash River is the only stream of any importance within the area, and it is too small to be of much use for transportation. Small flatboats, however, were built and floated down the river, and upon these were shipped considerable quantities of grain, beef, and pork. The construction in 1855 of the Ohio and Mississippi Railroad, now the Baltimore and Ohio Southwestern, furnished ready communication with other parts of the country and did much toward developing the county's resources.

Corn and wheat were for many years the principal products grown, and the exhaustive system of growing these crops upon the same land year after year caused a deterioration in the soil and a consequent decrease in the yields obtained, until the profit to be made from these crops was much decreased. The growing of hay and the raising of stock were gradually introduced and have proved profitable. The agricultural outlook, however, was not as encouraging as could be desired, and many farmers who were anxious to find some crop that would prove more profitable than the growing of corn and wheat turned their attention to fruit culture. From the time of the earliest settlers nearly every farmer had his small orchard to supply his own needs, but the apple crop did not become of sufficient importance to form one of the principal agricultural resources of the county until about 1883, and even then there were very few large orchards. Since then, however, the fruit business has been very greatly extended, until to-day Clay County ranks as one of the first counties in the Union in the growing of fruit. The fruit industry has infused new life into the agriculture of the area and is doing much to increase the general prosperity of the farmers.

#### CLIMATE.

The following table gives the normal temperature and precipitation at Flora, a Weather Bureau station in the northern part of the area. The figures show a comparatively uniform precipitation, with the maximum occurring during the growing season:

*Normal monthly and annual temperature and precipitation at Flora.*

Month.	Temperature.	Precipitation.	Month.	Temperature.	Precipitation.
	° F.	Inches.		° F.	Inches.
January .....	30.4	3.23	August .....	74.5	3.50
February .....	31.5	2.87	September .....	67.8	2.72
March .....	40.8	3.87	October .....	55.2	2.28
April .....	55.0	3.81	November .....	41.5	3.62
May .....	63.4	4.25	December .....	34.4	2.90
June .....	73.2	4.84	Year .....	53.5	42.45
July .....	76.9	4.56			

During the last two years the last killing frosts in spring have occurred about the middle of April and the first in the fall on September 30 and November 8, respectively. The records of frost occurrence are too meager to form the basis of a calculation of the length of the growing season.

#### PHYSIOGRAPHY AND GEOLOGY.

The surface of Clay County is that of a broad, level plain, through which the streams have carved out valleys from a few feet to 50 or 75 feet below the general level. The principal stream is the Little Wabash River, which crosses the county in a general southeasterly direction. This river, with its affluent streams, Big Muddy, Elm, and other smaller creeks, forms the natural drainage system, the general direction of which is toward the southeast. The bluffs along these streams generally rise rather abruptly to a height of from 10 to 50 feet or more, the height being greater in the northern than in the southern part of the county. In some cases, as north of Clay City, the ascent is very gradual and there is no sharp line between the bottoms and the uplands.

The erosive agencies have cut out narrow valleys which run back sometimes 3 or 4 miles into the uplands and give to the country along the streams a somewhat hilly and broken character. Between the streams level to gently rolling prairies extend, often for many miles. The general elevation of the county above sea level is about 500 feet.

Along many of the streams outcrops of the underlying rocks, which belong to the upper Coal Measures, were seen. These rocks are sandstones, sandy black shales, and limestones. Some thin seams of coal are found in these rocks, but they are not thick enough to be of much commercial importance. The seams of coal which are worked in St. Clair and other counties farther west probably underlie Clay County at a depth of from 800 to 1,000 feet below the surface, but they have not as yet been worked. Sandstones of fair quality for building purposes are found at several localities, and a few quarries were observed. Bands of iron ore are also intercalated in the beds of shale.

