SOIL SURVEY OF WRIGHT COUNTY, IOWA.

By T. H. BENTON of the Iowa Agricultural Experiment Station, In Charge, and C. O. JAECKEL, of the U. S. Department of Agriculture.—Area Inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Wright County, Iowa, is located about midway between the center of the State and its northern boundary and lies in the third tier of counties south of the Minnesota State line. The southeastern corner of the county is 66 miles due north of Des Moines. The county is bounded on the north by Hancock County, on the east by Franklin County, on the south by Hamilton County, and on the west by Webster and Humboldt Counties. It is composed of 16 townships, forming an approximate square, and comprises an area of 575 square miles, or 368,000 acres.

The area lies wholly within the region overrun by the Wisconsin ice sheet, and the topography is largely constructional; that is, the surface features were formed by the deposition of glacial débris and not modified to any great extent by subsequent erosion. The county has two general types of topography, a relatively smooth till plain and a morainic hilly region. A line drawn from the center of the northern boundary of the county to a point on the southern boundary about 5 miles west of the southeastern corner will roughly divide the till plain on the west from the morainic hills on the east.

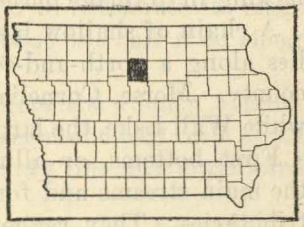

FIG. 36.—Sketch map showing location of the Wright County area, Iowa.

The till plain is characterized by nearly level to undulating topography. Boone River and its few tributaries have not yet eroded valleys but flow in narrow channels. Their minor drainage ways have not penetrated over the whole surface, so that areas of several square miles may be untouched by streams, and many streams that penetrate flat areas do not as yet carry away efficiently the surplus water. The flat topography and restricted drainage are indicated by the fact

that the soils over the greater part of this plain show evidence of poor drainage either at the present time or until within a very recent stage of their development. No lakes occur in this plain except Wall Lake, near its eastern border.

The morainic part of the county possesses a greater variety of topographic features. The region consists of a gently to sharply rolling plain traversed by chains of morainic hills. Some parts of this morainic section are almost as smooth as the till plain, but the general average, even at some distance from the moraines, is more rolling. The morainic hills range in prominence from mere swells to sharply rounded hills which stand up above the general level of the country. A very prominent chain of hills occurs a few miles northeast of Clarion, along the eastern side of Elm and Cornelia Lakes. Branching from this chain of hills a small range extends southward about 7 miles, passing 2 miles east of Clarion. Another chain leaves the main range west of Dows, extends in a northeasterly direction, and crosses the county line about 3 miles north of Dows. This range is cut through by the Iowa River. In the vicinity of Dows a few isolated hills or mounds, which are so regular in shape as to appear artificial, rise above the general level of the plain to a height of 40 or 50 feet. The land surface in the morainic area is almost unchanged by the effects of erosion. Many marshes and sloughs wind among the hills, but no drainage channels have begun rapid erosion. Nearly one-third of the total area of the morainic region is either flat or lacking in drainage outlets, so that it shows effects of poor drainage.

A chain of shallow lakes, ranging in size from 320 to 1,200 acres, lies along a north-and-south line a little east of the center of the county. Morse, Cornelia, and Elm Lakes lie in the morainic hills, while Wall Lake, the largest, lies in the level prairie.

First bottoms, or alluvial flood plains, are developed along all the main streams and for distances of from 1 to 5 miles along their tributaries. They range from 50 feet to about three-eighths of a mile in width. Second bottoms, or terraces, are found only along the Iowa River, the West Branch of the Iowa, and the Boone River, and along a small creek which enters the Iowa River about 3½ miles south of Dows. On this creek and at Belmond, on the Iowa River, two terraces are developed, one about 8 feet above the level of the first bottom and the other about 15 feet higher.

