



U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS—MILTON WHITNEY, Chief.

---

# SOIL SURVEY OF KAY COUNTY, OKLAHOMA,

BY

N. M. KIRK, IN CHARGE, AND R. C. JURNEY.

---

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

---

[Advance Sheets—Field Operations of the Bureau of Soils, 1915.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1917.

**BUREAU OF SOILS.**

MILTON WHITNEY, *Chief of Bureau.*

ALBERT G. RICE, *Chief Clerk.*

SOIL SURVEY.

CURTIS F. MARRUT, *In Charge.*

G. W. BAUMANN, *Executive Assistant.*

**COMMITTEE ON THE CORRELATION AND CLASSIFICATION OF SOILS.**

CURTIS F. MARRUT, *Chairman.*

HUGH H. BENNETT, Inspector, Southern Division.

W. EDWARD HEARN, Inspector, Southern Division.

THOMAS D. RICE, Inspector, Northern Division.

W. E. McLENDON, Inspector, Northern Division.

MACY H. LAPHAM, Inspector, Western Division.

J. W. MCKERICHER, *Secretary.*

U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS—MILTON WHITNEY, Chief.

---

# SOIL SURVEY OF KAY COUNTY, OKLAHOMA,

BY

N. M. KIRK, IN CHARGE, AND R. C. JURNEY.

---

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

---

[Advance Sheets—Field Operations of the Bureau of Soils, 1915.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1917.

## LETTER OF TRANSMITTAL.

---

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS,

*Washington, D. C., November 16, 1916.*

SIR: In the extension of the soil survey in the State of Oklahoma a survey was made of Kay County during the field season of 1915.

I have the honor to transmit herewith the manuscript report and map covering this area, and to recommend their publication as advance sheets of field operations of the Bureau of Soils for 1915, as provided by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

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

# CONTENTS

	Page.
SOIL SURVEY OF KAY COUNTY, OKLAHOMA. By N. M. KIRK, IN CHARGE, and R. C. JURNEY.....	5
Description of the area.....	5
Climate.....	7
Agriculture.....	9
Soils.....	15
Gerald loam.....	20
Gerald silt loam.....	21
Gerald silty clay loam.....	23
Oswego silt loam.....	24
Crawford silt loam.....	25
Summit stony loam.....	26
Summit silt loam.....	27
Summit silty clay loam.....	28
Vernon clay loam.....	28
Derby very fine sand, reddish-brown phase.....	29
Derby loamy sand.....	29
Derby fine sandy loam.....	30
Derby very fine sandy loam, reddish-brown phase.....	30
Derby silt loam.....	31
Osage silt loam.....	31
Arkansas fine sand.....	32
Arkansas very fine sandy loam.....	32
Arkansas silt loam.....	33
Arkansas silty clay loam.....	33
Yahola very fine sandy loam.....	33
Yahola silt loam.....	34
Reinach very fine sandy loam.....	34
Reinach silt loam.....	34
Reinach silty clay loam.....	36
Kay silt loam.....	36
Kay silty clay loam.....	36
Canadian silt loam.....	37
Neosho silt loam.....	38
Summary.....	38

## ILLUSTRATIONS.

### PLATE.

PLATE I. Limestone outcrop on Summit stony loam.....	24
--	----

### FIGURE.

FIG. 1. Sketch map showing location of the Kay County area, Oklahoma.....	5
---	---

### MAP.

Soil map, Kay County sheet, Oklahoma.



## SOIL SURVEY OF KAY COUNTY, OKLAHOMA.

By N. M. KIRK, In Charge, and R. C. JURNEY.—Area inspected by HUGH H. BENNETT.

### DESCRIPTION OF THE AREA.

Kay County is situated in the north-central part of Oklahoma, on the Kansas line. It is bounded on the north by Sumner and Cowley Counties, Kans., on the east by Osage County, Okla., on the south by Osage and Noble Counties, and on the west by Grant County. Its latitude is approximately that of Norfolk, Va., and northern Arizona, while its longitude is about that of Fargo, N. Dak., and Fort Worth, Tex.

Except for the southeastern boundary, formed by the Arkansas River, the county is rectangular in outline. Its greatest dimension from east to west is  $39\frac{1}{2}$  miles and from north to south 28 miles. The total area is 941 square miles, or 602,240 acres.

Kay County lies wholly within the Great Plains region. The surface is treeless, except for narrow strips of timber along the streams and in some places in the uplands adjacent to the stream bottoms.

The uplands have a predominantly smooth surface, and are largely level to undulating and gently rolling, with many long, gentle slopes. In the eastern part of the county the streams have carved comparatively deep drainage courses, forming steep slopes, occasionally precipitous, and exposing ledges of limestone. In places the streams have cut down to depths of 50 to 100 feet, forming canyons separated by table lands, as to the east and northeast of Washunga, where erosion has given rise to several areas of well-defined, level table-land. In the central part of the county the topography is undulating to gently rolling, with long, rather gentle slopes. In the western part, beginning in the vicinity of Bodock and extending in a general northwest direction to Willston, the surface is level to gently undulating.

Level areas occur here and there throughout the county. With the exception of the steeper slopes and stony areas, mainly confined to

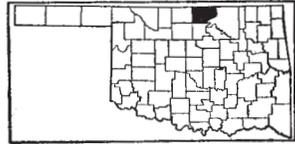


FIG. 1.—Sketch map showing location of the Kay County area, Oklahoma.

the eastern part of the county, all of the upland is topographically well suited to cultivation and to the use of improved machinery.

The level stream terraces and bottom lands vary considerably in width. The terraces or second bottoms along the Arkansas River are only one-half mile wide in most places and occasionally become very narrow; the first bottoms are also narrow, varying in width from less than one-quarter mile to about 1 mile. The alluvial lands are more extensive along the Salt Fork of the Arkansas and along the Chikaskia River; the terraces here are as much as 2 to 3 miles wide, but the first bottoms are seldom more than one-half mile in width. Along the smaller streams the first bottoms are relatively wide, but the terraces, where present at all, are very narrow. The terrace and bottom lands are practically everywhere admirably adapted to the use of farm machinery.

The range of elevation throughout the county is small. The altitude above sea level in the vicinity of the Canadian School, in the eastern part of the county, is 1,186 feet; Newkirk, 11 miles west, lies at an elevation of 1,145 feet. A bench mark about 3 miles east of Blackwell indicates an altitude of 1,020 feet. The elevation of the bridge across the Arkansas River, 6 miles east of Newkirk, is 1,019 feet. These figures indicate that the eastern part of the county lies at a higher level than the western part and that there is a gradual slope toward the west.

Drainage over the county as a whole is good, and practically every square mile of land is either traversed by a drainage way or drained by a perceptible slope toward some small stream. In the vicinity of Bodock, however, and in scattered areas in the western and northwestern parts of the county drainage has not become so well established as in the more rolling areas; the surface is level and water stands on the surface for some time after heavy rains.

The entire county is drained by the Arkansas River and its tributaries, the more important of which are the Salt Fork of the Arkansas, the Chikaskia River, and Beaver, Bois d'Arc, Duck, Bitter, and Deer Creeks. The streams have fairly rapid currents and are actively cutting their channels deeper.

The territory now comprised in Kay County was formerly a part of the "Cherokee Strip," a tract of land about 55 miles wide extending from the eastern part of Oklahoma to the Rocky Mountains, which was set aside for the use of the Indians after the opening of Oklahoma. This strip of land was formally opened for settlement in 1893. The county was organized in 1907, after Oklahoma was admitted to statehood. Its boundaries, however, had been established before that time.

The population of Kay County in 1910 was 26,999. Native whites constitute 91.3 per cent of the population and Indians 4 per cent.

A very large proportion of the white residents have emigrated from Kansas, Missouri, Iowa, and Illinois, but settlers have come from all parts of the United States. The Indians include Kaws, Poncas, and Tonkawas. The rural population, which in 1910 amounted to 78.6 per cent of the total, is well distributed over all parts of the county, except in Kaw and Beaver Townships. The average density of rural settlement in 1910 was 22.7 persons to the square mile.

In 1910 the total urban population was 5,787. The largest towns are Blackwell, with 3,266 inhabitants; Ponca City, with 2,521; Newkirk, with 1,992; and Tonkawa, with 1,776. Newkirk is the county seat. Kaw, Braman, Kildare, Peckham, Nardin, and Uncas are some of the smaller towns. The population of Washunga, 1 mile north of Kaw, consists chiefly of Kaw Indians.

The school facilities throughout the county are apparently good. Besides the numerous schools established at convenient intervals in the rural districts, the larger towns have modern high schools. At Tonkawa there is a State preparatory school. At the Chilocco Indian School pupils are instructed in the various branches of agriculture, mechanics, domestic science, and other subjects.

Transportation facilities throughout the county are good, no place being more than 10 miles from a shipping point. The main line of the Atchison, Topeka & Santa Fe Railway between Kansas City and Galveston passes through the eastern part of the county, and branch roads extend to Kaw, Blackwell, Tonkawa, Nardin, and Willston, and beyond. The St. Louis & San Francisco Railroad crosses the county in a northeasterly direction, passing through Eddy, Blackwell, and Middleton. The Midland Valley Railroad traverses the northeast corner of the county, passing through Hardy. The public roads are, as a rule, in fair condition. Where practical, they follow section lines, most of which are open for travel.

Kansas City, the principal market for the products of the county, is about 290 miles northeast. Wichita, another good market, is about 64 miles north. Oklahoma City is about 108 miles south.

Oil is produced in several parts of the county. Natural gas is also produced in large quantities and is an important source of fuel and light, being used in homes as well as factories. In some parts of the county farmers have access to this product.

#### CLIMATE.

Kay County has a mean annual precipitation of about 36 inches. Most of the rainfall occurs during the period from April to October. Some winters are extremely dry, with only 3 or 4 inches of precipi-

tation from November to March, and in some there is practically no precipitation of any consequence. Generally the spring rainfall is sufficient to produce good crops of wheat, but corn, alfalfa, and kafir very often suffer severely for lack of moisture later in the summer. The total amount of rainfall in the driest year recorded at Newkirk (1900) was 26.06 inches, and in the wettest year (1915) 50.15 inches. During 1915 the rainfall was so heavy that great difficulty was encountered in harvesting wheat and in cultivating corn and kafir. Such a condition, however, is of rare occurrence. Snow seldom falls and never stays on the ground for any considerable length of time. Thunderstorms and hail storms occur occasionally. Tornadoes are infrequent, although sometimes the winds reach a high velocity.

