SOIL SURVEY OF JOHNSON COUNTY, NEBRASKA.

By H. L. BEDELL, of the United States Department of Agriculture, in Charge, and H. E. ENGSTROM, of the Nebraska Soil Survey.

DESCRIPTION OF THE AREA.

Johnson County is situated in southeastern Nebraska, about 25 miles southeast of Lincoln. It is in the second tier of counties north of the Kansas line and is separated from the Missouri River by Nemaha County. The county is rectangular in outline, being 21 miles long east and west and 18 miles wide. It has an area of 374 square miles, or 239,360 acres.

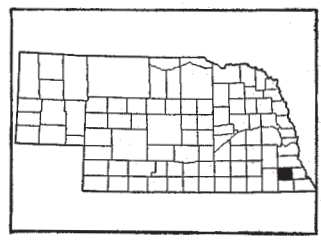

FIG. 37.—Sketch map showing location of the Johnson County area, Nebraska.

Johnson County lies within the glaciated part of the physiographic province known as the Great Plains. The general surface configuration is that of a plain sloping toward the southeast with the original constructional surface for the most part obliterated by stream erosion. The large streams of the county, including the North Fork Nemaha, and South Fork Little Nemaha Rivers and their larger tributaries, break up the surface into broad divides of upland, capped by the flat tablelike remnants of the old structural surface. These broad divides are in turn penetrated by numerous smaller streams of dendritic arrangement, creating narrower divides, so that practically the entire area, excepting some of the areas of the original plains, is dissected, the topography varying from gently to sharply rolling. By this erosion and by deposition the streams have produced three main topographic divisions: the comparatively flat remnants of the original plain, the eroded slopes below these tablelike flats, and the level alluvial flats and flood plains.

The largest of the remnants of the ancient plain not yet invaded by drainage ways lies along the eastern boundary of the county, east of Hawthorne School, and extends into Nemaha County. Another lies south of Cook, on the divide between Coon Creek and Spring Creek. The surface of these areas is level to gently undulating, but there are few depressions, basins, or other areas of restricted drainage. These very flat tables, which have been affected by erosion so slightly that the silty surface soil has not been removed, are almost coextensive with the areas of the soil mapped as Grundy silt loam. The structural surface, however, may be considered as extending beyond these extremely flat areas, as the smooth areas of the Carrington silt loam and the Pawnee silt loam are parts of the old plain which have had

their loess and drift coverings but little disturbed by erosion. This part of the higher upland is undulating to gently rolling, the relief being afforded by shallow drainage ways which are often mere swales.

The eroded upland, which covers about three-fourths of the county, has a topography that varies from gently to sharply rolling. The eroded slopes break off rather gently from the flat tops of the divides, but the line of advancing erosion in most places is clearly perceptible. The upper parts of these slopes have a gently rolling topography, as the valleys are rather broad for their depth and the hills are well rounded. On the lower slopes the valleys are deeper and more sharply cut, and the grades are steeper, often terminating in sharp slopes and bluffs next the flood plains of the streams.

The terraces of Johnson County are developed chiefly along the North Fork Nemaha and South Fork Little Nemaha Rivers and along the larger creeks tributary to these streams. They are not continuous, but occur as broken, elongated strips between the first bottoms and uplands. They consist of two distinct series, the high and the low terraces. The high terraces are from 20 to 25 feet and the low terraces from 3 to 5 feet above the present flood plains. The high terraces are best developed along the North Fork Nemaha River northwest of Tecumseh and along the South Fork Little Nemaha River in the vicinity of Cook. The surface is flat, sloping gently down the valley. The transition from the high terrace to the bottom lands is marked by an abrupt steep slope, while that to the uplands is more gradual. The surface of the low terraces is usually level, though in many places it has a slope from the edge of the flood plains to the base of the uplands.

The first bottoms are rather extensive, comprising about 14 per cent of the total area of the county. The largest body lies along the North Fork Nemaha River and extends diagonally across the county from northwest to southeast. It ranges in width from one-eighth mile to about 1½ miles. Another large body occupies the flood plain of the South Fork Little Nemaha River in the northeastern part of the county. This has an average width of about one-half mile. Narrower strips occur along the larger tributaries. The surface of the bottom lands lies from 8 to 12 feet above normal flow of the streams. The topography is generally flat, except along the rivers, where it is relieved by such minor features as depressions, cut offs, old channels, overflow channels, and intervening low ridges.

The average elevation of the county is about 1,100 feet. Cook has an elevation of 920 feet, Sterling 1,179, Smartville 1,149, Vesta 1,228, Tecumseh 1,114, and Elk Creek 1,067 feet above sea level. The general slope of the county is toward the south and east, except in the northeastern part, where it slopes northward.

Johnson County is drained by two important streams, the North Fork Nemaha and the South Fork Little Nemaha Rivers and their tributaries. In addition to the rivers and larger streams there is an intricate system of small drainage ways, intermittent streams, and draws which ramify all parts of the county. These give thorough drainage in all parts of the upland.

Small parts of the flood plains are not so thoroughly drained on account of the level topography, and are subject to frequent overflow, when water often accumulates on the surface and causes serious damage to crops and property. As a rule, however, the flood plains have

adequate drainage. The channel of the North Fork Nemaha has been straightened and this stream at present seldom overflows.

The first legislative assembly of Nebraska defined the boundaries of Johnson County in 1855, but it was later included with Nemaha and Clay Counties by act of the second assembly. The third legislature reestablished the county with its present territory taken from the west end of Nemaha County and the north side of Pawnee County.

The first permanent settlers were natives of Indiana, who settled about 3 miles southeast of the present site of Tecumseh in 1855. Later, settlers came from Iowa, Illinois, Mississippi, and the New England States. The present inhabitants are mainly native born.

The population of the county is reported in the census of 1920 as 8,940, all of which is classed as rural, as there are no towns with more than 2,500 inhabitants. The population has a density of 23.9 persons per square mile and is fairly evenly distributed, though densest in the vicinity of the larger towns and sparsest in the river bottoms.

Tecumseh, the county seat and largest town, with 1,688 inhabitants, is located in the east-central part of the county and is an important trading center for farm implements and supplies. Sterling, in the northwestern part, has a population of 804; Crab Orchard, in the southwestern part, has 278 inhabitants, and Cook, in the northeastern part, has 360. Elk Creek, Smartville, and Vesta are small villages in the southeastern and central parts. The towns and villages are local markets and shipping points for farm produce.

Transportation facilities in the county are good. The main line of the Chicago, Burlington & Quincy Railroad from St. Joseph, Mo., to Billings, Mont., crosses the county southeast-northwest through Elk Creek, Tecumseh, Smartville, and Sterling. A branch of this road from Beatrice to Nebraska City traverses the central part of the county east and west, passing through Crab Orchard, Vesta, and Tecumseh. The Crete Branch of the Missouri Pacific Railroad dips into the northeastern part of the county, passing through Cook.

Most of the public roads follow section lines, except in a few places along the rivers, where bridges have not been constructed. All the roads are earth roads. The more important highways are well graded and are dragged as soon after each rain as the ground permits. The minor roads receive little attention. Many of the creek and river bridges are serviceable steel structures, and concrete culverts are used extensively on smaller streams. Telephones and rural delivery routes reach all sections of the county.

The surplus products, consisting principally of wheat, corn, cattle, and hogs, are shipped to outside markets, chiefly to St. Joseph and Kansas City. Most of the grain is handled in local elevators, where it may be sold at once or stored until the price is satisfactory. A large part of the dairy and poultry products is shipped to Lincoln.

CLIMATE.

The climate of Johnson County is marked by rather wide seasonal extremes. The winters are fairly long and cold and the summers warm. The spring is usually cool, with considerable precipitation; the fall season is often long, with moderate temperature and only occasional periods of rainy weather.

The following table, compiled from the records of the Weather Bureau station at Tecumseh, gives the normal monthly, seasonal, and annual temperature and precipitation:

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

(Elevation, 1,114 feet.)

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1890).	Total amount for the wettest year (1883).
	°F	°F	°F	Inches.	Inches.	Inches.
December	28.6	70	−24	0.97	0.25	0.50
January	24.1	66	−30	.82	1.10	1.62
February	25.8	80	−26	1.17	.40	2.00
Winter	26.2	80	−30	2.96	1.75	4.12
March	39.0	96	−15	1.48	1.10	2.00
April	52.7	99	8	2.79	1.45	2.91
May	62.3	97	21	4.63	3.30	4.25
Spring	51.3	99	−15	8.90	5.85	9.16
June	72.3	107	36	5.04	1.30	20.00
July	77.6	112	42	4.15	3.97	3.38
August	75.2	108	40	3.49	1.79	1.50
Summer	75.0	112	36	12.68	7.06	24.88
September	67.1	102	23	3.18	2.16	1.50
October	54.6	98	14	2.60	1.52	5.50
November	40.3	86	−10	1.18	1.25	.86
Fall	54.0	102	−10	6.96	4.93	7.86
Year	51.6	112	−30	31.50	19.59	46.02

The mean annual precipitation is 31.5 inches. It is heaviest during the summer (June, July, and August), with a mean of 12.68 inches, and lightest during the winter (December, January, and February), with a mean of 2.96 inches. The average annual snowfall is about 20 inches. In the summer months the precipitation occurs chiefly during heavy thunderstorms. In May and June it is well distributed, periods of drought being practically unknown. In July the distribution is less favorable, and during August and September the rainfall is lighter, so that periods of drought occasionally occur in these months. The droughts are usually of short duration and crop failures have been rare, but the yield of corn is sometimes reduced by dry weather and hot winds.

The mean annual temperature is 51.6° F. January is the coldest month, with a mean temperature of 24.1° F., and July the warmest, with a mean of 77.6° F. The lowest temperature recorded is −30° F., in January, and the highest 112° F., in July. The average date of the last killing frost in the spring is May 1 and of the earliest in the fall October 6. In the 20 years from 1895 to 1914 there were 5 seasons in which the last killing frost in the spring was 10 days or more later than the average and 4 seasons when the earliest in the fall was 10 or more days earlier than the average. The latest recorded

killing frost occurred on May 30 and the earliest on September 13. The average growing season is 157 days, which is sufficient for the maturing of all crops common to the region.

