U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE KENTUCKY AGRICULTURAL EXPERIMENT STATION,
A. M. PETER, ACTING DIRECTOR.

SOIL SURVEY OF SHELBY COUNTY, KENTUCKY.

BY

[illegible] DUYNE, IN CHARGE, AND L. R. SCHOENMANN,
[illegible]. S. DEPARTMENT OF AGRICULTURE, AND S. D. AVERITT,
[illegible]E KENTUCKY AGRICULTURAL EXPERIMENT STATION.

H. H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1916.]

WASHINGTON:
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1919.

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U. S. DEPARTMENT OF AGRICULTURE.

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CORNELIUS VAN DUYNE, IN CHARGE, AND L. R. SCHOENMANN,
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OF THE KENTUCKY AGRICULTURAL EXPERIMENT STATION.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 2, 1918.

SIR: In the extension of the soil survey in the State of Kentucky work was undertaken in Shelby County and completed during the field season of 1916.

The accompanying report and map cover this survey and are submitted for publication as advance sheets of Field Operations of the Bureau of Soils for 1916, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

CONTENTS.

ILLUSTRATIONS.

SOIL SURVEY OF SHELBY COUNTY, KENTUCKY.

By CORNELIUS VAN DUYNE, In Charge, and L. R. SCHOENMANN, of the U. S. Department of Agriculture, and S. D. AVERITT, of the Kentucky Agricultural Experiment Station.—Area Inspected by HUGH H. BENNETT.

DESCRIPTION OF THE AREA.

Shelby County, Kentucky, lies in the north-central part of the State nearly midway between the cities of Louisville and Lexington. Oldham and Henry Counties bound it on the north, Franklin and Anderson Counties on the east, Spencer County on the south, and Jefferson County on the west. The county is irregular in shape, with a length and width through Shelbyville, near its center, of 18 and 22 miles, respectively. Its total area is 382 square miles or 244,480 acres.

FIG. 1.—Sketch map showing location of the Shelby County area, Kentucky.

Shelby County embraces a portion of an extensive general physiographic division of central and north-central Kentucky, known as the Lexington Plain. Viewed as a whole, this is an undulating, gently sloping plain. In Shelby County the slope is toward the west.

The degree of dissection of this plain varies in different parts, and the county may be divided according to the local relief, determined largely by erosion, into three divisions. These are, as a rule, fairly well defined, although topography typical of one division may be found within the other two, and vice versa. The divisions are as follows: (1) The rolling to hilly region in the eastern and southeastern part of the county; (2) the undulating to broadly rolling region, occupying the central part; (3) the rolling region of the extreme western and an area South of Jeptha Knob in the southeastern part.

The most prominent topographic feature of the county is Jeptha Knob, which is visible from nearly every ridge or hill crest and from whose summit may be seen the greater part of the county. Jeptha Knob is located just south of Clay Village and about 6 miles east of Shelbyville. It rises rather abruptly from the general level of the plain and attains an elevation of 1,185 feet,[1] or about 300 feet above the surrounding country. The base of the knob has a general circular shape nearly 2 miles in diameter. The slopes are compara-

[1] W. H. Linney, Geology of Shelby County, Ky. Geol. Survey.

tively steep and are deeply cut by the heads of the several branches which rise upon them. Four flat mesalike areas form the highest elevations on the knob. Several broad low outliers extend northward and northwestward for short distances beyond the limits of the knob.

The rolling to hilly region of the eastern part of the county comprises a belt from 2 to 6 miles wide extending southward from the Henry County line to a point east of Waddy, where it swings southwestward and then west, leaving the county about 3 miles southwest of Southville. This belt narrows opposite Bagdad and again at Waddy. It is widest in the basin of Sixmile Creek in the northeastern corner, and also in the southeastern corner north of Mount Eden. The most diversified topography of the county occurs within the limits of this region. It consists of the thoroughly and rather deeply dissected country within the basin of the Kentucky and Salt Rivers, where erosion has been very active and has met with only moderate resistance from the underlying rocks. The valleys are narrow and V-shaped, with steep but seldom precipitous sides. The small laterals of these rivers head abruptly and deepen quickly, so that there is usually a well-defined line between this region and the one to the west. The stream channels are from 100 to 300 feet below the crests of the ridges.

The main ridges divide and subdivide, becoming narrower and lower in the direction of the stream flow. They have a marked common level within the same general section, which indicates the former plainlike character of the region. The drainage system is dendritic in ground plan and the total length of stream channel, large and small, is large. There is practically no bottom land within the region. The largest streams, such as Big Beech and Sixmile Creeks, have a widely meandering course, with little or no bottom or terrace areas along them, the steep valley sides rising as a rule directly from the stream beds.

The undulating to broadly rolling region of the central and western parts of the county embraces the least diversified country. It is the largest of the three regions and covers about three-fourths of the county. It lies between the other regions. The divides are broad, long, and smooth, the valleys comparatively broad and shallow, with slopes which merge gradually with the ridge tops. The main streams are few in number and flow in a general southerly direction, some of them crossing the county. Their valleys along the upper courses are small, shallow, and comparatively narrow, but gradually widen and deepen in the direction of the stream flow, though never becoming very wide. Near the Spencer County line the surface is more uneven. Here in places short steep slopes face the stream courses. The lateral streams, though fairly numerous, are short, have few tributaries, and are often merely shallow, incon-

spicuous draws, in which water flows only after heavy rains. The creeks flow for the most part over solid rock, with here and there accumulations of gravel and cobbles. These large creeks have a medium gradient and flow in channels from 50 to 100 feet below the general level of the surrounding country. In the southern part of the county they follow broadly meandering courses, bordered here and there with narrow bodies of bottom and terrace land.

The rolling region of the western and southeastern parts of the county includes areas whose topography is intermediate between those of the other two regions. It occurs as practically a continuous belt on the west side of the county and includes nearly all of that part of the county lying in the Floyds Fork drainage. In addition it embraces another area in the southeastern quarter of the county south of Jeptha Knob and east of Guists Creek and the lower portion of Brashears Creek. Floyds Fork forms the county boundary for a few miles in the northwestern corner of the county. Its valley, the greater part of which is outside of this county, has lost its plain-like character and is a conspicuous topographic feature, being unlike any other valley in or near the county. A profile transverse to the longer axis is that of a widely spreading V. The valley slopes are moderately short and are traversed by numerous tributaries. The divides range from broad and rolling to moderately narrow and irregular. They become conspicuously lower toward the west and thus give the marked valley topography to the Floyds Fork Basin. The streams, which are intermittent, have a moderately steep gradient with channels in the bedrock.

The southeastern area of this division varies somewhat in topography from the above description. It represents a dissected plain of topography intermediate between that in the first division and in the second division. The valleys are narrow, V-shaped and steep sided, the divides broad and undulating. The valleys and streams are like those in the regions first described and the divides like those of the second division. The valley slopes break abruptly from the undulating tops of the ridges.

In the first topographic division the ridges range in elevation from 800 to 900 feet above sea level while the beds of the larger streams are from 620 to 750 feet above sea level where they cross the county line. To the west in the second division the highest determined elevations, aside from Jeptha Knob, are at Bagdad, 912 feet, and Christianburg, 903 feet. The divide on which these places are located doubtless increases in elevation toward the north so that higher elevations are found in the vicinity of Pleasureville. It is believed that the highest elevations in the county, aside from Jeptha Knob (1,185 feet A. T.), are found along the Henry County line southwest, south, and southeast of Eminence, Henry County. Other elevations of in-

terest are Shelbyville, 750 feet; Mulberry, 849 feet; and Simpsonville, 825 feet. On the western side of the county the hills range from 700 to 750 feet in elevation while the stream courses cross the line at elevations of 620 to 680 feet. The lowest known elevations are where Floyds Fork crosses the Shelby-Jefferson line near the northwest corner, where Cane Run crosses the same line near the southwest corner, and where Sixmile Creek crosses the Shelby-Henry line in the northeast corner, all approximately 620 feet.

Although all of the drainage from the county eventually reaches the Ohio River, it follows rather widely different courses. The southeastern part is drained southwestward by Salt River and the northwestern part northward by streams tributary to the Kentucky. The divide between the two systems runs across the county in an irregular line.

Drainage courses ramify to practically every farm in all parts of the county. Poorly drained areas of any considerable size are rare. Not all of the county is equally well drained, however, as conditions, degree of slope, depth to rock, and the structure of subsoil and substratum cause local variations in its thoroughness. In addition to surface drainage, a considerable flow of water is carried by subterranean channels in the underlying limestone formation.

Both perennial and intermittent streams exist in the county. The streams are slowly deepening their channels through the processes of solution and erosion. After rains the streams of the hill section carry abundant sediment but those of the central portion are usually clear or are only slightly muddy. Water power sufficient to operate grist and flour mills exists along a number of these streams, and such mills played an important part in the agricultural development of the county. At present practically no water power is developed within the county.

Shelby County was formed from a part of Jefferson County in 1792. Territory now included in Franklin, Henry, Gallatin, Oldham, and Spencer counties has since been cut off. The earliest recorded settlement was in 1779, near the present site of Shelbyville. Early immigration was slow. Most of the settlers came from the Eastern States, especially from Virginia, Maryland, and Pennsylvania. The present population consists chiefly of the descendants of the early settlers.

According to the United States census the population of the county in 1880 was 16,813; in 1890, 16,521; in 1900, 18,340; in 1910, 18,041. In 1850 the white population was given as 10,289 and the colored as 6,617, a total of 16,906. There has thus been only a comparatively small increase in the last 70 years. In 1910, the rural population was 14,629, or 81.1 per cent of the total population. There was a slight

increase in the urban population and a somewhat larger decrease in the rural population during the preceding decade. The rural population, which is 34.9 per square mile, is evenly distributed over the county.

Shelbyville, the county seat and largest town, had a population of 3,412 in 1910. It is centrally located and is the most important trading and shipping point of the county. It is strictly a residential town. Waddy, with a population of 254; Bagdad, 185; Simpsonville, 184; Cropper, 159; Christianburg, 140; Finchville, 100; and Hatton, are towns and commercial centers of local importance. Harrisonville, Graefenberg, Clay Village, Southville, Jacksonville, Peytona, Chestnut Grove, and Toddspoint are small trading points lying off the railroads. Mount Eden and Pleasureville are partly within the county. Eminence, lying about a mile beyond the line in Henry County, affords marketing and shipping facilities to quite an area in the northern part of the county.

Shelby County is reached by lines of the Louisville & Nashville Railroad system. The Chesapeake & Ohio Railroad also operates through trains over the Louisville & Nashville tracks. Besides these steam roads, the electric line, Louisville & Interurban, maintains frequent passenger and freight service. No part of the county is more than 10 miles from a station or shipping point on the lines of one or another of these systems. Shelby County has a large mileage of public roads, nearly all of which are surfaced with stone and are kept in good repair, but the earth roads are in a less satisfactory condition.

The farm products are usually sold to local dealers, Shelbyville being the principal marketing and shipping point within the county. Milk and cream are shipped in large quantities to Louisville; mules are shipped to the southern markets; and Burley tobacco is packed at Shelbyville for shipment to outside manufacturing points. Nearby markets outside the county include Louisville, which is only 30 miles distant from the center of the county; Lexington, approximately 50 miles; and Cincinnati, about 120 miles away.

Rural free delivery routes serve practically all parts of the county. Rural and long-distance telephone service is available throughout the county. The country districts are well supplied with schools, and graded and high schools are maintained in the several towns.

CLIMATE.

The climate of Shelby County is temperate. The winter is of moderate duration and, while the weather conditions are more or less changeable, periods of excessively cold weather are usually short. Snow may fall during the months of December to March, inclusive, but seldom stays on the ground for any considerable length

of time. The summers are long and warm, with hot spells seldom lasting more than a few days. As a rule the nights are cool. The mean annual precipitation, which is fairly evenly distributed throughout the year, is 44.8 inches, affording sufficient rainfall for agriculture without irrigation. The range in annual precipitation is from 32.18 inches to 65.45 inches. The average annual snowfall is 20.8 inches.

The average date of the last killing frost in the spring is April 15 and of the first in the fall is October 17, giving a growing season of 180 days. The dates of earliest and latest killing frosts in fall and spring, respectively, are September 22 and May 22.

The accompanying table, compiled from the records of the Weather Bureau station at Shelbyville, giving the normal monthly, seasonal, and annual temperature and precipitation, represents fairly the conditions prevailing over the county, as the station is not only centrally located but there are no physiographic features to cause marked differences in different parts of the county:

Normal monthly, seasonal, and annual temperature and precipitation at Shelbyville.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1904).	Total amount for the wettest year (1890).	Snow, average depth.[1]
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	35.9	69	−11	3.66	3.56	3.74	3.7
January	33.7	76	−15	3.97	3.45	7.12	4.6
February	34.0	74	−23	3.60	3.29	7.63	5.2
Winter	34.5	76	−23	11.23	10.30	18.49	13.5
March	45.3	92	− 3	4.91	6.08	10.60	4.7
April	54.9	93	22	3.03	2.73	3.71	0.7
May	65.0	102	28	4.01	1.23	3.85	0.5
Spring	55.1	102	− 3	11.95	10.04	18.16	5.9
June	73.9	105	41	4.70	3.31	9.66	0
July	77.1	107	46	4.20	2.30	3.69	0
August	75.5	104	44	3.03	3.53	5.34	0
Summer	75.5	107	41	11.93	9.14	18.69	0
September	69.5	103	28	2.89	1.87	1.69	0
October	56.4	94	18	2.13	.44	3.28	T.
November	43.9	80	8	3.95	.39	5.14	1.4
Fall	56.6	103	8	8.97	2.70	10.11	1.4
Year	55.4	107	−23	44.08	32.18	65.45	20.8

[1] Snowfall taken from the records of the Weather Bureau station at Lexington, Fayette County.

AGRICULTURE.

Agriculture has been the chief industry of Shelby County from the earliest settlement. The early agriculture was self-sustaining, only such products being grown as were needed to feed and clothe the settlers. Corn and other cereals, flax used to make clothing, and garden vegetables were the chief products. Live stock early became of some importance.

By 1792 the population had increased sufficiently to warrant the organization of a county government and the increased crop production made it necesary to seek outside markets for disposal of the surplus. Wheat early became an article of export, being shipped in boats on the Ohio River. Cattle were raised in numbers and driven to distant markets. Grist mills were early established. Agriculture, however, was and has continued to be the chief source of income.

A fertile soil, favorable topographic and climatic conditions, and the comparative ease of clearing the land were the main factors in the early agricultural development. Railroad building which began in the early fifties further stimulated growth. At this time corn and wheat were still the chief crops, while tobacco, which up to this period had been grown almost solely for home consumption, became an article of export. Live-stock raising had assumed greater importance and dairying became a growing industry.

The character of the agriculture and the general changes which have taken place within the last 30 years or more may be readily seen upon consultation of the several tables compiled from reports of the Federal census. Briefly, the farming has always been along general lines with a tendency in the last two or three decades toward a specialization in the production of tobacco as a money crop, and toward the extension of the live-stock and dairy industries. In the last few years there has been an increased interest in farming, and in maintaining and increasing the productiveness of the soil by better methods of cultivation.

The following table gives the total number of farms in Shelby County, their average size and their relation to the total area of the county, also the improved land per farm, as given in the Census Reports 1880 to 1910, inclusive:

Land and farm areas of Shelby County.

Year.	Number of farms.	Proportion of total area of county in farms.	Average size of farms.	Improved land in farms.		Proportion of land in county improved.
		Per cent.	*Acres.*	*Acres.*	*Per cent.*	*Per cent.*
1880	1,625	85.3	143.4	112.5	78.5	67.0
1890	1,513	80.7	146.0	116.0	79.8	64.3
1900	1,997	85.7	117.0	103.0	88.0	75.4
1910	2,301	87.1	103.8	94.1	90.7	79.2

A study of the above table shows that agriculture was extensively developed prior to 1880, that there has been a marked increase in the number of farms, in the percentage of total area in farms, and in the percentage of improved land in farms in the last two decades. Also that there has been a decrease during the same period in the average size of the farms and in the acreage of improved land per farm. During the period covered by the table there has been an increase of 12.2 per cent in the proportion of improved land in farms. These figures show a normal condition in a rather old settled agricultural county, with a slowly increasing population.

The following table gives the acreage and production of the principal crops of the county as reported by the last four censuses—1880, 1890, 1900, and 1910:

Acreage and production of the principal crops.

Crop.	1910		1900		1890		1880	
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Corn	31,584	1,133,885	32,954	1,003,240	33,310	1,313,807	40,959	1,493,101
Wheat	12,862	95,346	31,435	399,460	21,062	299,416	21,627	282,672
		Tons.		*Tons.*		*Tons.*		*Tons.*
Hay (tame grasses only)	19,868	22,001	11,639	11,791	11,171	10,776	9,632	7,066
		Pounds.		*Pounds.*		*Pounds.*		*Pounds.*
Tobacco	9,035	9,314,692	6,430	6,465,370	3,767	3,767,586	661	620,262
Oats	1,840	.....	1,582	.....	7,601	.....	4,868	.....
Rye	1,404	.....	573	.....	1,383	.....	4,256	.....
Hemp	471	.....	278	.....	910	.....	.....	.....
Other minor crops	2,609	.....	449	.....	473	.....	344	.....
Total acreage	79,673	.....	85,340	.....	79,677	.....	82,547	.....

Study of the above table shows that there has been a marked decrease in the acreage of the cereals, corn, wheat, oats, and rye; that the acreage in hay has much more than doubled; and that the acreage in tobacco is fifteen times as large as at the beginning of the period. The increased acreage in other minor crops is due mainly to their greater use as forage crops. The acreage and yields of corn have been fairly constant from 1890 to 1910. Wheat reached its greatest acreage and production in 1900 but showed a marked decline in 1909.

Briefly, there has been a strong tendency toward an increase in the production of hay and forage crops in connection with the growing live-stock industry and also the development of the production of tobacco as the chief money crop. The total acreage in cultivation to crops shows a decrease from 82,347 acres, or 45 per cent of the improved land, in 1880, to 79,416 acres, or approximately 40 per cent of the improved land in 1910. Hence, although there

has been an increase in the number of farms and in the percentage of improved land per farm, there has been a decrease in the acreage of cultivated crops. As there is less virgin soil and less waste and wasted land, this decrease, assuming that these data are approximately correct, must be accounted for by the increased acreage of improved land used for pasturage.

The following table gives the value of all property per farm and the proportion of value in land, buildings, implements, and domestic animals:

Value of farm property.

Year.	All property per farm.	Proportion in—			
		Land.	Buildings.	Implements.	Domestic animals.
	Dollars.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1880	6,294	[1] 87.2	.....	2.1	10.7
1890	6,539	[1] 86.4	.....	2.0	11.6
1900	5,479	65.4	20.4	2.4	11.8
1910	8,015	65.6	20.9	2.2	11.2

[1] In the Census Reports of 1880 and 1890 the value of land and buildings is included in one item, while in the reports of 1900 and 1910 the values are given separately.