These underlying rocks have very little influence, at least directly, upon the character of the soil, for they are buried beneath a deposit of glacial drift. As the surface of the country was more or less eroded and uneven before the Glacial epoch, the depth of the drift varies in different localities from 10 to 40 or more feet. Only in a few very small areas has the glacial material been entirely removed. At Xenia and Flora this drift is 13 to 14 feet thick, and in wells bed rock is struck generally at 10 to 20 feet. The lower portion of the glacial material usually consists of a hard bluish or ash-gray clayey stratum, which is sometimes termed "hardpan." The upper part is composed of a reddish-brown, gravelly, sandy till, the percentage of

gravel and sand decreasing toward the upper part until at 4 to 6 feet below the surface they are almost entirely absent. This material is composed largely of the ground-up sandstones, shales, and limestones of the Coal Measures, while fragments of granites, quartzites, and syenites are not uncommon, and occasional nuggets of copper are met with.

## SOILS.

Clay County does not possess a great variety of soils, only four different types being recognized. The names of these, with the area occupied by each, are given in the following table:

*Areas of different soils.*

Soil.	Acres.	Percent.	Soil.	Acres.	Per cent.
Marion silt loam .....	260,544	88.5	Yazoo sandy loam.....	1,344	0.5
Waverly silt loam .....	30,976	10.5	Total .....	294,336	.....
Yazoo loam.....	1,472	.5			

## YAZOO LOAM.

The Yazoo loam is a slightly granular brown loam containing a considerable amount of organic matter, which gives it its dark color. It is sometimes slightly sandy near the river or near the Yazoo sandy loam. This character of material extends to an average depth of 9 inches and is underlain by a yellowish, friable, silty, and fine sandy loam, in which the sand content gradually increases with the depth until at about 24 inches below the surface it becomes a sandy loam and often almost a sand. The lower-lying sandy material is usually stained in spots by iron.

This type of soil is found in small, narrow, disconnected areas in the Little Wabash bottom. It does not occur frequently along the lower reaches of the river. It occupies a small percentage of the total area of the county, but ranks first in value for general agricultural purposes.

The surface features of the Yazoo loam are very similar in all the area. It is generally level, with slight elevations and depressions. It is somewhat cut up by old stream channels or washes made during times of high water, its elevation above the river not being sufficient to secure it against overflow.

The sandy character of the underlying material gives to this soil excellent natural drainage, and artificial drainage is seldom necessary. The Yazoo loam has been formed from the sediment deposited by the Little Wabash River during periods of overflow. It is strictly an alluvial soil and has in a high degree the natural fertility of this class of soils.

Probably two-thirds of the area occupied by this soil type has been

cleared and brought under cultivation. Corn forms almost the exclusive crop. The yield is about 50 bushels per acre. Hay, wheat, sorghum, and broom corn are also grown, and good yields are obtained. This soil is well adapted to the growing of the crops named and for general farming purposes. Its liability to overflow, however, has to be considered in calculating the profits to be reaped from it.

The following table shows the texture of typical samples of the soil and subsoil of this type:

*Mechanical analyses of Yazoo loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7391	8 miles NW. of Louisville.	Brown sandy loam, 0 to 9 inches.	4.12	0.34	1.56	1.20	4.14	7.86	60.86	23.24
7392	Subsoil of 7391.....	Silty and sandy loam, 9 to 36 inches.	.97	.18	1.18	1.02	2.84	14.06	63.66	16.26

YAZOO SANDY LOAM.

The texture of the Yazoo sandy loam varies considerably, being more sandy in some places than in others. The general character is that of a fine sandy loam with the sand content rather high, 12 inches deep, and pale yellow or gray in color. The soil does not contain a large amount of organic matter, as its light color indicates. The subsoil consists of a fine sandy loam, also of high sand content, slightly heavier than the soil.

This soil is found in narrow strips along the Little Wabash River, occurring in small, disconnected areas along its banks, especially in the bends of the stream. It occupies only a small proportion of the area of the county, the greater portion of it lying north of Louisville, although a few scattered areas are found along the river south of this place. The surface of this soil may be described as generally level, with low ridges and shallow intervening depressions, a configuration due to flood action.