From September 1 to May 1 the prevailing wind is from the northwest, and from May 1 to September 1 it is from the south and southeast. Strong winds are common, though tornadoes are rare.

According to the records at Lincoln, the relative humidity is comparatively uniform. The average annual humidity is about 70 per cent. The percentage of clear, sunshiny days is high.

AGRICULTURE.

The early settlers in Johnson County established claims along the larger streams, where there was an abundance of fuel and water. The first of the virgin prairie sod was broken and planted to corn and wheat about 1855. Ranching was carried on to some extent by the early farmers, but never became important. The early development of agriculture was slow, on account of the lack of transportation facilities and the low market price of all farm products.

According to the reports of the Bureau of the Census, the number of farms in the county increased from 1,089 in 1880 to 1,594 in 1900, and decreased to 1,167 in 1920. The average size of the farms has fluctuated considerably, being 146, 154, 144.1, 168.4, and 176.9 acres, respectively, in the last five census years. The proportion of improved land in farms has consistently increased with the development of the county, being 64.5 per cent in 1880 and 91.1 per cent in 1920. As reported by the census, the value of all farm property per farm, including land, buildings, machinery, and domestic animals, has increased from $3,198 in 1880 to $31,837 in 1920.

The following table, compiled from the reports of the Bureau of the Census, gives the acreage and production of the leading crops and shows the general trend of agriculture during the four decades covered:

Acreage and production of principal crops for Johnson County, 1879, 1889, 1899, 1909, and 1919.

Crop.	1879		1889		1899		1909		1919	
	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Corn	48,354	2,166,868	73,943	3,312,424	103,918	3,841,200	98,142	1,598,127	51,618	843,108
Oats	5,466	123,151	16,421	555,462	26,169	861,750	24,857	627,299	17,384	429,751
Wheat	18,814	147,461	3,553	72,789	17,650	210,270	23,634	439,031	42,326	630,154
Rye	527	6,622	244	3,526	595	7,820	33	408	233	2,250
Barley	2,103	21,995	669	15,940	55	1,230	22	311	213	3,900
Flaxseed	.....	186	5,563	53,300	.....	.....	.....	.....	.....	.....
Potatoes	.....	39,654	1,057	97,613	577	49,133	655	49,570	409	18,594
		Tons.		*Tons.*		*Tons.*		*Tons.*		*Tons.*
Hay and forage	4,786	7,651	26,897	33,170	21,398	31,885	15,701	21,934	22,742	36,072
	Trees.	*Bushels.*	*Trees.*	*Bushels.*	*Trees.*	*Bushels.*	*Trees.*	*Bushels.*	*Trees*	*Bushels.*
Apples	.....	.....	53,386	49,786	127,501	42,554	81,857	83,447	13,297	19,436
Peaches and nectarines	.....	.....	6,564	14	67,607	718	52,185	5,178	2,753	.....

The present agriculture of the county consists mainly of grain production and hog raising, though increased attention is being

given to dairying and the raising of cattle and other livestock. Corn, wheat, oats, wild hay, alfalfa, and timothy and clover mixed are the principal crops.

Corn is the predominant crop. The Nebraska State Board of Agriculture reports 68,229 acres or 28.5 per cent of the entire county devoted to corn in 1920, with an average yield of 38 bushels per acre and a production of 2,592,702 bushels. Corn is grown on all the improved soils of the county. It does best, however, upon the better drained bottom-land soils. The acreage devoted to corn has steadily decreased since 1899, while that in wheat and alfalfa has increased Occasional hot winds and droughts during July and August sometimes do considerable damage to the corn crop and reduce the yields. The most popular varieties of corn in the county are Reid Yellow Dent, Iowa Silvermine, and Leaming. On farms operated by owners most of the corn is fed to hogs and other livestock. It is common practice to pasture horses and cattle in the stalk fields after the corn has been shucked. Many farmers fence off a few acres of the unshucked corn for the hogs to feed upon. Some corn is cut for fodder. There are numerous silos in the county, and on farms equipped with silos from 15 to 20 acres of green corn is cut for silage. On tenant farms most of the corn is sold. On most farms corn is not grown longer than two years on the same field. Where it is grown four or five years in succession the yields after the second year are appreciably lower. The crop does best where grown for two years in a systematic rotation with small grain and alfalfa or clover.

Wheat ranks next to corn in acreage. Winter wheat is grown almost exclusively, as it yields better than spring wheat, can be planted in the fall at a time when farm work is light, and usually matures before the dry, hot winds occur in the summer. Turkey is the principal variety. The Nebraska State Board of Agriculture reports that in 1920 only 394 acres were devoted to spring wheat and that the average yield of winter wheat was 18 bushels per acre. Wheat is grown with profit on all the improved soils of the county, but is grown most extensively upon the uplands. It is usually cut with a binder, except during exceptionally dry seasons, when it is headed. The crop is shocked or stacked in the field for threshing. Most of the grain is sold direct from the threshing machine, though there is a tendency in some sections of the county to store it until the market is satisfactory. The straw is usually left in the field, and stock is allowed to feed upon the stack. The Hessian fly does some damage, but rust is not often injurious to winter wheat. Wheat is usually grown for two years, and followed by oats in the crop rotation. Yields decline when the crop is grown more than two years in succession on the same land.

Oats rank third in acreage in Johnson County. According to the report of the Nebraska State Board of Agriculture, 22,919 acres were devoted to oats in 1920, with an average yield of 41 bushels per acre. The crop is grown on all the improved soils of the county, chiefly upon the Grundy and Carrington silt loams of the uplands. The Kherson and White Russian are the principal varieties. The Kherson has a short, stiff stem and is well adapted to the bottom-land soils where the crop is likely to lodge. Oats are less profitable than either corn or wheat, but the grain is more desirable as feed for work stock than corn, and most of the production is fed to horses. The crop occupies a step between corn and other grain and hay crops in nearly

all rotations. It is cut with a binder and shocked or stacked in the field for threshing. The straw has a higher nutritive value than that of any other small-grain crop common to the region, and is fed largely to cattle. Very little of the straw is baled and shipped.

Wild hay is still cut from a considerable acreage. The State board of agriculture reports 9,125 acres in wild hay in 1920, with an average yield of 1.3 tons per acre. The hay is grown chiefly on the more poorly drained areas of the bottom lands, though a considerable quantity is produced throughout the uplands. The upland areas yield less than areas in the flood plains; the quality, however, is much better, since the upland hay grows less rank, is finer in texture, and has a higher feeding value. The hay is stacked in the field and hauled to the feed lots as needed. A small part of it is baled for shipment.

According to the census, alfalfa was grown in Johnson County on 8,601 acres in 1919, with a production of 16,806 tons. According to the report of the State board of agriculture, 8,962 acres were devoted to alfalfa in 1920, with a total yield of 25,989 tons. The acreage of alfalfa has steadily increased at the expense of wild hay since 1900. It not only has a higher nutritive value and produces larger yields than the prairie grasses, but also is valuable in increasing the yields of other crops, particularly corn and oats. Alfalfa is cut three times during the season, and occasionally a fourth cutting is obtained. It is grown on all the improved soils of the county, but does best upon the well-drained terrace lands. The hay is stacked in the fields and hauled to the feed lots as needed. Small quantities are baled and shipped to the St. Joseph and Kansas City markets. On many farms hogs are allowed to run in the alfalfa fields during the summer. It is not advisable, however, to allow cattle to graze upon green alfalfa on account of the danger of bloating. The sod usually is not plowed up for a number of years after seeding.

Mixed stands of timothy and clover are grown on many farms. The seed is usually sown with a nurse crop of grain. As a rule considerable difficulty is experienced in obtaining a good stand, as the rainfall during the latter part of the summer is often insufficent to enable the delicate clover plants to withstand the hot, dry weather which occurs after the nurse crop has been removed. If the rainfall is ample when it is most needed, the crop does well and yields from 1½ to 2½ tons per acre. Mixed timothy and clover occupied 2,604 acres in 1919 and 3,990 acres in 1920. Most of the crop is grown upon the bottom-land soils where moisture conditions are most favorable. Smaller acreages of timothy alone and clover alone are also grown.

The less important field crops of Johnson County include potatoes, barley, rye, and sorghum. Potatoes are grown only for home consumption. The potato beetle is often very destructive to the vines, and it is usually necessary to spray them at least once or twice during the summer. Barley and rye are grown chiefly for the grain, though small patches of rye are sown for late fall pasture. Most of the barley is grown on the moist bottom-land soils. Rye is grown chiefly on the uplands. It is somewhat drought resistant and will flourish on soils of an impoverished nature. Sorghum was planted on 139 acres in 1920, and gave an average yield of 3 tons of fodder and from 15 to 20 bushels of seed per acre. Scarcely any sorghum is grown for the production of sirup.

There are very few commercial fruit orchards in the county. Most farmers have small orchards containing different varieties of apples, peaches, cherries, pears, and plums. When given proper attention apples can be grown very successfully, though they do not do so well as along the Missouri River bluffs in counties to the east. The farm orchards are seldom sprayed and pruned and a large number of the trees have died within the last few years. Small quantities of grapes, strawberries, blackberries, and raspberries are produced. Of the wild fruits, plums and grapes are the most important. They grow chiefly along the larger streams.

Hog raising is the most important branch of the livestock industry. From 10 to 50 hogs per farm are fattened each year for market, in addition to those slaughtered for home use. Some farmers feed as many as 150 head. Most of the animals are of grade stock, though there are several purebred herds in the county. The chief breeds are Duroc-Jersey, Poland-China, and Hampshire. According to the census, there were 25,789 hogs in the county in January, 1920. The prevalence of cholera has at times disastrously affected the hog-raising industry. Increased attention is being given to hog-cholera vaccination and to sanitary measures and the ravages of the disease have been greatly reduced.

Many farmers raise a few head of beef cattle every year and sell them when the prices are favorable. There are 48,357 acres of pasture land in the county, and many cattle are annually shipped in for summer grazing. On some of the large farms from one-half to three carloads are fattened for the St. Joseph and Kansas City markets. The beef cattle are mainly of Shorthorn and Hereford breeding. The census reports 18,380 cattle of all grades in the county in January, 1920.