The foregoing table shows that there has been a markedly uniform percentage valuation of all classes of farm property. In the decade ending with 1910 the average acreage valuation of land increased over $20 an acre, or more than 60 per cent. As the percentage valuation remained practically constant within the same period, there must necessarily have been an increased valuation of the other kinds of farm property.

Tenure of farms.

Year.	Farms operated by—		
	Owners.	Tenants.	Managers.
	Per cent.	*Per cent.*	*Per cent.*
1880	79.5	20.51	0
1890	82.02	17.98	0
1900	70.2	28.9	0.9
1910	61.4	37.5	1.1

The above table shows a gradual decrease since 1890 in the number of farms operated by the owners and a corresponding increase in the number operated by tenants and managers. Over 17 per cent fewer farms were operated by their owners in 1910 than at the beginning of the period.

PRESENT AGRICULTURE.

A summary of the data for 1910, given in the preceding tables, shows that 79,416 acres, approximately 40 per cent of the improved land, or in other words 29.2 per cent of the total acreage of the county, 273,280 acres, was in cultivation to annual farm crops. The remaining 60 per cent of the improved land in 1910 was in woodland, pasture, orchards, and farm yards or in waste land. This percentage seems high, but it must be kept in mind that the figures are for the whole county rather than for the best or the average section, and that there is a considerable acreage in the eastern and southeastern sections which, although under fence and classed as improved land, is allowed to grow up to brush and weeds and is put to no use. It also requires a large acreage of pasture to maintain the large number of live stock now in the county.

Revenue from crop and live-stock sources in 1909.

Product.	Acreage.		Value.		Per cent of total value.
	Acres.	*Per cent.*	*Dollars.*	*Per cent.*	*Per cent.*
Cereals	47,703	60.4	768,378	32.8	20.0
Other grains and seeds	331	.5	15,495	.7	.4
Hay and forage crops	19,868	25.2	244,834	10.4	6.4
Vegetables	772	1.0	15,124	2.4	1.4
Fruits and nuts	[1] 500	.6	13,463	.6	.4
Special crops (tobacco, hemp, etc.)	9,709	12.3	1,245,811	53.1	32.4
Total	78,983		2,343,105		
Live stock and products:					
Animals sold and slaughtered			1,107,660	74.0	28.9
Dairy products, excluding home use			213,559	14.3	56.9
Poultry and eggs			155,102	10.4	4.0
Wool			19,734	1.3	.5
Total			1,496,055		
Grand total			3,839,160		

[1] Estimated.

The above figures are from the last census and are the latest available from a reliable source. With a few exceptions they represent fairly the present conditions and outline in a general way the character of the agriculture in the county. The cereals lead in acreage, followed in order by hay and forage crops, the special crops including tobacco and hemp, vegetables, fruits and nuts, and other grains and seeds. On the basis of value the special crops, tobacco and hemp, lead with over 53 per cent, but these crops are exceeded as a source of revenue by live stock and live-stock products, the

value of which amounted to two-fifths of the farm income from all sources.

In general four types of farming prevail: (1) Live-stock farming, where farm operations mainly center on the production of feed for stock, with tobacco or hemp or both as money crops; (2) dairy farming, with dairy products as the chief source of income and tobacco as a minor source; (3) general farming, with no specialized industry or crop, with an income derived from various sources such as dairy products, the sale of live stock, tobacco, and the excess of other crops; and (4) general farming on a small scale with tobacco as the chief source of income and the sale of stock, poultry, and eggs as minor sources of income.

The money crops in order of acreage are corn, wheat, tobacco, and hemp. The last three are wholly money crops; only the excess of corn above the needs of the farm is sold. Tobacco is not only the leading source of income, but it is a more general source than any of the other crops. With many it is the only cash crop. In addition its production and marketing give employment to more labor than the other crops. Wheat is next in importance as a cash crop. It is grown on approximately 75 per cent of the farms. The income from the sale of corn is difficult to estimate, and varies greatly in different years. It is the most valuable crop grown from the standpoint of total acreage, acreage per farm, and the uses to which the crop is put. Hemp, although a minor crop, is an important source of income on the farms where it is grown. The net income from this crop is relatively large.

Approximately 60 per cent of the cultivated land in 1909 was used for the production of cereals, including 40 per cent in corn, 16.2 per cent in wheat, 2.3 per cent in oats, 1.5 per cent in rye, and a few acres in barley. The cereals lead in acreage but rank second in total value of crops and third in value of all crop and live-stock products.

Corn leads the cereals both in acreage and value of the crop and ranks second in value of all crops. In 1909 it was planted on 31,584 acres or approximately 40 per cent of the cultivated area of the county. The production the same year was 1,133,885 bushels, or an average of about 36 bushels per acre. Corn is the most widely grown crop in the county. It is grown on practically every farm in fields ranging from a few acres to 50 acres or more, the former prevailing in the hilly section and the latter over areas of more favorable topography. Its production is confined to no one type of soil.

The Shelbyville silt loam gives the highest yields, followed by the Cincinnati silt loam. Corn is easily the most important crop in the county from the standpoint of utility. It is the chief grain feed for horses, cattle, and hogs. The stover furnishes a large part of

the rough feed for farm stock during the feeding season. A large acreage is cut for silage. In addition it is a source of food for family use. As a rule the county produces sufficient corn for its own needs. Some farmers have an excess to sell, while others have to buy in order to have sufficient feed for stock. In unfavorable seasons when the yields are low, corn is imported; in others when the yields are exceptionally good, a portion of the crop is exported.

Shelby County ranks high in corn production in the State. It is planted on a fairly uniform acreage each year, the largest plantings occurring in the sections where the live-stock and dairy industries are most highly developed. It is a fairly dependable crop, the yields ranging from 40 to 100 bushels on the Shelbyville and Cincinnati silt loams to 25 to 70 in the more rolling and hilly sections of the county. A considerable acreage is cut for ensilage, and it is said that there are more silos in the county than in any other in the State. The silos are filled in the early fall, and the silage is used as feed for dairy cattle and beef cattle.

Corn is planted on sod land which has been plowed the previous fall or early in the spring and well prepared. The greater part of the crop is check-rowed, the remainder being drilled in, and it is given frequent and clean cultivation as long as its size permits. Corn is planted to a less extent on land which was in corn the previous season.

Several varieties are grown, the most important being Johnson County White, Johnson County Yellow, Boone County White, and Hardin County White. Quite a number of the farmers grow a Prolific variety for silage. The selection of seed is a more or less common practice.

Practically all the corn is cut by hand, but a comparatively small acreage is harvested by pulling the ears, and it is either husked in the field or hauled to the barn and husked later. The grain is usually stored in good cribs, only a few of the old-style rail cribs being in use. The stover is handled in various ways. A large part of it is shredded and stored in barns, another part is allowed to stand in the shocks in the field and is hauled to the barns as needed, while a smaller percentage is fed in the fields.

Wheat ranks second in acreage among the cereals and third in acreage in comparison with other annual farm crops. As a cash crop it follows tobacco. In 1909, 12,862 acres produced 95,346 bushels of wheat. In 1916, a poor wheat year, the estimated production was 60,000 bushels. Wheat is grown on about 75 per cent of the farms, the fields ranging from 5 to 100 acres or more. The greatest acreage is grown in the central portion of the county; in the hill section it is a very unimportant crop. Although the acreage is decreasing and the crop is of relatively less importance than formerly,

it is the medium through which land is seeded to grass and as such it has an important place in the present types of farming. The general opinion among the farmers seems to be that wheat growing is unprofitable.

The Shelbyville silt loam leads all other soil types both in acreage and yield of wheat. The Cincinnati silt loam and the Eden silt loam follow. The yields range from 8 or 10 to 25 or 30 bushels per acre. Wheat is almost wholly a cash crop. Only a very small proportion is fed and only when the price is low. It is sold to local dealers.

Wheat is sown in the fall either on corn, tobacco, or hemp land, or on land used the preceding year for wheat. Fultz and Harvest Queen have been the standard varieties, but declining yields are causing the introduction of other varieties. Rudy's Bearded was largely sown during the past fall (1916). This variety, although not as good a milling wheat, has given higher yields in the past two or three seasons than the older varieties. Corn, tobacco, and hemp ground is prepared for wheat by disking the surface from one to three times. In the case of the corn and hemp land, the crop is sown between the shocks, except where the former is cut for silage. In a few cases the seed is sown with a narrow drill between the corn rows. Ground that has lain fallow or has been in wheat the previous season is plowed and harrowed as in the preparation of other crops. The quantity of seed per acre ranges from 1 to 1½ bushels. The crop is cut with a binder, and it is practically all thrashed from the shock, only a small proportion being stacked and none hauled to the barns. Some loss or damage to the crop results from unfavorable weather between the time of cutting and thrashing. A small part of the straw is baled and sold.

In 1909 oats occupied 1,840 acres, producing 33,337 bushels, or approximately 18.6 bushels per acre. This crop is grown on 2.3 per cent of the farmed area and is therefore of relatively little importance. The yield ranges from 10 to 50 bushels per acre. Comparatively few farmers grow oats, and these only in small fields on practically all the soils in the county. The low yield is regarded as being due to unfavorable climatic rather than to soil conditions. Frequently the crop makes a good growth and then either lodges and does not fill properly or else is blasted by hot weather. Oats are thrashed in the same manner as wheat. The grain for the most part is used in feeding work stock. A small acreage is cut green for hay. A few farmers grow a mixture of oats and peas for feeding purposes.

Rye is another minor cereal crop with an acreage in 1909 of 1,404 acres and a yield of 10,626 bushels. About 1.5 per cent of

the farmed area was devoted to this crop. The acreage of rye varies quite widely from year to year. It is sown either early or late in the fall and furnishes some pasturage for cattle and sheep and in the spring is either allowed to ripen grain or is plowed under and the land planted to other crops. Its value as a cover crop is recognized to a certain extent and its use for that purpose is increasing. It is a valuable crop for the farmers of the county on account of the many purposes for which it may be used.

According to the 1910 census the production of hay was 22,001 tons from 19,868 acres, or an average of slightly over 1 ton per acre. This group of crops occupies approximately 25 per cent of the total acreage in farm crops. Most of the hay is clover and timothy mixed or one or the other of these grasses alone. Clover predominates in the new seeding and timothy in the meadows which have been in grass for two or more seasons. In general there is more clover on the Shelbyville silt loam in the central part of the county and more timothy on the Cincinnati silt loam in the western part. Hay is produced on all soil types except the bottom land. In places orchard grass is sown with the other grasses, especially on the Cincinnati silt loam.

Hay is an important crop in the county. It is almost entirely a subsistence crop and is used for feeding work stock, beef cattle, dairy cattle, and sheep. A few farmers buy and others sell hay, but practically none is exported to outside markets nor is there any imported. Whiteweed is abundant in the mowings. Wild carrot is also prevalent but does not become conspicuous until after the first crop is cut. A number of other weeds are common on much of the hay land. The clover usually grows tall and coarse and frequently lodges.

In changing the land to grass the general practice is to seed timothy with the wheat in the fall and to sow the clover in the spring. There is seldom any trouble in getting a stand of timothy, but getting a stand of clover is more uncertain. As a rule there is less difficulty in this respect in fields on the slopes than on the divides. A common practice is to cut hay from the field for a season or two, when it is either plowed for cultivated crops or is used for pasture. Land is kept in grass from 2 to 10 years, but ordinarily 3 or 4 years. On the dairy and live-stock farms, where large quantities of forage crops are required, the fields are left in grass a shorter period than in the general farming section. The fields are usually pastured after the second growth has a good start. Practically no attention is given to the care of the grass land.

The hay is cut when mature, and ricked or stacked in the fields. Only a small proportion of the crop is stored in barns; most of it is hauled to the barns as needed during the feeding season. There seems to be a tendency to let the grass become too ripe before cutting, as

the clover lodges and often smothers out the roots, allowing other less valuable grasses and weeds to grow. Frequently the weeds ripen their seed before the hay is cut.

The latest census report gives 741 acres of grains cut green and 549 acres of coarse forage. During the present season the cutting of grains for hay was by no means common. The coarse forage refers mainly to cowpeas cut for hay. In addition 321 acres of the same crop gave a yield of 2,454 bushels of peas. At present there is a larger acreage planted and a much greater proportion of the crop is cut for hay. Wheat in many cases follows cowpeas. In a few cases the crop is allowed to remain on the land or it may be plowed under as a green-manure crop. Good yields of either hay or seed are obtained. The value of this crop for its soil-improving qualities is widely recognized. Soy beans are planted on only a few acres.

Although no acreage of alfalfa was reported for 1909 and the present acreage is very small, the importance and possibilities of this crop are sufficiently great to justify its discussion. At present it is confined to a few small fields on the Shelbyville and Cincinnati silt loams. A few farmers are attempting its production on a larger scale. Many attempts have been made to grow this crop with indifferent success. Failures have resulted from one cause or another, so that the opinion among the farmers is that the soils are not adapted to it and that, as so much preparation is required to grow the crop successfully, better returns are obtained from clover, which also fits better into the rotation. Liming and inoculating the land for alfalfa generally have not been done, although their need is recognized. One of the difficulties in growing this crop is the reappearance of bluegrass in the fields. When a good stand is obtained, two or three cuttings of about 1 ton each are obtained each season.

Besides the value of grass in hay production, its value in pastures, especially in the live-stock country, is large. As less than 50 per cent of the improved land is in farm crops, it is evident that a considerable acreage is used for other purposes. The cattle, horses, sheep, and hogs graze during the greater part of the year on either permanent pastures, consisting of bluegrass fields used wholly for that purpose for a term of years, or temporary pastures, a step in the rotation between hay land and cultivated crops. Other pasture lands are fields which are turned out without seeding to grass, and hilly areas not used for cultivated crops. In the hill section these usually consist of steep slopes formerly farmed, but now so washed and gullied that cultivation is impossible. The latter produce comparatively little pasturage. Little attention is given to the care of pasture lands and they are frequently overgrazed.

The special crops of the county are tobacco, hemp, and sorghum. In 1909 these were grown on a combined acreage of 9,709 acres, 12.3 per cent of the area in annual farm crops. In acreage they thus rank third but in value they stand first. Tobacco was produced on 9,035 acres, hemp on 471, and sorghum on 203. The former, then, is an important crop and the others minor ones. It was grown on 11.3 per cent of the farmed area with a production of 9,314,692 pounds and an average yield of 1,030 pounds per acre. Shelby County in that year ranked third in the State in the production of Burley tobacco, being exceeded only by Lewis and Owen Counties. It produced about 4 per cent of the total Kentucky crop.

The yield of tobacco ordinarily ranges from 700 to 1,000 pounds on the soils of the Eden series in the hilly section of the eastern part of the county and from 1,000 to 1,800 pounds or more on the soils of the Shelbyville series. Very little tobacco is grown on the Cincinnati silt loam, except in areas adjacent to soils of the two series first mentioned. In the hilly section, where the farms are fairly small and where the crop is grown by the owner with some hired help, the fields contain from 1 to 10 acres with an average of about 4 acres. In sections of more favorable topography and soil, where the farms are larger and the crop is grown largely by tenants, the fields range from 5 to 50 acres or more, with an average of 10 or 12 acres. The general opinion is that the acreage in tobacco has not materially increased since 1909, and that, though varying somewhat from year to year, it is close to 10,000 acres. Tobacco is usually grown by tenants on shares. On many farms it is the chief source of income.

Well-drained land, which warms up early in the spring, seems to be best suited to the production of tobacco. The crop is planted much more frequently on the slopes than on the tops of the broad undulating divides. During the early stages of the commercial production of this crop virgin land was considered necessary, and many acres of woodland bluegrass pasture were broken for this purpose. Even now it is planted on the new land where available. There is, however, little left in any section of the county and clover sod forms the greater part of the land put in this crop. The cropping of steep hillside fields to tobacco without attention to seeding to grass has resulted in their erosion to such an extent that large areas are at present unfit for cultivation. A higher organic-matter content appears both to increase the yield and to improve the quality of the leaf.

It is a well-recognized fact that a better quality of tobacco is grown in the hill country of the eastern part than in other parts of the county. The factors causing this difference have not been determined. The soils of the hill section, although having a heavier and less permeable subsoil because of their sloping surfaces, have a more perfect run-off and so are well drained. They therefore warm up

early in the spring. Their lime and potassium contents, as indicated by chemical analysis, are also higher and their organic matter content is lower than in case of the soils of the Shelbyville series. In general the grade of tobacco varies within the same field and in adjoining fields, and it also varies on the same land in successive seasons when given the same treatment.

The tobacco grades are based upon the color and texture of the leaf. The lighter colored soils of the hill section are said to produce a leaf of light weight and fine texture, while the darker colored soils of the Shelbyville series grow a heavier and a darker colored leaf. The product of the former commands the higher price, but this is offset by the heavier yields obtained from the latter soils. All the tobacco produced in Shelby County is Burley and is used mainly for the manufacture of cigarette and chewing tobaccos.

Tobacco land is plowed in the spring and harrowed until in a fine, friable condition. Transplanting, which in most cases is done by hand, is begun as early as the weather permits. The plants are set at intervals of 18 inches in rows from 3½ to 4 feet apart. The crop is given cultivation with one or two horse implements, but a large amount of hand work is necessary to keep the fields in proper condition. As soon as the blossoms appear the plants are topped. Sprouts are removed from time to time in order that the strength of the plant may go to the main stem leaves which make the best grade of tobacco. A sufficient number of vigorous plants are allowed to ripen seed for the next year's planting. As soon as possible after the plants begin to turn yellow they are cut close to the ground, strung on sticks, and hauled to the barns, where the sticks are suspended in such a way as to allow free circulation of air. The tobacco barns are usually placed apart from other buildings and in such a position that there is nothing to interfere with the movement of air. The sides and ends of the barns have long hinged doors which may be opened at will to regulate the circulation of air. In some cases the plants are allowed to wilt in the fields before being placed in the barns. The tobacco cures without further attention; fires are not used. When thoroughly cured and in condition to handle without breaking, the leaves are stripped from the stalk, graded, and made into hands, ready for the market. The greater part of the crop is sold by auction on the loose-leaf market in Shelbyville.

The production of tobacco, although not favorably regarded by some farmers, is often necessary on leased farms, for the reason that most of the tenants are primarily tobacco farmers. Some of the owners have viewed with concern the destruction of the woodland bluegrass pastures, and there are evidences of a tendency to return the land to bluegrass, reducing the acreage in tobacco for this purpose. The crop is commonly regarded as hard on the soil on account

of the small percentage of the crop that is returned and because tobacco farming reduces the number of live stock that may be kept. The profits from the crop have been fairly large for the last few years, but labor is scarce and a large amount of labor is required to produce the crop. The acreage has remained fairly constant.