The average annual temperature at Newkirk is 58.6° F. The mean temperature during the three coldest months of December, January, and February is 36.2° F. The winters, as a rule, are short and mild, but an extreme of 21° below zero has been reported. The summers are long and hot. Temperatures of over 100° have been recorded in May, June, July, and August. The absolute maximum of record is 109° F., which was attained in June. The mean temperature for the summer season, however, is 79.2°. Occasionally hot winds occur in the summer months, doing much damage to corn and other crops.

The latest killing frost recorded in the spring occurred on April 27 and the earliest in the fall on September 28. The average date of the last killing frost in the spring is April 10 and that of the first in the fall October 24. The length of the normal growing season is thus 197 days and is ample for the maturing of the common farm crops. Sometimes late kafir and related crops are injured by early frosts.

The following table shows the most important facts relating to the climatic conditions as recorded at the Newkirk station of the Weather Bureau:

*Normal monthly, seasonal, and annual temperature and precipitation at Newkirk.*

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1900).	Total amount for the wettest year (1915).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	37.2	72	- 4	1.21	0.70	0.00
January.....	35.8	73	-12	1.39	.53	1.13
February.....	35.5	81	-21	1.36	2.07	5.00
Winter.....	36.2	81	-21	3.96	3.30	6.13

*Normal monthly, seasonal, and annual temperature and precipitation at  
Newkirk—Continued.*

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1900).	Total amount for the wettest year (1915).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
March.....	49.4	94	6	2.10	.15	1.77
April.....	58.6	95	23	3.12	4.04	6.21
May.....	67.0	102	31	6.17	4.45	11.35
Spring.....	58.3	102	6	11.39	8.64	19.33
June.....	75.6	109	28	5.43	.60	8.22
July.....	80.4	106	35	3.27	4.25	2.00
August.....	81.5	103	48	3.81	2.50	4.16
Summer.....	79.2	109	28	12.51	7.35	14.38
September.....	73.2	99	32	3.37	4.65	8.61
October.....	61.4	81	22	3.21	2.03	1.25
November.....	47.8	72	6	1.91	.09	.45
Fall.....	60.8	99	6	8.49	6.77	10.31
Year.....	58.6	109	-21	36.35	26.06	50.15

AGRICULTURE.

The earliest settlers came into this territory a long time before it was opened for settlement by the Government. They depended mainly upon cattle raising and made extensive use of the free grazing land. Some of the pioneers grew a little corn and small quantities of other crops on some of the stream-bottom lands. These early occupants, however, were forced to abandon the land when it was bought from the Indians and officially opened for settlement in 1893.

After the opening practically every quarter-section of land west of the Arkansas River was occupied by one or more families, and in a short time most of the more desirable land was under cultivation, both in the uplands and in the bottoms. At first a larger acreage was devoted to corn than to other crops, but in 1900 the wheat was grown on an acreage more than three times as great as that in corn. In 1910 the order had been reversed, and the corn acreage was more than four times that of wheat.

The following table shows the acreage and production of the principal crops and certain live-stock statistics as reported by the 1900 and 1910 censuses:

*Acreage and production of the principal crops, and number and value of live stock sold or slaughtered.*

	Census year.			Census year.	
	1900	1910		1900	1910
Wheat.....	{acres... 181,098	51,852	Animals sold or slaughtered:		
	{bushels.. 2,460,490	613,450	Cattle..... number..		19,092
Corn.....	{acres... 59,460	214,402	Hogs..... do.....		61,160
	{bushels.. 2,222,690	5,386,146	Sheep and goats... do.....		18,669
Hay and forage.....	{acres... 32,746	45,408	Horses and mules do.....		4,445
	{tons... 44,942	71,986	Value of animals sold or		
Oats.....	{acres... 10,297	34,299	slaughtered.....	\$564,792	\$2,224,469
	{bushels.. 450,550	1,018,451			

Corn, wheat, hay and forage crops, and oats were the principal crops in 1910, ranking in acreage in the order named. While corn occupied an acreage four times that devoted to wheat, at present the acreage in these two crops is about equal, and it is possible that wheat may be the first crop in point of acreage. Kafir, feterita, milo, and sorghum are also markedly increasing in acreage. In some parts of the county these crops have largely displaced corn, owing to their superior drought-resisting qualities. Alfalfa has recently become a very important crop, and this legume is increasing in acreage every year. It is now grown much more extensively than in 1910, when it occupied 9,468 acres. At first alfalfa was largely confined to the bottom lands, but it is now grown with some success in places on the upland.

No tame grasses are grown extensively in the county. Prairie grass is very abundant and is used both for pasturage and for hay, which is made throughout the uplands. In good seasons this hay yields about 1 ton to the acre. It is of fair quality, although generally weedy.

Peanuts are grown on a small scale on the sandy soils. Cowpeas are a crop of some importance, and a small area is devoted to millet. Irish and sweet potatoes are grown by most farmers, but not on a commercial scale; in fact, the potato production of the county is not sufficient to supply the local demand. Several farmers grow strawberries, watermelons, and muskmelons for home or local use. Apples, cherries, peaches, apricots, and pears, as well as the common vegetables, are produced on nearly every farm for home use.

Catalpa and locust trees have been planted to serve as windbreaks or to supply fuel and fence posts. Osage orange is used to quite an extent for hedges.

The prevailing system of agriculture on the stream-bottom lands and terraces is general farming, the products consisting chiefly of alfalfa, wheat, corn, and oats for sale, with some kafir and sorghum. Part of the corn, kafir, and sorghum grown is used for feeding work stock, cattle, and hogs. In some cases these crops are used as silage, comparing favorably with corn. The live-stock industry is of less importance on the bottom lands than on the uplands.

On the uplands the principal types of farming are: First, general farming, including chiefly the production of wheat and corn, with a small acreage in oats, kafir, and alfalfa, all the production being sold with the exception of that required for the live stock, mainly work animals; second, hay production, consisting of the harvesting of prairie hay for sale; and third, combined hay production, general farming, and stock raising (mostly the grazing of beef cattle). Grazing is most important in the rougher country east of the Arkansas River. Some mules and horses, and occasionally hogs, are raised for market throughout the county.

Practically all the first-bottom and terrace land is under cultivation, and in general the most improved farms are encountered here. Much of the upland, however, is cultivated, especially west of the Arkansas River, and the untilled areas are used advantageously for native-hay production and as pasture land.

On the rougher lands and the heavier soils, including the Summit stony loam, the Gerald silty clay loam, and the shallow phase of the Summit silty clay loam, which are confined to the eastern part of the county, the agriculture consists chiefly of raising and fattening live stock in conjunction with the production of prairie hay for winter feed.

The adaptation of particular soils to certain crops and to certain types of farming is recognized to a considerable extent in practice. The well-drained, friable first-bottom and second-bottom soils, those of the Arkansas, Osage, Yahola, Reinach, Canadian, and Kay series, are used principally for alfalfa and corn, which give good average yields. The more friable upland soils, including the Derby and Crawford series, are also given preference for these crops. The Gerald and Oswego silt loams are recognized as good wheat soils, and wheat is the chief crop grown on these types. The Summit stony loam and the Gerald silty clay loam are used largely for the fattening and raising of beef cattle by grazing. The sandy soils are

used locally in a small way for growing watermelons, sweet potatoes, peaches, and apples.

Plowing for wheat is begun as soon as possible after the preceding crop has been removed. The land is plowed to a depth of 4 to 6 inches, much of it with a single-gang sulky plow, which cuts a furrow usually about 14 inches wide. Three or four horses or mules are used, and occasionally tractors are employed. The land is gone over with a single or double disk harrow, and a spike-tooth smoothing harrow is finally used to break up some of the clods, level the surface, and work the soil into a better tilth. Wheat is usually seeded in September, with a four-horse drill. In many fields the crop is grazed by cattle and horses until about the first of February. Wheat seeded too early is subject to injury by the Hessian fly in some parts of the county, but later seedings seem to escape most of the damage due to this insect.

Harvesting of wheat usually begins about the middle of June, but varies with the season. Cutting is done mainly with 6 to 7 foot binders, drawn by four to six horses. The cutting and tying mechanisms are operated frequently with small gasoline engines, which are of advantage when the ground is too wet to afford a firm footing for the power wheel of the binder. Occasionally 10 to 12 foot push-binders are used. Eight horses are required ordinarily to operate this type of machine. The grain is sometimes thrashed directly from the shock, but in most cases it is stacked and allowed to sweat before thrashing. In wet years stacking has proved beneficial. The grain is usually stored in granaries on the farm and later sold at near-by elevators. The straw is usually burned.

Frequently a rank growth of smartweed and sunflower is allowed to take possession of the cut-over grain fields, causing the loss of considerable moisture. No attention is paid to fertilization or rotation, and wheat very often succeeds itself year after year. Sometimes wheat follows corn, in which case the ground usually is merely disked before seeding.

Oats are not important in the agriculture of the county. They are grown for use on the farm and for sale in the near-by towns. The crop is usually planted as early as possible in the spring on land used the preceding year for corn. The soil preparation generally consists of disking. The crop is harvested in the same manner as wheat.

Land for corn is usually prepared with a double-row lister. The crop generally is planted between the rows of the preceding year, on ground prepared at the time of seeding, and the kernels are placed on hard unbroken soil. Sometimes the ground is plowed in the same way as for wheat, and the seed planted with either a lister or

a double-row corn drill, in rows 38 to 40 inches apart. The plants are left 15 to 20 inches apart in the row. Planting usually takes place early in April. Cultivation begins as soon as the plants are up, the first cultivation usually with a spike-tooth smoothing harrow. Two more cultivations generally complete the tillage. Modern types of cultivators are used. Some farmers prefer the shovel type of riding cultivator, of either one or two row capacity, while others use the double-row disk type.

In good years corn is harvested the first part of August. Several methods are followed in handling the crop. The most common practice is to husk the corn by hand from the standing stalks, which are afterwards pastured. A corn binder is generally used in cutting corn and the stalks are either hauled directly to the silo or are shocked in the field and husked later. A few silos are in use in various parts of the county, and they are apparently increasing in number. No rotation is followed in growing corn, and no fertilizer is used.

For kafir and related crops the ground is plowed in the spring and the seed drilled or listed in the row in much the same manner as corn, although closer in the row. As a rule seeding takes place early in June, although it may be done as late as July 10. These crops are cultivated in the same manner as corn. Part of the crop is thrashed.

Generally, land to be sown to alfalfa is plowed in the early summer and subsequently harrowed frequently to kill the weeds. Some alfalfa is sowed in the spring, but sowing usually takes place the latter part of August or the first part of September. The first cutting in the spring is made in May. Sometimes four or five cuttings a year are obtained, depending on the seasonal conditions. Seed is often obtained from the second and third cuttings in dry seasons. Most of the alfalfa crop is stacked in the fields for feeding purposes, and part of it is baled and sold. Frequently the fields are pastured with hogs and horses, and occasionally cattle. Crab grass often tends to kill out old stands.