Dairying is not an important industry in the county, although it is receiving increased attention. There are very few purebred dairy animals, and most farmers milk cows of the beef breeds. The number of cows per farm ranges from 2 to 10 or 12, with an average of about 4. Some farmers keep merely enough to supply the family with dairy products, while others sell some butter and cream. Most of the milk is separated on the farms, and some of the surplus cream is shipped direct to the big creameries at St. Joseph and Omaha. A considerable quantity of butter is made for use on the farm and some is sold in the local towns. Very little attention has been given to breeding, housing, and proper feeding of dairy herds. The greatest drawback to the dairy industry has been the labor situation. The farmers are busy with their crops during the summer and do not care to assume the extra work of milking. This condition might be changed by breeding the cows so that they would become fresh in the fall, thereby increasing the milk production in the winter, when more labor is available.

Sheep raising has not been developed in Johnson County. A few sheep are kept on each of several farms, but the total number is comparatively small. Only 2,335 sheep were reported by the census in 1920. The sheep industry deserves increased attention. The animals are good rustlers, they live principally on weeds and roughage, and are produced at little cost.

Horse raising is confined chiefly to the breeding of the work mares. The stock has been greatly improved during the last 15 years. Most

farmers raise 1 or 2 colts a year and some of them as many as 6. The sires mostly used are Percheron and Shire. A comparatively large number of mules are raised. The census reports 7,034 horses and 1,084 mules in the county in 1920.

The poultry industry forms an important source of farm income in Johnson County. From 50 to 100 chickens are raised on nearly every farm, and in addition some geese, ducks, turkeys, and guinea fowls are raised. The principal breeds of chickens are Plymouth Rock, Leghorn, Rhode Island Red, and Buff Orpington. According to the census there were about 121,000 chickens and 1,800 other poultry in Johnson County in 1920. The surplus poultry products are shipped to Lincoln and St. Joseph.

Attention is being given to the adaptation of crops to the soils. It is generally recognized that the Grundy, Pawnee, and Carrington silt loams are well suited to all crops common to the region, but that the highest yields of corn and alfalfa are obtained on the well-drained terrace soils. The steep, hilly areas are well adapted to alfalfa, small fruits, and commercial orcharding. The eroded areas of Shelby loam are best suited to grazing and hay production, as are the more poorly drained lands of the bottoms. The heavy, well-drained bottom soils of the Wabash series are better adapted to corn than small grain.

There is no definite system of crop rotation in the county. Many farmers have evolved systems which they employ on their farms. The general tendency is to grow corn 2 to 4 years, oats 1 year, and wheat 2 years, returning to corn. Frequently corn is grown 4 to 6 years and wheat 4 years without changing to other crops. Under such practice the yields depreciate after the second or third year. Occasionally the wheat land is kept in clover and timothy 2 or 3 years or in alfalfa 5 to 7 years, and then returned to corn. Clover and timothy fit better into a short rotation than alfalfa, though the latter is a more certain and higher yielding crop. A rotation which appears to have merit is 2 years of corn, 1 year of oats, 2 years of wheat, and 4 to 6 years of alfalfa, returning to corn. Two principal objects must be kept in view in crop rotation, namely, the maintenance of soil fertility and profitable agriculture. The tendency to consider the rotation only in the light of immediate returns is much too common.

Stubble land is usually plowed in the fall if time permits. If corn follows wheat or alfalfa, the corn is either listed or checkrowed on the plowed and disked land. If the land has been plowed in the spring the crop is often listed in. Many farmers do not plow old corn or stubble ground, but disk it thoroughly before listing in the new crop. When corn follows corn the old stalks are cut with a stalk cutter before disking the ground. Subsequent to the planting, it is considered good practice to harrow the field several times before the corn is large enough to cultivate, in order to keep down the weeds. Some farmers disk the corn land a number of times, drag the fields and then seed with a press drill. Small grain is usually sown with a press drill on well-prepared corn or stubble ground. Wheat is sometimes drilled between the corn rows in the fall.

Not much attention is given to the use of commercial fertilizers. Some of the drift hill land could be improved by adding ground limestone, such as could be made from local rocks. Green crops are seldom turned under. Barnyard manure is applied to the land when

available. It is usually hauled in the spring or late fall, when farm work is light, and spread over the corn or wheat land. On the tenant farms the land in the immediate vicinity of the barnyards usually receives the greatest amount of manure.

Efficient farm labor is becoming scarce, and most of the work is done by the farmers and their families. Laborers receive $50 to $60 a month when hired by the year.[1] The daily wage ranges from $3 to $4 and during the harvest season as high as $6 with room and board has been paid. Corn shuckers receive 8 to 9 cents a bushel. Many farmers hire labor by the year and in this way guard against lack of help at critical periods.

The farms vary considerably in size, ranging from about 80 acres to over 1,000 acres. The most common size is about 160 acres. In 1880, 69.5 per cent, and in 1890, 65.9 per cent of the farms were operated by owners. Since 1900 the proportion of owner-operators has remained about 54 per cent. On the tenant farms both the cash and share rental systems, or sometimes a combination of the two, are followed. Cash rents range from $5 to $10 per acre, depending upon the soil. Under the share system the tenant furnishes all labor, seed, and machinery, and receives two-fifths to one-half of the crop. In the combination system of cash and share renting the land not used for crops is rented for cash and the grain land on shares. In some instances cash rent is paid for hay land. In any system of share rental the tenant delivers the owner's share of the crops to the nearest market.

The price of farm land in Johnson County ranges from $75 to $350 an acre, depending upon the character of the soil and the improvements and location. The average assessed value of the land alone is reported in the 1920 census as $145.85 an acre.

SOILS.[2]

The soils of Johnson County have been differentiated in this report into a number of series and types, on the basis of their most obvious physical characteristics and their chemical constituents, as far as these could be readily ascertained in the field. The characteristics of the soils of any region are the result of two factors: (1) The character of the parent material, and (2) the processes of soil formation, including weathering, leaching, aeration, and oxidation, to which the soils have been subjected during their development. The soil-forming processes, which are controlled to a large extent by climatic conditions, are believed to have been of greater influence in fixing the present character of the soils in this area than the composition of the parent rock.

The broadest and most striking characteristic of the soils of this area is their dark color, resulting from the large proportion of black organic matter that they contain. The county lies in a region where topography, moisture supply, and temperature have favored a heavy prairie vegetation, and it is from the decay of these grasses that the

[1] The wages of farm labor and the prices of land given in this report are those that prevailed in 1920, when the field work of this survey was in progress. They have become lower since that time.

[2] Johnson County adjoins Gage County on the west. In places the maps of these counties do not appear to agree along the boundaries. This is due to changes in correlation resulting from a fuller understanding of the soils of the State. The Carrington silt loam and the Carrington loam of Gage County have been subdivided to form a new series, so that in Johnson County parts of the areas of these types are mapped as Pawnee silt loam and Pawnee loam, respectively.

soils derive their organic constituent. Another feature of these soils is the comparative uniformity of their chemical composition, which has been brought about by a long period of weathering. It is almost certain that the parent soil materials varied widely in composition, particularly in their content of lime carbonate, but leaching has largely removed this and other carbonates and other relatively soluble constituents to a depth of more than 3 feet.

The dark-colored soils that have been weathered in their present positions for long periods of time fall into two groups. The soils of one of these groups, of which the Carrington series is representative, were developed under conditions of good soil and subsoil drainage. The typical profile has a surface layer of dark-brown color and friable granular structure. This is underlain by a brown, granular, heavy silt loam, which passes at a depth of about 24 inches into yellowish-brown clay loam. The carbonates have been largely removed to depths of more than 3 feet. With this group belong the soils of the Carrington and the Shelby series of the upland and the Waukesha series of the well-drained terraces.

The second group has dark-brown, friable, granular surface soils not differing essentially from those of the Carrington group, but the upper subsoil is a very dark brown or dark-gray compact silty clay loam or clay. The lower subsoil varies somewhat in color but less in texture and structure. It is a grayish-brown or gray and brown, mottled, tough, compact clay. Undisturbed weathering in their present position for a long period under conditions of imperfect drainage has given to this group the subsoils of mottled color and compact structure. The carbonates have been removed to depths of more than 3 feet. This group includes the Grundy series developed upon loess, and the Pawnee series developed upon drift.

Besides these two groups of soils, which have developed a certain definite arrangement of the several zones making up the profile, there is another which may be regarded as immature, since the soils have either not had sufficient time since accumulation of the material to develop a characteristic profile, or conditions have not been uniform or favorable for such development. These soils, which include the Wabash series, have been subjected to continous or occasional conditions of excessive moisture. The surface soils are dark colored and the subsoils are heavy in texture and are gray or mottled.

The principal characteristics mentioned above have been those impressed upon the soil by the great soil-forming processes, such as leaching, oxidation, and the accumulation of organic matter, and no account has been taken of the characteristics due to the composition and the processes of accumulation of the material from which the soils have been developed. In the following pages the differentiation into series has included a consideration of the parent material.

Originally the surface of the county was covered with a thick mantle of plains loess. Most of this deposit has been washed away, until at present only small remnants remain to mark the level of the original constructional plain. The largest of these lie along the eastern county line, in the vicinity of the Hawthorne School and upon the high divide between Spring and Coon Creeks, in the northeastern corner of the area. Many smaller remnants occur throughout the upland, but most of them have been considerably lowered by erosion and their surfaces lie below the level of the original deposit.

In its unweathered condition the loess is an even-textured material composed largely of silt particles. It varies in color from brownish yellow to yellow, light gray, or almost white. The lime content is moderate, and rusty streaks and blotches indicate the presence of iron. The material is characterized by its tendency to split into vertical planes, producing perpendicular bluffs along water courses and roads.

Subsequent to its deposition, the surface material of the loess has undergone marked change in color, structure, and composition, caused principally by the accumulation of organic matter and the chemical and physical changes due to weathering, such as the concentration of clay in the subsoil and the partial removal of lime from the soil and upper subsoil. In Johnson County the soil produced by these processes upon the loess is mapped as the Grundy silt loam.