The highest elevation in the county occurs on the morainic divide just east of the center of the county. Three miles east of Clarion the altitude is given as 1,240 feet above sea level. The lowest elevation, 1,108 feet, is in the west-central part of the county at Goldfield. This gives a variation of 132 feet between extremes.

The county has a simple natural drainage system, rather poorly developed, since a longer period is needed to develop an elaborate network of streams than has elapsed since the drift was deposited. Two rivers and their few tributaries carry all the drainage water of the county. The tributaries have the form of natural streams only a short distance from their mouths, their upper courses having been straightened and deepened by dredging. Many large open drainage ditches and covered concrete mains empty into them. Some sloughs and depressed areas are still undrained.

The northern and eastern parts of the county are drained by the Iowa River and its few short tributaries. This river enters the county 4 miles north of Belmond, takes a general southeasterly course, leaves the county 1 mile north of Dows, reenters it about one-half mile south of Dows, skirts the county line for 3 miles, and then turns abruptly eastward into Franklin County. The winding channel of the Iowa River has a somewhat narrow flood plain, ranging from a few hundred feet to three-eighths of a mile in width. The current is rather slow except during high water. A continuous terrace, or second bottom, from one-eighth mile to 2 miles in width, extends from the north boundary of the county along the river to within 2½ miles of Belmond. It reappears north of Dows and follows the river throughout the rest of its course in the county. Three and one-half miles south of Dows, where the river leaves the county, the terrace extends back nearly 3 miles along a small creek, which has been dredged to accelerate its sluggish current. It has an average width of about one-half mile along this creek.

The West Branch of the Iowa River enters the county 5 miles northwest of Belmond and joins the main stream one-half mile north of Belmond. Its present channel at the county line and northward is a large dredged ditch.

The Boone River and its tributaries drain the rest of the county west of the morainic hills. This stream flows in a channel ranging from about 10 feet below the level of the upland where it enters the county, to 50 feet below where it crosses the southern boundary. It is sluggish and meanders back and forth across its bottom land, which is from 20 feet to about one-fourth of a mile wide. Occasional broken strips of bench-like terraces well above overflow are found in the concave bends of the river. At the lower end of the river these terraces are about 30 to 40 feet above the stream. The valley walls range from short, gentle slopes along the upper course to steep, nearly parallel walls, 50 to 60 feet high, where the river leaves the county.

Otter, Eagle, and White Fox Creeks, tributaries of Boone River, have cut channels through the flat prairies. They are characterized by narrow bottom lands, winding courses, short, gently sloping valley walls, and sluggish flow. All have a general southwesterly course. The natural drainage along the Boone River and these tributaries is limited to the adjacent farms, and in many cases almost to the channels of the streams themselves, the topography being such that in places the drainage of the upland is actually away from the streams.

Artificial channels in the upper courses of the tributaries increase their capacity to carry the drainage water from the intricate network of open ditches and large concrete mains which have been built to drain the flat interstream areas. About $1,000,000 has been spent to date on these artificial drainage ways. The fall in the ditches averages about 1 foot to the mile. The tiling is so extensive as to afford a continuous flow of water in many open ditches, and the flow is strong enough to maintain the channel. In many of these large ditches 48-inch concrete tile is being laid and covered over, thus eliminating the expense of redredging certain sections of the ditches where wind, weathering, and cattle have gradually filled them. Because of the very gradual fall, only a slight filling is necessary to impair the drainage efficiency.

The only native forest areas are scattered strips on the slopes adjacent to the streams and lakes and on the narrow first bottoms. The growth consists of red cedar, cottonwood, aspen, quaking asp, willow, walnut, butternut, hickory, oak, elm, ash, basswood, sumac, hackberry, cherry, and other hardwood trees. Artificial plantings for windbreak protection are mostly of cedar, spruce, pine, willow, cottonwood, ash, and maple.