As is generally the case along streams, the elevation near the banks of the river is greater than back near the bluffs, and so the Yazoo sandy loam lies slightly higher than the other bottom soils. This fact, together with its sandy character, gives it excellent drainage. In fact, its open, porous nature and unretentiveness of moisture sometimes cause crops to suffer from drought.

It is a well-known fact that the carrying power of water decreases

rapidly with a decrease in the velocity of the current. When a stream overflows its banks the current is checked by weeds, bushes, etc., and by friction against the surface of the ground. With the slackening of the current sedimentation is increased, the coarser material being deposited first. It is of the coarser particles carried by the river that the Yazoo sandy loam has been built up, and it is because of the coarseness of the particles that the areas of this soil occur in narrow strips along the banks. The sand is very largely composed of quartz which has been derived from the weathering of the glacial material and washed into the river by its tributaries.

Corn forms the chief crop grown upon this type. The smallness of the area renders it almost impossible to obtain anything like an accurate estimate of the average yield. Fair crops are produced, however. Some sorghum, broom corn, watermelons, and tomatoes are also grown. This soil is rather too light and sandy for corn, but is well adapted to the growing of truck crops, and it is often sought out for this purpose. There is, however, more liability of damage from overflow to early truck than to corn. The floods usually come early in the spring, and there is little doubt that at least late truck crops could be made more profitable than corn.

The following table shows the texture of this soil:

*Mechanical analyses of Yazoo sandy loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7393	2 miles NW. of Louisville.	Brown sandy loam, 0 to 10 inches.	1.27	0.00	0.10	2.16	29.10	20.52	34.32	13.70
7394	Subsoil of 7393.....	Sandy loam, 10 to 36 inches.	.53	.00	.02	3.26	36.34	21.26	28.52	10.60

WAVERLY SILT LOAM.

The surface soil of the Waverly silt loam consists of a light-brown to whitish, very silty loam with a depth of 10 inches. In a few places the soil contains enough organic matter to give it a brown color, but typically it ranges in color from gray to almost white. It also has usually a somewhat mottled appearance, light spots being intermixed with darker ones. When dry and recently cultivated it is very loose and dusty, but the particles run together after a rain. The subsoil, which is a silty loam, heavier than the soil, is often called clay, but this term is not well applied. It is of a whitish or mottled color, often

stained with iron. This character of material extends to a depth of several feet.

The smaller areas, occupying old lake beds in the northwestern part of the county, are somewhat heavier in character and of better quality than the average of this type.

This type of soil occupies the greater portion of the bottom lands of Clay County. It is found along the Little Wabash River and all of its affluent streams. The bottoms are much wider in the lower than in the upper portion of the river. The largest area is found east of Clay City, between the Little Wabash River and Big Muddy Creek.

The surface of this soil is generally level and the areas it occupies are sometimes called "water-oak flats." Sloughs and old stream channels dissect it in many places, and it is lower at the foot of the bluffs than near the streams. This fact, together with the level character of the surface, gives this soil rather poor natural drainage. The old stream channels, however, help to carry off the water. The river, in periods of high water, breaks over its banks at some low place, or backs up from below, so that the bottom land farthest from the streams is overflowed before the higher-lying areas nearer the streams. After floods the water remains in some places until carried away by evaporation, but there is very little of this type which can not be drained, and much of it could be improved by drainage.

The Waverly silt loam is an alluvial soil and represents the material which has been washed off the uplands, brought down by the streams, and deposited in comparatively quiet water. In character it is very much like the Marion silt loam, being composed of the same glacial material modified by stream action.

Corn is the principal crop grown on the Waverly silt loam, as well as on the other bottom soils, and averages about 30 bushels to the acre. Some farmers, however, report yields much above this average. Hay is also grown and produces three-fourths of a ton to the acre. Some wheat and oats are also sown. Probably 50 per cent of this soil type is still in forest, oak largely predominating. This type seems to be as well adapted to the crops principally grown (corn and hay) as to any others, but it should not be used for these crops exclusively. It is not a strong soil and generally contains a relatively small proportion of organic matter. Cowpeas are used to a limited extent by some farmers and are of undoubted benefit to the soil and should be more extensively grown. The soil is not very retentive of moisture, and crops are apt to suffer in dry weather. The incorporation of more organic matter into the soil would improve it in this respect.