Underlying the loess mantle and exposed extensively throughout the county lies the Kansan drift sheet. The materials composing this sheet consist of rock débris carried down and deposited during the last glacial advance into Nebraska. Subsequent to its deposition, the surface of the drift sheet has been deeply weathered. The coarser materials have been so reduced by chemical and physical forces and so mixed with sediments from the overlying silty deposits that they have become almost as silty as the true loess. This highly decomposed surface material is classed by the State geologists as the weathered phase of the Kansan drift. While it is sufficient to separate the true loess deposits from those of the weathered phase of the underlying drift sheet, there are a few fine distinctions which may be pointed out. The weathered drift material contains a little coarse sand and a few small pebbles. It has a more horizontal compact structure and contains more clay but less silt than the true loess. The soils of the Carrington and Pawnee series have been developed upon the weathered phase of the Kansan drift.

The lower stratum of the Kansan drift sheet is known as the Kansan drift proper. It is exposed only along hillsides and the crests of the sharper divides where erosion has been severe. The material is distinctly glacial till and consists of a loosely consolidated mass of bowlders, pebbles, and clay. Where exposed for a considerable time it has developed an upper oxidized zone varying in color from yellowish brown or brown to reddish brown. Below the oxidized layer the drift is light gray or pale yellow. It contains numerous iron stains, and lime is present in the form of concretions, seams, and marly pockets. The Kansan drift proper has weathered into the soils of the Shelby series.

Below the Kansan drift sheet lies the Aftonian sand sheet, composed mainly of yellow sand and gravel with a few bowlders. The material outcrops in a few places along the North Fork Nemaha River, but does not form a continuous bed throughout the county. The exact derivation of the sand sheet is not understood by the Nebraska geologists. It is believed to represent sediment deposited by streams heading in the receding ice sheet of the Kansan advance. It does not give rise to any soil type, but has contributed some material to areas of a sandy phase of the Shelby loam, too small to be shown satisfactorily on the soil map.

Underlying the loess and glacial drift sheet at various depths are alternating beds of limestone and shale of Pennsylvanian age. This

bedrock has given rise to no soil type in Johnson County, but has been shown as rock outcrop and stony areas on the soil map.

The terrace soils of Johnson County occur chiefly along the main rivers, although smaller developments lie along the larger tributaries to these streams. The benches occur at two levels. The higher terraces are well developed on the south side of the North Fork Nemaha River about 1½ miles northwest of Tecumseh and on the north side of the South Fork Little Nemaha in the vicinity of Cook. They lie from 20 to 25 feet above the present flood plains. The lower benches are of more recent origin. They are in most places elevated from 3 to 5 feet above the first bottoms. In many places, however, they occupy gradual slopes leading from the lower edge of the uplands to the flood plains. The terraces represent deposits laid down by the streams when they were flowing at higher levels than at present. The lower benches have undoubtedly been considerably modified by colluvial wash from the adjoining hillsides. The materials are fine in texture, consisting chiefly of very fine sand, silt, and clay washed from the surrounding uplands and from loess deposits to the north and west. The derived soils have been classed with the Waukesha series.

The flood plains or first bottoms of Johnson County are extensively developed along the rivers and their larger tributaries. They were formed by the intrenchment of the streams below the terrace levels and the subsequent deposition of sediments along their channels. The materials were derived in the same manner and from much the same sources as those of the terrace soils. They are, however, of much more recent origin and are in many places receiving additions with each overflow of the streams. The flood-plain soils are classed with the Wabash series.

In the classification adopted by the Bureau of Soils the soils are grouped into series on the basis of similarity in color, structure, and minor details of the soil profile and on the basis of the source, character, and process of accumulation of the material from which the soils have been developed. Each series is further divided into types on the basis of texture, which depends upon the relative proportions of sand, silt, and clay. The type is the unit used in soil mapping. The following are descriptions of the soil series recognized in this area.

The surface soils of the Grundy series are dark grayish brown to black. The subsoil consists of three successive layers. The upper layer is brown or light brown and a little heavier than the soil. The second layer is a dark-brown to dark-drab and brown mottled, heavy clay, rather plastic when wet and hard when dry. The third layer, or lower subsoil, is a little lighter in color and less tough than the intermediate layer. The topography is usually flat. The material is derived from silty deposits of glacial age, usually defined as loess. Only one type, the Grundy silt loam, is mapped in Johnson County.

The surface soils of the Carrington series are dark grayish brown in color, with a loose, finely granular structure. The upper subsoil is a brown to yellowish-brown silty clay loam and the lower subsoil is moderately friable and lighter in texture. The topography is gently undulating to rolling, although some areas are nearly flat. This series has been developed upon glacial deposits. Both soils and

subsoils are leached so that they carry a moderate to low content of lime. Two types, the Carrington silt loam and the loam, are mapped in this county.

The surface soils of the Pawnee series are dark brown to almost black and range in depth from 6 to 12 inches. The subsoil has two distinct layers. The upper, which extends to an average depth of about 20 inches, is a dark grayish brown heavy clay loam or clay often mottled with gray. In places this layer is darker than the surface soil. The lower subsoil, extending to a depth of more than 36 inches, is a grayish-brown or yellowish-brown clay loam slightly mottled with gray. In most places the soil does not effervesce within the 3-foot section, but in places it contains fragments of limestone or lime concretions. The topography varies from almost level to gently rolling. These soils have been developed on an old drift sheet.

The surface soils of the Shelby series are predominantly dark brown and have a finely granular texture, being similar in all respects to the soils of the Carrington series. The subsoil is composed of yellow, reddish-yellow, or light-brown, tenacious sandy clay, and locally it contains iron pipes and nodular masses and streaks of calcareous material. These soils are derived from the Kansan drift sheet and occupy steep stream slopes and narrow crestlike divides. They are subject to excessive erosion. The Shelby loam has been mapped in Johnson County.

The soils of the Waukesha series are dark grayish brown and are underlain by a grayish-yellow to yellow subsoil. They are derived from water-assorted glacial material deposited in broad, filled-in valleys or on outwash plains and terraces. The topography is mainly flat to gently undulating and drainage is good. Two types, the Waukesha silt loam and very fine sandy loam, are mapped.

The soils of the Wabash series are prevailingly dark brown to black and contain a high percentage of organic matter. The subsoil ranges in color from dark brown to brownish gray or gray or mottled brown and gray. It is usually heavier and more compact than the surface layer. The soils are developed in the first bottoms of streams. The material is composed of sediments washed down from the loessial and associated soils of the region. The Wabash soils have a flat topography, but are generally fairly well drained, considering their low position. During periods of high water they are in places subject to overflow. Two types, the Wabash silt loam and very fine sandy loam, are mapped in this county.

The following table shows the actual and relative extent of each of the soil types mapped in Johnson County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Carrington silt loam	71,168	29.7	Pawnee loam	10,880	4.6
Carrington loam	46,400	19.4	Waukesha very fine sandy loam	4,800	2.0
Pawnee silt loam	39,872	16.7	Wabash very fine sandy loam	4,544	1.9
Wabash silt loam	29,312	12.2	Waukesha silt loam	3,328	1.4
Grundy silt loam	15,616	6.5			
Shelby loam	13,440	5.6	Total	239,360	

GRUNDY SILT LOAM.

The surface soil of the Grundy silt loam is a dark grayish brown heavy silt loam, 8 to 12 inches deep. The soil is deepest on the flatter areas and shallower near the margins of the bodies, where it merges into the Carrington silt loam. The material is rich in organic matter and when moist appears almost black. It contains a very large proportion of silt and a relatively small quantity of clay, but little or no sand of any grade. The upper subsoil or subsurface layer, 2 to 6 inches thick, consists of a brown heavy silt loam which is heavier than the surface soil. This layer passes abruptly into a brown or nearly black heavy clay to silty clay which generally extends throughout the 3-foot section, becoming heavier with depth. In a few places the material is mottled with dark drab and yellowish brown to brown, but the mottlings are not a conspicuous feature of the subsoil as a whole. The subsoil is compact, hard, tough, and moderately crumbly when dry, but plastic and impervious when wet.

Scattered through the type there are areas in which the subsoil varies from the typical in that it becomes slightly lighter in both color and texture below 30 inches. In these places the substratum material consists of a gray to yellowish-gray only slightly compact silty clay, which is usually highly calcareous. The subsoil of the greater part of the type, however, does not effervesce in dilute hydrochloric acid. A few small bodies, seldom exceeding 4 acres in extent, are included in which the surface material is a silty clay. There are also included small patches in which there appears to be only a slight concentration of clay in the subsoil. In these areas the surface soil is a dark-brown smooth silt loam, 6 to 14 inches deep, underlain by a light-brown silty clay loam, which passes below 24 inches into a yellowish-gray, highly calcareous, loose silty clay. If these areas were large enough to warrant mapping they would have been classed with the Marshall silt loam, but owing to their small extent and local occurrence they were not separated on the soil map.

The Grundy silt loam is developed in the eastern part of the county in several areas of considerable size. One of the most typical areas lies south of Cook, in the northeastern part of the county, where it occupies the high divide between Coon and Spring Creeks. The largest uniform body of the type lies along the eastern county line in the vicinity of the Hawthorne School. Small areas are scattered through the upland in the eastern part of the county. The type as a rule occupies the highest parts of the upland, having been developed upon remnants of the loess plain that once covered the entire upland part of the county. Extensive weathering, the accumulation of organic matter in the surface layer, and the concentration of clay in the subsoil have produced the present soil.

The topography is almost flat to slightly undulating. There is usually sufficient slope to afford adequate drainage, though in wet seasons, especially on the broader divides, the drainage is not sufficient for maximum crop production. In dry seasons crops do not withstand drought quite as well as on types with more open subsoils, because the heavy lower subsoil does not permit a sufficiently free upward capillary movement of water for best results.

The type was originally covered with a thick growth of prairie grasses, but practically all of it is now under cultivation. It is one of

the strongest and most fertile upland soils of the region, but owing to its small extent, it is not so important in this county as the Carrington silt loam or loam soils.

Corn, wheat, oats, and alfalfa are the leading crops. Hogs are raised on nearly every farm, but the cattle industry receives very little attention beyond the raising of stock for the home meat and dairy needs.