In some parts of the county the live-stock interests are more important than general farming, especially east of the Arkansas River. According to the census, the value of animals sold or slaughtered in 1909 amounted to \$2,224,469, about three-fifths the value of all crop production. Before the county was opened for settlement cattle raising was the principal interest, but since then it has gradually become restricted to certain localities. Some farmers all over the county winter fall-purchased cattle on alfalfa hay and corn silage and put them on the Kansas City market in May or June, when they usually bring a high price. Farmers living near the Arkansas River and in some parts of Kaw and Beaver Town-

ships follow this line of farming on a more extensive scale. Most of them buy 2-year-old or 3-year-old steers from Texas. A large proportion of these are bought in the spring, pastured through the summer on prairie grass, and put on the market in the fall as "grass-fed" cattle. Some farmers buy calves and yearlings and keep them for several years, carrying them over the winter on hay and roughage and cottonseed-oil cake. These cattle remain in the open all winter. The feed lot usually is in some protected place, as in timber along a stream.

Some farmers keep a few dairy cattle and sell butter to local customers. Cream is sold to some extent. A creamery at Newkirk pays good prices for the product. Hogs are raised by practically all the farmers, but none of them make pork production a specialty. The animals are often kept on alfalfa pasture during the greater part of the summer and are fattened on corn and kafir in the fall. The most popular breeds are Duroc Jersey and Poland China, but some farmers prefer the Berkshire. There are a good many cross-bred animals in the county. Horses and mules are raised by most farmers in small numbers, mainly for use on the farm. An occasional farmer has a flock of sheep or goats, kept mainly for sale on the local markets or for use on the farm.

In view of the damaging effects of drought in some years upon corn and to a less extent upon some of the other crops, it would seem that the live-stock industries, particularly the raising of beef cattle, hogs, and perhaps sheep, could well be extended. Large areas of land are known to be well suited to stock farming, producing an abundance of native hay and pasture grasses and such forage crops as alfalfa, kafir, milo, feterita, and sorghum. Other forage crops, such as cowpeas and peanuts, have proved successful on certain soils and could be used for feeding cattle, horses, and hogs. Owing to the excellent transportation facilities and the good near-by markets, conditions are especially favorable for the raising of beef and pork stock and draft animals. The farmers recognize that an increase in stock raising would encourage the more extensive production of certain crops that are especially adapted to the local conditions, such as kafir and, on the proper soils, alfalfa. Incidentally, it would encourage the practice of crop rotation, which is now given little attention.

Farm laborers in Kay County are paid \$25 to \$30 a month, with board and washing. During the harvest period they receive higher wages, \$2 to \$3 a day, with board. During this period laborers are plentiful.

Of the total area of the county 60 per cent or more was under cultivation in 1910, according to the census, the remainder being mainly

used for pastures. Practically all the land is in farms, of an average size of about 199 acres, of which about 147 acres is improved. About 56 per cent of the farms in 1910 were operated by owners and about 43 per cent by tenants.

An annual cash rental of \$2.50 to \$5 an acre is paid for farming land and of 50 cents to \$1 an acre for pasture land. Few farms are leased on a share basis. Nearly all the land in Kaw and Beaver Townships and some land south of Ponca City is owned by Indians. This land is generally rented to white farmers.

Land in the stream bottoms and on the terraces ranges in price from about \$80 to \$150 an acre; on the smoother upland from about \$40 to \$80 an acre, depending on the location, improvements, and topography. In the eastern part of the county, where the surface is rougher and more broken, the land is held at \$30 to \$50 an acre. The discovery of oil and gas in various parts of the county has done much to raise the price of most farms, especially on the uplands.

#### SOILS.

Kay County lies in the Great Plains region. The upland soils are very largely residual, the exception being the comparatively small strips of wind-blown material, classed with the Derby series, immediately along the outer bottoms of the Arkansas River and to some extent along the Salt Fork of the Arkansas River. The residual soils are derived from limestone, shale, and sandstone. In the eastern part of the county the material comes largely from limestone, including some chert (Chase formation);<sup>1</sup> west of the Arkansas River the nature of the parent rock is less obvious, as there are fewer exposures. Most of the exposures are along the drainage ways and consist principally of thin-bedded and shaly limestone. The formation here is designated by Gould as the Marion and Wellington<sup>1</sup> formation, which he describes as consisting of gray, blue, drab, and yellowish shale, with ledges of impure limestone. In several places bluish shaly material is associated with outcrops of limestone, and it is not improbable that a considerable part of the material is derived from shale. This point, however, is of no material importance, as the soils have for the most part been mapped elsewhere in large areas and there is no question as to their identity.

The material representing the residuum accumulated through the decay of the underlying rocks appears to have undergone changes since its decomposition, which have resulted in variations in color and probably in structure. These changes, in part at least, seem to have been brought about through the influence of topography; that

---

<sup>1</sup> See Water-Supply Paper, U. S. Geol. Survey, No. 148.

is, the influence of the surface configuration upon drainage and indirectly upon oxidation. The black soils are largely confined to the level areas, and those having a clay hardpan occur mainly as level or gently undulating or as very gently sloping areas, while those soils having friable subsoils are for the most part confined to the higher and more sloping positions and to those areas where bedrock lies near the surface.

The direct relation of the underlying rocks to the character of the soil material could not be determined in all cases, partly for the reason that the nature of the rocks themselves could not be ascertained, being too deeply covered and too thoroughly decomposed. In many places the same rocks in areas of similar topography appear to give rise to markedly different soils. For example, the Gerald and Summit soils are found in close association in their typical development, overlying limestone on the same slope in many places. It seems that these two soils, which are very unlike, may owe their distinctive characteristics to a difference in the degree of weathering, the Summit being found very close to the limestone and the Gerald where the limestone lies deeper. There is some soil material the color of which is directly related to the parent rock; for example, the chocolate-red Vernon material is derived from rocks having a chocolate-red color.

The material throughout the uplands is very silty in the surface soil and very high in clay in the subsoil. The clay subsoils vary from moderately friable or decidedly friable in structure and light brown to reddish in color to very tough and compact in structure (clay hardpan) and chocolate brown to black in color. The surface soils prevailing are friable and reddish brown to black in color.

The alluvial material representing stream-deposited wash from the upland soils, occurring over the first and second bottoms of streams, varies widely both as the result of differences in the origin of the material and of variation in drainage conditions. The first-bottom material along the streams rising in the county or in regions of similar soils outside the county is predominantly silty and black or dark brown in the surface, becoming heavier in the subsoil. This soil is classed with the Osage series. The material in the Arkansas River bottoms ranges from fine sand to silty clay loam in texture and is predominantly brown, with lighter textured and lighter colored subsoils. These soils are classed with the Arkansas series. The alluvium of the bottoms and second bottoms of the Salt Fork of the Arkansas and the Chikaskia River, which rise in the Red Beds region, shows the presence of material from these beds by the reddish color in either the soil or subsoil or both. Here the first-bottom soils are classed with the Yahola series, and the second-bottom, or terrace,

soils with the Reinach and Kay series. Some of the imperfectly drained soil of these series is dark colored in the surface section. The terraces of the other streams are occupied by brown soils with lighter colored, heavier textured subsoils, which occur in well-drained positions and are classed with the Canadian series, and by grayish soils with dark-colored, clay-hardpan subsoils in the poorly drained positions, classed with the Neosho series.

The Summit soils characteristically consist of very dark brown to black, friable soils overlying yellowish subsoils, usually consisting of clay which is plastic and sticky when wet and slightly friable when only moderately moist. This clay material does not assume the very dense structure found in the hardpan of the associated Oswego and Gerald series. Frequently the yellow material is not present in the 3-foot section, except possibly in the lowest part, and on this account it is not everywhere easy to draw sharp boundaries between the Summit and Oswego and the darker phases of the Gerald soils. Where the typical yellow clay is present it very often has a greenish cast. Where the underlying limestone lies at shallow depths the subsoil frequently contains soft, whitish, highly calcareous material and is more friable than typical. The subsoil generally is calcareous. Where the underlying rocks are exposed they are seen to consist of limestone, shaly limestone, and beds of chert limestone. The topography is undulating to rolling, with many steep slopes and occasional level areas. These soils do not average so nearly level as the Gerald. Drainage is well established. The shallow areas include some patches of Brackett soil.

The Gerald soils characteristically have brown, friable soils and chocolate-brown, dark-brown or dark yellowish brown to dark reddish brown, tough clay subsoils resembling in some respects a hardpan. Frequently the upper subsoil is reddish and suggestive of the Crawford, but this passes downward into tough clay, which is browner or a dark yellowish brown mottled with chocolate brown or reddish brown. The material is residual from limestone, at least in part. Shale may enter into the composition of the soil, but no shale rock remains. These soils mainly occupy undulating or nearly level to gently rolling and gently sloping areas. In some areas the surface is level. The drainage apparently is good, being better, as a rule, than that of the associated Oswego soils. The Gerald soils are extensively developed in Kay County.

The Oswego soils are characterized by the black color of the surface material and by the tough structure and black to very dark brown color of the heavy clay subsoils. Usually this tough clay, which has the nature of a hardpan, begins abruptly at not more than

about 10 inches beneath the surface. In Kay County the rocks from which the Oswego series is derived can not be determined, as there are no exposures near enough to the surface to offer conclusive evidence. Only one type, the Oswego silt loam, is developed. It is closely associated in occurrence with the Gerald and Summit soils, which would indicate that to some extent at least it is residual from limestone. Typically the surface is level, although a few areas are gently sloping. The drainage is imperfect in many of the level areas, yet all parts of the type are cultivated to some extent. The type is extensively developed in the county.

The Crawford soils are reddish brown to brown or dark brown, and mellow in the surface section, while the subsoils consist of red to reddish-brown clay, which becomes stiffer at lower depths, frequently showing some yellowish and brownish mottling. The material is residual from limestone, and in many places the limestone is encountered within the 3-foot section, with occasional outcrops. These soils are found on slopes, ridges, knolls, and nearly level and undulating areas. The drainage is everywhere good.

The Derby soils are characterized by the brown to dark-brown color and mellow structure of the surface material and by the reddish-brown to dull-red or reddish-yellow color and friable structure of the subsoil. The principal difference between the subsoil of this series and that of the Crawford is the more friable nature and somewhat lighter texture of the Derby. These soils occupy level to undulating areas and gentle slopes along and near the bottoms of the Arkansas and the Salt Fork of the Arkansas. It is believed that a considerable part of the material was blown up from these bottoms. As mapped, there are included areas near the river which correspond very closely with the characteristics of the Derby. The drainage of these soils is well established.