The following table gives mechanical analyses of the soil and sub-soil of this type:

*Mechanical analyses of Waverly silt loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7385	2½ miles E. of Clay City.	Silty loam, 0 to 10 inches.	1.71	0.74	2.62	1.14	2.66	7.56	62.58	22.06
7387	3 miles N. of Hord.	Brown silty loam, 0 to 10 inches.	1.99	.34	1.60	1.56	5.14	4.94	61.54	24.04
7389	2½ miles SE. of Louisville.	Brown silty clay, 0 to 12 inches.	1.88	.34	1.66	1.38	4.16	8.42	56.18	27.24
7386	Subsoil of 7385.....	Whitish silty loam, 10 to 36 inches.	.48	.90	2.46	.94	1.50	7.72	65.36	20.58
7388	Subsoil of 7387.....	Mottled-gray silty loam, 10 to 36 inches.	.62	.06	.82	1.04	3.64	4.82	66.68	22.24
7390	Subsoil of 7389.....	Silty loam, 12 to 36 inches.	.93	.96	1.72	.84	2.88	7.40	57.72	27.80

MARION SILT LOAM.

The Marion silt loam consists of a light-brown to whitish, very silty loam with a small percentage of organic matter. It has an average depth of 12 inches. It also contains some very fine siliceous sand, and in fact the entire soil is composed largely of silica. A small percentage of shotlike concretions of iron are also present. After a rain the soil becomes rather hard, but when stirred and pulverized it changes into a fine, floury dust. Certain areas, known as "post-oak lands," are whiter and contain less organic matter than the typical soil. This soil grades gradually into a layer of white siliceous silt and very fine sand, which also shows a small percentage of iron concretions. This white layer is usually called "hardpan," although it is not a true hardpan, but crumbles quite readily between the thumb and finger. It is thicker in some places than in others, and occasional areas are found where it is entirely absent. This is most often the case near the streams or other places where there is good drainage. There is a sharp line of demarcation between this layer of white material and the underlying true subsoil. The subsoil is heavier and contains more clay, as is shown by the mechanical analyses, but the difference in the character of the soil and subsoil is greater than one would expect from the analyses. From a depth of 20 inches to 4 or 5 feet the subsoil consists of a rather hard, impervious, very silty mottled-yellow clay. In some cuts along the roads outcrops of this material had become almost as hard as brick, and contained many iron concretions. At 4

or 5 feet a small percentage of glacial gravel is struck, and the gravel content increases with the depth. This gravel is found outcropping along nearly all of the streams. The subsoil is more tractable and less impervious in the timbered areas than on the prairies, due probably to the better drainage conditions which exist there.

There are a few low ridges in the area upon parts of which the soil is somewhat different from the general type. It is more loamy, the white layer between soil and subsoil is often absent, and the subsoil is redder and contains more sand.

The Marion silt loam is a very extensive type of soil, occurring in broad areas and covering the entire uplands of Clay County. It occupies about 88 per cent of the entire area. It is also found in all of the adjoining counties and covers a larger area in this portion of the State than any other soil.

The surface is generally level to slightly rolling, although near the streams it is somewhat broken and hilly. A few low preglacial ridges also occur, the most prominent of these being south of Clay City and north of Xenia.

As before stated, when the first settlers came to Clay County the level uplands were wet and swampy, with many ponds scattered about over them. The area has now all been drained, either by natural or artificial means; but even now, after heavy rains, especially in the winter and spring, water stands for several weeks upon some of the more level areas. Many instances were noticed where the fields were plowed in narrow lands in order to provide surface drainage. The rather impervious nature of the subsoil does not let the water soak readily into the ground, and the surface is often too level for it to flow off quickly, and it is therefore necessary to provide drains to carry away the surplus. Very little underdrainage of the soil has been done, but there is little doubt that it improves the land, although the cost is considerable because the drains have to be put rather closely together. Areas near the streams have good natural drainage.