During the present season hemp was grown on about a dozen farms, in fields ranging from 25 to 75 acres and upward. This must be classed as a minor cash crop. The census of 1910 gives a total acreage of 471 with a production of 419,485 pounds of fiber. On account of its importance on the farms where it is being grown and also on account of the acreage suited to its production, the crop warrants special mention. It is grown within a radius of a few miles of Shelbyville on undulating areas of the Shelbyville silt loam, which appears to be well suited to its production.

Hemp requires a warm, well-drained, fertile soil. It takes the place of tobacco or corn in the rotation and is grown on sod land, plowed in the fall or early spring. The land is prepared in much the same way as for corn and the seed is sown broadcast or in drills as early as the season permits. The crop requires little attention from sowing to cutting time. It is cut as close to the surface of the ground as possible either by hand or with machinery. It is then shocked and allowed to stand until late fall when it is spread thinly and left to rot, or ret. Later it is again shocked and still later broken in the fields in late winter or early spring. The fiber is made into bales of about 100 pounds each and is sold or stored as the market warrants. The yields average around 1,200 pounds per acre. The hemp hurds are usually burned.

Hemp fits well into the rotation of crops and into the system of farming on the larger farms. It makes a rank growth and serves to keep down the weeds. The farmers regard the crop a profitable one and would plant it more extensively if it were not for scarcity of labor. The availability of town labor is one of the factors which determines the location of the acreage used for the crop. Only a small percentage of the hemp seed is home grown. At its present price the production of seed for sale would be profitable.

Of the minor crops sorghum occupied 203 acres, giving a production of 883 tons in 1909. This crop is grown in small patches by many farmers, especially in the hill section of the county. It is used for forage or for the manufacture of sirup. The latter is mainly for home use, although a small amount is sold locally. The value of sorghum as a forage crop is widely recognized. Another minor crop of some importance is potatoes, of which 280 acres, yielding 31,282 bushels, is reported in 1909. Practically all the potatoes are grown in small patches for home use. In favorable seasons the yield is good and the quality fair.

An acreage of 480 was reported for vegetables. These are grown for home use, except for a few acres in the vicinity of Shelbyville, used to produce a supply for the local market. Good results are obtained from the small market gardens.

The census of 1910 reports 16,500 apple trees and 7,742 peach trees. These are mainly in small orchards to produce fruit for home use and are confined to no particular section of the county or type of soil. The few orchards of commercial size are given very little care or attention. Grapes are grown for home use only. The production of small fruits, such as strawberries, raspberries, and blackberries, is not practiced on a commercial scale.

Live-stock farming.—In Shelby county live-stock farming consists in the raising of pure-bred dairy and beef cattle for sale locally or to breeders in this or other States and in the feeding of mules and beef cattle for outside markets. The county is widely known as a breeding center for beef and dairy cattle. The auction sales are attended by breeders and dairymen from many States and herds are well and favorably known at fairs and stock shows throughout the country. The farms engaged in breeding cattle lie almost wholly in the central part of the county. The farms are comparatively large and practically all the forage needed to feed the stock is grown on the farm, mixed and concentrated feeds only being imported.

The 1910 census reports 5,773 cattle and 1,742 calves as sold or slaughtered, and the number of all cattle other than milch cows as 9,812. While the raising of cattle for beef is not a specialized industry with many farmers, yet their production for this purpose has assumed considerable importance in the county as a whole. In many cases the calves are fed and sold by the farmers who raised them. In other cases they are purchased as yearlings. The cattle of beef breeds are pastured during the grazing season and fed mainly roughage during the remainder of the year. When from three to four years old they are fattened and sold in July or August usually to dealers who resell in the large cattle markets. The beef cattle are mostly Herefords and Shorthorns. The feeders imported are obtained as near home as possible, usually from this and surrounding counties. This system of farming provides a market for the bulky farm crops at home and returns considerable fertility to the soil. It has proved profitable in the last few years.

The raising of mules for the market is another important branch of the live-stock industry. It is engaged in on a large scale by only a comparatively few farmers, but mules to supply the local work stock are raised in small numbers throughout the county. Their sale is a minor source of income to many farmers who practice general farming. The farmers who feed mules for the outside markets

usually buy locally in this and surrounding counties during the late summer months. The mules are allowed to graze until the middle of September or in some cases as late as the middle of October, when they are housed and fed liberal quantities of hay and corn. They are generally sold between the middle of November and the first of the year to buyers, who ship in carload lots to the southern markets. The last census reports 2,522 horses and mules sold.

The sale of horses is not an important source of income to the farmers of the county, although more are produced than needed to supply the local demand, a few saddle and driving horses being exported. The Census of 1910 reported 6,823 horses[1] in the county.

The importance of sheep raising is shown by the 1910 census returns, which give 34,078 sheep on the farms, 16,282 sheep sold or slaughtered, and $19,734 as the value of the wool crop. These figures represent closely the present status of the industry. Sheep raising is not specialized, but flocks of 25 to 100 head or more are found on many farms. While less attention has been given to the production of pure-bred sheep than in the case of other farm animals there are many good sheep in the county. Several different breeds are represented among which are the Shropshire, Dorset, Hampshire, and Southdown. The sheep graze during the greater part of the year, and on some farms little or no shelter is provided. On others they have access to barns during the most severe weather and are fed inside for short periods. Winter pasture is afforded by rye, wheat, and bluegrass. Sheep raising as practiced in this county is a profitable side line in general farming. Pasture and water are abundant during the greater part of the year, and the sheep require very little attention on the part of the owner.

Hog raising is an extensive industry in Shelby County. The census of 1910 reported 24,835 hogs on farms and 31,356 as sold or slaughtered. There probably has been little change in the status of the industry since 1910. The census figures show an average of 20 hogs per farm, but on many 100 hogs or more are fattened each year. These are marketed at any time from spring to late fall. Hogs are allowed to graze and are fed liberally on corn during the fattening period.

The present status of the dairy industry is not fully shown by the reports of the 1910 census, which returned 6,689 milch cows on farms, with products, excluding home use, valued at $213,559. This is 5.6 per cent of the total value of all crops and live-stock products. The value of dairy products nearly tripled in the decade ending 1909, and has also increased rapidly since that year. It is now regarded as one of the leading industries, being the chief source of income on many farms and an accessory source on many more. Dairy farming

[1] Probably includes mules.

is more highly developed in the central and west central portions of the county, tributary to the Louisville & Nashville, and to the Southern, and the interurban electric railroads. Large quantities of milk and cream are shipped daily to Louisville. Other dairy sections of smaller extent lie in the eastern half of the county, near a number of towns. In the south-central part a good dairy section is developing along the Bloomfield Branch of the Louisville & Nashville Railroad. There is a small creamery in Shelbyville, the only one in the county. Small amounts of butter are made on farms in sections distant from the railroads.

Some of the dairies are maintained for milk or cream production alone, while others keeping high-grade stock depend for a part of their income on the sale of cows and young animals. Ninety per cent of the dairy herds consist of pure-bred Jerseys and grade Jersey animals. The county ranks high in the quality of its dairy cattle. The dairy farms are provided with modern conveniences, silos, etc.

Good transportation facilities, adequate near-by markets, a sufficient water supply, and soils and climate adapted to the production of pasture and forage crops have combined to foster the development of this industry. Its further extension is assured. Bluegrass and other grasses furnish pasturage during the greater part of the year, so that the feeding season is comparatively short. An abundance of corn or other forage crops for silage or fodder can be grown. The county can produce practically everything necessary in the way of feed.

In 1909 the value of poultry and eggs sold was $155,102, or 4 per cent of the total value of all farm products. The raising of poultry is not a specialized industry. Poultry provides food for family use and a small income from the sale of the excess products.

The census of 1910 gives the percentage valuation of all farm property as follows: Land, 65.6 per cent; buildings, 20.9 per cent; implements and machinery, 2.2 per cent; and domestic animals, 11.2 per cent. These figures represent fairly the present relative valuation of the farm equipment, which ranges from poor to very good in various sections of the county. Outside of the hill section, and especially in the central part of the county, there are many large houses, surrounded by spacious bluegrass lawns and yards in which many of the original oak, maple, and other trees still remain. On these farms the barns, though fairly good, are not in proportion to the houses. The tobacco barn is frequently the largest and best barn on the farm. Silos are numerous. The tenant houses are of fairly good grade.

In the hilly sections small to medium-sized frame houses are the rule. The tobacco barns are fairly good. Other farm buildings are usually small and often in a poor state of repair.

Except in the steepest parts of the hilly sections, practically all the land is adapted to the use of modern labor-saving farm machinery. Cultivators, drills, and binders are in common use. Tractors have been tried for plowing, but only one was observed in use for that purpose during the season of the survey. There is a considerable area which seems to be adapted to their use for certain operations. Tractors and other gasoline engines are extensively used for other power purposes about the farm buildings.

A good grade of work stock is maintained throughout the county. On some farms mules, on others horses, and on others both are used for motive power. The grade of saddle and driving horses is very good. Many automobiles are owned by the farmers, and their value as a part of the farm equipment is generally recognized.

Water for farm use is secured in several ways. The underlying rock formation, as a rule, furnishes only moderate amounts of hard water for wells and springs. The greater part of the well water is obtained from moderately shallow dug wells, as drilled wells seem to yield comparatively little water. As practically all the well water is hard, cistern water is used in the farmhouses on many farms. Springs occur occasionally in some sections, but furnish comparatively little water for domestic use. With proper precautions to collect only pure water, cisterns are a very satisfactory source of water for home use. Artificial reservoirs or ponds are extensively used as a source of water for stock. In some sections an abundant water supply for cattle is furnished by the creeks.

The character of the agriculture as developed at present in the various parts of the county has been influenced greatly by topographic and soil conditions. The topography has affected the general character of the farming more than it has the kind of crops grown. It has been one of the chief factors in determining the large size of the farms and the big scale of the farming operations in the central part of the county. At the same time it has largely determined the necessity of small farms and a diversified farming system in the more hilly section. It has also been a factor in the location of the dairy industry, although transportation has been a much more important factor. Considering topography as determining the adequate character of the surface drainage, it has been the deciding factor in the kinds of crops and the character of the agriculture. The luxuriant growth of bluegrass in parts of the county early furnished abundant pasturage and thus became an important factor in the development of the live-stock industry, indirectly influencing the increased production of forage crops. The matter of soil determines largely the tobacco and nontobacco producing sections of the county.

The rather uniform soil conditions and the little attention to special crops render the matter of adaptation a more simple problem

than in counties where a greater variety of soils is found. Corn, wheat, tobacco, etc., are grown to a greater or less extent on all the soils. There is, however, a general recognition of the adaptation of the soil to different crops. That recognition is more common than the distribution of the crops seems to indicate. It is universally recognized that tobacco requires a warm, well-drained soil, and that the heaviest yields are secured on well-drained slopes of the Shelbyville silt loam, and that lighter yields of better quality are obtained on the steep slopes of the Eden clay of the hilly sections. Virgin soil is the first choice for this crop, followed by bluegrass sod and then by clover sod. It is also recognized that the Shelbyville silt loam is the best clover soil and that timothy and orchard grass do better on the Cincinnati silt loam. On typical areas of the latter soil tobacco is seldom grown. It is said to produce only medium yields of average quality in favorable seasons. The Shelbyville silt loam is recognized as the best soil for hemp in the county. A few farmers are recognizing the value of grass in preventing the erosion of steep slopes in the hill section.

The general character of the farming with a tendency toward specialization in the dairy and live-stock industries has not resulted in a fixed rotation of crops, although a general plan is quite consistently followed. Sod land is broken for the cultivated crops—corn and tobacco—followed by wheat and seeding to grass, which is cut for hay or used for pasturage for two years or more. Variations from the above are common and consist mainly in planting the field to corn for a second season or leaving the land in grass for a longer period; also in following corn by cowpeas, and in turn by wheat. Oats usually follow corn and are followed by wheat or grass. Sod land is used for hemp which is usually followed by wheat.

The expenditure for fertilizers according to the 1910 census was $10,296, or an average of $38 on the farms reporting, 283, or 12.3 per cent of the total number. This is a decrease of $5,224 over that reported in 1900. Fertilizers are used in small quantities by a few farmers for tobacco, grain, and corn, the character and amount depending upon the location of the farm. In general in the western part of the county bone meal and acid phosphate are more frequently used. In certain other sections high-grade complete mixtures are used. The use of ground limestone is increasing. In some cases the rock is quarried and crushed on the farm, in others it is shipped from outside points. Rock phosphate is used by a few farmers.

The expenditure for labor, according to the 1910 census, was $297,309, or an average of $250 per farm, 1,190 farms, or 51.7 per cent of the total number, reporting. The laborers are both native-born white and colored. They are fairly efficient, but the supply is

inadequate to handle the farm work at all seasons, as the demand is not steady, the greatest coming during the planting and harvesting periods. Obtaining labor when needed is one of the most important, as well as the most difficult, problems of the farmers of the county. The uneven demand and the proximity to Louisville and other cities where a higher wage is paid and where the demand is steady, renders the supply of farm labor inadequate. There is a tendency also for the colored population to move to the towns, where they are available for day labor, only on farms lying within a convenient distance. The scarcity of labor is influencing the character of the farming in the county. Wages by the month range from $20 to $35 with board. Day labor costs from $1.50 to $2.50. The highest wages are paid during haying and harvesting and during the tobacco cutting season. Laborers paid by the piece receive 15 cents per shock for cutting corn, 15 cents per shock for husking corn, and $1.25 per hundred for breaking hemp.

The census of 1910 shows that there are 2,301 farms in the county, comprising 87.4 per cent of its area; also that the average size of the farms is 103.8 acres, 90.7 per cent of which, or 94.1 acres, is improved land. In other words, 79.2 per cent of the total area of the county is improved land. The average size appears to be too low, but doubtless results from the census classification of each tenancy as a farm. Similar statistics for the whole State show that 86.3 per cent of it is in farms and that there is 55.8 per cent of improved land in the farms. Over an extensive area in the central part of the county the farms range in size from 50 to 1,000 acres or more, with a general average of between 200 and 300 acres, which exceeds that for the county. The individual holdings, although in one large tract, are usually subdivided into two or more farms. In the hill section and also in the extreme western part of the county the farms are small in comparison with those of the central part and doubtless the average size is less than that for the whole county.

In 1910 61.4 per cent of the farms were operated by the owners, 37.5 by tenants, and 1.2 by managers. The percentage operated by tenants is unusually high.

Land is rented largely on a share basis under several slightly different systems. The most common form of lease is that in which the landlord furnishes house, land, pasture for stock, and barns, and the tenant the work stock and labor, with an equal division of the crops. In case no pasture is furnished the landlord provides the stock. In some cases the landowner selects the crops, directs their cultivation, and attends to their marketing. There are many farms leased as a whole, but it is also a common practice to lease only a small part of a farm to be used mainly for tobacco. Cash rent is uncommon and ranges from $3 to $10 an acre,

According to the 1910 census the average value of land in the county was $50.65 an acre. At the present time the average is doubtless somewhat higher. The sale value varies widely with the character of the soil, topography, location, and improvements. In the central part of the county within a radius of several miles of Shelbyville good farms sell readily for $100 to $140 an acre. At a greater distance similar or only slightly less desirable farms sell for $75 to $100 an acre. In the hill section in the eastern part of the county the values range from $20 to $60 an acre, and in the western part from $50 to $100 an acre.

SOILS.

Shelby County is underlain by nearly horizontal beds of limestones, shaly limestones, and calcareous shales.[1] Taken as a whole, the rocks are calcareous and argillaceous, and from these the soils have been developed through the processes of weathering. The divergence of these beds from the horizontal position takes the form of a slight westward dip, so that, since the upland surface is in a broad way a plain, the oldest beds are exposed in the eastern and the youngest in the western part of the county. The lowest beds of those in the eastern part of the county contain a high proportion of shale. The limestone beds interstratified with them are thin. The shales are calcareous, but their disintegration leaves a thicker layer of material for a given thickness of rock and a soil higher in its percentage of clay than is the case with the beds with a larger proportion of limestone. The latter are more abundant throughout the central part of the county, though the difference consists mainly in the occurrence of some massive limestone beds rather than in the absence of shale. The latter still makes up a considerable proportion of the rocks. The western part of the county, except a small area in the extreme northwest where the proportion of massive limestone is high, is underlain by highly argillaceous limestones and calcareous shales. A striking characteristic of the rocks of the county as a whole, therefore, is a rather high percentage of argillaceous material with a maximum of this material in the eastern part and a minimum throughout the central and in the extreme northwestern parts. This has caused the development of a considerable area of heavy soil in the eastern part of the county and silt loams elsewhere. The freshly disintegrated but still imperfectly oxidized product of all these rocks throughout the area is a sticky plastic clay and the soils of the county, so far as soil type, based on physical characteristics, is concerned,

[1] In the preparation of this chapter the following literature has been consulted: Geology and Mineral Resources of Jefferson County, Kentucky. Charles Butts. Geology of Franklin County, Kentucky. A. M. Miller. Water Resources of the Blue Grass Region, Kentucky. Water-Supply Paper No. 233. Geology of Henry, Shelby, and Oldham Counties, Kentucky. W. M. Linney.

differ mainly in the thickness of the thoroughly weathered and uniformly oxidized horizon overlying the imperfectly oxidized, freshly disintegrated material. Other variations in color, structure, texture, and content of organic matter are of less importance.

The normal soil profile of the maturely developed soil of the region consists of a 6-inch horizon of light-brown material, having a decided yellowish shade. This is underlain by a yellowish-brown, friable, somewhat more compact and slightly heavier horizon extending to a depth of about 20 inches. This in turn is underlain by a heavier, somewhat plastic yellowish-brown horizon, in which the texture becomes somewhat heavier downward. The latter horizon is the lowest one in the true soil profile and changes gradually downward to the unoxidized or partially oxidized freshly disintegrated clay from the underlying shale or limestone or into the rock itself.

The profile of the most maturely developed soil in this area varies slightly from the normal, as just described, in the presence at the base of the soil profile, and lying between the latter and the disintegrated parent rock of a horizon of iron concretions and incipient concretions in the form of black or dark-brown spots. This horizon is more friable than the one immediately above it or that immediately below it, and now lies at about 30 inches beneath the surface and is uniformly characteristic of the Shelbyville silt loam. It is the base of the soil horizon and marks the surface of the rather heavy and somewhat impervious clay, on which subsoil water is checked in its downward percolation. The presence of well-formed iron concretions above this horizon seems to indicate that it was first formed higher up and has moved downward with the gradual increase in the thickness of the zone of complete oxidation.