The water supply for stock and domestic use generally comes from drilled wells 25 feet deep. In the higher central part of the moraine belt a lift of from 50 to 100 feet is required in the deep wells, while farther east on the lower ground the water rises nearly to the surface. In the lower part of the valley of the Iowa River, and at Belmond and Dows, flowing wells have been obtained. In the greater part of the western half of the county the water rises to within a few feet of the top of the wells, or above the surface in the lower areas. Two-thirds of the western part of the county is in the artesian-water district, which is said to have more flowing wells for its size than any other area in the country. It is stated that a flow can be obtained at some point on approximately half of the farms. The water is of excellent quality, and wells in that area have never been known to go dry. A few springs are found along the slopes of the Boone River. Some windmills are in use, but gasoline engines are generally used for pumping.

The first settlers came into Wright County from Hamilton County in 1854 and settled along the streams in wooded areas that afforded fuel and shelter during the winter and protection from prairie fires during the summer. Most of these pioneers were originally from New York, Indiana, Ohio, Missouri, and Illinois. Prior to this trappers and United States soldiers were the only whites here. In 1830 the southern part of the county was ceded to the Government by the Sac and Fox Indians, and the northern part by the Sioux. The county was established in 1851. The first settlements of importance were made near the present town site of Woolstock, in the southern part of the county. The northern part was settled much later by homesteaders, mostly of Scandinavian descent. In the southern half of the county farmers of French extraction predominated, with those of German extraction second. At present people of German descent have largely displaced the French. Many other nationalities are now represented, some having been attracted to the county in recent years by the beet-sugar industry. They include Russians, Mexicans, Greeks, Italians, Poles, and Austrians.

This particular region was among the last in the State to be occupied. This can be accounted for in part by the poor drainage of the broad, level prairie lands, which were simply a continuation of shallow sloughs and ponded areas most of the year. Further, much of the land was in the hands of speculators, who held it at relatively high prices, and homeseekers did not stop here but continued west, toward the Missouri River, where fertile and better drained farm lands could be obtained for much less.

According to the 1920 census, the total population of the county is 20,348. Somewhat more than 65 per cent of this is rural, giving a density of 22.8 persons per square mile. The farming population is rather uniformly distributed over the county, being only a little more concentrated near the large towns. Probably the northeastern corner is slightly less densely populated than the average. Clarion, with a population of 2,826, is the county seat. It is a division point on the Chicago Great Western Railroad, which gives direct connection with Chicago, Omaha, and St. Paul. It is an important trading center and shipping point for cattle, hogs, poultry, and grain. Eagle Grove, population 4,433, in the southwestern part of the county, is the largest town. The Chicago & North Western Railroad shops are located here. It is also an important distributing point and center for live stock and agricultural products. Belmond, in the northeastern part of the county, has a population of 1,797. A large cement-tile works and a beet-sugar factory are situated in this place. Dows, an important trading center located on the county line in the southeastern part of the county, has a population of 1,145.

Other towns of local importance are Goldfield, with a population of 749; Woolstock, with 294; Rowan, with 302, and Galt, with 134. Olaf, in the northern part of the county, is a local trading center and shipping point. Grain elevators are located at Palsville, Cornelia, Solberg, Florence, and Nuel. There are no towns away from railroads.

The railroad facilities of the county are fair, no farm being more than 12 miles from a shipping point. The Chicago Great Western Railroad runs diagonally across the county from northeast to southwest through Palsville, Belmond, Cornelia, Florence, Eagle Grove, and Nuel. At Clarion the main line to Chicago turns directly eastward, providing transportation and market facilities for Solberg and Rowan. The Chicago, Rock Island & Pacific line passes through Goldfield, Clarion, Galt, and Dows. At Dows a branch line extends to the north through Rowan and Belmond. The Chicago & North Western lines traverse the county in a northwesterly direction, passing through Woolstock, Eagle Grove, and Goldfield. A branch of this line extends northwest from Eagle Grove. The Minneapolis & St. Louis Railroad passes through Olaf and Belmond. These roads provide transportation to the various large markets.