The Marion silt loam in Clay County has been formed directly from the weathering of the débris left by the ice during the advance known as the Illinois glaciation. Before this advance of the ice the surface of the country for many miles to the north was formed by the rocks of the Coal Measures, consisting principally of sandstones, shales, and limestones, with thin seams of coal and bands of iron ore. As the ice moved over these rocks, portions of them were ground off and transported southward. An examination of the glacial gravel shows it to consist chiefly of these rocks. Sandstones and shales are composed very largely of the insoluble, or very slightly soluble, residue of the igneous rocks, and a soil derived from these sedimentary rocks would be relatively low in plant food and high in silica, characteristics which the Marion silt loam possesses to a marked degree. The large

amount of iron which is present in the soil came principally from the bands of iron ore which were ground up along with the rocks in which they were bedded.

Corn, hay, and fruit are the principal products grown upon the Marion silt loam. Wheat, oats, sorghum, broom corn, and cowpeas are also grown. A few small patches of tobacco were seen. The average yield of corn is not much more than 15 bushels per acre, although the crop this year (1902) will probably average nearly twice that quantity. Hay produces about three-fourths of a ton per acre. Broom corn does fairly well, and the quality is said to be very fine.

The Marion silt loam is not a strong soil and is not well adapted to general farming purposes. The small yield of corn indicates that it is not a good soil for that crop, although the profit from corn, according to many farmers, is as much as from other crops. Redtop grass is a very important product and the soil seems to be fairly well adapted to it. Timothy also does well. There is no crop, however, so far as experience goes to show, to which it is any better adapted than fruit, and fruit growing is now one of the most important industries in the county. (See Pl. XXIX.)

The uniformly light color of this soil shows it to be deficient in organic matter, and an effort should be made to supply this by means of stable manure and the growing of leguminous crops. Many of the farmers grow cowpeas for the double purpose of providing forage and improving the soil, and this practice is to be highly commended.

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

*Mechanical analyses of Marion silt loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
				P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
7370	1½ miles N. ¼ mile W. of Biblegrove.	Silty and sandy loam, 0 to 12 inches.	1.75	0.26	2.40	2.78	5.26	2.90	70.08	15.52
7379	4 miles W. of Louisville.	.....do.....	1.63	.04	1.64	1.80	3.84	6.36	67.24	18.14
7373	1½ miles N. of Flora.	Light gray silty loam, 0 to 12 inches.	1.49	.24	1.80	2.42	4.98	2.84	68.52	19.18
7371	Subsoil of 7370.....	Silt and sand, 12 to 18 inches.	.77	.98	2.16	2.48	4.70	2.88	69.54	17.24
7380	Subsoil of 7379.....	.....do.....	.48	.98	2.24	2.40	3.40	5.84	66.60	18.06
7374	Subsoil of 7373.....	Silt and sand, 12 to 20 inches.	1.34	.60	1.70	2.82	5.44	7.10	61.14	20.66
7375	.....do.....	Silty clay, 20 to 36 inches.	.54	.60	1.28	2.18	4.24	5.70	58.32	26.94
7372	Subsoil of 7370.....	Silty clay, 18 to 36 inches.	.82	.28	1.42	1.78	3.14	1.92	60.90	30.32
7381	Subsoil of 7379.....	.....do.....	.29	.44	1.04	1.24	2.74	4.32	50.48	39.30



AN EXTENSIVE APPLE ORCHARD ON THE MARION SILT LOAM, CLAY COUNTY AREA, ILLINOIS.

This soil, having a hardpan from 12 to 18 inches below the surface, is poorly adapted to farm crops, but has been shown to be admirably adapted to apple trees, which are set out in holes dug through the hardpan.