The Vernon series is represented in the county by a single type, the clay loam. This soil is derived from shale, which is characteristically chocolate red. The soil and subsoil show the same color as the parent rock. The subsoil consists of rather stiff clay. The drainage is good.

In the Osage series are included black or nearly black soils with black to dark-brown, rather compact subsoils, which frequently are lighter brown in the lower depths. The soils of this series occur in the first bottoms of streams carrying material from the various upland soils of the region, such as the Summit, Gerald, Oswego, and Crawford. They are subject to overflow, but between periods of overflow the drainage is good. Only one type, the silt loam, occurs in Kay County.

The Arkansas soils are characteristically brown in the lighter textured members to black in the heavier types, with subsoils of

yellowish-brown to brown color and compact structure, grading in the lower part of the 3-foot section into more friable sandy material. They occur in the first bottoms of the Arkansas River, and are subject to occasional overflows. Between periods of overflow, however, the drainage is good. The material is derived from the various soils that occur in the drainage basin of the Arkansas River, that is, from residual prairie material and material brought down from the Rocky Mountain region.

The surface soils of the Yahola series are reddish brown, with reddish-brown or salmon-colored and lighter textured subsoils. These soils occur in the first bottoms of streams rising in or flowing through the Red Beds region, and contain enough wash from the reddish soils of that region to give the distinctive chocolate-reddish color. The drainage is good.

The Reinach series is the terrace or second-bottom equivalent of the Yahola.

The Kay soils are characterized by the dark-brown to black color of the surface soils and the reddish-chocolate color of the subsoils. They occur on second bottoms of streams carrying material washed in part or entirely from the soils of the Red Beds region. They were laid down by overflow waters when the streams flowed at higher levels than at present. Imperfect drainage conditions, it is believed, have brought about the dark color of the surface soil. Typically these soils are fairly well drained. They occur on flats or in slight depressions where moist conditions have favored the accumulation of dark-colored organic matter in the surface soil. The dark color does not seem to be due to an overwash of dark material. The Kay soils differ from the McLain, mapped elsewhere in Oklahoma, in that the dark material occurs at the surface and the reddish material in the subsoil, the reverse being true in the case of the McLain.

The Canadian series includes brown, mellow surface soils and light-brown to yellowish-brown, friable subsoils. These soils occur on stream terraces having good drainage. The material consists of wash from the soils of the Great Plains and Rocky Mountain regions.

The Necsho series, represented by a single type in this county, is characterized by the ashy-gray color of the immediate surface soil, the light-gray color and powdery nature of the subsurface material, and by the dark-brown or brownish-drab color of the clay subsoil, which resembles hardpan. Some of the included darker areas, if of sufficient extent, might properly be mapped in the Brewer series. The Neosho soil occurs in level stream-terrace areas, and the drainage is rather imperfect. The material apparently is old alluvium, corresponding in origin with that of the Osage.

The names of the different soil types and their actual and relative extent are given in the following table:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Gerald silt loam.....	242,880	40.3	Derby very fine sandy loam, reddish-brown phase.....	8,320	1.4
Oswego silt loam.....	49,600	8.2	Canadian silt loam.....	7,552	1.3
Osage silt loam.....	39,872	6.6	Arkansas very fine sandy loam..	6,784	1.1
Crawford silt loam.....	31,616	6.3	Yahola silt loam.....	3,584	.6
Shallow phase.....	6,464		Derby loamy sand.....	3,584	.6
Gerald silty clay loam.....	25,728	4.3	Arkansas fine sand.....	3,456	.6
Summit silty clay loam.....	18,816	4.2	Derby very fine sand, reddish- brown phase.....	3,072	.5
Shallow phase.....	6,656		Arkansas silt loam.....	3,072	.5
Reinach silt loam.....	23,872	4.0	Vernon clay loam.....	2,432	.4
Summit stony loam.....	21,184	3.5	Reinach silty clay loam.....	2,240	.4
Kay silty clay loam.....	16,704	2.8	Yahola very fine sandy loam...	1,792	.3
Summit silt loam.....	14,656	2.4	Askansas silty clay loam.....	1,664	.3
Kay silt loam.....	12,928	2.1	Neosho silt loam.....	768	.1
Reinach very fine sandy loam..	12,352	2.1			
Derby fine sandy loam.....	10,752	1.8			
Gerald loam.....	10,176	1.7			
Derby silt loam.....	9,664	1.6	<b>Total.....</b>	<b>602,240</b>	<b>.....</b>

GERALD LOAM.

The Gerald loam consists of a brown, mellow loam with a relatively high content of silt and fine sand, underlain at 10 to 15 inches by light-brown to chocolate-brown clay loam or silty clay loam, which passes quickly into brown or chocolate-brown, tough, heavy clay. In places this clay grades into a very plastic, drab clay, mottled faintly with rusty brown.

The largest areas of this type are those southeast of Eddy, north and northeast of Tonkawa, and in the northwestern corner of the county. Scattered areas of various sizes occur, following in a general way the Salt Fork of the Arkansas River. In nearly all cases the type adjoins areas of the Derby soils or other types of the Gerald series. It seems probable that the loamy texture of the surface soil is due to some extent to the deposition of fine sand from the river bottoms by wind action. The surface is level to gently undulating, and the drainage good.

This soil is not very extensive, and it has little importance in the general agriculture of the county, although practically all is under cultivation. The soil works up easily into a good tilth. Owing to the greater depth to the tough clay subsoil, it is slightly more productive than the silt loam member of the series. The chief crops grown are wheat and Kafir and related crops. Alfalfa is grown to some extent and does well. Wheat yields from 20 to 30 bushels per

acre. Corn is a very uncertain crop, but Kafir and feterita give fairly good results.<sup>1</sup> The type is valued at \$45 to \$60 an acre.

For its improvement this soil needs about the same treatment as the silt loam, including deeper plowing, shallow cultivation, the use of barnyard manure, and the systematic rotation of crops.

#### GERALD SILT LOAM.

The typical Gerald silt loam consists of a brown, rather mellow silt loam, underlain at 8 to 10 inches by lighter brown silt loam or silty clay loam. A brown or chocolate-brown, tough, heavy clay (clay hardpan) lies 10 to 15 inches below the surface. This layer extends to a depth of 3 feet or more without change, except that the lower part frequently has a somewhat lighter color, being light brown or mottled brown, chocolate brown, and yellowish brown. In places, as in the vicinity of Peckham, Owen, and the Alberta oil fields, and about 4 miles west of Newkirk, the tough clay is deeper, being encountered at a depth of about 2 feet, and in such cases the upper subsoil is somewhat friable. In the higher positions and on slopes in the more rolling areas, mainly in the eastern part of the county, the upper subsoil has a reddish-brown color, resembling that of the Crawford subsoil, but is much tougher than the subsoil of the Crawford, and grades below into mottled brown or yellowish brown and reddish brown or chocolate brown. In these higher positions the freshly plowed soil when moderately dry has a faint reddish-brown color, as seen across the fields, but a sample in the hand appears more brownish. When moist the soil is dark brown and that of some of the gentle slopes and more nearly level areas is dark brown when fairly dry and nearly black when wet. The subsoil of those areas having the darker soil is often dark brown or dark drab, such areas approaching the characteristics of the Oswego silt loam. The type is locally known as "hardpan" soil.

This type is residual. Rock exposures are infrequent. The underlying rock seems to consist mainly of limestone, but there is some shale. The relative extent to which shale and limestone enter into the composition of this and the other Gerald types can not be definitely stated.

The type is widely distributed throughout the uplands of the county. There is relatively more of it in the central part, the largest development being between Newkirk and Willston. This is the most extensive soil in the county. It occurs in level, undulating, and gently rolling areas. Most of the type is undulating, and all of it is topographically suited to the use of modern farm machinery. The

---

<sup>1</sup> The yields given in this report are based on statements of farmers and observations in the field.

surface drainage is good, but the impervious character of the subsoil is unfavorable to good internal circulation of moisture and air. Corn suffers severely in long dry periods.

This is a very important soil in the agriculture of the county. Probably 50 per cent of the type is under cultivation, the remainder being in prairie hay and pasture. The chief crops grown are hay (mainly native grass), wheat, kafir, feterita, milo, sorghum, and corn, with some alfalfa and oats. Many farms have small home orchards of apples and peaches, but there are no commercial orchards. On the whole, the live-stock industry is not nearly so important on this type as is general farming. Most farmers raise a few head of cattle and some hogs, chiefly for home needs, and occasionally one or more calves and sows and a few hogs are sold. Most farmers have one or more milch cows, and a few sell cream. The work stock is largely raised on the farm and consists mainly of mules. A large number of mules and some horses are sold. The raising and fattening of beef cattle is a fairly important industry on this soil east of the Arkansas River, this industry being of more importance here than the production of sale crops. The cattle, many of them feeders, are grazed throughout the year, being fed for comparatively short periods in the winter.

Wheat yields about 25 bushels per acre in good years, corn about 25 bushels, and hay 1 ton to 1½ tons. In dry years the yield of corn is very low. Kafir and related crops yield fairly well.

The soil works comparatively easily. Three-horse and four-horse teams and sulky turning plows are used in breaking the land. For wheat it is plowed to a depth of 4 to 6 inches as soon as possible after the preceding crops are removed. A few tractors are used in plowing; they are especially desirable in breaking the virgin prairie. Disk and spike-tooth harrows are used after the breaking and the soil usually is put in a fair to good condition of tilth. Cultivation is performed with riding plows, double-row disk plows being very common. Crop rotation is given little attention. Manure is seldom applied and no commercial fertilizer is used.

Farm land of this type is held at \$35 to \$80 an acre, according to location and farm improvements.

This soil is in need of deeper plowing and shallow cultivation, to conserve the greatest possible amount of moisture. Barnyard manure should be saved and applied to the land, and applications of burnt lime or ground limestone probably would give good results. The practice of crop rotation is productive of better average yields on almost all soils, and there is no reason to doubt that it would prove beneficial on this type.

The Gerald silt loam is primarily a wheat soil, this crop giving better average returns than any other crop at present grown. Next

to wheat it seems best adapted to native grass and kafir and related crops. It is a poor corn soil for the average season. Alfalfa is grown in a small way with fairly satisfactory results.

The adaptation of this soil to grass and forage crops, the transportation facilities, and the accessibility of good markets are favorable to the raising of beef cattle.