The more advanced stage in soil development reached by the Shelbyville silt loam than has been reached by the other soils of the county seems to be due more to the relatively smooth topography under which it has been developed than to the character of the rock that has supplied the material. The smoothness of the topography has prevented excessive erosion and has allowed the soil material to lie in position long enough to become weathered to a greater depth than in any of the other soils. Some of the soil, possibly a considerable part of it, has doubtless existed as such throughout the period of the existing topographic cycle and may have existed during a previous one. However that may be, its subsoil is better oxidized and better aerated than that of any other soil in the county. Analyses so far made, however, do not indicate any more thorough leaching of this soil than of the other types.

The Cincinnati silt loam stands next to the Shelbyville silt loam in its stage of development as a soil. The depth of the thoroughly

oxidized and aerated horizon is less than in the case of the latter soil and the layer of iron-oxide concretions and spots is not so generally present or so well developed. The subsoil is more plastic and sticky and the mottled blue and yellow partially weathered parent rock material is usually found at shallower depths than in the Shelbyville. A somewhat larger proportion of shale in the parent rock as well as a topography somewhat rougher than that of the Shelbyville silt loam area both act toward the retardation of the oxidation of this soil, the former by making the deepening of the zone of oxidation difficult and slower, and the latter by causing a thinning of the weathered zone from above by erosion. The latter process tends to decrease the amount of organic matter in the soil at any given time by keeping the humus layer thin. The chemical composition of the parent rock seems to have had some influence on the chemical composition of the soil, though it is very slight, and the data at hand seems hardly sufficient to draw definite conclusions.

The Eden clay, the other important upland soil in the county, is the youngest soil in the county, exception being made of the recent alluvial soils. Its stage of development is the least advanced of all of them, its subsoil being in many cases little else but the disintegrated and partially weathered parent calcareous shale and thin bedded limestone.

The thoroughly oxidized and aerated zone in the clay type is rarely more than 12 inches thick, and often thinner. The layer of iron-oxide concretions is absent, the steep slopes on which the soil occurs preventing any stagnation, on the surface of the unweathered zone, of the subsoil water.

On account of the severe erosion to which the types of the Eden series are subjected the surface soils have a lower content of organic matter as a whole than either of the other two principal upland soils. They are lighter in color, therefore, than any of the other types.

The Hagerstown silt loam, the remaining upland type, is more completely oxidized than the Shelbyville silt loam, but its area is so small that it does not need discussion here.

The county lies within the Limestone Valley and Uplands Soil Province as defined by the Bureau of Soils in Bulletin 96. Two groups of soils are represented, (1) residual upland soils and (2) river flood plain soils, comprising both present alluvial and terrace soils. The former covers the main part of the county, the latter being comparatively inextensive and of minor importance.

The above broad divisions are further subdivided into soil series or groups and the series into soil types. The latter is the unit of classification and is determined by the texture, or the relative proportion of the different-sized particles of mineral matter which make up the soil mass. The series classification is based upon origin, structure,

color, topography, and agricultural value. Types of different textures but similar in the above characteristics comprise a soil series.

Six such series embracing eight types and three phases have been recognized in the survey of Shelby County. The series distinction is usually clearly defined, but in places one series may grade into another so gradually that the separations can not everywhere be made along very sharp lines. The type distinctions in regard to texture are as a rule fairly well defined, but here also graduations occur which make it difficult to draw everywhere sharp boundaries. Gradations and other minor differences where not of sufficient extent and agricultural importance to warrant the establishing of a distinct type are mapped as phases. The extent and distribution of the soil types and phases are shown on the accompanying soil map.

The residual soils belong in the Shelbyville, Cincinnati, Eden, and Hagerstown series.

The Shelbyville series includes types which have a brown surface soil, yellowish-brown upper subsoil, and a yellowish-brown to yellow lower subsoil usually with moderate to high content of rusty-brown and black concretions and concretionary material. Faint grayish mottlings are frequently present in the lower subsoil. Both soil and upper subsoil have a fairly compact though friable structure while the lower subsoil though rather heavy is brittle or crumbly. In places the substratum consists of heavy stiff clay, like the subsoil of the typical Cincinnati. Bedrock is usually encountered at depths ranging from 4 to 10 feet. Rock fragments are uncommon on the surface or within the 3-foot section. The surface features range from undulating to broadly rolling (Pl. I, fig. 1) with a few moderately steep slopes toward the larger streams. The drainage is adequate. The soil types of this series are residual from limestone, shaly limestone, and calcareous shales. They have a fairly high organic-matter content. The Shelbyville silt loam and two phases represent the series in this county.

The types in the Cincinnati series have a light-brown soil, yellow upper subsoil, and yellow plastic clay lower subsoil, often mottled with gray or pale yellow, and in places containing brown and black concretions and concretionary material. The structure of the soil is friable while that of the subsoil is sticky and plastic when wet and tough when dry. Bedrock is encountered at 5 to 10 feet below the surface. The surface is gently rolling to rolling. The drainage though usually adequate is slightly retarded by the heavy texture and close structure of the subsoil and substratum. The material is residual from limestone and shaly limestone. The soil contains a moderate amount of organic matter, and tends to erode on slopes. The series is represented by two types and one phase in this county.

FIG. 1.—CHARACTERISTIC UNDULATING SURFACE OF THE SHELBYVILLE SILT LOAM.

The crop in shock is hemp. This soil is one of the better types in the county and is largely used for the production of corn, with a considerable area devoted to hay (timothy and clover), wheat, and tobacco. The raising of cattle and dairying are important industries.

FIG. 2.—PATCHY CULTIVATION OF SOME OF THE MORE BADLY ERODED LAND IN THE EASTERN PART OF THE COUNTY.

Cedar reproduction is taking place on the severely eroded slope in the middle ground. Such slopes probably can best be used as grass and pasture land.

The Eden series consists of soil types which have gray to yellow soils, yellow upper subsoils, and mottled yellow and gray lower subsoils. The soils are comparatively shallow and have a moderately friable structure. The subsoils have a smooth, greasy feel, are slightly plastic when wet, and are relatively impervious to water and air. The series occupies rolling to hilly areas whose drainage ranges from adequate to excessive. It is derived through the processes of weathering from shale interbedded with thin strata of limestone. The rapid removal of material and colluvial accumulation have modified to some extent certain of the types. As a whole they are characterized by a low organic-matter content and tendency to erode. (Pl. I, fig. 2.) Material of this character is classified in two types, the silt loam and the clay.

The Hagerstown soils have a brown to slightly reddish-brown surface soil and a reddish-brown subsoil. The soil is fairly deep and friable. The subsoil is moderately friable to brittle. These soils occupy flat or undulating ridge tops and benchlike positions whose surface features have been determined largely by the character of the underlying rocks. The drainage is well established. The soil material is derived from fairly massive strata of magnesian limestone. The soils are productive, easily tilled, and adapted to a variety of crops. Only one type, the silt loam, is mapped.

The soils of the river flood plain group fall into two classes, (1) terrace soils and (2) first-bottom soils. They are inextensive in Shelby County and occur only along certain of the larger streams, as isolated areas instead of the usual long narrow strips. Frequently it is difficult to draw the line between first bottom and terrace. The distinction often rests upon whether the tract in question is subject to overflow. The soils of this group are composed of sediments derived from the uplands of the basin of the stream along which they occur and deposited in quiet water during overflow. The terrace areas were deposited before the streams had cut to their present levels. The Huntington series occupies first bottoms and the Elk series the terraces.

The soil types of the Huntington series are characterized by brown friable soils and lighter brown subsoils of heavier texture. The surface is level and the drainage is good, except during infrequent short periods of overflow. The material is composed of sediments washed from the uplands of the basin of the stream along which it occurs and consists of reworked portions of the soils of the Shelbyville and Cincinnati series. The types have a moderate content of organic matter. The silt loam is mapped.

The Elk series includes the soil types which have light-brown soils and yellowish-brown subsoils. The types occupy flat or nearly flat second bottoms standing above normal overflow. The drainage is good. The poorly drained areas represent inclusions of other soils,

and should not be included in the series described. The material consists of alluvial sediments washed down from residual upland limestone soils and deposited at a time when the present streams were flowing at higher levels. The soils are adapted to a wide range of crops.

The following table gives the names and the actual and relative extent of the soil types and phases mapped in Shelby County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Shelbyville silt loam	73,600		Cincinnati silty clay loam	7,744	3.2
Rolling phase	19,328	45.4	Huntington silt loam	3,968	1.6
Shallow phase	17,920		Hagerstown silt loam	1,280	.5
Cincinnati silt loam	54,080	26.8	Elk silt loam	832	.3
Rolling phase	11,520		Total	244,480	
Eden clay	43,200	17.7			
Eden silt loam	11,008	4.5			

SHELBYVILLE SILT LOAM.

The surface soil of the Shelbyville silt loam is a light-brown, friable silt loam about 6 or 8 inches deep. The subsoil consists of a light-brown silt loam which passes at 10 to 14 inches into light-brown or yellowish-brown, brittle silty clay loam, this in turn passing at 16 to 20 inches into light yellowish brown, moderately friable to slightly stiff silty clay to clay. This usually contains rusty-brown and black concretions and concretionary material, in moderate to abundant quantity. Below a depth of about 30 inches pale-yellow and gray mottlings are common. In a few places the upper subsoil shows a reddish cast, but the yellowish clay is reached beneath this, within the 3-foot section. The substratum is similar to the lower subsoil. The change from upper to lower subsoil is in many places abrupt. The latter becomes heavier and more plastic and sticky with depth and more mottled as bedrock is approached. The depth of the soil mantle ranges from 4 to 10 feet, with an average of about 5½ feet. Typically the 3-foot section is free from rock fragments.

Some small patches of the Hagerstown and Cincinnati silt loams are included with this type as mapped.

The greatest variation in this type is in the depth to the lower, heavy subsoil. This appears to depend largely on the topography and the depth to bedrock. Here and there, in small areas on stream slopes, the deep, heavy subsoil is comparatively near the surface, and the soil is lighter brown and slightly heavier than is typical. Where these areas are of sufficient extent they are separated as a shallow phase. As a rule the depth decreases inversely with the degree of

slope. and with this decrease there is a tendency toward a slightly yellowish-brown color. In general the more rolling the surface and the shallower the soil blanket over bedrock, the less the depth of the surface layer of silt loam. There is increased mottling and an abundance of concretions and concretionary material where the drainage is slightly retarded by topography or by an especially heavy substratum.

Over extensive areas of gently undulating land the type has a uniform brown color and silt loam texture, with little range in depth to the heavy lower subsoil. Here practically the only variation is the appearance of faint mottlings in the extreme lower subsoil in small, very gently undulating to almost flat areas on broad divides or near the heads of small streams. In these places there is usually a greater number of small concretions.

The boundary lines drawn between this type and the Cincinnati silt loam are only approximate, as these types, being derived from successive formations, merge into each other very gradually and in most places with no change in topography. In addition, the material from the upper formation thins out gradually, and prolonged erosion has removed a greater or less proportion of it in places.

The Shelbyville silt loam and its phases occupy a large continuous area in the eastern half of the county, mainly within the drainage basins of Clear and Guists Creeks.

The surface is that of a broadly undulating plain. The divides are for the most part broad and gently undulating and the slopes long and gentle. The streams flow in shallow, though wide, valleys which gradually become deeper in the southern part of the county where the surface in places is rolling, with here and there a conspicuously steep slope. The topography is more rolling than typical along Bullskin Creek.

There are few large streams throughout this soil, but tributaries are sufficiently widespread to give good surface drainage, and the underdrainage appears to be fairly good. In a few places at the heads of small branches or on almost flat divides the drainage is somewhat retarded during periods of heavy rainfall. There are very few springs of any considerable size.

Some small patches of the original timber remain in places. The growth includes beech, sugar maple, oak, poplar, and ash.

The Shelbyville silt loam is the most important soil in the county. It is very extensive, and is universally considered the most productive type. It is known to be well adapted to all the common crops. It includes most of the best farms. All of the type is easily accessible, and much of it is within a few miles of Shelbyville. Practically all the type is in cultivation. The soil is quite well supplied

with organic matter and is easily tilled, and its structure permits of good aeration as well as the retention of moisture.

Hay and pasture grasses occupy the largest acreage, followed by corn, wheat, and tobacco. Clover makes up a large part of the hay crop. The land used for pasture consists of permanent bluegrass sod and of fields which have been used for hay crops a season or two. Corn is the most important subsistence crop, and tobacco the leading money crop. This is the chief tobacco-growing soil of the county. Wheat is also a money crop. In certain seasons some corn and hay are sold. The minor crops are hemp, cowpeas, rye, oats, vegetables, and fruit. Hemp is grown as a source of income, while the others are of relatively little commercial importance. Alfalfa, although of minor importance at present, is a very valuable crop under the prevailing type of agriculture. On many farms general farming is carried on, with tobacco as the main money crop, but it is on this type that the greatest development of the various branches of the live-stock industry has taken place, including dairying, the raising and feeding of beef cattle, the finishing of mules, the raising of pure-bred stock for sale and show purposes, and the raising of hogs and sheep. Many farmers make a specialty of one or more of these branches. On all such farms efforts are made to grow all the necessary forage and feed, but in some seasons it is necessary to purchase additional feed. Concentrated feeds are often purchased.

The ordinary range in the yield of crops is as follows: Hay from 1 to 2 tons per acre; corn, from 40 to 80 bushels; wheat, from 10 to 30 bushels; tobacco, from 1,000 to 1,800 pounds; and oats, from 30 to 40 bushels. The yields are seldom reduced seriously by an excess of rainfall, but are lowered in some years by drought.

Farms on this type are larger than the average for the county, and operations are conducted on a fairly large scale, a considerable acreage being handled by tenants. Tobacco is the chief crop produced by tenants.

This is the most efficiently farmed type in the county. The grade of work stock is good, and there is an adequate supply of up-to-date farm machinery. Crops are generally rotated. The most common rotation consists of plowing sod land for corn or tobacco, which is followed by wheat and this by grass. Tobacco is seldom if ever grown two years in succession, but a few farmers plant corn the second year on the same land. The rotation is varied by the introduction of other crops, such as cowpeas or hemp. The former usually follows corn and is, in turn, followed by wheat. All cultivated crops are given frequent clean cultivation. In the fall the land is generally disked and wheat sown, but this practice seems to be gradually going out of use. For hemp, which is grown only on this type, a

well-drained, productive field is selected. Land is left in sod for two to four years. It may be used for pasturage during part of this period. The first year after seeding the hay crop is mainly clover. This seems to give way to timothy, so that succeeding crops are mixed. Fall plowing is quite a general practice. The land is plowed to a depth of 6 to 8 inches, and the seed bed is usually well prepared. Rye is sometimes sown in the fall for turning under in the spring. Cowpeas are usually cut for hay. Infrequently they are turned under for green manure.

Commercial fertilizers are seldom used on this type. A few farmers use small quantities to aid in giving crops a good start or to insure a better stand of clover. Very little of the type is regarded as "run down," although it has been farmed for many years and yields of some crops are lower than formerly. By feeding the greater part of the crops at home, much plant food is returned to the soil in the form of manure. Leguminous crops are grown for soil improvement and the growing of clover has aided in maintaining the productiveness. Ground limestone is used by a few farmers.

Farms on this type command the highest sale value in the county. There is a range in price from $75 to $150 an acre, depending upon the location and the state of cultivation. The exchange of farms seems to be quite active.

The adaptation of this soil to pasturage, hay, and forage crops, and its good location with respect to markets and transportation facilities have favored the development of the live-stock industry. The extension of live-stock farming would apparently be profitable, especially in view of the high prices for beef and pork and for mules. Feeding of green crops during the summer months would decrease the necessary acreage in pasture and make more land available for cultivation. It would seem that the high feeding value and good yields of alfalfa would justify greater efforts to grow this crop. Much of the type can be adapted to it by liming and inoculation. Liming would also increase the chances of obtaining a good stand of clover.

Shelbyville silt loam, rolling phase.—The rolling phase of the Shelbyville silt loam consists of 6 to 10 inches of brown, mellow silt loam which grades into a brown to yellowish-brown, brittle, heavy silty clay loam, and this in turn at about 24 inches into a brownish-yellow to yellowish, somewhat plastic, heavy silty clay, faintly mottled with rusty brown and gray. The lower subsoil has numerous small dark spots or iron stains and small rounded concretions. Bedrock lies 4 to 6 feet below the surface, and the soil is practically free from rock fragments.

This phase closely resembles the typical Shelbyville silt loam in many respects, including the brown surface soil and broadly undu-

lating topography. The lower subsoil of the type is practically identical with the upper subsoil of this phase, except that the latter tends toward yellow, while the former is usually brown. The deep substratum of the type is similar to the lower subsoil of the phase except for the yellowish color of the latter. The phase differs from the Cincinnati silt loam in having a darker brown surface soil and a less pronounced yellow upper subsoil and in the absence of the distinctly mottled lower subsoil. It differs from the shallow phase in topography, depth of surface soil, and in color of, and depth to the lower subsoil. In depth of material it is intermediate between the main type and its shallow phase.

The rolling phase as mapped includes areas which are practically identical with the main type. Its variations consist mainly in the depth of the silt loam mantle and the color of the lower subsoil. Some unimportant areas of this phase are encountered in places in the main type where their separation is not warranted.

The rolling phase covers the tops of ridges within the hilly section of the county and in the less hilly section where the associated types belong to the Eden series. It is confined to a belt along the eastern side and to the southeastern quarter of the county. Its surface is gently undulating to broadly rolling, flanked by steep slopes occupied by the Eden soils or by the shallow phase of the Shelbyville silt loam. The drainage is adequate, and in some places excessive.

This phase covers a fairly extensive area, nearly all of which is farmed. Each main ridge is traversed by a public road, along which there are numerous farm houses. It is the best, as well as the most important, soil in the sections where it is encountered. The soil has a fairly high content of organic matter, and is productive and easily tilled. It is a desirable type for general farm and special crops.

General farming, with tobacco as the chief money crop, predominates. The farms are of medium size and situated in part on other soils. The adjoining soils in many cases are used for tobacco and pasture, while this phase is used for grass, corn, and wheat. Some dairying and live-stock raising are carried on. The income is from a mixed source. In general the farming methods are not as good as on the typical soil, and the phase has not been maintained in as high a state of productiveness. On the average the yields range slightly lower.

Land of this phase sells for $50 to $75 an acre. Part of it lies at a considerable distance from railroads.

A general need of this soil is the keeping of more stock, in order to have a home market for the bulky crops and to return more plant food to the soil in the form of manure. Leguminous crops should be grown more extensively. The growing of winter cover crops would be beneficial in protecting the surface from erosion and leaching.