## THE HARDPAN PROBLEM.

One of the most important soil problems of Clay County and the surrounding region lies in the hardpan stratum of subsoil of the Marion silt loam. This term "hardpan," as used in the area surveyed, refers sometimes to the whitish layer between the soil and the true subsoil, and sometimes to the hard, rather impervious subsoil itself. It is believed by some that the impermeability of the Marion silt loam is due to the white layer, but the writer, for reasons which will presently appear, inclines rather to the opinion that it is due to the underlying layer, and that the presence of the white layer is simply the result of the impervious character of the underlying subsoil.

This so-called hardpan greatly impairs the agricultural value of the land. Its injurious effects are chiefly felt in two ways, namely: It hinders the development of the roots and prevents the maintenance of proper moisture conditions, the soil seeming to be capable of holding but a very small moisture reserve. Water percolates through the hardpan layer very slowly, and this layer is easily puddled and in that condition holds water like a pan.

The texture of the subsoil, as shown by the mechanical analyses, is not such as would indicate as impervious a character as is possessed by this soil, and the reason, or reasons, for this marked characteristic is not evident. There are two explanations which suggest themselves: Either the condition might result from an impervious layer beneath the soil, or else from some peculiarity in the structure of the soil itself. An examination shows that there is no impervious layer below the subsoil that could cause the condition, and so one must conclude that it is due to some peculiarity in the structure.

Iron is always more or less abundant, and in some cases is present in sufficient quantity to form almost an iron "hardpan." It is seen in both soil and subsoil in the form of iron concretions, and wherever the iron appears to exist in the greatest quantity there the subsoil seems most impervious. The presence of so large an amount of iron in the soil has already been stated as probably due to the fact that the glacial material here was derived principally from the rocks of the coal measures, which contain bands of iron ore as well as ferruginous sandstones. It may be that the presence of the iron gives the soil its impervious character by filling up the small spaces between the soil grains and by more or less coating and cementing them together, so that the water can not readily pass through the resulting loosely bound conglomerate.

It was noticed that wherever there was good drainage, as, for instance, near the streams, the subsoil appeared to contain less iron and was more pervious. The fact was also observed that the bottom soils here, which have been formed by the wash from the uplands, contain many

indications of the presence of large amounts of iron. On the slopes where the water can drain off readily through the soil the iron has undoubtedly been partially leached out and later deposited in the bottoms, so the soil on the slopes contains less of it, while on the level areas, where there is very little opportunity for the water to drain out through the subsoil, the mineral remains in larger quantities.

If the close structure of this subsoil is due to the presence of iron, the land could be improved by underdrainage. Iron compounds are not, however, readily soluble, and the improvement would therefore be rather slow, but would increase gradually as the iron was removed, the soil becoming more and more permeable.

The Marion silt loam is also in general an acid soil, as has been shown by examinations made in the laboratories of the Bureau of Soils. This acidity can be readily corrected by the use of lime or by underdrainage, or, best, by a combination of the two.

#### AGRICULTURAL METHODS.

The methods which have been too generally practiced in Clay County have tended toward the exhaustion of the soil rather than to the maintenance of its productiveness. Nearly all the farmers say that they can not produce as large yields now as formerly. This is due largely to the removal of organic matter from the soil, which has resulted not only in a decrease in the available supply of plant food, but in a change of texture lessening the capacity of the soil for moisture and interfering with perfect aeration.

The grain crops are generally fairly well cultivated, but many of the orchards appear to be almost entirely neglected so far as care of the soil is concerned. Weeds have been permitted to grow and have done much damage to the trees. The soil in an orchard should be thoroughly and repeatedly stirred in order to secure the best results, and, according to the best authorities, small grain and grass should have no place there. The cultivation of the soil is as essential to the proper development of fruit trees as it is to the production of grain and other field and garden crops. Many fruit growers have realized this fact and have their orchards in good condition. Even where cultivation is attempted one of the most common practices is to plow only in one direction, thus leaving a strip between the trees uncultivated. It is much better to plow both ways, turning the furrows alternately toward and from the trees.