#### GERALD SILTY CLAY LOAM.

The Gerald silty clay loam typically consists of a brown to dark-brown silty clay loam, underlain at 5 to 8 inches by lighter brown silty clay loam which passes abruptly at 10 to 12 inches into a chocolate-brown, tough, heavy clay. Occasional small areas of limestone outcrop are included in the type. In some places, as about one-half mile south of Hardy, 1 mile west of Canadian School, and about 4 miles west of Hardy, the surface soil is quite dark in color, approaching that of the Oswego series. The subsoil, however, in these areas has the characteristic chocolate-brown Gerald color. In other locations, as along the Osage County line east of Washunga, and south of Uncas, some small areas of Vernon and Kirkland material are encountered, and as these two soils are not extensive and have some of the Gerald characteristics, and are closely associated with areas of typical Gerald silty clay loam, they have been mapped with the Gerald.

The Gerald silty clay loam is found chiefly east of the Arkansas River, the largest single developments being an area east of Washunga and a long, narrow strip along Little Beaver Creek. West of the river there are scattered areas in the eastern part of Dale Township, and from Uncas to Ponca City some areas of varying size are mapped. The type is not encountered west of Newkirk. It occurs mainly on gentle slopes below limestone escarpments. In most cases it is topographically suited to the use of modern machinery. The surface drainage is good, but the internal drainage is slow.

On account of its small extent, this soil is not very important in the agriculture of the county. A small part of the type is under cultivation, the greater part being used for the production of prairie hay and for pasture. Corn has been grown on this soil with generally poor results, yielding but 10 to 15 bushels per acre even in good seasons. Prairie hay yields three-fourths ton to 1½ tons per acre. General farming is less important on this type than the raising of beef cattle, horses, and mules for market.

The soil is difficult to plow, four-horse, single-gang riding plows being used, and a good tilth can be provided only under the best moisture conditions.

Observations in the field indicate that this type is a good grass soil, native prairie grass growing luxuriantly in good seasons, and

owing to the uncertainty of the general farm crops, it is best used for hay and pasture.

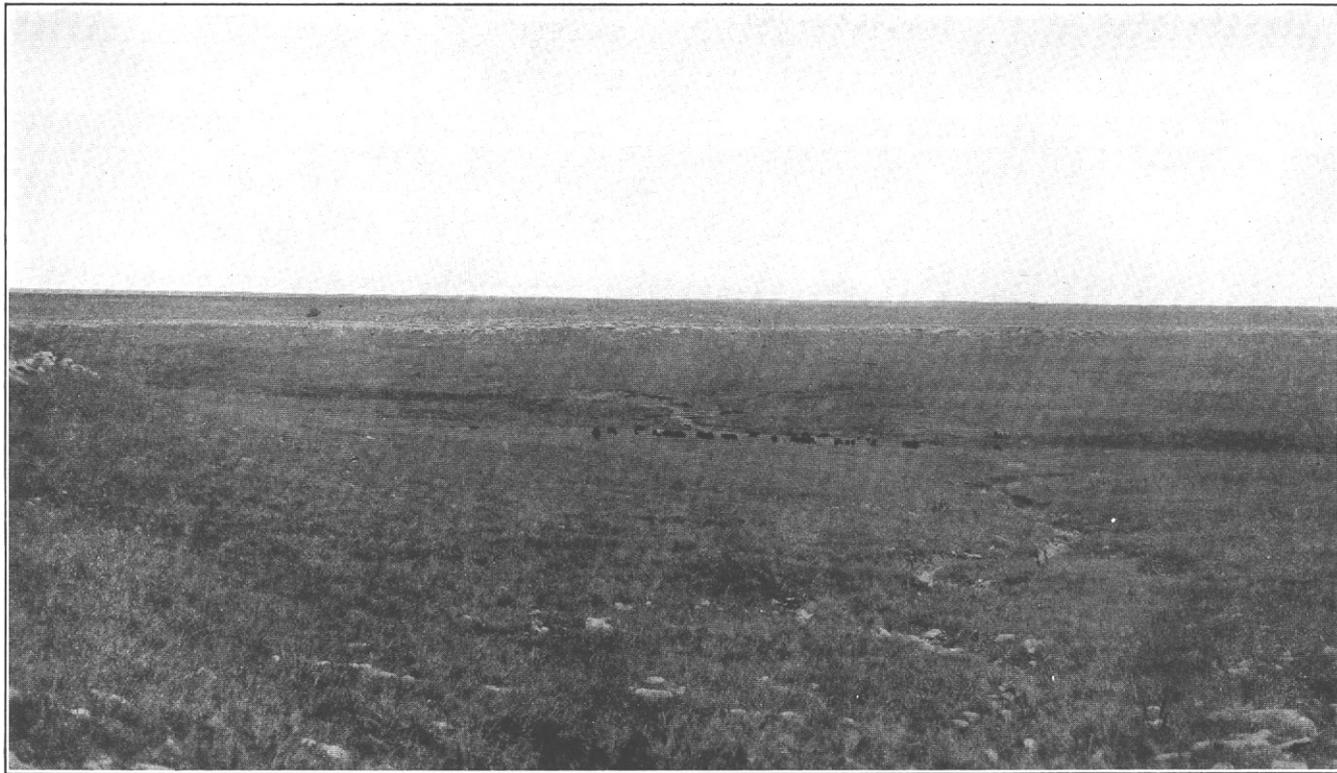
#### OSWEGO SILT LOAM.

The typical Oswego silt loam is a black silt loam 8 to 12 inches deep, underlain abruptly by black, waxy, heavy clay, which is extremely tough when dry, forming a clay hardpan, and plastic when very wet. When dry the immediate surface material of some patches has an ashy color, giving rise to the local name of "white ashy land" and "alkali flats." There is no important change in the clay subsoil within the 3-foot section, except that the lower part is often a little lighter in color. Generally the subsurface material, or the lower part of the surface soil, is a silty clay loam. Some included wet areas, as at Battle Axe School, southwest of Braman, have a dark-brown soil and a dark chocolate brown or very dark brown subsoil, with faint brown mottling. About 2 miles north of Newkirk some flat areas, in which the soil approaches the Summit characteristics, are included with the type.

This type is found throughout the uplands of the western part of the county. Practically all of it occurs west of Newkirk, the largest single areas being in the vicinity of Bodock, Retta, and Nardin. It occurs as level, gently undulating and gently sloping areas, and is topographically suited to the use of farm machinery.

The drainage is poorly established. The run-off is not sufficiently rapid, owing to the flat, level surface, and the impervious nature of the subsoil is unfavorable to the free downward movement of rain water. In wet years considerable difficulty is encountered in harvesting wheat and in cultivating crops. In 1915 nearly the entire crop on this type was lost because of the impossibility of using harvesting machinery on the soft, saturated land. After heavy rains water stands on the surface until evaporated. On drying out the soil cracks, which causes an excessive evaporation of moisture, and breaks the roots of growing plants. A yellow-flowered plant, locally called wild flax, is a characteristic growth on the type.

This is an important soil in the agriculture of the county. About 50 per cent of the type is under cultivation, the remainder being used for prairie-hay production and for pasture. The principal crops are prairie hay, wheat, kafir, feterita, and oats. Corn does not do well, but is grown to some extent. The live-stock industry is not developed to any important extent on this soil, general farming being given more attention, though most farmers raise a few head of cattle and some hogs for home use. The work stock is raised on the farm and consists of horses and mules. Some horses and mules and occasionally some hogs and cattle are sold.



LIMESTONE OUTCROP ON SUMMIT STONY LOAM, OCCURRING ALONG THE BREAK BETWEEN THE UPLANDS (GERALD SILT LOAM) AND THE SLOPE LEADING TO DRAINAGE WAY (GERALD SILTY CLAY LOAM).

Cattle grazing on prairie grass in middle distance.



Wheat does well in average seasons, yielding from 25 to 30 bushels per acre, and as much as 35 bushels in good years. Prairie hay yields three-fourths ton to 1½ tons per acre, and kafir and related crops do fairly well in favorable years.

The soil is not as easily worked as are the related Gerald soils. Clods are formed unless the soil is plowed when in a moderately moist condition. If plowed when too dry it breaks up into clods which are slow to weather, giving rise to a poor condition of tilth. The seed bed is prepared in the same manner as on the Gerald silt loam.

Farm land of this type ranges in price from \$40 to \$75 an acre, according to location and improvements.

The Oswego silt loam is primarily in need of drainage, either with open ditches or tile or a combination of the two. Drainage is practicable in nearly all cases, and would not only remove the excess water, but would probably cause the subsoil to become more friable through aeration, particularly where tile is used. Deeper plowing and more frequent shallow cultivation, to conserve a proper amount of moisture during the growing season, is needed. Burnt lime or ground limestone would no doubt tend to make the soil easier to handle.

#### CRAWFORD SILT LOAM.

The typical Crawford silt loam as mapped in Kay County consists of a chocolate-brown or faint reddish brown, mellow silt loam, underlain at 8 to 10 inches by a reddish-brown, friable silty clay loam, which grades at 14 to 18 inches into yellowish-red to reddish-brown, moderately friable clay. This becomes stiffer, more compact, and redder with increasing depth, the lower subsoil being a red clay, which is quite compact and only moderately friable. Frequently in the lower subsoil there are some faint mottlings of yellow and yellowish brown and the clay is quite tough, such areas representing an approach toward the characteristics of the Gerald. In many places the surface soil is brown, although showing a reddish cast in freshly plowed fields. A few small areas having a yellowish-brown subsoil are included with this type, as that about 2½ miles south of Tipton School. Where this soil adjoins areas of the Derby silt loam it is, in places, difficult to draw sharp boundaries.

The Crawford silt loam occurs chiefly east of Newkirk and west of the Arkansas River, from the Kansas line to south of Ponca City, in areas ranging in size from about 40 acres to several sections. There are scattered areas in all parts of the county. The type mainly occupies slopes and the crests of ridges. Its surface is level to gently undulating and gently sloping, the level areas occurring principally in the eastern part of the county, above the Summit stony loam. The

smooth topography is favorable to the use of improved farm machinery. Both the surface and subsoil drainage are good.

While this type is less extensively developed than the Gerald silt loam, it is one of the important agricultural soils of the county. Nearly all of it is under cultivation. The chief crops are wheat, kafir, feterita, milo, and corn, with some alfalfa. Many of the farmers have small orchards for home use. Apples and peaches seem to do better on the soil than on the Gerald silt loam, probably because of the more friable nature of the subsoil. Most farmers raise a few head of cattle and some hogs for home use, and occasionally some cattle and hogs are sold. The work stock, consisting of mules and horses, is raised on the farm. Occasionally some of these are sold.

Wheat yields 25 to 30 bushels per acre, and corn 25 to 35 bushels, in good years. Kafir does about as well as corn and is a more certain crop.