The average yields of crops on this type are as high as on any of the upland soils of the county. Corn occupies the largest acreage and yields an average of about 35 bushels per acre, although as high as 60 bushels have been obtained in favorable years on well-managed fields. Wheat yields 20 to 30 bushels, oats 25 to 40 bushels, and alfalfa from 3 to 3½ tons per acre. Alfalfa is usually cut 3 times, and a fourth cutting is obtained during seasons of high rainfall.

Considering its heavy texture the Grundy silt loam is easy to handle. It clods badly if plowed when wet, but the clods are not difficult to reduce. The smooth topography and silty, stone-free character of the type, together with its natural productiveness and ready response to good farming methods, make it highly prized for general crop production. Commercial fertilizers are not used; barnyard manure, however, is applied when available.

The selling price of the Grundy silt loam ranges from $200 to $300 an acre, depending largely upon improvements and location.

CARRINGTON LOAM.

The surface soil of the Carrington loam consists of dark-brown to dark grayish brown mellow loam, 8 to 14 inches deep. It is relatively high in silt and clay, but contains enough of all grades of sand to give it a loamy character. The upper subsoil is a rather heavy silty clay loam, containing a small proportion of very fine sand. It usually ranges in color from light brown to yellowish brown, but in places it is reddish brown. Below an average depth of 20 inches the material becomes lighter in color and texture as the less weathered parent drift is reached. In many places, however, the change in the subsoil material to a depth of 3 feet is slight. Brown iron oxides are found here and there below 30 inches. The subsoil is rarely calcareous within the 3-foot section, but lime concretions are abundant below 4 feet. Occasional small pebbles and bowlders occur on the surface and in the soil, but are rare in the subsoil. The depth and color of the soil varies with its topographic position. On the more level areas, where conditions have favored undisturbed weathering and accumulation of organic matter, the soil is a very dark brown, and in places 12 to 14 inches deep. On the steeper slopes the weathered surface material has been considerably thinned and the organic matter has generally been removed by erosion, so that the soil is of lighter color and shallower depth.

Along intermittent streams the Carrington loam includes numerous narrow strips of colluvial material too small to be shown on the map. The surface soil in these areas is usually a black silt loam to very fine sandy loam having a depth of 30 to 40 inches.

The Carrington loam differs from the Pawnee loam in the darker color and less compact nature of the subsoil. The two types, however, grade into each other, and in many places it was necessary to draw arbitrarily the lines separating them.

The Carrington loam is one of the most extensive soil types in Johnson County. It is developed in numerous areas throughout the upland. The soil is derived from the weathered phase of the Kansan drift sheet. In places a considerable quantity of silt has been washed down from the higher lying silt types and incorporated with the surface soil.

The topography ranges from gently to sharply rolling. The type normally occupies the gentle to steep slopes between the higher lying divides of Carrington silt loam and the bottom lands, but in many places occurs on the sharp crests of low divides. Where areas of Shelby loam are developed, the Carrington loam occupies the upper slopes and tops of well-rounded ridges.

Drainage is everywhere thorough and in a few places excessive, so that erosion on the steeper slopes has become serious. The type is retentive of moisture and on the more level areas it withstands protracted droughts almost as well as the Carrington silt loam.

The Carrington loam is quite strong and fertile. Owing to its productiveness, water-retaining capacity, and large extent, it is one of the leading agricultural types in Johnson County. Originally it was covered with a luxuriant growth of prairie grasses. Most of the virgin sod has been broken for crop production; only about 10 per cent remains in native grasses. The uncultivated areas comprise the steeper slopes, which are used chiefly for pasture.

Corn, wheat, oats, and alfalfa are the leading crops. Corn occupies the largest acreage, and on farms where it is not fed to stock it is the chief cash crop. The soil is well adapted to corn production, good yields being obtained in all but the driest years. Yields of 30 to 40 bushels per acre are common, and well-managed fields produce 50 to 60 bushels per acre. Wheat follows corn in acreage. It is strictly a cash crop and is usually hauled to the elevators direct from the threshing machine. Wheat does well in normal years. Yields in good years ordinarily range between 18 and 25 bushels per acre, but occasionally 30 to 35 bushels are obtained. Oats are grown extensively and usually do well. The average yield is 25 to 30 bushels per acre, and in favorable seasons yields of 50 to 60 bushels may be expected. Alfalfa produces an average yield of about 3 tons per acre. It is usually cut 3 times during the season. Occasionally a fourth cutting is obtained, which increases the total yield about one-half ton per acre.

The livestock industry on this soil consists chiefly of the production and fattening of cattle and hogs. The cattle industry is confined largely to the winter fattening of steers, although a few cattle are shipped in for summer grazing. From 10 to 150 hogs are raised on nearly every farm. The livestock is fattened on corn and alfalfa and shipped to St. Joseph and Kansas City after the home needs are supplied.

The Carrington loam can be cultivated under a wider range of moisture conditions than the associated silt loam, on account of its larger sand content and more friable structure. Clods are formed if the land is plowed when wet, but the lumps are easily reduced. This type, however, is not so well suited to general farming as the Carrington silt loam, on account of its more sloping surface and the greater danger of soil erosion.

Commercial fertilizer is not used and the supply of barnyard manure is inadequate for best results. Systematic crop rotation is not practiced, although many farmers change their crops with reasonable regularity.

Land of the Carrington loam sells for $150 to $250 an acre, depending largely upon its topography, improvements, and location.

While the soil is naturally strong and fertile, except where erosion has removed much of the surface material, little attention is given to maintaining its fertility. A more systematic crop rotation should be planned and followed, in order to prevent the decline in crop yields. A good rotation for this land is corn two years, oats one year, wheat one or two years, and alfalfa three to five years, returning to corn. Clover and timothy could be substituted for alfalfa in the rotation. Owing to the difficulty of obtaining a stand of clover, however, it is doubtful whether this crop could be satisfactorily used except during favorable seasons. By listing corn in rows parallel to the upper and lower edges of the slopes the danger of erosion on the steeper grades would be largely eliminated.

CARRINGTON SILT LOAM.

The surface soil of the Carrington silt loam is a silt loam that varies in color from dark brown to dark grayish brown and in depth from 8 to 15 inches, with an average depth of about 12 inches. The soil is typically finely granular and has a loose structure, but in places where a relatively large percentage of clay is present it breaks down upon drying into very small angular granules. The upper subsoil is a brown silty clay loam, which passes gradually into a yellowish-brown or light-brown heavy silty clay loam through a transitional zone ranging in thickness from 4 to 6 inches. Below this to 24 inches the material consists of a yellowish-brown silty clay loam. This becomes lighter in color with depth, being yellowish-gray or yellow faintly mottled with gray to 30 or 40 inches. The lower 6 inches of the profile is normally looser and the color somewhat lighter and stained more or less with brown iron oxides. Lime concretions may occur at a depth of about 3 feet and are invariably present at greater depth. Small glacial bowlders and gravel are found throughout the soil section, and in places scattered over the surface. On the rather flat divides the soil is deeper and the transitional layer between the dark surface soil and the lower horizons is thicker, but on the slopes, on the tops of hills, and along sharply cut valleys the surface soil is more shallow and has a lighter color.

In places throughout the type the material washed from the higher lying land has accumulated at the foot of slopes, and the soil developed on this colluvial material is a dark-brown to nearly black heavy silt loam, 20 to 40 inches deep. These areas, however, are too narrow to warrant separate mapping. In a few places upon the slopes bordering the North Fork Nemaha River the Kansan drift proper lies near the surface and a variation of the type has been developed. Here the soil is a dark-brown heavy silt loam, 10 to 12 inches deep, underlain by a silty clay loam having a brown or yellowish-brown color slightly tinged with red. Below an average depth of 20 inches the subsoil is a rather tough silty clay, which becomes gradually lighter in color and heavier in texture with depth. In the lower part

gritty material is frequently encountered. These variations are also too small to show on a map of the scale used in this survey.

The Carrington silt loam may be readily distinguished from the Grundy silt loam by its lighter colored surface soil, less abrupt change from soil to subsoil, and less compact subsoil. The Grundy silt loam usually occupies high, almost flat structural planes. The Carrington silt loam contains a few pebbles, while the Grundy silt loam has none. The Carrington silt loam differs from the Pawnee silt loam chiefly in the character of the subsoil, the Pawnee subsoil having a somewhat lighter color and being heavier and more compact. The two types merge gradually into each other, and in places the lines separating them are arbitrarily drawn.

The Carrington silt loam is the most extensive type in Johnson County. It occurs in all parts of the upland. The areas on the divides are usually extensive and uniform in character, but in the more rolling part of the county they are irregular and interspersed with smaller bodies of other types, including the Carrington loam, Shelby loam, Pawnee silt loam, and Grundy silt loam.

The topography as a whole is gently rolling to rolling, although there are numerous small areas upon the broader divides where the surface is very gently undulating to almost flat. In a few places, especially along the North Fork Nemaha River, the type extends well down the steeper slopes, and in these places erosion is rather severe. Drainage is everywhere good, but as a rule it is not excessive, except upon the steeper grades. The soil is very retentive of moisture and withstands protracted droughts as well as any of the upland types.

The Carrington silt loam is one of the most important farming soils in Johnson County. It is naturally strong and fertile and well adapted to all crops common to the region. The type was originally covered with a luxuriant growth of prairie grasses, but practically all of it is now in cultivation, with the exception of small areas upon the steeper slopes which are used for pasture. Corn is the predominant crop, and is the leading cash crop on farms where it is not fed to livestock. Several varieties of corn are grown, chief among which are Reid Yellow Dent and Iowa Silvermine. Wheat, which is next to corn in acreage, is strictly a cash crop and is receiving increased attention. Most of it is winter wheat, Turkey being the leading variety. Oats are grown rather extensively. This crop is not so profitable as either corn or wheat, but is valuable as an intermediate crop between corn and wheat in rotations. Kherson and White Russian are the chief varieties. The grain is fed chiefly to work stock. Alfalfa is the leading hay crop and is grown to a greater or less extent on all farms. It is important in the rotations, as it tends to replace the nitrogen taken from the soil by grain crops. Most of the alfalfa is fed to beef cattle and hogs.

Potatoes are a minor crop and scarcely enough are grown to supply the home demand. Some sorgo is grown for making sirup. Many farms have small fruit orchards.