Shelbyville silt loam, shallow phase.—The shallow phase of the Shelbyville silt loam consists of 5 or 6 inches of brown silt loam underlain by a brittle, yellowish-brown or light-brown silty clay loam which grades at about 15 inches into a plastic, heavy silty clay or clay of a yellowish-brown color, mottled with pale yellow, gray, and rusty brown. The latter material continues to the bedrock, which usually ranges in depth from 2 to 4 feet below the surface. Iron stains and small concretions or accretions are fairly common in the lower subsoil. Numerous small areas occur, especially on slopes, where the surface soil has been removed and the heavy subsoil exposed. Here fragments of limestone are fairly common and limestone outcrops occur in places. Occasionally the gullies extend to the bedrock. As mapped the phase includes patches of Shelbyville silty clay loam or clay too small and irregular to map. These occur mainly adjacent to streams where the slope is rather abrupt.

This phase differs from the typical Shelbyville silt loam in the occurrence of the heavy, plastic clay substratum within the 3-foot section. The more rolling topography has not permitted the accumulation of a silt loam mantle as deep as over the less rolling areas of the type, hence the lower subsoil of the type forms the upper subsoil of the phase. The surface soil is also lighter in color and the lower subsoil is more typically mottled.

The shallow phase occurs chiefly on sloping or steeply sloping areas along or near streams, and occupies an intermediate position between the typical Shelbyville silt loam and the Eden clay. It is largely confined to the eastern and southeastern parts of the county. The slope is in places sufficient to permit rapid run-off, resulting at times in rather excessive drainage.

In average seasons the phase is nearly as productive as the typical soil, if well farmed, but in a series of years the yields do not equal those obtained on the main type. The greater slope and the slight tendency to erode in certain areas also render it less desirable. Practically all of it is cleared and approximately 75 per cent is used for annual farm crops. The remainder includes land used for permanent pasture, small areas somewhat eroded, and inextensive timbered tracts. Here the growth consists of oak, maple, hickory, and walnut

Grass for hay or pasturage, wheat, corn, and tobacco are the chief crops, named in order of acreage. There is a tendency to grow a minimum acreage of cultivated crops and more grass and grain crops than on the typical soil, owing to the tendency to wash. The phase is regarded as good tobacco land. It produces a good grade of leaf. Tobacco and wheat are money crops, the others being grown mainly as subsistence products. The phase is farmed in conjunction with larger adjoining areas of the main type, under the same meth-

ods. As only small tracts are included in individual farms, its sale value differs little from that of the main type.

It is quite generally recognized that a large part of this phase can best be used for grass and grain crops, on account of the tendency to wash. In an average season it may be profitably farmed to tilled crops, but it should be returned to grass as soon as possible.

In the following table are given the average results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the typical Shelbyville silt loam:

Mechanical analyses of Shelbyville silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391007, 391018, 391042..	Soil	0.3	2.1	1.4	2.2	5.4	72.5	16.2
391008, 391019, 391043..	Subsoil	.3	1.6	1.1	1.9	4.0	65.9	25.2
391009, 391020, 391044..	Lower subsoil.	.2	2.1	1.3	3.9	4.3	50.4	37.8

CINCINNATI SILT LOAM.

The surface soil of the Cincinnati silt loam is a light-brown to yellowish-brown friable silt loam, ranging in depth from 6 to 10 inches. It is underlain abruptly by yellow or yellowish-brown, stiff silty clay or silty clay loam which quickly passes into stiff silty clay. The lower subsoil is characteristically plastic and sticky and of a pale-yellow color, often with a greenish cast or of a mottled pale-yellow and grayish color. In places there is considerable rusty-brown and black concretionary material in the subsoil, such material making it less plastic but probably not less impervious. Usually, however, stiffer clay is reached in the lower part of the 3-foot section, even where there is an abundance of the concretionary material in the subsoil above, than in the case of the Shelbyville silt loam.

The substratum consists of mottled gray and yellow, plastic clay extending to the bedrock, which is encountered at depths of 5 to 12 feet below the surface. Cuts indicate that there is only a thin layer of partially disintegrated material overlying the bedrock, and that the surface of the rock conforms fairly closely to the surface features of the soil. Rock fragments are very scarce, although there are some rounded bowlders in places on the surface and through the soil section. As mapped there are included on eroded slopes patches of Cincinnati clay and silty clay loam and of Shelbyville silt loam.

This soil is fairly typical throughout a belt crossing the county on the west side of Bullskin Creek. To the east of this belt, where the type grades toward the Shelbyville silt loam, it frequently

has a deeper surface soil, of a darker brown color, and a less pronounced yellow subsoil, which is less stiff than typical. The soil here consists of a light to medium brown silt loam 8 to 10 inches deep, underlain by a moderately stiff to plastic, yellow or brownish-yellow silty clay loam, which at a depth of 24 to 30 inches rests upon a brownish-yellow silty clay or clay. This is usually mottled with gray and rusty brown. In the extreme northwestern corner of the county the texture is slightly lighter than a silt loam in several places. The surface soil grades toward gray rather than brown and the subsoil is quite typically yellow throughout. In the same part of the county occasional red mottlings appear in the subsoil.

A gravelly area on and near the top of Jeptha Knob is mapped with this soil. The gravel consists of angular and subangular chert fragments, occurring on the surface and through the soil section. The soil here is in part colluvial. This area is indicated on the map by gravel symbols.

The Cincinnati silt loam is the predominant soil in the western half of the county, where its continuity is broken only by areas of Shelbyville silt loam along Fox Run and Bullskin Creek. Isolated areas occur along the main Kentucky-Salt River divide from a point near Christianburg northward to the Henry County line. Another area lies about 5 miles south of Shelbyville, and a few small areas around the base of Jeptha Knob.

Typical areas have a gently rolling topography similar to that of extensive areas of Shelbyville silt loam. Here and there rolling areas or steep slopes occur. Over considerable areas of the type both the run-off and the subsurface drainage are somewhat slow, on account of the slight slope and the rather impervious character of the subsoil. In other places the drainage is adequate under normal conditions. None of the type is poorly drained.

Only occasional small trees of the original timber growth remain, consisting of beech, ash, poplar, and black locust.

The Cincinnati silt loam is the second most extensive and most important soil in the county. It covers approximately one-third of the county. With the exception of a few small tracts here and there all of it is in cultivation. The type has a medium organic-matter content, is fairly retentive of moisture, and is comparatively easily tilled. As a rule it warms up rather slowly in the spring.

Grass for hay and pasture, corn, and wheat are the chief crops, followed by oats, tobacco, rye, and fruits. A larger acreage is in grass than in all other crops combined. Hay is the leading crop, consisting mainly of timothy alone or timothy and clover mixed. Other grasses are orchard grass, clover, and bluegrass. The greater part of the hay and corn is fed to stock, but a small percentage is

sold locally. The acreage in bluegrass is comparatively small. Corn for silage and for seed is widely grown. Wheat is almost entirely a money crop. Tobacco is not grown extensively, and is largely confined to portions of the type adjacent to the Shelbyville silt loam. The quality is fair. Fruit is produced only in home orchards. General farming on a medium to large scale, with a tendency toward specialization in dairying, is the predominating type of agriculture. The live-stock industries consist of dairying, hog and sheep raising, and the raising of some beef cattle. On account of the easy accessibility of much of the type there has been quite an extension of the dairy industry within the last few years. An abundance of forage crops is usually available. The dairy farmers keep from 8 to 25 cows, mainly pure-bred and grade Jerseys, and the dairies usually are efficiently managed. The dairy products are shipped to distributors and creameries in Louisville.

On a few farms wheat and tobacco are the chief sources of income, with the sale of live stock and products as accessory sources. On others dairy products form practically the only source of revenue. On still others dairy products, live stock, wheat, and small amounts of other crops are sold.

Wheat yields from 10 to 20 bushels per acre in favorable seasons, but yields as low as 6 bushels per acre have been obtained. Corn yields vary from 20 to 90 bushels per acre, but under efficient management the yields range from 50 to 75 bushels in the average season. Silage corn yields 5 to 8 tons per acre. Hay yields range from three-fourths ton to 1½ tons per acre. Tobacco yields from 700 to 1,500 pounds per acre, the higher yields being obtained on areas of the type which grade toward the Shelbyville silt loam.

The farming methods on this type range from efficient to poor. On the whole it is not as well farmed as the Shelbyville silt loam, but better farmed than the remainder of the soils. There are many efficiently managed farms on this type, mainly in a belt bordering the Shelbyville silt loam. Crops are generally rotated. Sod land is broken for corn, which is followed by wheat, and this by grass. Timothy is usually sown in the fall and clover in the spring, and land is kept in grass for two to five years or more. Tillage is generally efficient, modern machinery and a good grade of work stock being used. The farm buildings range from adequate to poor. Silos are fairly numerous in the sections where dairying is carried on. Considerable plant food is returned to the soil in the form of manure, and in addition cowpeas are grown for soil improvement. Commercial fertilizers are in more general use than on the Shelbyville silt loam, being used for tobacco, corn, and wheat. The applications are light and consist of complete mixtures or mixtures of bone meal and acid phosphate, while a few farmers apply lime.

The sale value of this land depends largely upon its location, the character of the surrounding farms, and the farm improvements. Farms at present sell for $60 to $100 or more an acre.

Good markets and transportation facilities favor dairying and the industry should be extended. The production of forage could be increased if the leguminous crops, such as cowpeas, were grown more extensively, both for their nitrogen-gathering qualities and as sources of organic matter. Applications of lime would greatly improve the chances of getting a stand of clover, and would also increase the yields. In places the type drains rather slowly, and the planting of crops is sometimes delayed. Artificial drainage would be beneficial over such areas. While crops seldom suffer from drought, deeper plowing, the adding of organic matter, and frequent cultivation would reduce the chances of loss from this source. Many of the attempts to grow alfalfa have failed because attention was not given to inoculation, liming, or other methods of proper preparation of the soil. The crop may be successfully grown over portions of the type with proper care. Sweet clover is suggested as a valuable crop to precede alfalfa. In places where there is sufficient slope the soil has a tendency to erode, and such areas should be kept in grass and grain crops as much as possible. The Kentucky Agricultural Experiment Station has a cooperative experiment field at Lincoln Ridge, where a study is being made in the use of fertilizers, crop adaptation, and farming methods on this type.

Cincinnati silt loam, rolling phase.—The rolling phase has a lighter colored and shallower surface than the typical Cincinnati silt loam, as well as a slightly heavier and tougher subsoil, owing to the lesser depth to bedrock. Also, there is less gray mottling and less concretionary material in the subsoil. This phase consists of about 6 inches of grayish to yellowish-brown silt loam, underlain by a yellow silty clay or silty clay loam passing into silty clay. The deep subsoil is a tough or plastic silty clay or clay, often sticky. In places there are gray mottlings and some rusty-brown and black concretions, but the characteristic color is yellow, frequently with a greenish cast. The phase is in general free from rock outcrops, but occasionally there is a partly rounded bowlder on the surface or embedded in the soil. Where erosion has been severe the gullies in places have cut down to bedrock. As mapped, the phase includes small patches of Cincinnati silty clay loam and clay and a shallow phase of the silt loam.

The greater part of this phase lies within the drainage basin of Floyds Fork, where it covers a belt of varying width along the western side of the county. Some small areas are not mapped separately, being included with the typical soil.

The phase as a whole has a rolling topography, varying in places to sloping or hilly. There is more surface relief and a more extensive drainage system than over the typical Cincinnati silt loam. The run-off is fairly rapid, but underdrainage is necessarily slow.

This phase is rather extensive, and the greatest part of it is farmed. The uncultivated land includes small patches which have never been cleared and fields formerly cultivated but now somewhat eroded and allowed to grow up to weeds and brush. The soil is apparently deficient in organic matter. It holds a medium amount of moisture for growing crops and is moderately productive. It seems better adapted to grasses and grain than tilled crops.

Grasses for hay and pasturage are grown on the largest acreage. Probably more of the phase is used for pasture than for all crops combined. Corn is an important crop, but tobacco is seldom grown. Live-stock farming is not well developed, although part of the farm income is derived from the sale of stock. General farming predominates. The yields range with the season, sometimes being as high as those obtained on the typical soil and sometimes considerably lower.

There is apparently a tendency to keep most of this soil in grass and grain. This plan should be generally followed, on account of the erosion on exposed surfaces. Winter cover crops would serve to protect the surface during the winter season and, in addition, increase the low organic-matter content when plowed under in the spring. The growing of leguminous crops, such as cowpeas, either for seed or for plowing under, would be very beneficial. With the use of lime the production of clover may be materially increased.

The following table gives the average results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the typical Cincinnati silt loam and of its rolling phase:

Mechanical analyses of Cincinnati silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
Typical soil:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391010, 391027.	Soil.....	0.1	0.8	0.6	1.3	5.5	75.7	15.8
391011, 391028.	Subsoil.....	.0	.7	.5	.9	5.2	67.8	24.8
391012, 391029.	Lower subsoil.	.5	2.0	.9	1.8	3.3	63.4	27.9
Rolling phase:								
391030, 391033.	Soil.....	0.7	1.0	0.4	1.3	8.0	71.7	16.8
391031, 391034.	Subsoil.....	.2	.6	.3	2.0	5.7	54.2	36.6
391032, 391035.	Lower subsoil.	.1	.4	.3	2.2	5.8	39.9	51.2

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 391035, 10.70 per cent.

CINCINNATI SILTY CLAY LOAM.

The top soil of the Cincinnati silty clay loam consists of yellowish-brown silty clay loam or a thin covering of light-brown to yellowish-brown silt loam over yellowish silty clay loam. At depths of 3 to 8 inches yellow silty clay is reached. This abruptly passes into yellow or greenish-yellow, sticky, plastic clay, containing fewer concretions, as a rule, than occur in the subsoil of the silt loam type. Over much of the type more or less of the surface soil has been removed, resulting in the exposure of the yellow clay in patches on slopes. Rock fragments and outcrops seldom occur. Perhaps half of the type has a yellow silty clay loam as the surface material.

This type occurs along streams in the western part of the county, almost wholly within the drainage basin of Floyds Fork. The surface is sloping to rolling or hilly, and the drainage is good. In places the run-off frequently carries away some of the soil.

Practically all of the Cincinnati silty clay loam has been cleared and farmed. At present most of it supports a rather poor stand of grass and is used for pasturage. The remainder has grown up to brush. More efficient methods of handling these areas, such as keeping them in grass and maintaining the supply of organic matter, would have minimized the destructive action of erosion. Small tracts here and there are in cultivation to grain, corn, and grass, which give medium yields. Some areas are growing up to black locust. There is some walnut and considerable redbud and sassafras.

The sale value of this soil alone would be low. It is sold in connection with farms located mainly on the silt loam, bringing $40 to $80 an acre.

Care should be taken to prevent the further erosion of this soil. It should be kept in grass as much as possible. Sweet clover would doubtless be successful if the soil were properly limed, and should prove an effective means of reclaiming the land. Exceptionally rough areas should be reforested.

EDEN SILT LOAM.

The Eden silt loam consists of a pale-yellow loam to an average depth of about 6 inches, passing abruptly into yellow silty clay to clay. At 18 to 24 inches the material is yellow silty clay, mottled with pale yellow and gray and rusty brown. The surface soil though compact is fairly friable. The upper subsoil is usually stiff. The lower subsoil is tough and impervious when dry, and plastic and impervious when wet. The lower subsoil continues with little change to the bedrock, which is usually encountered at 4 to 10

feet below the surface. The surface soil is practically free from rock fragments, but small pieces of calcareous shale are common in the subsoil.

The depth of the surface soil ranges from 4 to 8 inches, and where the yellow upper subsoil material is especially close to the surface its incorporation with the surface soil by plowing has resulted in a yellowish-gray color for the latter. In the upper subsoil a few faint mottlings sometimes occur, but as a rule the yellow color is more pronounced and extends to greater depths than in the case of the silty clay loam of the series. The type grades on the one hand into the Eden clay, which usually covers the slopes of the divides occupied by this soil, and on the other toward the Shelbyville silt loam, which usually covers slightly higher elevations in the same general region. As mapped, small areas of the latter type are doubtless included, as the boundary is in many places somewhat arbitrarily placed.

The Eden silt loam occurs only in the hill section of the eastern and southeastern parts of the county. It occupies comparatively narrow, high divides or spurs. The areas are for the most part small and have a rounded or gently sloping contour. There is usually sufficient slope to allow much of the rainfall to be lost as run-off, although no drainage ways traverse the numerous areas. The internal drainage is somewhat slow on account of the impervious subsoil and substratum.

The Eden silt loam is not extensive, but practically all of it is in cultivation to corn, tobacco, wheat, and grass. It is an important soil in the hill section of the county where it frequently produces the greater part of the grain and grass crops, as it has the most favorable topography. Its organic-matter content is apparently rather low. Crops seldom suffer from drought, as the soil is fairly retentive of moisture. The type is fairly productive.

Grass crops lead in acreage, followed by corn, grain, and tobacco. Almost none of the type is used for pasture except sod land in the fall. Few farms are located wholly on this soil, and the income is derived from farming the adjoining Eden clay areas in conjunction. The latter are used for pasturage and also provide the acreage for the greater part of the tobacco and a small part of the corn, but very little of the grain and grass. The farm income is derived from the sale of tobacco and live stock and of the excess of other crops such as corn, wheat, and hay. No branch of live-stock farming is specialized in. Cattle are raised and small numbers are sold from time to time. Some of the farmers raise a surplus of hogs, others sheep, and some raise both. Dairy cows are kept mainly to supply home needs.

As a rule yields are lower than on the typical Shelbyville silt loam. Tobacco yields from 700 to 1,000 pounds per acre, corn 25 to 70 bushels, wheat 10 to 20 bushels, and hay an average of 1 ton.

The soil is farmed in much the same manner as the Shelbyville silt loam. The farms and individual fields are smaller, and a higher proportion of the farm work is done by the owners. Crops are rotated in a general way. All the stable manure is applied to cultivated crops. The methods of cultivation are fairly efficient.

Land values depend closely upon the adjoining soils. Farms containing a fairly high percentage of good arable land of this and other types sell for $40 to $60 an acre.

Crop yields would be increased by supplying organic matter to the soil. Leguminous crops, such as cowpeas, do well and may be used both to supply forage and for soil improvement. The growing of winter cover crops such as rye would also prove beneficial. It is probable that liming, in conjunction with the above treatment, would greatly increase the chances of obtaining good yields of clover.

In the following table are shown the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Eden silt loam:

Mechanical analyses of Eden silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391001	Soil	0.2	1.2	0.9	1.2	4.6	79.3	12.5
391002	Subsoil	.1	1.0	.9	1.9	3.4	55.2	37.6
391003	Lower subsoil	.1	.6	.6	2.8	4.6	38.4	53.1

EDEN CLAY.

The surface soil of the Eden clay consists of a pale-yellow to yellow clay with an average depth of 6 inches. At depths of 3 to 8 inches yellow silty clay is reached, which passes abruptly at 18 to 20 inches into a mottled pale yellow and gray plastic clay which is quite sticky when moist and tough when dry. Frequently there are rusty-brown and black concretions or concretionary material and grayish and pale-yellow mottlings, but usually the lower subsoil is a plastic and impervious clay continuing to a depth of 3 feet or more. This lower subsoil clay, which frequently has a greenish cast, extends to bedrock. This is usually encountered at depths of 4 to 10 feet or more. Small fragments of partially decomposed shale are often visible in the subsoil where exposed, and slablike fragments of limestone frequently occur on the surface.