The soil works easily, three-horse and four-horse teams and sulky turning plows being used to break the land. Crop rotation is given little attention. Manure is seldom applied and no fertilizer is used.

This is one of the best upland soils in the county and is held at \$60 to \$100 an acre.

Better yields unquestionably could be obtained by gradually deepening the seed bed, plowing more deeply, and turning under barnyard manure or some green cover crop, such as cowpeas or rye. This practice, combined with more frequent shallow cultivation, would increase the moisture-holding capacity of the soil. The use of some rotation, including leguminous crops, such as cowpeas or alfalfa, would probably prove beneficial, as on similar soils elsewhere.

*Crawford silt loam, shallow phase.*—This soil is essentially similar to the Crawford silt loam as mapped in this county, except that limestone bedrock is reached within the 3-foot section. The soil is a chocolate-brown or brown to reddish-brown silt loam, underlain at about 5 to 8 inches by reddish-brown silty clay loam, which passes quickly into reddish-brown to dull-red, moderately friable clay.

This phase is developed chiefly east of the Arkansas River in level areas directly above the Summit stony loam. The drainage is excessive, and vegetation suffers in periods of drought.

This soil is of little importance in the county. It is used for pasture and for the production of wild hay.

#### SUMMIT STONY LOAM.

The soil of the Summit stony loam prevailingly is a black silt loam, 3 to 8 inches deep, overlying a yellowish clay, which grades into whitish, rotten limestone. Frequently the black soil passes directly

into whitish, soft calcareous material. Bedrock is commonly encountered at depths of less than 2 feet. The soil is deepest in the bench-like areas on the slopes. Small chert fragments are scattered over the surface and through the soil in many places. Larger fragments of limestone and, in places, chert, and also large slabs of limestone, occur on the surface. Limestone outcrops in most areas as a narrow band which follows the upper slope with noticeable regularity, winding about the "breaks" at the same elevation (see Pl. I). There are some patches in which Crawford material (red) and Vernon material (chocolate-red) are present. Also there are some included patches of whitish chalky material (Brackett). It was impracticable to separate these patchy bodies.

This soil comprises most of the "breaks," or the steep slopes between the smooth uplands and the drainage ways. It is confined to the eastern part of the county.

The type is not suitable for cultivation, being too stony, thin, and steep. It makes good pastures, however, and is used for that purpose.

#### SUMMIT SILT LOAM.

The soil of the Summit silt loam is a nearly black to black friable silt loam, grading at 8 to 10 inches into a dark-brown to nearly black, friable silty clay loam, which, in turn, passes at about 10 to 14 inches into yellowish-brown to brownish-yellow clay. In some places where the drainage is poor the lower subsoil is somewhat grayish or shows some yellowish-red mottling. The clay is quite plastic when wet, but is slightly friable when partly dry. In some places the lower subsoil has a greenish tint, and frequently lime concretions are encountered at lower depths. In the more nearly level areas the typical yellow of the lower subsoil is not always present in the 3-foot section, the subsoil being somewhat brownish. When wet such areas are difficult to distinguish from areas of Gerald soil.

The Summit silt loam occurs on slopes along small drainage ways and in low, flat areas near the smaller streams. While it is scattered throughout the county the principal areas are those in Kildare and Cross Townships. It lies in a lower position than the Gerald, the latter occupying the ridges and divides, while this soil is found below on the slopes and in level areas. The surface as a rule is gently sloping and well suited to the use of farm machinery. The type is moderately well drained, but not so well drained as the Crawford.

This soil is not very important in the county, comprising only 22.9 square miles. Locally, however, it is preferred to the associated Gerald type. About 75 per cent of the type is in cultivation, the remainder being used as hay and pasture land. Wheat, kafir, feterita, milo, corn, and alfalfa are grown, and all these crops do well.

The soil is easy to handle and apparently it is being used for those purposes to which it is best adapted.

#### SUMMIT SILTY CLAY LOAM.

The Summit silty clay loam is a very dark brown to black friable silty clay loam, 5 to 8 inches deep, usually underlain by black to very dark brown clay, which is yellowish brown in the lower part. The clay is plastic and sticky when wet, but slightly friable when moderately dry. Frequently the lower subsoil is faintly greenish yellow and contains some whitish calcareous material. In many places thin fragments of limestone are scattered over the surface. In the vicinity of Hardy the type grades into or closely resembles the Oswego.

This type is encountered in small areas in all parts of the county. It occurs on slopes adjoining drainage ways and sometimes extends over the tops of hills. The drainage is good.

This soil is not very extensive in the county. It is used almost entirely for pasture and for hay production, although wheat, kafir, and corn are locally grown, as in the vicinity of Hardy. The soil is rather difficult to keep in a pulverulent condition, but this can be accomplished by seasonable plowing. There seems to be no reason why alfalfa should not succeed.

*Summit silty clay loam, shallow phase.*—The Summit silty clay loam, shallow phase, consists of a very dark brown to black silty clay loam, underlain at 4 to 8 inches by brownish silty clay loam, which passes quickly into either a yellowish clay or a whitish rotten limestone. This in turn rests upon limestone bedrock at about 8 to 24 inches.

This phase occurs throughout the eastern part of the county, occupying positions directly above the Summit stony loam, and slopes and benchlike positions on the "breaks." The surface is level to undulating and gently sloping.

The phase is not cultivated, but is used as pasture or hay land. The grass suffers in dry years.

#### VERNON CLAY LOAM.

The Vernon clay loam consists of a chocolate reddish brown to reddish-brown clay loam, underlain at about 3 to 5 inches by chocolate-red or purplish-red clay, which in most cases passes into chocolate-red clay, frequently mottled with grayish and bluish colors. The clay is very plastic when wet. The color is distinctly different from that of the Crawford, being purplish red or chocolate red instead of brick red. In places partly decomposed rock is reached within the 3-foot section.

The type is confined to the southwestern part of the county and occurs on slopes and low ridges. It is well drained. The material is residual from shale of the Red Beds formation.

The Vernon clay loam is not very extensively developed, and is mainly used for hay land or pasture. A small area is under cultivation, and gives good yields of wheat. The type is of little importance because of its small extent.

DERBY VERY FINE SAND, REDDISH-BROWN PHASE.

The Derby very fine sand, reddish-brown phase, is a light reddish-brown, loose, very fine sand, passing into slightly reddish or salmon-colored material of the same texture. It occurs mainly in association with the bottom soils of the Salt Fork of the Arkansas River, in the vicinity of Tonkawa and westward, as hummocks or dunes standing as high as 40 to 50 feet above the associated bottoms, and also as lower, flattish or hummocky areas. It is obviously of wind-blown origin, and its surface configuration is subject to change by drifting where the covering of vegetation is removed. Wild plum and sand spur are characteristic plants.

This is a poor agricultural soil, being of low productiveness and subject to drifting when cleared. It is of little agricultural importance in the county. With liberal incorporation of vegetable matter or manure it possibly could be used successfully for early vegetables and for such crops as watermelons, sweet potatoes, and peaches.

DERBY LOAMY SAND.

The Derby loamy sand is a brown to dark-brown loamy sand, passing into brown or yellowish-brown loamy sand. The dark surface color is due to the presence of organic matter, and the dark-brown soil occurs in forested areas. In places the lower subsoil is a little heavy, approaching a fine sandy loam.

This type occurs in scattered areas in the uplands along the Arkansas River. It occupies slopes rising from the bottoms and undulating upland areas. It is well drained.

The Derby loamy sand in this county is very inextensive. About 50 per cent of the type is under cultivation; the remainder supports a growth of blackjack oak and grass, and is used as pasture land. Wheat does fairly well. The soil seems well adapted to peanuts, sweet potatoes, and watermelons, and probably with liberal applications of manure and commercial fertilizer it could be used profitably for these crops and for early vegetables, whenever market conditions are favorable.

## DERBY FINE SANDY LOAM.

The Derby fine sandy loam is a brown fine sandy loam, passing at 6 to 8 inches into reddish-brown or chocolate-brown fine sandy loam, which in turn grades at 10 to 15 inches into a reddish-brown, friable sandy clay, becoming redder and more compact with depth. The subsoil in places is a yellowish-red sandy clay, and in some included areas it has a decidedly yellow to yellowish-brown color. The uncleared areas support a rather dense growth of blackjack oak, and the type is locally known as "blackjack land."

This type occurs on the uplands along the outer bottoms of the Arkansas River and the Salt Fork of the Arkansas River, the largest areas being those in the vicinity of Washunga and west of Steele School. It occurs as undulating to gently rolling areas in close association with the Derby loamy sand. The drainage is well developed.

This soil is not very important in the agriculture of the county, owing to its small extent. About 50 per cent of it is under cultivation. Locally, however, it is highly prized. Crops are said to withstand dry periods better on this type than on the heavier upland types. Corn, alfalfa, kafir, and wheat are the principal crops, and a few peanuts are grown.

Under average conditions corn yields about 30 to 40 bushels per acre, kafir 35 to 45 bushels, and alfalfa 4 to 5 tons. Watermelons and sweet potatoes do well. Many farmers say that this soil produces better in dry years than in wet years. Except for the fact that it is inclined to drift to some extent, it is very easily handled.

The Derby fine sandy loam is valued at \$50 to \$60 an acre. A large part is owned by Indians and is not for sale.

For the improvement of the Derby fine sandy loam the use of heavy applications of barnyard manure and the growing of winter cover crops, such as rye or clover, are needed. Since alfalfa is known to grow successfully in seasons of low rainfall, the use of a larger acreage for this crop and the raising of more cattle and hogs should prove profitable.

## DERBY VERY FINE SANDY LOAM, REDDISH-BROWN PHASE.

The Derby very fine sandy loam, reddish-brown phase, consists of slightly reddish brown very fine sandy loam, passing at about 15 to 20 inches into a red, friable fine sandy clay, which becomes heavier and stiffer with depth. Frequently the subsoil consists of a red silt loam which is more or less compact, the fine sandy clay material not being present within the 3-foot section.

The type is found on the uplands in the vicinity of the 101 Ranch and Tonkawa. It occupies rolling to nearly level areas near or adjoining the Salt Fork of the Arkansas River. The soil is easily

worked and is very productive, giving good results with the general farm crops, including alfalfa and potatoes.

#### DERBY SILT LOAM.

The Derby silt loam consists of a brown, mellow silt loam, which passes at about 8 to 10 inches into a lighter brown silt loam to silty clay loam. This grades within the 3-foot section into reddish-brown or reddish-yellow, friable silty clay loam to silty clay. In places the subsoil is somewhat compact, but it is decidedly more friable than the subsoil of the Crawford and contains less clay. In places the type merges gradually into the Crawford silt loam, and definite boundaries are difficult to establish. In a few places the texture ranges to a very fine sandy loam or fine loam.