Aside from fruit, corn and hay form the principal crops, and most farmers plan to keep the land in these the greater part of the time. The general practice is to sow the land in grass and allow it to remain in sod until there is a material decrease in the yield of hay. The average period for which fields are thus kept in grass is perhaps four or five years. The sod is then turned and the land planted in corn for

two or three years successively, then sowed in oats or wheat for one year, in order to get the soil in proper condition to sow in grass again. Some farmers keep their land in corn for a much longer period than that stated above. This is the general rotation practiced upon the upland, while on the bottom lands corn is grown almost exclusively. This system is a rather heavy drain on the soil. No system of rotation should be considered which does not include a leguminous crop. Cow-peas produce fairly well and should be grown more extensively.

#### AGRICULTURAL CONDITIONS.

The prosperity of any agricultural community is dependent largely upon the character of the soil, as well as upon the climate, market facilities, character of the people, and other factors. Clay County was not blessed with a very fertile soil to begin with, and the profits from the growing of the staple crops have not been as great as in some other areas, but the fruit industry has become one of great importance within the last few years, and is bringing thousands of dollars into the county and adding to the general prosperity of the farming class. Many of the farmers have substantial, well-built residences, with good barns and outhouses. The average dwelling house is not, however, very expensive, but is neat and shows evidences of prosperity. A number of fine herds of cattle were noted, and much more attention is being given to stock raising than formerly. In an area where so much hay is grown the raising of stock should be one of the chief industries. The hay should be fed to the stock and the manure put upon the land. In this way the original fertility of the soil could be more nearly maintained.

The majority of the farms are owned and tilled by the farmers themselves. Many of them, however, are cultivated by renters, who usually pay a grain rent. One-third of the crop is the proportion generally taken by the landlord, but when the tenant wishes to grow hay, one-half the crop is required.

About 25 per cent of the land in Clay County is yet unimproved. There are a great number of small farms of from 10 to 40 acres, and the average size is probably a little less than 60 acres. There are also a large number ranging from 120 to 320 acres, and a few farmers own more than an entire section. The price of farm lands varies much, depending upon the improvements, location, and the percentage which is in orchard. Some of the orchards will sell for \$75 or \$100 an acre, and the best lands without orchard will bring \$30 to \$40 an acre. The average assessed value of the improved land of the county is \$4.27 an acre, while of the unimproved it is \$1.71 per acre. Lands in this State are assessed at 20 per cent of their actual value, so the real average value for the county is about \$20 an acre.

The labor employed is generally home labor. Many farmers do not find it necessary to employ any help in cultivating their crops. Some men who own small farms or who live on rented land do day labor for a part of the time. There is some difficulty in obtaining farm labor, especially during the harvesting season. The apple crop this year (1902) is very large, and it has been hard for the growers to obtain hands to help harvest the crop. The wage of labor ranges from \$1 to \$1.75 a day.

General farming and fruit growing are the principal agricultural industries of Clay County. Corn is cultivated by nearly all the farmers, but the soil of the uplands, as before pointed out, is not well adapted to this crop. There are no grain elevators in the county, and very little corn is shipped. The chinch bugs do much damage to corn, especially when near a field which has been in wheat. The farmers have almost ceased to raise wheat on account of this pest.

The production of hay ranks among the first of the industries of Clay County. Quite a little timothy hay is cut, especially in the northeastern part of the county, but red top is the variety of grass principally grown, and is considered one of the best-paying crops. It is not grown for the hay alone, but also for the seed. An acre will produce on an average about three-fourths of a ton of hay and about 7 bushels of seed. The hay or straw is better than before thrashing, as the dirt is all blown out of it. It makes fairly good feed. The hay sells for \$4 per ton, which pays for cutting the grass and thrashing the seed. The value of the seed, which is about \$5 per acre, will thus be clear profit. The fields are often used for pasture after the crop of hay is taken off.