The wagon roads of the county are mostly of earth. Extensive plans are in progress for improving and graveling the main highways in the immediate future. A few of the main highways have been surfaced with gravel and can be used for autos and trucks practically the entire year. The Diagonal Trail runs from east to west through the center of the county, and the Albert Lea Road runs along the eastern side from north to south. The less important roads are nearly all graded and during the summer are kept in good shape by dragging. Except along the rivers and streams where topography prevents, the roads generally follow land lines.

The county is liberally supplied with rural mail routes, and practically all farms have telephone service.

The public-school systems are well developed, and schools are accessible to all communities. The rural districts around Rowan have consolidated and established an excellent school there. Other rural schools in the county are independent.

Excellent houses and other farm buildings, mostly of wood construction, are generally found throughout the county.

The important local markets are Clarion and Eagle Grove. A large proportion of the live stock and other agricultural products is sold to local buyers, although a few producers ship direct to the larger cities. Chicago, St. Paul, Sioux City, and Omaha are the principal markets for the products of the farm.

CLIMATE.

The climate of Wright County shows wide variation in temperature, the difference in extremes being 140° F. It is nevertheless healthful and suitable for the growing of staple crops common to this region.

The mean annual precipitation is 32.36 inches. The greatest annual rainfall, 42.58 inches, occurred in 1918, while the least, 20.38 inches, fell in 1910. The rainfall is generally well distributed through the growing season, about 73 per cent falling from April to September, inclusive. The rain usually falls slowly and gently. Occasionally convectional storms, some accompanied by hail, cause considerable damage in narrow belts of country.

Owing to the high moisture-holding capacity of most of the soils, the periods of drought that sometimes occur during the growing season have never caused a crop failure. However, crops on the sandy ridges and gravelly-subsoil terraces suffer considerably during such periods. Excessive rainfall is more apt to be injurious to the crops than drought.

The mean temperature of the summer is 70.5° F., the highest temperature on record being 103° F. Periods of excessive heat are generally of very short duration. Prevailing summer winds are from the south and southwest. Strong winds are common, but tornadoes are of very rare occurrence.

The winters are usually quite cold, the temperature averaging 17.5° F. Heavy snows are of usual occurrence, the average annual snowfall amounting to about 2 feet. Frequently the drifting snow causes much trouble by blockading roads and railroads.

Clover and wheat are not infrequently injured by winter killing. The winds in the winter generally come from the northwest, and nearly every farmstead has a windbreak of trees on that side for protection. Narrow, broken belts of timber along the rivers and creeks afford the only natural protection in the county.

The earliest recorded killing frost in the fall occurred on September 17, and the latest in the spring, on May 17. The average date of the first killing frost in the fall, however, is October 5, and the average date for the last in the spring is May 6. This gives an average growing season of 152 days.

The heavy prairie soils, because of their moisture-holding capacity, are rather slow in warming up in the spring, and early-maturing varieties of corn should be planted to avoid injury by fall frosts. On the lower lying lands especially, even where the drainage is well established, it is important to grow the earlier maturing varieties of corn to insure a normal crop.

The following table, giving normal monthly, seasonal, and annual temperature and precipitation, is taken from the records of the Weather Bureau station at Belmond:

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

[Elevation, 1,205 feet.]

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1910).	Total amount for the wettest year (1918).
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*
December	22.6	56	−26	1.14	0.38	1.22
January	12.3	51	−37	1.42	1.51	1.38
February	17.5	60	−28	.94	.22	.63
Winter	17.5	60	−37	3.50	2.11	3.23
March	31.1	84	−20	1.22	.23	.93
April	47.1	93	6	2.72	1.04	2.12
May	58.9	92	25	5.71	3.52	10.48
Spring	45.7	93	−20	9.65	4.79	13.53
June	68.0	98	36	4.62	3.05	8.37
July	73.0	103	42	3.58	3.13	4.21
August	70.4	101	34	3.05	3.58	3.40
Summer	70.5	103	34	11.25	9.76	15.98
September	61.8	100	24	3.96	2.14	2.56
October	49.7	86	4	2.76	1.25	4.34
November	37.2	76	− 5	1.24	.33	2.94
Fall	49.6	100	− 5	7.96	3.72	9.84
Year	45.8	103	−37	32.36	20.38	42.58

AGRICULTURE.