The typical Eden clay, conforming to the above description, occurs in virgin or recently broken areas or in fields which have been

carefully farmed for a period of years. In many cases the yellow upper subsoil has been incorporated with the surface soil by plowing, giving the whole a yellowish-gray color. In places, especially over virgin areas, there is a 2 to 4 inch veneer of gray silt loam, which is incorporated with the deeper material upon plowing. On cultivated slopes where the surface soil has been washed off in places by gullies which frequently extend to bedrock the surface soil is conspicuously yellow and thickly strewn with small shale fragments, with a lesser amount of those from thicker limestone. Areas of this character are numerous. Their irregular outline, small size, and promiscuous occurrence would make their mapping as an eroded phase of the type difficult. Over especially steep slopes, where very little soil has accumulated, a medium to dark gray, sticky, silty clay has developed. Outcrops occur, and flat limestone fragments are fairly common on the surface. On some of the lower slopes the soil is deeper, owing to the accumulation of material washed down from above.

The Eden clay is the predominant soil type in the hill section of the eastern and southeastern parts of the county. It occurs in association with the Eden silt loam, which occupies many of the divides, and also occurs on steep slopes along Guists and Jeptha Creeks within the area of Shelbyville soils.

The type covers the roughest parts of the county. Adjacent to the Shelbyville soils on the west it occupies narrow V-shaped valleys, with the silt loam of the same series on the lateral divides. Farther to the east, where the several branches or valleys join, the ridges become lower and narrower, and this type occurs alone, as in the vicinity of Sixmile and Benson Creeks and the Middle Fork of Crooked Creek.

A highly ramified drainage system is characteristic of this type. The run-off is very rapid, on account of the steep slope and the impervious subsoil. The streams have a steep gradient and flow over rocky beds. On exposed surfaces erosion is very active, and the growing of cultivated crops has resulted in the erosion of many acres of good farming land to such an extent that its abandonment has been necessary.

As the Eden clay is the predominant type in the sections where it occurs, it is of considerable agricultural importance. A much smaller percentage is in cultivated and grass crops than in the case of other types. Approximately 75 per cent of the type has been in cultivation, but at present probably not over 25 per cent is in use for cultivated and grass crops. The remainder consists of fields which have become eroded and are now abandoned to brush and used for pastures, and also of land which has never been broken and supports a growth of small timber and brush. The results in carefully farmed fields show that the prevention of erosion is possible. Agricultural

development has been retarded by the steep topography, the ease of erosion, and the careless methods of farming. The type is fairly productive and moderately retentive of moisture. It warms up rather early in the spring. The steep slope renders tillage operations somewhat difficult, and certain modern farm machinery can not be used.

General farming on a small scale, with tobacco as the money crop, is carried on almost universally. Corn and grass are the leading crops. The live-stock industries are of minor importance, although some income is derived from the sale of cattle, sheep, and hogs. Tobacco is grown mainly in small fields on virgin soil or on the newest land available. The leaf is of good grade and commands a high price. The cultivated area is scattered over the type, frequently consisting of small patches in fields which were once wholly in cultivation. As a rule areas of most favorable topography were cleared first; later many of these were abandoned, and the recent clearings are mainly on very steep slopes. The trees are girdled, the brush cleared, and the land devoted to tobacco.

The yields range widely, but average lower than for most other types. Tobacco yields from 700 to 1,000 pounds per acre, corn 20 to 50 bushels, hay about 1 ton, and wheat 5 to 20 bushels.

The farming methods are practically the same as on the other types. The fields are plowed in the spring and planted as early as possible. Sod land is used for cultivated crops to a large extent. Smaller farm machinery and more hand labor are required than on types of more favorable topography. The fields are frequently kept in cultivation for a period of years without the use of winter cover crops or seeding to grass. Careless methods are largely responsible for the nonagricultural character of large areas. Where fields become eroded they are turned out without being seeded to grass.

Land values on this type vary from $10 to $40 an acre, depending upon the location and state of cultivation. When this land is sold in conjunction with the Eden or Shelbyville silt loams it commands a higher price. There is no great demand for this type of land.

The first need of this soil is the prevention of erosion, by such means as the growing of winter cover crops, which protect the surface from washing and provide organic matter to be plowed under in the spring. The contouring of the rows of cultivated crops and the leaving of narrow strips in grass would tend to check erosion. The type would be benefited by a crop rotation allowing a long period in grass. The grass land could be advantageously used for furnishing hay and pasturage for the increased number of stock which could be maintained under such a system. The reclaiming of the areas which are too badly eroded for farming is fully as impor-

tant, and more difficult, than the prevention of future erosion. Grass comes in slowly, especially over the eroded spots. Sweet clover has been a successful and profitable crop in the reclamation of similar land in other parts of the State. It grows abundantly along the highways, but no effort has been made to plant the crop in fields.

The following table gives the average results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Eden clay:

Mechanical analyses of Eden clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391004, 391024...	Soil.....	0.2	1.0	0.8	2.1	4.8	58.2	32.8
391005, 391025...	Subsoil.....	.3	1.0	.6	5.2	5.7	42.5	44.6
391006, 391026...	Lower subsoil.	.1	.8	.6	2.6	5.3	44.6	45.9

HAGERSTOWN SILT LOAM.

The Hagerstown silt loam consists of a brown, mellow silt loam, underlain at 8 to 12 inches by reddish-brown or reddish-yellow silt loam. This quickly grades into reddish-yellow or dull-red silty clay, which extends to a depth of 3 feet or more. The type is free from rock fragments, and rock outcrops occur only where the type breaks away to lower lying soils. Iron stains and mottlings do not appear within the 3-foot section. Bedrock is encountered at depths ranging from 5 to 15 feet.

This type as mapped includes all soil areas in which a reddish color is developed in either the surface soil or subsoil, and comprises a number of small areas of slightly varying character which if more extensive would be mapped as distinct types or phases. In places the surface soil consists of 8 to 12 inches of slightly reddish brown to brownish-red, mellow silt loam, which grades very slowly into a light reddish brown to yellowish-red silty clay loam subsoil. Such areas belong to the Decatur series. The red color is usually pronounced over shallow areas near the numerous sinks, and along the marked change in topography which generally separates this from the lower soil types.

The Hagerstown silt loam covers isolated areas of 10 to 200 acres or more in the extreme northwestern corner of the county, associated with the Cincinnati silt loam and its rolling phase. It occupies flat to slightly sloping or undulating, narrow ridge tops and benches. Its structure permits good internal drainage. No stream courses traverse the various areas.

The type consists of the weathered products of rather massive limestone. Its bedding on similar formations largely accounts for its characteristic topography.

This type is not very important agriculturally on account of its small extent, but it is regarded as one of the best soils in the county. All of it is in cultivation. The soil contains a moderate amount of organic matter, and is retentive of moisture. Approximately equal acreages are devoted to corn, grain, and hay. A small portion of the type is used for pasture. Yields are practically the same as those obtained on the Shelbyville silt loam.

Few farms are located on this type alone, so that the sale value depends to some extent upon the character of the surrounding soils, some of which are of comparatively low agricultural value. The type is located at some distance from markets. The farms sell for $50 to $85 an acre.

ELK SILT LOAM.

The Elk silt loam consists of a light-brown to brown, mellow silt loam underlain at 10 or 12 inches by light-brown or yellowish-brown silty clay loam which in many places overlies at about 20 inches a mottled yellow and gray, plastic clay loam or silty clay. This soil with the mottled lower subsoil is not typical of the Elk series. The mottled and plastic character of the lower subsoil is not so common in the case of narrow areas where the drainage is well established, the light-brown or yellowish-brown material here extending to a depth of 3 feet or more. The line of separation between this and the associated first bottoms in places is rather indefinite, but usually the boundary is distinct. In some instances terrace-like areas along streams are covered by residual soils, such terraces representing stream-cut benches rather than those built up of stream-deposited material.

The Elk silt loam is mapped in a few strips along Sixmile, Bullskin, and Brashears Creeks. The largest area is about 2 miles southeast of Finchville, occupying an abandoned meander of Brashears Creek. The surface is practically level. The type lies 10 to 25 feet above the normal level of the streams, and drainage is usually adequate, but sometimes it is retarded by the rather impervious substratum and the level surface. A few small tracts would be benefited by artificial drainage.

Practically all of this soil is in cultivation to corn, grain, and grass. Part of it is used for pasturage. Good yields are usually obtained, as the type is productive. The surface soil has a moderately high organic-matter content and is easy to cultivate. The subsoil in places does not permit the free movement of air and water, and artificial drainage is necessary. This condition occurs mainly on areas adjacent to slopes from which the type receives drainage or seepage.

The selling value of this type depends largely on the adjoining types, as it seldom occurs in sufficiently large tracts to be sold by

itself. Together with the surrounding types it sells for $50 to $100 an acre.

HUNTINGTON SILT LOAM.

The Huntington silt loam consists of a brown, mellow silt loam underlain at 10 or 12 inches by slightly lighter brown to yellowish-brown silty clay loam, which extends to a depth of 3 feet or more. Along many of the smaller streams the narrower strips of this type are not mapped.

Strips of the Huntington silt loam occur in the central and south-central parts of the county, chiefly along Fox Run and Bullskin, Clear, Guists, and Brashears Creeks. It lies 6 to 10 feet above the normal level of the creeks, and is subject to infrequent short periods of overflow. At all other times the drainage is adequate.

The Huntington silt loam is a relatively unimportant type, although practically all of it is under cultivation to corn, grain, and grass, or is used for pasture. Good yields are obtained and crops are seldom damaged by overflow. Scattered trees along the stream banks furnish abundant shade for cattle during the heated portions of summer days, and water for stock is abundant.

This is a productive soil, and as a rule it is well farmed. Its value for providing pasturage is recognized. The greater part of it lies within that part of the county devoted largely to dairying and other live-stock industries. No farms are located wholly on this type. In conjunction with the adjoining soils it sells for $50 to $100 an acre.

SUMMARY.

Shelby County is situated in the north-central part of Kentucky. It has a maximum length, east and west, of 24 miles, and a maximum width of 22 miles. Its area is 382 square miles, or 244,480 acres.

The county lies within the Lexington Plain, a broadly undulating to rolling area within which the divides have a fairly common elevation, ranging from 750 to 900 feet above sea level. The stream courses in the larger valleys lie 600 to 700 feet above sea level. The county comprises three fairly distinct upland topographic divisions, the rolling to hilly area in the eastern and southeastern parts, the undulating to broadly rolling areas covering the central part, and the rolling areas in the western and an area south of Jeptha Knob in the southeastern part.

The county is well drained. The greater part of its area drains in a general west-of-south direction through tributaries of the Salt River. The northeastern and eastern parts drain eastward and northeastward through tributaries of the Kentucky River.

The settlement of the county dates from the latter part of the eighteenth century. The present population consists chiefly of descendants of the early settlers of this and surrounding counties. The

population of Shelby County in 1910 was 18,041, and is all classed as rural except the population of Shelbyville, 3,412. The rural population averages 34.4 persons per square mile. All parts of the county are well settled.

The county is well supplied with railroad facilities. Through and local passenger and freight service is maintained by several lines. An extensive system of limestone-surfaced roads or pikes covers all parts of the county, radiating in a general way from Shelbyville, the county seat.

As the population in towns is comparatively small, all the excess farm crops and products must find outside markets. Milk and cream are shipped to Louisville. Live-stock products are shipped to various packing centers. Mules are shipped to southern markets. Wheat is sold locally for home consumption and for shipment to outside markets.

The winters are short and not very severe. The summers are long and usually pleasant. The mean winter temperature is 34.5° F.; the summer mean, 75.5° F.; and the annual mean, 55.4° F. The mean annual precipitation of 44.08 inches is quite equally distributed throughout the year. The average length of the growing season is 180 days. Climatic conditions are favorable for the growing of a wide variety of crops.

From the time of the first settlement agriculture has been the chief industry. General farming together with dairying and other branches of the live-stock industry predominate. Tobacco is the most important money crop. Wheat ranks next. Hemp is a minor income crop. Corn, hay, and other forage crops are largely fed at home, but in some seasons a small percentage is sold locally. Except for the imported concentrated feeds, the county produces sufficient subsistence for its needs. It is noted for its pure-bred dairy and other stock.

The industries of Shelby County are entirely agricultural. The soils are productive and are fairly well farmed. Comparatively little of the farm income is expended for commercial fertilizers. The grade of work stock is good. Modern machinery is in general use and most of the farms present an attractive appearance.

Acording to the census there were 2,301 farms in the county in 1910 with an average size of 103.9 acres, of which 90.7 per cent was improved land. Over 79 per cent of the total area of the county is improved land. Of all the farms 61.4 per cent are operated by the owners, 37.5 per cent by tenants, and 1.1 per cent by managers. The average value of all farm property in 1910 was $8,015, of which 65.6 per cent, or $50.65 an acre, represented the land value.

The special crops, tobacco and hemp, rank first in value, followed by the cereals. The cereals lead in acreage, occupying about 60 per

cent of the cultivated area, and are followed in order by hay and forage crops and special crops. The percentage values of crops and live-stock products are 61 and 39, respectively.

Well-located farms sell for $100 to $140 an acre. Farms at a greater distance and slightly less desirable sell for $75 to $100 an acre. In the hill section land values range from $20 to $60 an acre.

The soils of the county are divided into two groups—the residual types of the uplands and the alluvial types of the stream terraces and bottoms, the latter being comparatively inextensive. The residual soils consist of the weathered products of limestones and shales and are classed in the Shelbyville, Cincinnati, Eden, and Hagerstown series. The alluvial soils consist of reworked material washed from one or more of the residual series and are classified in the Elk series on the terraces and in the Huntington series on the first bottoms.

The Shelbyville silt loam, with its rolling phase and shallow phase, covers an extensive area in the central part of the county. These soils are brown in color and friable. The subsoils are also brown, with faint mottlings in the lower part of the 3-foot section. The surface is undulating to gently rolling, and drainage is good. These soils comprise many of the best farms of the county. Corn, tobacco, wheat, hay, and pasture grasses are the chief crops.

The Cincinnati silt loam, with a rolling phase, and silty clay loam are the predominating soils in the western part of the county. The surface soils are light brown. The subsoils are yellow and heavy, and markedly mottled below a depth of 24 inches. The topography is gently rolling to rolling, resulting in adequate drainage. Corn, wheat, hay, and pasture grasses are the principal crops.

The Eden silt loam and clay cover the greater part of the hill section in the eastern part of the county. They are characterized by gray surface soils and yellow to mottled yellow and gray lower subsoils, which are stiff and impervious. The surface ranges from steeply sloping to rolling and hilly. Tobacco, corn, hay, and pasture grasses are the main crops. A considerable area has been eroded under careless management and is not at present under cultivation.

The Hagerstown silt loam has a brown surface soil and a reddish-brown to yellowish-red subsoil. All of the type is in cultivation to corn, grain, and grass.

The Elk silt loam is characterized by a light-brown soil and a yellowish-brown to mottled yellow and gray subsoil. The surface is level and the drainage is good. All of the type is cultivated to corn, grain, and grass.

The Huntington silt loam covers first bottoms along some of the larger creeks. The soil is brown and the subsoil is light brown. All of the type is used for corn, grass, or pasture.

CHEMICAL COMPOSITION OF THE SOILS OF SHELBY COUNTY, KENTUCKY.

By S. D. AVERITT, of the Kentucky Agricultural Experiment Station.

INTRODUCTION.

In the following discussion of fertility of the different types of soil in Shelby County, as described in this report and shown in the accompanying map, it will be assumed that the dry soil over an acre, to the depth of 7 inches, weighs 2,000,000 pounds. Seven inches is about the depth to which the soils are plowed and there are few crops whose roots feed to more than a limited extent below this depth. The subsoil on an acre, from 7 to 20 inches, is assumed to weigh 4,000,000 pounds. In order to convert percentages to pounds per acre it is only necessary to multiply by 2,000 for surface and 4,000 for subsoil.

The following table shows the amount of nitrogen, phosphorus, and potassium contained in the principal crops grown in Kentucky, calculated for the yields indicated:

Amounts of nitrogen, phosphorus, and potassium contained in various crops.

Crop.	Nitrogen.	Phosphorus.	Potassium.
	Pounds.	*Pounds.*	*Pounds.*
Corn, 50 bushels per acre, contains	50	10	10
Stalks of same, 2 tons	30	7	29
Total	80	17	39
Wheat, 25 bushels per acre, contains	30	5	5
Straw of same, 1½ tons	7.5	.6	15
Total	37.5	5.6	20
Oats, 25 bushels per acre, contains	20	3.5	5
Straw of same, 2 tons	24	3.5	40
Total	44	7	45
Tobacco, 1,000 pounds of leaf, contains	40	2.2	50
Stalks from same, 300 pounds	10	.8	10
Total	50	3	60
Red clover, 2 tons per acre	80	10	60

These figures will be used in the discussion relative to the limiting factors in the production of profitable crops. The three elements, nitrogen, phosphorus, and potassium, are the ones supplied by commercial fertilizers, and since all three are absolutely necessary to plant growth, deficiencies in any one of this group will limit crop production. The figures for nitrogen, in the tabulation of analyses, represent total nitrogen; how much is available it is not possible to say. It would be a safe statement, however, to say that, in the long cultivated soils of Shelby County, nitrogen is undoubtedly one of the limiting factors in the production of profitable crops.

The supply of organic matter in the soil to the depth plowed is largely a matter of crop rotation, cultivation, and care, and since it is mainly from the organic matter that the nitrogen of crops is derived, the discussion of this element is left to come under that of legumes in the rotation.

With these few preliminary statements in mind it is possible to discuss with a fair degree of accuracy the different types of soil found in Shelby County, with reference to the plant food they contain and the requirements of the crops usually grown on them.

SHELBYVILLE SILT LOAM.

This is the most important type in the county and, as mapped and described in this report, is a type in which there exists a considerable range in the phosphorus content. This is due to the origin of this soil. It is bedded on the rocks of the Maysville formation, which consists of several strata of limestone varying rather widely in phosphorus content. Two analyses of one of these limestones (the Arnheim, the uppermost member) reported by the Kentucky Geological Survey, show 0.35 and 0.39 per cent phosphorus, respectively, an amount quite sufficient to place it in the phosphatic class. Analyses of the other members, from the same authority, show from a trace to 0.15 per cent phosphorus.