Reference has already been made to the great interest which the farmers of Clay County have taken in the growing of fruit. Twenty-five years ago there were only a few small orchards, but to-day conservative estimates give the area in orchards as 30,000 acres, which places Clay County in the front rank of apple-producing counties of the United States. In 1883, the first year the apple crop was of sufficient proportions to become of commercial importance, 17,042 barrels were shipped from the county. During the season of 1902, according to estimates of the Flora Commercial Association, there were produced 272,770 barrels, with a value of \$281,485. It is thus seen that there has been a very large increase. The inferior fruit is sold to the evaporators. The peelings and cores are also dried, so that nothing is allowed to go to waste. There are 9 large evaporators in the county. They pay from 10 to 25 cents per bushel for apples.

Different methods of disposing of the fruit are practiced by different growers. Some sell the fruit on the trees and the buyer picks only such apples as he wishes to ship, while others pick their fruit and ship it themselves. The most common practice, however, is for

the grower to pick the apples and deliver them at the sorting table, where they are graded and packed by the buyer. The price necessarily varies, but \$1.25 per barrel is about the average price for the unbarreled apples and \$1.75 to \$2 for barreled fruit delivered at the cars. A large cold-storage building is being constructed at Flora with a capacity of 18,000 to 20,000 barrels. The apples are picked by hand, carried in baskets to tables in the orchard, and there graded and barreled.

The Ben Davis is the variety which largely predominates, though the Jonathan is also a prime favorite. Grimes Golden, Rome Beauty, Winesap, and many other varieties are also grown, though in much less quantities. The bitter rot is doing much damage to the fruit and is causing a loss of thousands of dollars to the growers. The canker-worm also causes considerable trouble, but this pest can be controlled by spraying.

Some fruit growers claim that little profit is being made from the growing of fruit, while others are undoubtedly obtaining handsome returns upon their investment. One average orchard of 25 acres near Flora, which has been planted fourteen years, has paid \$125 per acre, or an average of a little more than \$800 per year for the entire period it has been set out. The land was cropped until the trees were 7 years old, and the returns from this source were not taken into consideration. Another orchard of 40 acres was bought two years ago for \$1,100. Last year the apples sold for \$400 and this year the product of 20 acres brought \$800. Some orchards in good years will pay \$100 per acre, and an instance is known where \$250 per acre was obtained from one orchard for two different years. These instances are given to show what profits have actually been made by some growers.

Other fruits besides apples are grown, but to a much less extent. Many pear orchards were noted, and where the trees have not been injured by the blight profitable yields are obtained. The blight, however, has done a great deal of damage, and the injury from this disease is so extensive that many farmers have abandoned the growing of pears and are cutting out the trees. Peaches are also grown with profit.

In order to make a success of fruit growing it is necessary to give much care and attention to the trees. The proper management of an orchard requires considerable knowledge and experience, and this had to be acquired by the farmers, as very few of them had had any training in the growing of fruit. With the knowledge gained from experience better results will be obtained and handsome profits will be secured by those who give to their orchards the proper care and attention.

The general uniformity in the soils of the county does not give an opportunity for a great diversity of crops. The farmers generally

have recognized that the Marion silt loam is not well adapted to the growing of wheat and corn, although large areas are still planted to corn. Its adaptability to the growing of fruit is now a matter of common knowledge. The small areas of Yazoo sandy loam are sought out by many farmers for the growing of truck crops.

Clay County has good transportation facilities. The Baltimore and Ohio Southwestern Railroad crosses the southern part of the county in an east and west direction, and also in a north and south direction. The Illinois Central touches the northwestern corner and serves as an outlet for the products of that part of the county.

While the area is not situated in close proximity to any of the great markets of the country, St. Louis is only about 100 miles west, Cincinnati less than 250 miles east, and Chicago about the same distance north. Direct lines of railroads connect the area with these great cities, as well as with many smaller cities, so that the products of the county can be readily and quickly put upon the market.

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