Hog raising constitutes the chief livestock industry, although the winter feeding of cattle is practiced quite extensively. From 10 to 20 hogs are raised on each farm annually and on a few farms from 75 to 100 head are fattened. Some cattle are shipped in as feeders from

St. Joseph or Kansas City. The animals are fattened on corn and alfalfa and returned to the markets late in winter or early in spring.

Crop yields on the Carrington silt loam are as high as on any of the upland soils of the county. The average yield of corn is about 30 bushels per acre, although yields of 50 to 60 bushels are not uncommon on well-managed fields. Wheat yields from 10 to 30 bushels, with an average of about 20 bushels per acre. The yield of oats ranges from 25 to 40 bushels per acre, depending upon the season, the average yield being about 30 bushels. From 3 to 3½ tons of hay are produced on each acre of alfalfa. The crop is usually cut three times, although in exceptional years a fourth cutting is made.

The Carrington silt loam is not so easily handled as most of the other upland types, on account of the high clay content of the surface soil. Hard clods are formed if the land is plowed when wet, and they are reduced with difficulty. A four-hitch team is used almost entirely in the preparation of the seed bed on this type. Gang plows are generally used, and the land is seldom plowed deeper than 5 inches. Corn is either listed in or checkrowed on well-prepared stalk or stubble ground. The checkrow method has been more generally practiced during recent years. Small grain is planted with a press drill after the ground has been either plowed or double disked. Alfalfa is usually sown broadcast on a well-prepared mellow seed bed.

Crop rotations are not systematically practiced, although many farmers have adopted indefinite systems subject to numerous substitutions. On the better managed farms the land is kept 2 or 3 years in corn, 1 year in oats, 1 or 2 years in wheat, and 5 to 7 years in alfalfa.

Green crops are seldom turned under and commercial fertilizers are not used. Barnyard manure is applied when available, but the supply is usually inadequate for best results.

Land of the Carrington silt loam sells for $175 to $250 an acre, depending largely on improvements and location.

More systematic crop rotation, deeper tillage, and increased acreage of alfalfa would prove beneficial on most farms. The soil is naturally fertile, and every means should be used to maintain its productiveness.

PAWNEE LOAM.

The surface soil of the Pawnee loam consists of a loose, friable, dark-brown to dark grayish brown loam. The depth ranges from 6 to 16 inches, with an average of about 10 inches. It contains a considerable percentage of the various grades of silt and sand, and numerous small pebbles. The proportion of clay is sufficiently high to give it a coherent loamy consistency. The upper subsoil changes downward from a dark brown to brown, is composed of a heavy, slightly compact clay loam containing some coarse sand and fine gravel. Below 18 inches the material changes to a brown, heavy, compact, almost impervious, gritty clay loam. The content of gravel and coarse sand as a rule decreases with depth, but a small admixture continues throughout the 3-foot section. On the flatter divides the surface soil is deepest and is darker and usually more silty, and the subsoil is heavier. The greater part of the type, however, is on rolling land where erosion has been more active and conditions less favorable to a deep development of the dark surface soil. Over a few areas

near deeply cut stream channels the type constitutes a thin cover over weathered limestone. In these areas the subsoil, a weathered product of the limestone, is chocolate brown or reddish brown in color, and somewhat calcareous. In other places the Pawnee loam has a considerable proportion of gravel below 2 feet, and in such areas it merges gradually into the Shelby loam.

The topography varies from gently to sharply rolling. As a rule the type occupies a topographic position intermediate between the Pawnee silt loam on the higher divides and the Shelby loam on the lower slopes. It is also in a stage of erosion intermediate between these types.

The Pawnee loam is not extensive in Johnson County, the total area covered being only 17 square miles. The largest and best developed body of the type lies south and east of Crab Orchard. Three small areas occur north of the North Fork Nemaha River, 2 to 9 miles northwest of Tecumseh, and one area lies 3 miles southeast of that place.

The higher, smoother parts of the type are under cultivation to about the same extent as the Pawnee silt loam, but the steeper slopes are used only for pasture. Less than 40 per cent of the type is under cultivation. Corn, wheat, oats, and alfalfa are the principal crops, ranking in acreage in the order named. The yields compare favorably with those on the Carrington loam. Listed corn land washes badly in places on the steeper grades, so that many farmers follow the contours of the hills in laying off corn furrows.

This soil is easy to handle and can be cultivated under a wide range of moisture conditions. It has a tendency to clod when plowed too wet, but no great difficulty is found in bringing it into a good condition.

PAWNEE SILT LOAM.

The surface soil of the Pawnee silt loam is a dark grayish brown almost black silt loam. The depth of the soil varies from 8 to 16 inches, with an average of about 12 inches on the smooth gently rolling area. The soil has a finely granular structure, but this is not everywhere the loose, single-grain structure of the silt loams of this region, as a slightly larger proportion of clay causes the formation in many places of fine granules or clods. The soil is underlain by a heavy and rather compact layer which varies in color and thickness. The typical development is a dark grayish brown or more rarely a slightly reddish dark brown clay loam, silty clay loam, or clay. When wet, this material is tough and hard to penetrate with the auger, and when dry it breaks into coarse angular clods. It commonly contains some coarse sand, gravel, and bowlders. This layer generally varies in thickness from 10 to 24 inches, but in places it extends without much change to a depth of more than 3 feet. Below this is a layer of grayish-brown or yellowish-brown material that approaches more nearly the character of the parent drift. It varies from a heavy loam to a clay, is less compact than the layer above, lighter in texture, and more porous. This material grades without much change into the substratum of unweathered glacial drift. It is probable that this type was developed upon a calcareous drift, but if so, the carbonates have now been largely removed to a depth of more than 3 feet, with the

exception of occasional small fragments of limestone or small lime concretions in the lower subsoil.

While the above description is that of the typical profile—that is, where development has reached a mature stage undisturbed—there are many minor variations where erosion has been more active in marginal areas of the type. These variations commonly occur on the one hand where the drift is thin and residual material from rock enters into the lower part of the soil profile, or, on the other hand, where loess has entered into the composition of the surface soil. As the soil is very similar in many of its characteristics to the Grundy silt loam, it is often very difficult to distinguish between the two.

The Pawnee silt loam is extensive in Johnson County. The largest areas lie in the southwestern part on the broad divides on both sides of Yankee Creek and cover more than one-half of that section of the county. An area occupying several square miles lies a few miles north of Tecumseh and another lies on the county line west of Sterling.

The topography varies from undulating to rolling. Very few areas of any size are flat, but where these occur it is very difficult to distinguish this type from the Grundy silt loam. The greater part of the type occupies broad, smooth, gently rolling divides, and it is here that the type is best developed. The drainage is everywhere adequate.

The Pawnee silt loam has been developed upon glacial drift, under the influence of moderate moisture conditions. It is probable that the type owes the characteristics that distinguish it from the Carrington soils either to differences in composition of the parent materials of the two series or to the greater age of the drift sheet on which the Pawnee series is developed, but no evidence has been found to support either of these suppositions.

The Pawnee silt loam ranks with the best upland soils of the county. More than 50 per cent of its area is under cultivation, and the rest is used for pasture and hay land. The native vegetation consists mainly of big bluestem, little bluestem, grama, and buffalo grasses. Corn, wheat, oats, and alfalfa are the principal cultivated crops. A few small patches of barley, rye, and millet are grown for feed. Some cattle are raised, but there are no exclusive stock farms or ranches on the type. Some farmers fatten a few cattle for market, but the practice is not general, and most of the beef cattle are sold as stockers and feeders after coming off the summer range. Hogs are raised on nearly every farm, and on some farms they are kept in large numbers. Crop yields vary considerably with the seasons. The average yield of corn is less than 40 bushels per acre, but yields of 65 bushels or more have been attained on well-managed farms. In normal years the average yield of wheat is less than 20 bushels; however, in favorable years 25 bushels or more is not an unusual return. Oats will average about 30 bushels on all parts of the type and in all seasons.

The quality of the equipment and farm improvements on this type is equal to that on any other type in the county, and the methods of cultivation are practically the same. Four-horse teams are common and a few tractors are used. The greater part of the corn is listed. When corn follows corn or wheat, the land is disked 3 or 4 times and the seed planted with a lister. Wheat is sown with a press drill on well-prepared corn or stubble ground.

SHELBY LOAM

The surface soil of the Shelby loam is a dark-brown to dark grayish brown, light-textured loam, 6 to 12 inches deep. It is fairly loose and friable and contains considerable sand of all grades together with some gravel and occasional small bowlders. The silt content is high on the smoother divides or on slopes below silty soils. The upper subsoil is a brown, gritty, silty clay loam to clay loam mottled with rusty brown, yellow, and gray. It is slightly compact and somewhat plastic when wet, but becomes rather hard and brittle upon drying. Below an average depth of 20 inches the subsoil becomes gradually lighter in color and at about 30 inches changes to a yellowish-brown or yellow silt loam to silty clay loam. The lower part of the subsoil is seldom noticeably compact. Iron stains are numerous below 30 inches. A few gravel fragments and small bowlders occur scattered throughout the subsoil, and in local areas are so thick that the subsoil is almost impenetrable with the soil auger. The surface soil is usually rich in organic matter, except upon the steeper slopes, where erosion is severe. The subsoil is seldom calcareous within the 3-foot section, although lime concretions become abundant below 4 feet.

Over many local areas the subsoil of the Shelby loam has a decidedly reddish shade. This is not due to oxidation, but to the color of the original material from which the soil has been derived.

In a few places small areas of sandy soil, not large enough to indicate as a separate phase, are developed. The soil in such areas is a brown sandy loam of medium to fine texture, underlain at an average depth of 8 inches by a rusty-brown friable sandy clay. These bodies are locally known as sand pockets. They occur wherever there are any considerable exposures of the sandy Aftonian material.

Southeast of Tecumseh, on the east side of the North Fork Nemaha River, the Tarkio limestone of the Pennsylvanian series outcrops on this type in a few places. These exposures are indicated on the soil map by the rock-outcrop symbol. Northeast of Elk Creek there is a small area in which gravel and small bowlders are scattered so thickly over the surface as to make cultivation difficult. This area is indicated on the map by stone symbols.