Reference to the table of analyses of these soils shows from 1,400 to 4,200 pounds of total phosphorus in the acre—7 inches, with an average of 2,400 pounds. There is an average of 5,600 pounds in the next acre-foot, or subsoil. Of easily soluble phosphorus there is an average of 66 pounds in the surface soil and 256 pounds in the subsoil. The individual analyses, however, show a wide range (soil, 12 to 300 pounds; subsoil, 28 to 1,512 pounds) and a marked deficiency of phosphorus is shown in about half of the samples analyzed. At many places within the boundary of this type, as mapped, the soils would undoubtedly respond to the application of phosphatic fertilizers. The supply of total potassium is ample. There is an average of 230 pounds of easily soluble potassium in the surface soil and

376 pounds in the subsoil. While the amount of easily soluble potassium is below the average in quite a number of cases, it is not likely that any of the well-drained soils would respond to potassium.

There is no decided tendency to acidity in the soil of this type, but the use of ground limestone will generally be necessary for the best results with most legumes; indeed, the use of limestone in this connection can not be too strongly emphasized, as it is becoming increasingly difficult, on the long-cultivated areas, to grow clover without it.

CINCINNATI SILT LOAM.

This type stands second in agricultural importance in the county. It is derived mainly from the rocks of the Richmond formation. The Arnheim limestone, mentioned in connection with the Shelbyville silt loam, occurs near the boundary of the Shelbyville and Cincinnati silt loams, and samples of the latter collected near this boundary sometimes contain a much larger quantity of phosphorus than generally obtains in the type.

An examination of the tabulated analyses representing this type shows from 1,000 to 3,400 pounds of total phosphorus in the surface soil, with an average of 2,200 pounds. In the subsoil there is an average of 5,200 pounds of total phosphorus. Of easily soluble phosphorus there are from 6 to 154 pounds, with an average of 48 pounds in the surface soil and an average of 188 pounds in the subsoil. Except near the boundary between this type and the Shelbyville silt loam, as noted above, the Cincinnati silt loam is deficient in easily soluble phosphorus and probably will respond to the application of phosphatic fertilizers. The supply of potassium, both total and easily soluble, is as large as in the Shelbyville silt loam, and the observations under the type apply equally well to this type.

A cooperative experiment field of the Kentucky Agricultural Experiment Station, with Lincoln Institute, is located on the Cincinnati silt loam at Lincoln Ridge. Laboratory Nos. 43506 and 43507 in the tabulated analyses represent soil and subsoil from this field. In the field experiments covering four years, corn, soy beans, and clover have been grown. All crops have responded well to phosphorus and limestone when used together. Clover and soy beans have responded well to limestone. Potassium has shown no profitable increase in any crop.

CINCINNATI SILT LOAM, ROLLING PHASE.

In the rolling phase of the Cincinnati silt loam there are from 1,000 to 1,400 pounds of total phosphorus, with an average of 1,200 pounds in the surface soil, and an average of 2,400 pounds in the subsoil. Of easily soluble phosphorus there is an average of 14

pounds in the surface soil. Reference to the table on page 55 shows that this is not sufficient for a 50-bushel crop of corn.

In order that these soils may be made reasonably productive the organic-matter content must be increased and phosphorus must be supplied. The rational and most economical way to do this is to grow clover or some other legume, with the aid of ground limestone and phosphatic fertilizers. The supply of total potassium is ample, and there is a good supply of easily soluble potassium. The only attention necessary to maintain the supply of easily soluble potassium is to increase and keep up the organic matter, which, in the process of decay, will render available the potassium in its more insoluble compounds.

CINCINNATI SILTY CLAY LOAM.

The analyses of the Cincinnati silty clay loam are so much like those of the Cincinnati silt loam, rolling phase, that a separate discussion is not necessary. It will be seen from the tabulated analyses that there is an average of 146 pounds of easily soluble potassium in the surface and 330 pounds in the subsoil. If the organic matter content is increased and maintained the amount of potassium available will be sufficient for profitable crops.

EDEN SILT LOAM.

The Eden silt loam occupies the tops of ridges and lies just above the Eden clay. The higher content of sand and the lower content of clay in the lighter textured type is due to the character of the materials from which the type is derived. The analyses of this soil are so similar to those of the Cincinnati silt loam, rolling phase, that the discussion of that phase applies here, with the exception that in the Eden soil there is less easily soluble potassium than in the phase.

EDEN CLAY.

The soil of this type has resulted from the disintegration of alternating shales and thin limestones of the lower part of the Eden formation. The analyses representing this type show that it is characterized by a large amount of total potassium in both surface and subsoil. This feature has been noted in the Eden soils of Franklin, Madison, Scott, and other counties. The total potassium is about double that in the other types. There is an average of nearly 300 pounds of easily soluble potassium in the surface and nearly 500 pounds in the subsoil. There is an average of 52 pounds of easily soluble phosphorus in the surface and over 600 pounds in the subsoil. This is a fairly good supply of easily soluble phosphorus. It is not likely that this soil will respond very materially to phosphorus, especially with the crops usually grown on it. While there is more

easily soluble calcium than in the other types, it is not present as the carbonate and the soil has a decided tendency to acidity. For this reason the application of ground limestone should increase the growth of clover and other legumes.

HAGERSTOWN SILT LOAM.

The Hagerstown silt loam is bedded on Silurian rocks. The plant food content is almost identical with that of the Cincinnati silt loam, rolling phase.

HUNTINGTON SILT LOAM AND ELK SILT LOAM.

The Huntington silt loam and the Elk silt loam are very inextensive, being confined chiefly to the bottoms and probably second bottoms of Brashear and Bullskin Creeks in the southwestern and central-western parts of the county. Both types lie near the boundary of the Shelbyville and Cincinnati silt loams and are very closely associated with the Arnheim limestone. No discussion of these types is necessary. Inspection of the tabulated analyses shows an abundance of total and easily soluble phosphorus in both soil and subsoil. The easily soluble potassium will be ample, provided the organic matter content is increased and maintained.

PERMANENT FERTILITY.

The maintenance of soils in a state of profitable productiveness is of first importance. The first essential in permanent fertility is the maintenance of organic matter in the soil, which, in the process of decay, in addition to furnishing nitrogen, renders available the phosphorus and potassium locked up in insoluble compounds.

From the table on page 55 it will be seen that a 2-ton crop of clover, if plowed under, would add to the soil about 80 pounds of nitrogen, a large part of which, presumably, has come from the atmosphere through the action of root-nodule bacteria. This shows the importance in grain growing of giving legumes a prominent place in the rotation in order to maintain the supply of organic matter and nitrogen in the soil.

Another important fact to be deduced from a study of the table referred to is that in grain farming a large part of the plant food removed in the crop may be returned to the soil in the stalks and straw. This is especially true in the case of potassium.

Nitrogen-gathering crops (legumes), grown in the rotation, will not maintain, much less increase, the organic-matter supply unless the crop residues (stalks and straw) are returned, either directly or by carefully conserving and returning them in the form of manure. Catch crops and cover crops should be turned under and the second

crop of clover, where it is grown in rotation, should be left on the ground. The application of ground limestone, usually to grow the nitrogen-gathering crops, is necessary on long-cultivated soils to correct acidity, so that bacterial action in the soil may be promoted. In the soils low in phosphorus that element must be supplied. In soils well supplied with organic matter this may be done most economically with ground rock phosphate. But if the organic-matter content is low some more available form of phosphorus should be used. If manure is available, 50 pounds of rock phosphate per ton of manure makes a very effective fertilizer.

SUMMARY OF RESULTS OF ANALYSES.

METHOD OF SAMPLING THE SOILS.

The sampling was done uniformly in all cases as follows: On a thoroughly representative area of the type or phase, selected after mapping, with a soil auger, such as used by the Bureau of Soils, samples of surface soil, 0 to 6 inches, and subsoils, 6 to 18 inches, were taken. In the case of the surface soils, a composite sample from a dozen or more borings was used in the analyses. The subsoils were made up of material from about half of the borings made for the surface soils. After these samples were air-dried they were ground in a wedgewood mortar to pass a 2-millimeter sieve and thoroughly mixed. Some of the sample was then ground to powder for total K, P, and N determinations. The N/5 HNO_3 digestion was made on the 2-millimeter material.[1]

[1] Methods of soil analysis used in making the determinations in the following table are as follows:

Total N, plain Kjeldahl, 5 hours digestion.

Total P, magnesium nitrate method. Journal of A. O. A. C., vol. 1, No. 4, p. 25.

Total K, the modified J. L. Smith method, as adopted by the A. O. A. C. in 1909. See Bureau of Chemistry Bulletin No. 132 and Bulletin No. 122, p. 116, for method.

N/5 HNO_3 digestion for easily soluble K, P, and Ca 150 grams water-free soil digested in 1,500 c. c. N/5 HNO_3 for 5 hours at room temperature. One thousand c. c. clear filtrate evaporated to dryness and treated twice with HCl to get rid of HNO_3, taken up with HCl and water and the silica filtered out and washed, the filtrate made to 100 c. c. Aliquots of 10 c. c., 50 c. c., and 32.2 c. c. were taken for Ca, P, and K, respectively. CaO to neutralize. The method is essentially that given in the Journal of A. O. A. C., vol. 1, No. 4, p. 25. One c. c. St. KOH=0.004 grams $CaCO_3$ or to 0.01 per cent instead of 0.001 per cent as stated in the method.

Chemical analyses of important soils of Shelby County, Kentucky. Results stated on the basis of moisture-free sample.

SHELBYVILLE SILT LOAM.

Sample No.[1]	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Lime (CaO) to neutralize.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
51351	0.104	0.09	0.0020	1.58	0.0142	0.105	0.001
51355	*.068*	*.11*	*.0024*	*1.52*	*.0093*	*.132*	*.003*
51356	.140	.11	.0039	1.58	.0127	.276	.0005
51358	.148	.09	.0007	1.57	.0090	.122	002
51359	*.064*	*.08*	*.0007*	*1.64*	*.0101*	*.101*	*.002*
51360	.120	.07	.0006	1.52	.0139	.114	.002
51361	*.086*	*.06*	*.0007*	*1.46*	*.0099*	*.100*	*.033*
51362[2]	.190	.11	.0011	1.36	.0108	.129	.004
51363[2]	*.106*	*.08*	*.0008*	*1.44*	*.0095*	*.056*	*.079*
51369	.204	.11	.0026	1.41	.0113	.362	[3]
51370	*.140*	*.09*	*.0008*	*1.39*	*.0090*	*.273*	[4]
51383	.102	.12	.0018	1.46	.0079	.116	.002
51384	.128	.14	.0047	1.65	.0098	.199	.0005
51385	*.064*	*.45*	*.0378*	*2.07*	*.0076*	*.680*	*.063*
51386	.132	.14	.0037	1.34	.0178	.127	.001
51387	*.074*	*.09*	*.0016*	*1.45*	*.0102*	*.112*	*.001*
51390	.182	.21	.0150	1.39	.0076	.410	[5]
51391	.104	.11	.0044	1.63	.0121	.167	.004
51405	.150	.12	.0012	1.23	.0103	.141	.002
50672	.144	.10	.0007	1.34	.0100	.109	.018
Average, 0-6 inches	.143	.12	.0033	1.466	.0115	.183	.003
Maximum	.204	.21	.0150	1.650	.0178	.410	.018
Minimum	.102	.07	.0006	1.230	.0076	.105	0
Average, 6-18 inches	.086	.14	.0064	1.567	.0094	.208	.026
Maximum	.140	.45	.0378	2.070	.0102	.680	.079
Minimum	.064	.06	.0007	1.390	.0076	.056	0

CINCINNATI SILT LOAM.

51357	0.130	0.12	0.0049	1.56	0.0076	0.181	0.0005
51372	.142	.17	.0077	1.44	.0080	.168	.003
51373	*.080*	*.20*	*.0125*	*1.56*	*.0075*	*.179*	*.005*
51374	.144	.06	.0004	1.43	.0179	.084	.004
51375	*.056*	*.07*	*.0004*	*1.59*	*.0180*	*.096*	*.003*
51376	.088	.13	.0051	1.53	.0069	.135	.003
51377	*.048*	*.16*	*.0067*	*1.77*	*.0088*	*.165*	*.088*
51381	.170	.08	.0006	1.31	.0136	.096	.006
51382	*.070*	*.08*	*.0012*	*1.40*	*.0069*	*.076*	*.073*
51388	.128	.12	.0023	1.45	.0108	.111	.003
51389	*.060*	*.12*	*.0028*	*1.54*	*.0105*	*.198*	*.0055*
51392	.086	.05	.0003	1.35	.0063	.069	.004

[1] Kentucky Agricultural Experiment Station number.

[2] Nos. 51,362 and 51,363 were collected from virgin soils.

[3] Neutral; sample contained 0.1 per cent $CaCO_3$.

[4] Neutral; sample contained 0.046 per cent $CaCO_3$.

[5] Slightly alkaline; sample contained 0.202 per cent $CaCO_3$.

NOTE.—Results in italics are for subsoils.

Chemical analyses of important soils of Shelby County, Kentucky—Continued.

CINCINNATI SILT LOAM—Continued.

Sample No.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Lime (CaO) to neutralize.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
51397	0.130	0.14	0.0026	1.57	0.0056	0.130	0.002
51398	.162	.09	.0009	1.29	.0177	.116	.003
51399	.142	.13	.0006	1.23	.0083	.101	.004
51400	.114	.10	.0007	1.40	.0074	.117	.0025
Average, 0–6 inches	.131	.11	.0024	1.415	.0101	.119	.0032
Maximum	.170	.17	.0077	1.570	.0179	.181	.006
Minimum	.086	.05	.0003	1.230	.0056	.069	.002
Average 6–18 inches	.063	.13	.0047	1.572	.0103	.143	.0345
Maximum	.080	.20	.0125	1.770	.0180	.198	.0880
Minimum	.048	.06	.0004	1.400	.0069	.076	.0030

CINCINNATI SILT LOAM, ROLLING PHASE.

51378	0.104	0.07	0.0006	1.34	0.0076	0.100	0.004
51379	*.054*	*.07*	*.0005*	*1.46*	*.0060*	*.133*	*.006*
51380	.114	.05	.0007	1.45	.0160	.143	.001
51406	.152	.05	.0006	1.54	.0108	.197	.001
43506	.120	.05	.0007	1.52	.0114	.110	.0015
43507	*.076*	*.05*	*.0006*	*1.59*	*.0114*	*.117*	*.0105*
Average, 0–6 inches	.122	.06	.0007	1.46	.0114	.140	.0019
Maximum	.152	.07	.0007	1.54	.0160	.197	.0040
Minimum	.104	.05	.0006	1.34	.0076	.100	.0010
Average, 6–18 inches	.065	.06	.0006	1.525	.0087	.125	.0082
Maximum	.076	.07	.0006	1.59	.0114	.133	.0105
Minimum	.054	.05	.0005	1.46	.0060	.117	.0060

CINCINNATI SILTY CLAY LOAM.

51393	0.110	0.08	0.0007	1.51	0.0074	0.160	0.001
51394	*.054*	*.12*	*.0007*	*1.98*	*.0091*	*.179*	*.167*
51395	.116	.06	.0005	1.44	.0072	.116	.001
51396	*.056*	*.05*	*.0005*	*1.23*	*.0076*	*.142*	*.001*
Average, 0–6 inches	.113	.07	.0006	1.475	.0073	.138	.001
Maximum	.116	.08	.0007	1.510	.0074	.160	.001
Minimum	.110	.06	.0005	1.440	.0072	.116	.001
Average, 6–18 inches	.055	.09	.0006	1.605	.0083	.160	.084
Maximum	.056	.12	.0007	1.980	.0091	.179	.167
Minimum	.054	.05	.0005	1.230	.0076	.142	.001

EDEN CLAY.

51350	0.140	0.09	0.0011	2.26	0.0180	0.134	0.044
51351	*.060*	*.14*	*.0076*	*2.70*	*.0129*	*.186*	*.113*
51366	.080	.10	.0032	2.51	.0129	.222	.217
51367	*.056*	*.15*	*.0227*	*3.22*	*.0108*	*.403*	*.151*
51368	.130	.10	.0035	4.25	.0130	.333	.0005

Chemical analyses of important soils of Shelby County, Kentucky—Continued.

EDEN CLAY—Continued.

Sample No.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Lime (CaO) to neutralize.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Average, 0–6 inches	0.117	0.10	0.0026	3.01	0.0146	0.233	0.0872
Maximum	.140	.10	.0035	4.25	.0180	.333	.2170
Minimum	.080	.09	.0011	2.26	.0129	.134	.0005
Average, 6–18 inches	.058	.15	.0151	2.96	.0119	.294	.132
Maximum	.060	.15	.0227	3.22	.0129	.403	.151
Minimum	.056	.14	.0076	2.70	.0108	.186	.113

EDEN SILT LOAM.

51352	0.100	0.06	0.0007	1.51	0.0052	0.070	0.017
51353	*.058*	*.06*	*.0006*	*1.62*	*.0059*	*.060*	*.126*
51364	.088	.07	.0006	1.53	.0067	.097	.004
51365	*.058*	*.07*	*.0006*	*1.70*	*.0082*	*.135*	*.061*
51371	.096	.09	.0008	1.67	.0044	.087	.020
Average, 0–6 inches	.095	.07	.0007	1.57	.0054	.085	.014
Maximum	.100	.09	.0008	1.67	.0067	.097	.020
Minimum	.088	.06	.0006	1.51	.0044	.070	.004
Average, 6–18 inches	.058	.06	.0006	1.66	.0070	.097	.094
Maximum	.058	.07	.0006	1.70	.0082	.135	.126
Minimum	.058	.06	.0006	1.62	.0059	.060	.061

HAGERSTOWN SILT LOAM.

51409	0.106	0.04	0.0010	1.46	0.0117	0.130	0.002
51410	*.048*	*.03*	*.0011*	*1.44*	*.0129*	*.125*	*.002*
51411	.136	.06	.0008	1.51	.0124	.120	.001
51412	.158	.08	.0010	1.57	.0173	.266	.001
51413	*.058*	*.06*	*.0007*	*1.68*	*.0083*	*.234*	.001
Average, 0–6 inches	.133	.06	.0009	1.513	.0138	.172	.0013
Maximum	.158	.08	.0010	1.570	.0173	.266	.0020
Minimum	.106	.04	.0008	1.460	.0117	.120	.0010
Average, 6–18 inches	.053	.05	.0009	1.56	.0106	.179	.0015
Maximum	.058	.06	.0011	1.68	.0129	.234	0020
Minimum	.048	.03	.0007	1.44	.0083	.125	.0010

ELK SILT LOAM.

51403	0.134	0.23	0.0272	1.43	0.0088	0.123	0.008
51404	*.075*	*.26*	*.0452*	*1.48*	*.0073*	*.141*	*.032*
25077	.180	.27	.0395	1.60	.0158	.352	.003

HUNTINGTON SILT LOAM.