All the Derby silt loam occurs in the uplands adjoining or near the bottoms of the Arkansas River. In some areas the type occupies ridgelike situations along the stream bottoms, thins out away from the stream, contains considerable fine sand, and evidently is of wind-blown origin. The surface is undulating to nearly level and gently sloping, and the drainage is good.

This soil is not very important in the agriculture of the county owing to its small extent. Locally, however, it is highly esteemed for its productiveness and the ease with which it can be tilled. All of it is under cultivation. Most of it is used in the production of wheat, alfalfa, and corn. Kafir and related crops are also grown to some extent. The average yields are high.

#### OSAGE SILT LOAM.

The typical Osage silt loam consists of a black, mellow silt loam 10 to 15 inches deep underlain by a black to dark-brown silty clay loam, which usually becomes lighter in color with depth, the lower subsoil consisting of a brown silty clay loam or silty clay. In places the soil is dark grayish brown, and occasionally the subsoil is a black plastic clay, as in the first bottom of the Salt Fork, south of Ponca City. In some places the surface soil is a brown, mellow silt loam underlain at 8 to 10 inches by a light-brown silt loam, grading into lighter colored silty clay loam. Such areas represent the Verdigris silt loam, but are not sufficiently extensive or important to be mapped separately. There are also some included patches of Osage silty clay loam.

The Osage silt loam occurs in the first bottoms of creeks and is widely distributed over the county. The most extensive areas are those along Bois d'Arc, Beaver, Duck, and Bitter Creeks. The surface is level and drainage is good between the occasional overflows.

This is one of the important soils of the county and is highly prized. Except for the narrow, irregular areas along the smaller drainage ways, the entire area of the type is under cultivation. Most of it is used for alfalfa and corn, though some wheat is grown. It is one of the most productive bottom-land soils in the county. Alfalfa yields 4 or 5 tons per acre and corn about 30 to 35 bushels. The soil is easily cultivated.

Land of this type ranges in price from about \$60 to \$100 an acre.

The Osage silt loam is used apparently for those crops to which it is best adapted—alfalfa and corn. It seems, however, that more cattle and hogs could be raised with profit, especially by increasing the acreage of alfalfa.

#### ARKANSAS FINE SAND.

The Arkansas fine sand consists of a brownish fine sand, which in places is loamy, underlain by grayish to pale-yellowish fine sand.

This type occurs as hummocky, relatively high areas in the bottoms of the Arkansas River. Its hummocky surface undoubtedly is due largely to wind action. It is excessively drained, and is seldom overflowed, and supports a growth of sand plum and black-jack oak. Little of it is under cultivation. Watermelons do well. With heavy applications of manure or fertilizer the more nearly level areas would probably produce fair yields of other crops.

#### ARKANSAS VERY FINE SANDY LOAM.

The Arkansas very fine sandy loam is a brown very fine sandy loam to grayish-brown loamy very fine sand, passing into brown very fine sandy loam, which, at 15 to 20 inches, grades into yellowish very fine sand or loamy very fine sand. Some included areas approach somewhat a loam in texture and others incline toward a fine sandy loam, but such areas are not of sufficient extent to be mapped separately.

This type is encountered in the first bottoms of the Arkansas River, where it occurs as level to slightly undulating areas. Except in periods of occasional overflow the drainage is good.

This soil is not very extensive in the county, but it is the most extensive type in the Arkansas River bottoms. Practically all of it is under cultivation, being used in the growing of corn, alfalfa, and wheat. All these crops do well. The greater part of the type is held at \$45 to \$60 an acre. Some areas near Kaw have sold for \$100 an acre.

This is a good agricultural soil, and with liberal applications of barnyard manure could be made to produce as good yields as any soil in the county.

## ARKANSAS SILT LOAM.

The Arkansas silt loam consists of a brown, mellow silt loam, passing at about 10 inches into lighter brown silty clay loam to silty clay, which grades into a yellowish fine sandy loam to fine sand at a depth of 20 to 30 inches.

This type occurs in the first bottoms of the Arkansas River. The surface is flat but the drainage is good, except for occasional overflows.

The Arkansas silt loam is of small extent, but is highly prized locally, all of it being under cultivation. It is used almost entirely for corn, alfalfa, and wheat. Corn yields average about 30 bushels per acre, and alfalfa 4 to 5 tons an acre as the total of several cuttings. The soil is easy to cultivate. It is handled efficiently, and is being used for the crops to which it appears best adapted.

## ARKANSAS SILTY CLAY LOAM.

The Arkansas silty clay loam is a dark-brown to nearly black silty clay loam, passing at 8 to 10 inches into dark-brown or drabbish-brown silty clay or drabbish-brown very fine sandy loam, which, in turn, is underlain at 20 to 30 inches by light-brown to yellowish very fine sandy loam to very fine sand. In some of the depressions there is some silty clay on the surface, while on the associated hummocks included with the type the surface soil is a very fine sandy loam.

The type occurs in depressions in the Arkansas River bottoms, generally back from the river, along the foot of the uplands. Its drainage is poor. With proper drainage good results have been obtained with corn and alfalfa. Most of the type is forested with pecan, elm, honey locust, and hickory.

## YAHOLA VERY FINE SANDY LOAM.

The Yahola very fine sandy loam in its typical development consists of a light chocolate red very fine sandy loam, grading into a salmon-colored very fine sand of rather loose structure.

This soil occurs in the first bottoms of the Salt Fork of the Arkansas River and the Chikaskia River. Only one area lies along the latter stream—that in the vicinity of Rock Falls School. The type is level, with some slight swales and hummocks. The drainage is well established.

This soil is not important, owing to its small extent. However, it is a good agricultural soil and practically all of it is under cultivation. Alfalfa and corn do well. It is also a good watermelon soil. Peaches, apples, and pears succeed.

## YAHOLA SILT LOAM.

The Yahola silt loam consists of a reddish chocolate brown silt loam, underlain at 8 to 12 inches by a compact silt loam which usually is lighter in color. This in turn passes into a light-reddish to salmon-colored very fine sandy loam, fine sand, sand or loamy sand.

This soil occurs in narrow strips in the first bottoms of the Salt Fork of the Arkansas River and the Chikaskia River. Its surface is level to slightly undulating. The land is well drained and seldom overflowed.

The Yahola silt loam is of little importance in the agriculture of the county, owing to its small area. Nearly all of it is under cultivation. It is easy to handle and is well adapted to the general farm crops of the region. Corn and alfalfa do well.

## REINACH VERY FINE SANDY LOAM.

The Reinach very fine sandy loam consists of chocolate-brown to reddish chocolate brown very fine sandy loam, passing at about 8 to 12 inches into compact reddish chocolate brown loam. This in turn grades into chocolate-red silt loam or silty clay loam, which at about 30 to 36 inches is underlain by chocolate-red very fine sandy loam. In some places the chocolate-red silt loam or silty clay loam stratum is absent or is very thin; in others, the upper subsoil is dark brown to nearly black, but chocolate-reddish material is reached below.

The Reinach very fine sandy loam occurs chiefly on the terraces of the Salt Fork of the Arkansas River, with several small areas along the Chikaskia River. It occurs as level or nearly level areas in the same relative position as the silt loam type, except that it generally lies nearer the stream, the silt loam occurring mainly back toward the foot of the uplands. Drainage is well established.

This is a good agricultural soil, but it is not so important as the Reinach silt loam, owing to its small extent. The chief crops grown are alfalfa, small grain, kafir, and corn, all of which give good yields. The type is well suited to vegetables, Irish potatoes, and sweet potatoes. Peaches, pears, and apples apparently do well. The type is easily handled.

The value of this soil is slightly lower than that of the Reinach silt loam.

This type can be improved by applying barnyard manure or plowing under green-manure crops, such as alfalfa or cowpeas. If left bare in the winter it is likely to drift, and some winter cover crop, such as rye, should be grown.

## REINACH SILT LOAM.

The typical Reinach silt loam consists of a brown, chocolate-brown or reddish-brown, mellow silt loam grading at about 10 to 12 inches into a light-brown or reddish chocolate brown, friable silty clay loam.

This passes quickly into reddish chocolate brown to chocolate-red, friable but rather compact clay, which, in turn, grades at about 30 to 36 inches into chocolate-red or red very fine sandy loam. In some places the upper subsoil is dark colored. There are small included areas, particularly in poorly drained depressions, where the surface soil is dark brown and the subsoil mottled brownish and rusty brown, becoming reddish in the lower, friable sandy substratum. In such areas the type approaches the characteristics of the Kay soils.

This type occurs as level areas on the terraces or second bottoms of the Salt Fork of the Arkansas River and the Chikaskia River. It occupies positions 5 to 10 feet higher than the related Yahola soils, and in places adjoins the river. The drainage is good.

The Reinach silt loam is one of the most important soils in the agriculture of the county, and practically all of it is under cultivation. It is used for the production of alfalfa, corn, kafir, and wheat.

Most of the farmers on this type feed some beef cattle through the winter on alfalfa hay, corn, and kafir, either as dry fodder or ensilage. The feeders usually are brought from Texas about October and marketed in Kansas City in May. Some of the alfalfa hay and corn produced on the type is sold locally, and some is shipped out of the county. Hogs, also, are raised and fattened, but mainly for home use. The work stock, consisting of horses and mules, is practically all raised on the farm, and most farmers raise a few horses or mules each year for sale. Dairying receives little attention.

This is a very productive soil, and is easily handled. Alfalfa yields, as the total of several cuttings, 4 or 5 tons per acre, corn 50 to 75 bushels, and wheat 20 to 25 bushels in favorable years. Ordinarily 3-horse and 4-horse riding plows are used in breaking the land, which is done usually to a depth of about 4 or 5 inches. For wheat the field is plowed as soon as possible after the preceding crop has been harvested. The wheat is generally sowed about the 1st of September. Plowing for corn is done either in the fall or spring. Disk harrows are used to break up the clods and to reduce the surface to a fair condition of tilth, after which spike-tooth smoothing harrows are generally used. This puts the soil in good condition for seeding. Alfalfa is generally sowed in the fall. Good stands have been obtained by spring seeding, but seeding in the fall is more certain to be successful, according to the belief of some farmers. Corn is cultivated with the double-row disk cultivator and the double-row and single-row shovel cultivator. Fertilizer is not used on the type, but some farmers make an occasional application of manure. Little attention is given to crop rotation.

This type is one of the highest valued soils in the county, being held at \$100 to \$150 an acre, according to location and improvements. The improvements are generally good.