The agricultural development of Wright County began in 1854 with the incoming of the first settlers. The first farms were situated along the wooded streams, and it was only after the development of artificial drainage that settlers in any number attempted to farm the heavy, black, flat prairie land. Patches of barley, flax, and wheat for home use were the first crops grown. Flax was soon abandoned because it was so hard on the wheat crop following, making a difference of about one-third in the grain yield. Corn and oats were not brought in until 1875 to 1880. As late as the nineties, part of the prairie land, with its luxuriant growth of nutritious grasses, re-

mained in open ranges. Cattle were driven in from Hamilton and Franklin Counties in the summer to graze and were taken back in the fall.

With the advent of railroads in 1880 and 1881 settlers began coming in very rapidly. At that time only 29.9 per cent of the land of the county was under cultivation. At present 93.6 per cent of the area is in farms, and about 90 per cent is improved. At first spring wheat was the principal cash crop, but with the introduction of oats and early varieties of corn these crops became more important.

Grain growing and the raising of live stock have, since the very first settlements, been the main agricultural industries.

The table given below shows the acreage and production of the principal field crops as reported in the United States census of 1880 to 1920, inclusive.

Acreage and production of principal field crops, census 1880 to 1920, inclusive.

Census year.	Corn.		Oats.		Wheat.		Hay and forage.		Barley.	
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Tons.	Acres.	Bushels.
1879....	25,263	997,750	8,010	262,639	16,858	204,289	7,218	11,553	461	9,626
1889....	68,982	2,245,013	48,594	2,102,332	4,161	74,407	70,090	84,656	2,696	90,629
1899....	103,524	3,829,660	79,627	3,201,250	18,058	293,850	51,838	63,751	5,857	192,220
1909....	99,659	3,468,716	79,556	1,985,823	1,364	21,721	89,608	119,525	3,037	52,611
1919....	106,805	4,154,115	89,219	3,112,637	2,761	39,246	45,403	93,973	1,839	40,279

A very large increase in the total acreage in crops has occurred since 1880, owing in great measure to the reclamation of poorly drained areas. Corn has been the leading crop since the early eighties, and at present nearly 35 per cent of the improved land of the county is annually planted to this crop. The average yield in the five years covered by the census ranges from 35 to 38.9 bushels per acre. Except for a phenomenal increase from 1880 to 1890, the acreage of oats shows about the same rate of increase as the acreage of corn. Oats is an important cash crop. Until after 1900 wheat was one of the more important cash crops. Since that time its production has rapidly decreased.

Until the late eighties the prairie was open range. The inclosing of this open range accounts for the 871 per cent increase in hay and forage crops cut in 1879 and 1889. Barley is grown on a considerable acreage, but has shown a steady decrease since 1900. The average yield, as reported by the 1920 census, was 22 bushels per acre. Flax was formerly raised on a large acreage, but its production has gradually decreased until now only an occasional crop is grown on sod. Very small acreages of buckwheat, rye, and emmer are sown.

At present the prevailing type of agriculture consists of grain growing and the raising and feeding of hogs, cattle, and other live stock. Corn, oats, hay, barley, wheat, flax, rye, and alfalfa are the chief crops, named in order of their importance. A considerable quantity of oats and shelled corn has been sold direct, especially in the last few years, because of the high cash grain market. However, the bulk of the crop is fed to cattle and hogs, and a small part to work stock. The grain that is sold is practically all shipped through privately owned or coöperative grain elevators, which are located in every part of the county.