The Shelby loam is developed rather extensively in Johnson County. The individual bodies are not large, seldom exceeding 2 square miles, but they are thickly scattered throughout the upland of the county. One of the largest areas lies southeast of Tecumseh and occupies a part of the slope along the east side of the North Fork Nemaha River. Another typical area lies along Corson Branch, southwest of Tecumseh. Smaller areas occur along most of the drainage ways of the county.

The type is derived from the Kansan drift proper. It may be readily distinguished from the Carrington loam by the larger gravel content of both surface and subsoil and in its more eroded and more steeply sloping topography. The type usually occupies the lowest position of any of the upland soils, occurring along the lower slopes adjacent to the terraces and bottom lands and upon the narrower and more eroded divides. Drainage is everywhere thorough and in most places excessive, and erosion has become a serious problem in the cleared areas.

Owing to its steep topography and eroded surface, only about 25 per cent of the type is under cultivation. The native vegetation

consists of a great variety of prairie grasses common to the region. Narrow strips of forest occur along the larger drainage ways. About 4 per cent of the type is still in native forest. The grasses on this soil afford good pasturage, and grazing is the principal industry, though considerable wild hay is cut on favorably situated areas. Corn, wheat, and oats do well on the more gradual slopes. Alfalfa is seldom grown, though the crop seems adapted to the soil. The average yield of corn is less than 20 bushels per acre, wheat 18 bushels, oats 25 bushels, and alfalfa 2 to 3 tons, from three cuttings. Wild hay yields one-half to three-fourths ton per acre, depending upon the rainfall. The native grasses will support about 70 head of cattle on each quarter section during the summer grazing season.

Most of the cattle on this type are grade Herefords and Shorthorns. A few cattle are raised, but many cattle are shipped in for summer grazing and sold in the fall as feeders either to the eastern markets or to local buyers. Hogs are raised on nearly every farm, fattened on corn, and shipped to St. Joseph and Kansas City.

Systematic crop rotation is not practiced, commercial fertilizer is not used, and the supply of barnyard manure is inadequate.

The price of land of the Shelby loam ranges from $100 to $200 an acre, depending upon its topography, improvements, and location with respect to roads and markets.

The chief need of this soil is better management. The pasture areas should probably be left with their native covering of grasses, and the cultivated land needs better protection from erosion, a more systematic rotation of crops, and the incorporation of organic matter. Corn should be listed in rows running with the contour of the slopes, as this tends to prevent erosion. Brush and stone should be piled in the gullies to check their encroachment on the fields. Alfalfa should be grown more extensively, especially upon the steeper slopes, as this crop not only increases the organic matter and nitrogen content of the soil but also aids in controlling erosion. Any system of rotation that provides for a change of crops every two or three years and includes a legume such as alfalfa or clover would be very beneficial to this soil.

WAUKESHA VERY FINE SANDY LOAM.

The surface soil of the Waukesha very fine sandy loam is a dark grayish brown very fine sandy loam, 10 to 14 inches deep. It is loose and friable and contains a large quantity of organic matter, which gives it its dark color and mellow structure. The upper subsoil consists of 4 to 6 inches of brown silty clay loam slightly heavier and more compact than the surface soil. Below an average depth of 18 inches the subsoil changes rather abruptly to a heavy stiff silty clay of light-brown color. This layer is hard and tough when dry, but sticky and plastic when wet. It contains scattering yellowish and rusty-brown splotches, and in a few places these are so numerous as to produce a general mottling of the material. Below about 30 inches the subsoil becomes much lighter in texture and color. The material below 3 feet is a light-gray or light yellowish brown floury silt loam to silty clay. This layer is highly calcareous, the lime appearing both as a finely divided silty powder and as small irregular-shaped concretions.

The type as mapped in this county includes several variations. In many of the smaller areas and locally in the larger there is no noticeable accumulation of clay in the subsoil. The profile in these places consists of dark-brown very fine sandy loam, 10 to 18 inches deep, underlain by a brown friable silt loam extending to an average depth of 30 inches, below which the subsoil is a light-gray floury silt having a high lime content.

In several places, especially where the type lies only a little above the first bottoms and slopes gradually from the flood plains to the edge of the uplands, large quantities of colluvial wash from the higher slopes have greatly thickened the surface soil, so that it has an average depth of about 24 inches and over small patches extends to below the 3-foot section without change in color. The lower part, however, contains very little sand and consists of dark-brown mellow silt loam. If this variation were extensively developed, it would have been classed as the Judson very fine sandy loam (a colluvial soil) or as a colluvial phase of the Waukesha very fine sandy loam, but owing to its irregular occurrence and small total extent it was not mapped separately.

The Waukesha very fine sandy loam occurs mainly as narrow elongated strips bordering the flood plains of the rivers and their larger tributaries. The parent material consists of sediments carried down and deposited by the streams when they were flowing at higher levels than at present. Surface wash from the adjoining uplands has also contributed material, especially near the foot of the steeper slopes.

The topography is for the most part flat to very gently undulating, although in a few places there is a gradual slope from the flood plains to the foot of the uplands. The type occupies a lower position than the Waukesha silt loam and lies from 3 to 6 feet above the first bottoms. The transition to the uplands is usually a long, gradual slope, while that to the flood plains is more often short and steep. Drainage is everywhere adequate for maximum crop production, even the flatter areas having sufficient slope to carry off all surplus water.

The Waukesha very fine sandy loam is naturally strong and fertile and well adapted to all crops common to the region. Originally the type supported a luxuriant growth of prairie grasses, but at present only small patches of the virgin sod remain. Practically all the type is used for the production of corn, wheat, oats, and alfalfa. A few hogs are raised on every farm, and some farmers annually fatten one or two carloads for the St. Joseph and Kansas City markets. Cattle are raised only in sufficient numbers to supply the home with meat and dairy products.

The average yield of corn in favorable seasons is about 40 bushels per acre, wheat 20 bushels, and oats 35 bushels. Alfalfa yields 3½ to 4 tons per acre. Most of the corn, oats, and alfalfa is fed on the farms or sold to local feeders. Wheat is the chief cash crop and is usually hauled direct from the threshing machine to the elevators for later shipment to outside markets.

The soil of the Waukesha very fine sandy loam is easy to handle and can be cultivated under almost any moisture conditions without serious injury. No commercial fertilizers are used, and barnyard manure is seldom applied as the wash from the adjoining uplands tends to maintain the land in a productive condition.

The selling price of this land ranges from $250 to $350 an acre, depending upon improvements and nearness to markets.

WAUKESHA SILT LOAM.

The surface soil of the Waukesha silt loam is a dark-brown friable silt loam, with an average depth of 12 inches. It is rich in organic matter, as the color indicates, and has a smooth, velvety feel. The subsoil is a brown to light-brown compact silty clay which normally grades at 30 inches into a light-gray or yellowish-brown friable silt loam. The upper subsoil is hard and tough when dry and sticky and plastic when wet. In places it is mottled with light-gray splotches and rusty iron stains, but this development is not typical. Lime concretions also occur in the lower subsoil, though their presence is not characteristic, and the type as a whole is not calcareous within the 3-foot section. The change from soil to subsoil is abrupt. Around the outer margins of this type, where it adjoins the upland, the surface soil is deeper because of addition of colluvial wash from the slopes above. This is especially true along the west edge of the large area in the northeastern part of the county, where the material consists of a dark-brown to almost black mellow silt loam to an average depth of 24 inches.

The Waukesha silt loam occupies only about 5 square miles in Johnson County, the greater part of which is included in the large area along Spring Creek. A smaller though very typical area lies west of Tecumseh. The remaining areas are small. The type has been developed upon alluvial sediments deposited by the streams when they were flowing at higher levels. Colluvial wash from the adjoining uplands has also contributed material.

The topography in general is almost level to very gently undulating. In many places, however, there is considerable slope toward the bottom lands. The surface lies from 15 to 25 feet above the flood plains. The transition to the first bottoms is marked by a rather short, steep slope while that to the uplands is long and gradual. Drainage is everywhere good but not excessive. There is usually sufficient grade, even on the more nearly level areas, to carry off all surplus water.

Owing to its small extent, the type is of little agricultural importance in this county. It is a very strong and fertile soil, however, withstands drought well, and is adapted to all crops common to the region. It is devoted to the production of corn, wheat, oats, and alfalfa. Yields on this type are slightly higher than on the upland soils, as the moisture conditions on these terraces are somewhat more favorable. Corn yields 35 to 50 bushels, wheat 20 to 30 bushels, oats 30 to 35 bushels, and alfalfa 3 to 4 tons per acre. The alfalfa is usually cut three times during the season, a fourth cutting being made occasionally.

The system of agriculture is similar to that followed on the Carrington silt loam. Practically no manure is applied to the land, as the surface wash from the adjoining uplands tends to maintain its fertility.

Land of the Waukesha silt loam sells for $250 to $300 an acre, depending upon improvements and location, the higher prices being paid for land in the immediate vicinity of towns.

WABASH VERY FINE SANDY LOAM.

The surface soil of the Wabash very fine sandy loam is a dark grayish brown to almost black, mellow, very fine sandy loam, with an average depth of 10 inches. The material is composed of about equal proportions of silt and very fine sand, together with a large quantity of organic matter. Very little of the medium or coarser grades of sand is encountered. The subsoil is slightly lighter in color than the surface soil, is rather compact, and ranges in texture from very fine sandy loam to silt loam, which usually continues to below the 3-foot depth. Faint gray and brown mottlings are present locally below 24 inches. The subsoil is not calcareous as a rule, but below an average depth of 4 feet the substratum changes abruptly to a light-gray, loose, floury silt to silty clay which is rich in lime.

Throughout the type there are patches of silt loam, but owing to their small size and irregular occurrence they were not separated on the soil map.

The Wabash very fine sandy loam occurs chiefly in irregular-shaped bodies along the North Fork Nemaha River, although narrow strips extend up Coon and Silver Creeks and Badger Branch. The type has been formed from alluvial sediments carried down by the streams from the adjoining uplands and deposited along their channels during flood stages. Colluvial wash from the higher lying and coarser textured soils has been largely responsible for the sand content of this type.