51401	0.178	0.32	0.1054	1.54	0.0098	.0454	0.002
51402	*.044*	*.55*	*.2985*	*1.75*	*.0075*	*.844*	*.019*

NOTE.—No averages were made of Huntington silt loam or Elk silt loam, as samples of only one soil and subsoil of each were analyzed.

Silicate analyses of Shelby County soils.

Constituent.	Eden clay.			Eden silt loam.				Cincinnati silty clay loam.		Cincinnati silt loam, rolling phase.
	No. 51350, soil, 0 to 6 inches.	No. 51351, subsoil, 6 to 18 inches.	No. 51368, soil, 0 to 6 inches.	No. 51352, soil, 0 to 6 inches.	No. 51353, subsoil, 6 to 18 inches.	No. 51364, soil, 0 to 6 inches.	No. 51365, subsoil, 6 to 18 inches.	No. 51395, soil, 0 to 6 inches.	No. 51396, subsoil, 6 to 18 inches.	No. 51406, soil, 0 to 6 inches.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Moist.....	1.44	2.22	1.92	0.85	1.30	0.81	1.44	0.73	1.06	1.11
Ig.....	5.81	5.68	7.09	4.45	4.69	4.21	5.03	4.74	5.61	5.29
SiO_2.....	71.78	64.34	60.02	80.06	74.20	80.82	73.04	79.34	76.44	76.92
Al_2O_3.....	11.91	16.18	16.77	8.67	12.75	8.98	12.66	9.11	10.39	9.87
Fe_2O_3.....	2.95	4.07	4.71	2.00	2.88	1.80	3.03	1.84	2.72	2.40
TiO_2.....	1.25	.86	1.00	1.10	1.10	.95	1.16	1.10	1.25	.95
P_2O_5.....	.21	.33	.22	.13	.13	.17	.15	.13	.12	.12
CaO.....	.84	.87	.90	.24	.21	.26	.35	.28	.34	.64
MgO.....	1.22	1.63	2.10	.56	.52	.45	.78	.51	.65	.93
K_2O.....	2.72	3.25	5.12	1.82	1.95	1.84	2.05	1.74	1.48	1.86
Total...	100.13	99.43	99.85	99.88	99.83	100.29	99.69	99.52	100.06	100.09

LOCATIONS OF SAMPLES ANALYZED.

SHELBYVILLE SILT LOAM.

Lab. No.

51354. County line road ¾ mile east and ¼ mile north of Harrisonville. Situated top of divide, the lower slopes of which are brown silt loam. This sample represents lower portion of Maysville.

51355. Subsoil of preceding. Yellowish-brown silty clay loam. Fairly friable.

51356. Located ⅝ mile west of Clay Village. Brown silt loam, overlying Arnheim limestone. Wheat field.

51358. Located 1 mile south of Clay Village, on top of Jeptha Knob. From wheat field. Light-brown silt loam. Represents material overlying Silurian rock.

51359. Subsoil of preceding. Yellow silty clay loam. Fairly stiff.

51360. Located ⅘ mile north of Peytona, on divide between Kentucky and Salt River drainage. On crest of broad ridge. Brown silt loam. From cowpea field. Fairly well up on Maysville.

51361. Subsoil of preceding. Somewhat lighter brown than surface soil.

51362. Located ¾ mile west of Bagdad. Virgin soil from a walnut grove. Flat, drainage probably not the best. Brown silt loam. Maysville.

51364. Subsoil of preceding. Not very different from surface soil.

51369. Located ¾ mile west of Mulberry, on Christianburg Pike. Level wheat field. Brown silt loam. Maysville.

51370. Subsoil of preceding. Not very different from surface soil. The subsoil is only very slightly lighter brown than the surface, and extends to 24 inches before there is much change in texture.

51383. Located ¾ mile west and ¼ mile south of Southville, south side of pike. Ridge tops. Brown silt loam. Maysville, lower part has yellow subsoil (probably Eden subsoil).

51384. One-half mile northeast of Christianburg. Lower slopes. Brown silt loam, shallow phase. Maysville, lower portion.

Lab. No.

51385. Subsoil of preceding. Lower slope, shallow phase. Lighter in color than surface soil.

51386. Located 1½ miles south and 4½ miles west of Shelby County courthouse. Level hemp field, low ridge. Brown silt loam, overlying Arnheim limestone. Top Maysville or bottom Richmond.

51387. Subsoil of preceding. A little lighter brown than surface soil.

51390. Located 2 miles east of Shelby County courthouse, on Frankfort Pike. Near top of broad undulating divide. Brown silt loam. Field in corn. Well up on the Maysville.

51391. Located 1½ miles south and 3 miles east of courthouse, Shelbyville. Brown silt loam. Sample taken on slope toward small tributary of Guists Creek. Field apparently abandoned on account of tendency to erode. Maysville.

51405. Located ¼ mile north of Olive Branch Church. Brown silt loam. Top of narrow divide between Guists Creek and Wises Run. Hay land—clover the past season.

50672. Located 3 miles northeast of Shelbyville, on Eminence Pike. (Collected by George Roberts, Oct. 23, 1915.) From clover field, home farm. Good clover.

CINCINNATI SILT LOAM.

51357. Located ¾ mile south and 1 mile west of Clay Village. Taken in corn field. Light-brown silt loam. Represents type as mapped in vicinity of Jeptha Knob.

51372. Located ¾ mile north of Burks Branch School, on Eminence Pike. In clover field. Light-brown silt loam to 10 or 12 inches. Richmond(?). Well above the Arnheim limestone.

51373. Subsoil of the preceding. Yellow heavy silt loam to yellow silty clay loam at 12 to 15 inches.

51374. Located 2½ miles south and 1¼ miles west of Simpsonville. Light-brown silt loam. Richmond.

51375. Subsoil of preceding. Yellow, heavy silt loam. Richmond.

51376. Located 1¼ miles south and 1¼ miles west of Joyes Station. Light-brown silt loam. Rests on Arnheim at 4 to 5 feet.

51377. Subsoil of preceding. Yellow heavy silt loam at 12 to 15 inches to silty clay loam. Above Arnheim. The subsoil becomes heavier than typical—nearer to rock than usual.

51381. Located ¾ mile north and ½ mile west of Cropper. Light-brown silt loam 7 to 8 inches. Richmond (?).

51382. Subsoil of preceding. Yellow silty clay loam.

51388. Located 1½ miles north and 2¼ miles west of Shelbyville (Shelby County courthouse). N. Roach farm. Light-brown silt loam to 7 or 8 inches.

51389. Subsoil of preceding. Yellow heavy silt loam to silty clay loam.

51392. Located 2 miles west of Toddspoint. Top of broad divide. Light-brown silt loam. Hay field. Richmond.

51397. Located 2 miles north of Maple Hall School. Light-brown silt loam. Corn field on a very gentle slope toward small tributary of Bullskin Creek.

51398. Located 1¾ miles north ½ mile east of Dover Church. Light-brown silt loam. Sample taken on divide between Bullskin and Floyds Fork drainage. Hay field, badly infested with briers.

Lab. No.

51399. Located 1 mile south ½ mile east of Gleneyrie School. Light-brown silt loam. Sample taken on long gentle slope toward Fox Run, near divide between it and Bullskin Creek. Wheat field, following corn.

51400. Located 1 mile south of Finchville. Light-brown silt loam. Top of fairly broad divide between Brashears and Buck Creeks. Field in grass—poor stand.

CINCINNATI SILTY CLAY LOAM.

51393. Located ¼ mile north and 1 mile west of Toddspoint. Slope toward Junkers Run. Brown silt loam. Taken in pasture land, badly eroded. Richmond area.

51394. Subsoil of preceding. Yellow silty clay loam to silty clay.

51395. Located ¾ mile north and 1 mile east of Toddspoint. Light-brown silt loam. Sample taken in corn field near top of narrow divide between small drains.

51396. Subsoil of preceding. Light-brown silt loam, underlain by a yellow silty clay loam.

CINCINNATI SILT LOAM, ROLLING PHASE.

51378. Located 1 mile south and ½ mile east of Clark. Light-brown silt loam to 6 or 7 inches. Sample taken on lower slope in a hay field. Richmond.

51379. Subsoil of preceding. Yellow silty clay loam at 10 to 12 inches. Richmond.

51380. Located ½ mile south of Clark. Corn field, top of ridge. Light grayish-brown silt loam. Richmond area, well up toward top of formation.

51406. Located ¼ mile north, 2½ miles west of Simpsonville. Grayish-brown silt loam. Sample near top of divide, between forks of Long Run.

43506. Lincoln Institute experiment field, about 1 mile west from Simpsonville, on Louisville & Nashville Railroad. (Collected by George Roberts, December, 1913.)

43507. Subsoil of preceding. Subsoil red clay, perhaps a little yellow.

EDEN CLAY.

51350. Located ½ mile north and ¼ mile west of Harrisonville. One or 2 inches silt loam underlain by silty clay loam. Slope near crest of ridge, on which no silt loam is mapped. Color (immediate surface gray) very light yellow. Eden.

51351. Subsoil of preceding. Yellow mottled with gray or drab.

51366. Located 2 miles northeast of Jacksonville, 100 yards from Franklin County line. On slope below crest of ridge. Yellow (immediate surface gray) silty clay loam. Eden.

51367. Subsoil of preceding. Yellow silty clay loam to clay, with mottling (gray or drab). Eden.

51368. Located 2½ miles north and ½ mile east of Bagdad, near junction of Indian Fork and Sixmile Creeks. Taken on lower slope. Grayish silty clay loam. Field in corn. Eden. This soil is underlain by yellow heavy silty clay (common throughout the Eden on the slopes).

EDEN SILT LOAM.

Lab. No.

51352. Located ½ mile north of Harrisonville, on slope below crest of ridge, which has slightly brownish color due to influence of Maysville rocks. Taken in grain field. Light brownish gray silt loam.

51353. Subsoil of preceding. Yellow heavy silt loam to silty clay.

51364. Located 1¾ miles north and 1 mile east of Jacksonville, on crest of ridge. Light yellowish-gray silt loam. Grain field. Eden.

51365. Subsoil of preceding. Yellow heavy silty clay loam to silty clay. Eden.

51371. Located 1¼ miles south of Southville, south side of Big Beech Creek. Yellowish-gray silt loam underlain by yellow silty clay. No subsoil collected. Eden. Field produced corn in 1915; not cultivated in 1916; now included in pasture.

HAGERSTOWN SILT LOAM.

51409. Located ¼ mile north of Flat Rock Church. On top of ridge (flat top). Brown friable silt loam. Tobacco field.

51410. Subsoil of preceding. Reddish-brown to red silty clay loam. Upper part 6 to 10 inches brown silt loam similar to surface soil.

51411. Located 1 mile south and ¾ mile west of Flat Rock Church. On flat top ridge. Brown to reddish-brown silt loam. Corn field, now in wheat.

51412. Located ½ mile northeast of Flat Rock Church. Reddish-brown silt loam. Taken on low branch, adjacent to Floyds Fork. Pasture land.

51413. Subsoil of preceding. Red silty clay loam.

ELK SILT LOAM.

51403. Located 1 mile north and ½ mile east of Finchville, along Bullskin Creek, near Taylorsville Pike. Light-brown silt loam. Taken on terrace 6 to 8 feet above first bottom. Does not overflow.

51404. Subsoil of preceding. Light-brown silt loam to 10 inches, underlain by greenish to yellow mottled with gray silty clay loam.

25077. H. D. Rodman, 5 miles west of Shelbyville, on Bullskin Creek. Rich-looking, brown soil.

HUNTINGTON SILT LOAM.

51401. Located 1 mile north and ½ mile east of Finchville, along Bullskin Creek, near Taylorsville Pike. Brown silt loam. Low-lying flat, probably subject to overflow.

51402. Subsoil of preceding. Brown silt loam grading into lighter brown silt loam, then into yellowish-brown heavy silt loam.

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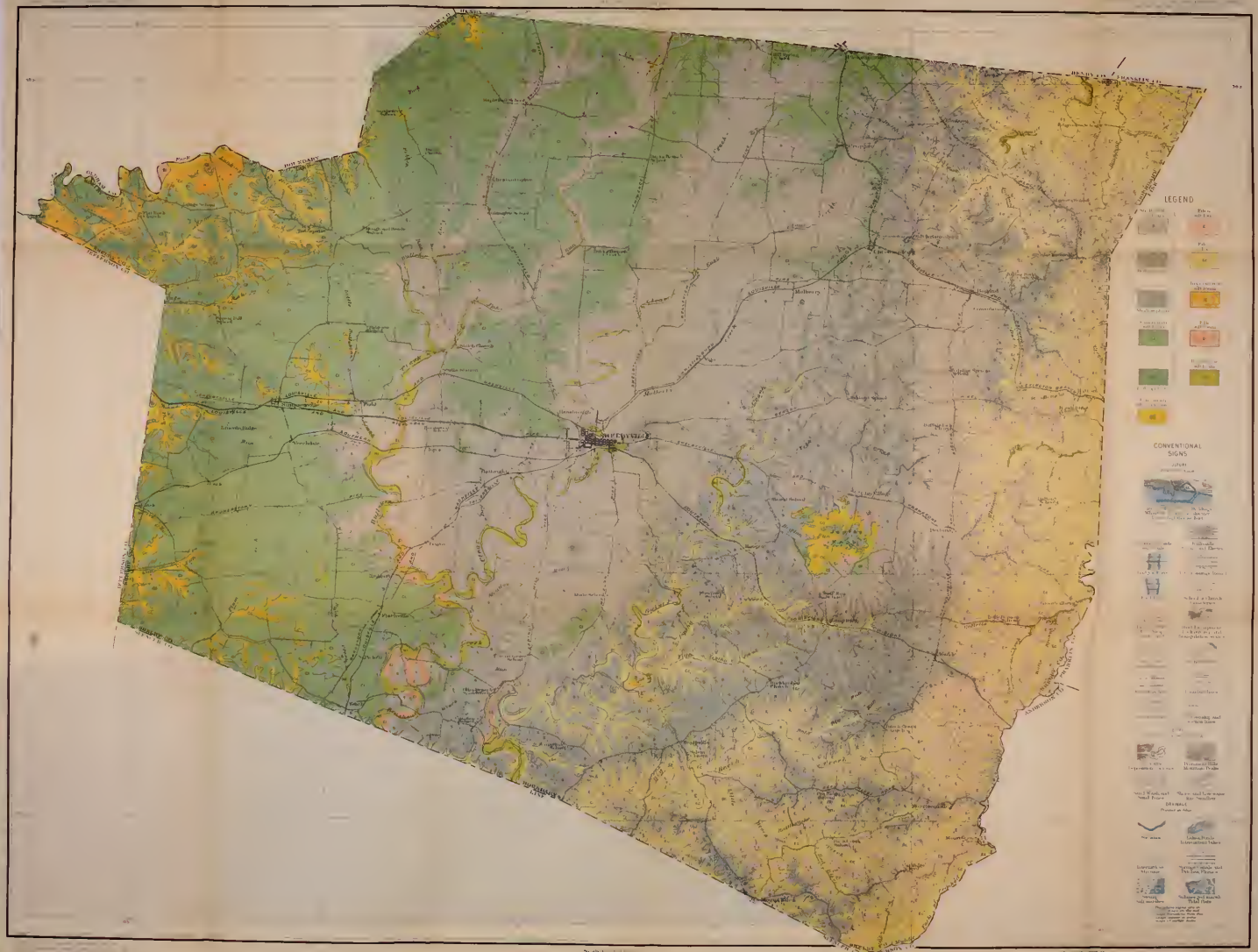
SOIL MAP



[PUBLIC RESOLUTION—No. 9.]

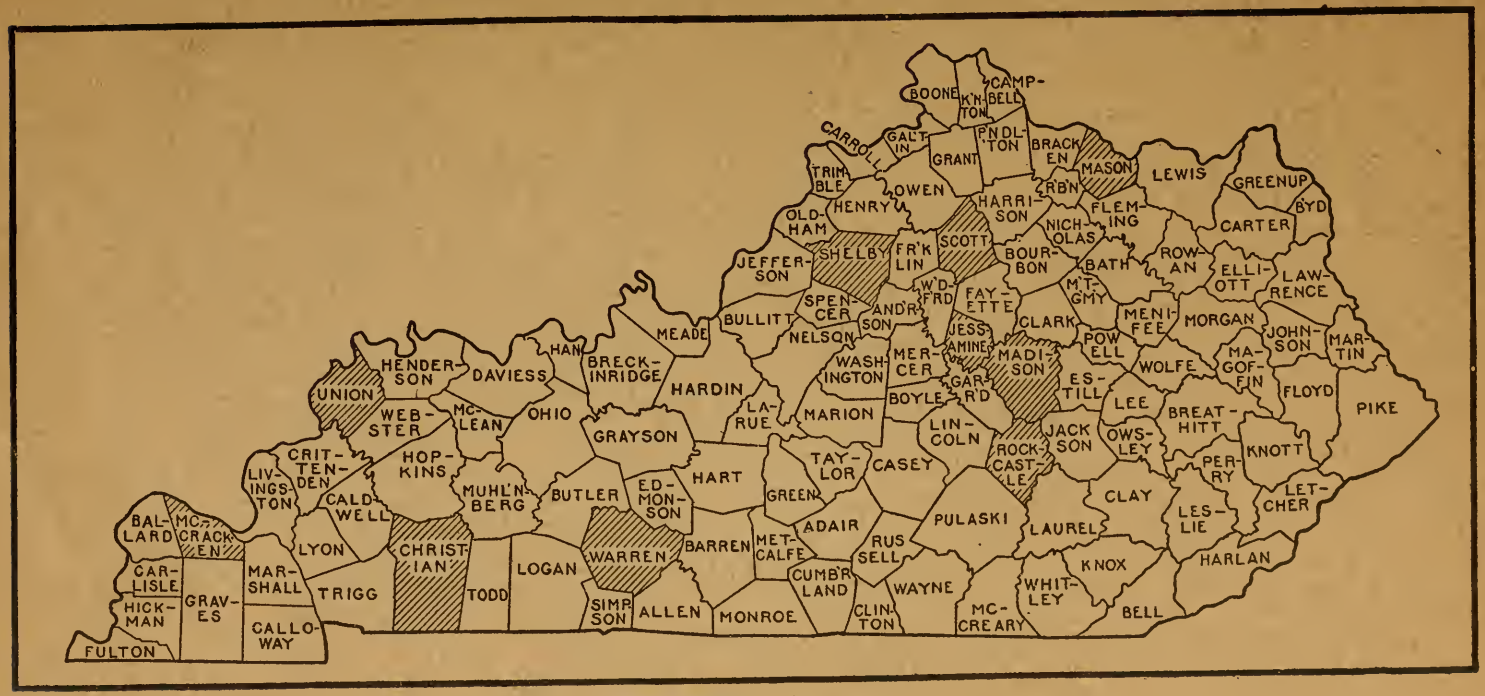
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Kentucky.