In general this soil appears to be efficiently handled, and used for the crops to which it is best adapted. Deeper preparation of the seed bed and shallower and more frequent cultivation probably would prove beneficial.

#### REINACH SILTY CLAY LOAM.

The Reinach silty clay loam consists of a chocolate-brown to reddish-brown silty clay loam, passing at about 8 to 15 inches into dark-brown to reddish-brown, compact silty clay loam to silt loam. This grades into reddish-brown very fine sandy loam at 30 to 36 inches. In places fine sand or sand is present in the lower subsoil.

This soil occurs on terraces of the Chikaskia River and the Salt Fork of the Arkansas River. It occupies level or slightly depressed areas. The drainage is good. Although all under cultivation, the type is of little importance in the agriculture of the county, owing to its small extent. It can not be cultivated as easily as the other Reinach soils, but with seasonable plowing clods can be avoided or easily reduced. Alfalfa, corn, and wheat are grown with good results and locally the land is highly prized.

#### KAY SILT LOAM.

The surface soil of the Kay silt loam consists of a dark-brown to black silt loam. This grades into a black clay which quickly passes into chocolate-red to dark chocolate red clay. In places the clay is rather tough and mottled with dark brown. Occasionally alternate layers of reddish and darker colored material are encountered in the 3-foot section. Typically, the soil is dark colored and the subsoil is reddish. Some small areas of very fine sandy loam are included with the type.

This soil occurs in positions similar to those occupied by the silty clay loam type on terraces of the Salt Fork of the Arkansas River and the Chikaskia River. The surface is level, although there are some sloughs or abandoned stream channels. The type is fairly well drained.

The Kay silt loam is not very extensive and does not have a very important influence on the agriculture of the county. It is a good agricultural soil and gives good yields of small grain, corn, alfalfa, and hay. It is less difficult to handle than the silty clay loam type, and has a somewhat higher value. Underdrainage with tile would doubtless prove beneficial.

#### KAY SILTY CLAY LOAM.

The Kay silty clay loam consists of a black silty clay loam, which grades at about 15 to 20 inches into dark-chocolate to dark chocolate red, plastic clay. Frequently the brown or reddish-brown sub-

soil is not encountered until the lower part of the 3-foot section is reached, and in places it is not present, the type approaching a terrace equivalent of the Osage.

This type occurs as level and depressed areas on the terraces, or second bottoms, of the Salt Fork of the Arkansas River and the Chikaskia River. It occupies positions farther back from the stream than the associated Reinach soils, lying next the foot of the uplands. Imperfect drainage conditions probably have caused the dark color of the surface material. While drainage is not so well established on this soil as on the closely associated Reinach soils, it is sufficient in ordinary seasons for the growing of most farm crops. In 1915 considerable difficulty was experienced in harvesting wheat and curing alfalfa hay.

This soil is not extensively developed and is not very important in the general agriculture of the county. Locally, however, it is important, owing to its high productiveness. Wheat, alfalfa, corn, and kafir do well. In favorable seasons wheat yields 25 to 30 bushels per acre, alfalfa 4 to 5 tons, and corn 40 to 60 bushels.

Considerable care is required in the preparation of the seed bed on this type. If plowed when rather wet it forms clods, which become hard on drying out, and weather down only after several rains. Four-horse teams and single-gang riding plows are used in breaking this soil. Occasionally tractors are used.

This type is held at \$80 to \$125 an acre, the price varying with improvements and location.

The Kay silty clay loam is less well drained than the other terrace soils of the county, and full development in most cases will require the installation of drainage systems. Tile drains seem advisable, as open ditches occupy considerable land that could otherwise be cultivated. Underdrainage would also be more effective in improving conditions in the plastic, tenacious subsoil, which will become more open with increased aeration.

#### CANADIAN SILT LOAM.

The typical Canadian silt loam is a brown, mellow silt loam which passes at 10 to 12 inches into a lighter brown, friable silt loam, somewhat more compact than the soil, grading quickly into yellowish-brown, compact but friable silty clay loam. In some places the subsoil has a faint reddish cast.

This soil occurs on the terraces, or second bottoms, of the Arkansas River and in several places along the smaller streams, as Deer and Beaver and Little Beaver creeks in the eastern part of the county. It occurs as level to very faintly undulating areas about 20 feet above the level of the Arkansas River bottoms. The largest single area is

south of Ponca City. Smaller bodies are found at Uncas,  $4\frac{1}{2}$  miles east of Newkirk, and at Tipton School. The type is well drained.

The Canadian silt loam is of small extent, and is not important in the agriculture of the county as a whole. However, it is highly prized locally and all the type is under cultivation. Most of it is used for alfalfa, but wheat and corn are fairly important crops. It is a good soil and withstands drought probably better than any soil in the county. In wet years wheat does better on this soil than on the residual upland soils, where the heavier subsoils hold water to such an extent that harvesting is sometimes difficult or impossible. Alfalfa yields about 5 tons per acre per season. Corn yields 35 to 70 bushels and wheat 25 to 30 bushels per acre.

This is a very desirable soil for farming and is held at \$90 to \$135 an acre.

The type is very easy to handle. The prevailing methods of plowing and listing crops appear to be quite efficient, although perhaps somewhat deeper plowing would be beneficial.

#### NEOSHO SILT LOAM.

The Neosho silt loam consists of an ashy-gray silt loam, underlain at about 10 to 12 inches by brownish-drab to dark-brown tough clay (clay hardpan). When dry the soil assumes a light-gray to whitish color, and locally it is known as "white land." South of Tipton School there is a small included body that resembles closely the Oswego silt loam.

This type occurs on terraces of the Arkansas River, about 20 feet above the first bottoms. The principal and most typical area is that about 4 miles south of Ponca City. The areas are level or slightly depressed and closely associated with the Canadian silt loam. The drainage is rather poor.

The Neosho silt loam is of little agricultural importance in the county. It is not extensive, and very little of it is under cultivation. Much of it is used as pasture or hay land. Where cultivated, wheat usually is grown, and does fairly well in favorable seasons. Corn gives low yields.

#### SUMMARY.

Kay County is located in the north-central part of Oklahoma, on the Kansas State line. It has an area of 941 square miles, or 602,240 acres. The topography in general is level to gently undulating and undulating, and in the eastern part of the county somewhat hilly. The county is drained by the Arkansas River and its tributaries. Drainage is well established.

The population is mainly American. The total population, 1910 census, is 26,999, 78.6 per cent of which is given as rural. It is well

distributed over the county. The density is 22.7 persons per square mile. Newkirk is the county seat and Blackwell the largest town.

Transportation facilities are good. Kansas City, the principal market of the region, is 290 miles northeast of the county.

Oil and gas have been discovered in several parts of the county. The latter is used to supply domestic and commercial needs for fuel and light.

The mean annual precipitation is about 36 inches. The average temperature is about 59° F. The summers are long and hot and the winters short and mild. Crops maturing in late summer and fall sometimes suffer from drought.

The principal field crops of the county are wheat, corn, alfalfa, kafir and related crops, and oats. The raising of stock, consisting of beef cattle, horses, and mules, is practiced in various parts of the county, but is especially important east of the Arkansas River. All the farmers raise some hogs. Wheat is sold but most of the remaining crops are consumed on the farm. In general, no system of crop rotation is followed, and no fertilizers are used. Farm hands are plentiful at harvest time and receive \$2 to \$3 per day.

Farm land in the bottoms and second bottoms sells for \$80 to \$150 an acre. Upland areas in the smoother sections sell for \$40 to \$80 an acre, and in the rougher sections for \$30 to \$50. Most of the tenanted land is rented for cash, the rate ranging from \$2.50 to \$5 an acre for land suitable for farming. Grazing land rents for 50 cents to \$1 an acre.

The upland soils of Kay County are mainly residual in origin, and are derived principally from limestone and shale. They are prevailingly black to brown in color, and consist chiefly of silt loam to silty clay loam. They are generally underlain by black to brown, tough heavy clay, forming a clay hardpan. Most of the residual soils belong to the Oswego and Gerald series, the former including the black soils and the latter the brown. They are used generally for the production of wheat. The reddish-brown to brown soils, with red, friable clay subsoils, are classed with the Crawford series, which occupies the ridges and divides in the eastern part of the county. The types with black surface soils underlain by drab to yellowish subsoils are mapped as the Summit. They are generally found adjoining drainage ways.

Nearly all the residual upland soils are easy to handle, and could doubtless be made more productive by deeper plowing, more frequent and shallower cultivation, the incorporation of organic matter, and the rotation of crops.

Some of the upland soils are of eolian origin, being derived from material blown up from the river bottoms. These soils are brown in color and are underlain by brown to reddish, friable subsoils. These

soils are included in the Derby series. In texture the surface soils range from silt loam to loamy sand. The soils are easily handled, and are well suited to the production of alfalfa and corn.

The alluvial soils of the first bottoms of the Arkansas River are derived from material from the Rocky Mountain and the Great Plains regions. They are brown at the surface and become lighter both in color and texture with depth. These soils are classed with the Arkansas series. They range from silty clay loam to fine sand in texture, and are well suited to alfalfa and corn.

The second bottoms along the Arkansas River comprise (1) soils consisting of brown silt loam with lighter brown, friable silty clay loam subsoils, classed with the Canadian series, and (2) gray silt loam soils underlain by brown to dark-gray, tough clay, mapped as the Neosho. Each series is represented by one type. The Canadian silt loam is a good farming soil, well suited to corn and alfalfa. The Neosho silt loam is cultivated to only a small extent.

The soil in the first bottoms of streams rising in or near the county consists of black silt loam underlain by a black to dark-brown heavier subsoil. It is mapped as the Osage silt loam. This is a good agricultural soil, and is well suited to corn and alfalfa.

The first bottoms of the Chickaskia River and the Salt Fork of the Arkansas River are occupied by soils that are brown to reddish in the surface section, becoming lighter in texture and redder with depth. These are good soils for farming, producing good crops of corn, alfalfa, and wheat. They belong to the Yahola series.

On the second bottoms of these streams the Reinach series is recognized. This is the terrace or second-bottom equivalent of the Yahola series. The Reinach soils are well suited to the production of alfalfa and corn. Other soils found on the terraces with the Reinach series belong to the Kay series. They have dark-brown to black surface soils and chocolate-brown to reddish, plastic subsoils. They are not extensive, but are well suited to general farming where well drained.



[PUBLIC RESOLUTION--No. 9.]

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

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

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

Approved, March 14, 1904.

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

# **NRCS Accessibility Statement**

---

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at [ServiceDesk-FTC@ftc.usda.gov](mailto:ServiceDesk-FTC@ftc.usda.gov). For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.