The surface is practically flat, except where modified by old stream channels, cut-offs, and shallow depressions. There is usually a gentle slope down the valley and toward the stream. Drainage is adequate for crop production, except in local depressions. The type lies from 4 to 8 feet above the normal flow of streams and is subject to occasional inundations, but water seldom stands on the surface longer than a few hours.

Owing to its small extent, the Wabash very fine sandy loam is of little agricultural importance in the county. Originally the type was covered with a luxuriant growth of prairie grasses, except along the margins of streams, where it supported a fairly dense stand of mixed timber, including oak, elm, box elder, ash, cottonwood, hackberry, and occasional trees of walnut, hickory, and basswood. All but about 10 per cent of the type has been put under cultivation, and the virgin areas are used for pasture land and woodlots. Corn, wheat, oats, and alfalfa are the leading crops, ranking in acreage in the order named. Small patches of rye, clover, and millet are grown, and potatoes and garden vegetables are raised to supply home needs.

The yields of all crops compare very favorably with those obtained upon the Wabash silt loam. The soil is easy to handle and can be cultivated under a wide range of moisture conditions. It is naturally strong and fertile and is highly prized for general farming. Commercial fertilizer is not used, and barnyard manure is seldom applied to the land. The type receives sufficient wash from the adjoining uplands and from sediments deposited during the flood stages of streams to maintain its high fertility.

The selling price of this type ranges from $250 to $300 an acre, depending upon drainage, location, and improvements.

WABASH SILT LOAM.

The surface soil of the Wabash silt loam is a very dark grayish brown to black heavy silt loam, of an average depth of 12 inches. It is rich in organic matter, as the color indicates. The subsoil consists of black silty clay loam which becomes heavier and more compact with depth. It is extremely sticky and plastic when wet and becomes hard and tough upon drying. Faint brown mottlings occur locally in the subsoil. Deep ditches along the North Fork Nemaha River show that below an average depth of 4 feet the heavy dark-colored subsoil passes rather abruptly into a light-gray silt loam, streaked and blotched with iron stains. The material at this depth is highly calcareous, the lime existing both in finely divided form and as small irregular-shaped concretions. In the more poorly drained areas light-gray mottlings occur within the 3-foot section. The change in texture from soil to subsoil is usually abrupt.

Upon many of the narrower flood plains along the smaller creeks and branches the subsoil is less stiff and compact than typical, and the transition in texture between the soil and subsoil is gradual. In these areas the surface soil is black friable silt loam, 10 to 12 inches deep, underlain by a slightly heavier silt loam of practically the same color.

In section 14, T. 5 N., R. 10. E., there is a small area of Wabash silty clay loam lying around the head of Yankee Creek. This body was originally separated on the soil map, but since it is small and is the only area in the county, it was later included with the Wabash silt loam. The surface soil of this area is a black heavy silty clay loam, with an average depth of 12 inches. The subsoil is a black, stiff, compact clay, which in places contains gray, drab, and rusty-brown mottlings below 20 inches. Near the stream channel the lower subsoil has a faint bluish cast. Both soil and subsoil are rich in organic matter. In a few places, especially near the outer margins of the area, the subsoil below 30 inches is faintly calcareous, although no lime concretions were encountered.

The Wabash silt loam has a fairly large total area in this county. It is the most extensive of the alluvial soils and includes the greater part of the bottom lands. The largest developments are along the rivers, but narrow strips extend up the larger tributaries. The type has been developed from sediments deposited by streams along their channels during periods of high water, with some colluvial wash from the higher terraces and upland slopes.

The topography is for the most part flat, with an almost imperceptible slope down the valleys and toward the streams. In a few places the surface is modified by old channels and other shallow depressions.

Originally the drainage of the type was rather inadequate, but by cleaning the stream channels and clearing the land the conditions have been greatly improved. With the exception of local areas, the drainage is good except during periods of excessive rainfall. Much of the type is subject to occasional overflows, but the water seldom stands on the land longer than three or four hours. A large drainage ditch has been dug along the North Fork Nemaha River, reclaiming all the larger areas of poorly drained land.

The Wabash silt loam is a rather important soil in this county, on account of its high fertility and smooth surface. Originally it was

covered with a luxuriant growth of prairie and marsh grasses, with marginal strips of forest trees along the larger streams, but most of the land has been cleared, drained, and broken for crop production. About 20 per cent remains in its virgin state and is used for pasture land, hay land, and woodlots. Corn, wheat, oats, and alfalfa are the leading crops.

The type is considered to be the strongest soil of the county and produces exceptionally high yields of all crops. Corn is grown chiefly and yields 40 to 50 bushels per acre. Wheat ranks second in acreage. The average yield is about 20 bushels per acre. Oats yield 30 to 40 bushels per acre. In exceptionally wet years oats have a tendency to grow rank and lodge, resulting in reduced yields. Kherson, a short, stiff-stemmed variety, gives better results on this type than the long-strawed varieties. Alfalfa yields higher than on any other soil in the county, from 3½ to 5 tons per acre being obtained. The crop is usually cut three times during the season, though a fourth cutting is often made.

Hogs are raised on practically all farms and many farmers fatten one or two carloads each year for the eastern markets. The cattle industry is confined largely to the raising of a few dairy cows and beef animals.

The Wabash silt loam is easily handled considering its heavy nature. It clods badly when plowed wet but breaks down into a good tilth with subsequent tillage. The soil is managed in the same manner as the Carrington silt loam, except that barnyard manure is seldom applied. Crop yields on this type are not declining, as the wash from the adjoining uplands, together with the sediments deposited by the streams during flood stages, tends to maintain the productiveness.

The Wabash silt loam sells for $200 to $350 an acre, depending upon location, drainage, and improvements.

SUMMARY.

Johnson County is located in southeastern Nebraska. It is rectangular in outline and comprises an area of 374 square miles, or 239,360 acres.

The county lies within the glaciated region of the Great Plains. The topography ranges from almost flat to hilly. By far the greater part has a rolling surface.

The average elevation of the county is about 1,100 feet above sea level and the general slope is to the south and east.

The county is drained by two principal streams, the North Fork Nemaha and the South Fork Little Nemaha Rivers. Practically all of it has adequate drainage for maximum crop production. There are a few areas along the steeper slopes where drainage is excessive and erosion has become serious. Local depressions within the first bottoms are poorly drained, but their total area is small.

The first permanent settlement in the county was made by settlers from Indiana in 1855. Later settlers came from the East-Central and New England States.

The population of the county, as reported by the 1920 census, is 8,940, all of which is classed as rural. Settlement is fairly even. Tecumseh, the county seat, with a population of 1,688, is the largest town.

The county has good transportation facilities. It is crossed by several railroads, and public highways follow most section lines. All communities enjoy the advantages of rural free mail delivery and telephone service.

St. Joseph and Kansas City are the leading grain and livestock markets. A large part of the dairy and poultry products is shipped to Lincoln.

The climate of Johnson County is well suited to general farming. The mean annual temperature is 51.6° F., and the mean annual precipitation 31.5 inches. The rainfall is generally quite favorably distributed, but droughts occasionally occur in the late summer. The average length of the growing season is 157 days.

Agriculture is the basic industry of Johnson County and consists largely of grain growing and hog raising. The principal crops are corn, wheat, oats, and alfalfa. Small patches of rye, timothy, and clover are grown. Corn occupies by far the largest acreage. The corn and oats produced are mainly used on the farm, although considerable corn is sold to local buyers. Wheat is the chief cash crop. Nearly every farmer fattens a few hogs for market each year. Cattle raising is increasing in importance. Horse raising is confined largely to the breeding of the work mares. The stock has been materially improved during the last few years.

Increased attention is being given to the adaptation of crops to different soils, although the common crops are grown more or less indiscriminately throughout the county. There is no definite system of crop rotation, but some of the more progressive farmers have evolved systems subject to numerous substitutions. Commercial fertilizer is not used on any of the soils. Barnyard manure is applied when available, but the supply is usually inadequate for best results.

Efficient farm labor is becoming scarce. Many farmers hire labor by the year in order to insure against lack of help at critical periods.

The average size of farms in the county is about 160 acres. The value of the farm land ranges from $75 to $350 an acre, depending upon its location, topography, drainage, character of the soil, and improvements.

Ten soil types, representing 6 series, are mapped in Johnson County. The upland soils are classed in the Carrington, Pawnee, Shelby, and Grundy series; the terrace soils in the Waukesha series, and the first-bottom soils in the Wabash series.

The Grundy silt loam is one of the strongest upland soils of the region, and in counties where it occurs in large bodies it is highly prized for general farming purposes. It has a flat to gently undulating topography and is not subject to erosion.

The Carrington silt loam of the uplands is the most extensive type in the county. It is a strong, fertile soil and well adapted to all crops common to the region. The type has been derived from the weathered phase of the Kansan drift sheet.

The Carrington loam ranks second in acreage in Johnson County. This type compares very favorably with the Carrington silt loam for general farming purposes. It has a somewhat more rolling topography, however, and is more subject to erosion.

The Pawnee silt loam occupies a large area in the southwestern part of the county. It has a topography similar to that of the Carrington silt loam, and its rank as a farming soil is as high.

The Pawnee loam occupies only a small area. In topography and crop adaptation it is similar to the Carrington loam.

The Shelby loam usually contains more or less gravel in the soil and subsoil and in a few places gravel and small bowlders occur abundantly throughout the subsoil. The type occupies the steeper slopes and is in many places subject to severe erosion.

The Waukesha soils occur at two different terrace levels. The silt loam type occupies the higher benches and the very fine sandy loam occurs on the lower terraces and colluvial slopes. Both types are productive and well adapted to all crops common to the region. Their extent, however, is small and for this reason they are not very important agriculturally.

The Wabash silt loam is the most extensive alluvial soil of the county. It occurs chiefly in the first bottoms or flood plains along the North Fork Nemaha and South Fork Little Nemaha Rivers. The Wabash very fine sandy loam is of small extent. Both types are highly productive and comprise some of the most fertile land in the county. They are unusually well drained, considering their low position and relatively flat surface. The soils are well adapted to corn, wheat, and alfalfa. Oats has a tendency to grow somewhat rank and lodge in seasons of heavy rainfall, and therefore the Kherson variety is better adapted to these soils than the long-strawed oats.

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