The live-stock industry in Wright County consists mainly of the raising and feeding of cattle and hogs. A few sheep are raised, and some western feeders are shipped in to be finished for market.

The raising of hogs is the most important branch of the live-stock industry. On January 1, 1920, there were 79,427 hogs on farms. Purebred stock is mostly of Poland-China, Duroc-Jersey, and Chester White breeds, but mixtures of these breeds predominate. Purebred sires are commonly used, but there are only a few purebred herds in the county. Most of the pigs are farrowed in the months of March and April and are marketed at a weight of about 250 pounds. Corn and tankage are used for finishing. Some shorts, ground oats, and barley are fed. Several carloads of stock hogs are shipped in annually from Omaha and Sioux City for fattening. Most of the hogs are marketed in Chicago and St. Paul, a few going to Omaha. The larger feeders ship carload lots direct to the market, but most of the hogs are handled by local buyers and shipping associations at Clarion and Goldfield.

The beef-cattle industry is second in importance to hog raising. About 90 per cent of the cattle raised for beef are grade Shorthorns. Quite a number of grade Angus are fed. The total number of beef cattle in Wright County January 1, 1920, was 27,593. Many western feeders are shipped in during the latter part of September and the first part of October and marketed in December and January. Most of these are handled around Eagle Grove, Dows, and Clarion. They are kept on pasture until the middle or last of November, then finished on corn, molasses feed, and cottonseed meal. Roughage is mostly silage, timothy hay, and clover hay. Some straw and fodder and shredded fodder are fed. A number of purebred herds are scattered over the county. Polled and Horned Herefords predominate, Aberdeen-Angus being second, and Shorthorn third. A considerable number of purebred animals for breeding purposes are shipped out of the county every year. Purebred sires are now owned on nearly every farm where beef cattle are raised.

Small flocks of sheep are found in different parts of the county, mainly in the east-central and western part, on the roughest farms.

The total number of sheep in the county is given as 6,540 in 1920, and the total wool clip is 28,867 pounds. A few western feeders are shipped in each year from Omaha and Sioux City. Most of the sheep are grades, with some purebred Shropshires and a few Oxfords and Southdowns.

The horses raised in the county are mostly farm chunks and light drafters. In 1920 there were 15,465 horses in the county, and 543 mules. A few colts are raised every year to take the place of the older animals which are sold. From 8 to 12 horses usually are kept on each farm. A few purebred Percherons are raised, mostly around Rowan and Solberg. There are also a few purebred Shires and Belgians.

Dairying, at one time a very important industry in Wright County, is now carried on in only a small way. The production is barely sufficient to supply farm needs and the local markets. Most of the dairy cattle are grade Holstein and grade Shorthorn, with a few of the Jersey and Guernsey breeds. There are a few excellent dairy herds in the county, located mostly around the larger towns, where the products are locally consumed. Cooperative creameries are located at Clarion, Belmond, Goldfield, and Eagle Grove. Cream-buying stations are located in nearly every town.

Poultry raising is an important industry. Every farm has a flock that yields a good annual revenue. The number of poultry on farms January 1, 1920, is given as 245,222 chickens and 7,943 other poultry, and the eggs obtained during 1919 amounted to 957,790 dozens. Considerable attention is paid in some localities to purebred chickens. Buff Orpington, Rhode Island Reds, White and Buff Wyandotte, and Barred Plymouth Rock have the preference in the order named. A good many ducks and geese, some turkeys, and a few guinea fowls are also raised. The products are marketed through local buyers, who ship to larger markets.

Corn is the most important field crop in the county and occupied 106,805 acres in 1919. It is grown on practically all soil types. The average yield is fairly constant. Moisture conditions, however, cause considerable local variation. The black prairie soils, where well drained, will produce on an average slightly higher yields than the lighter and more rolling sandy types of soil. The average yield for 1919 was 38.9 bushels per acre. According to an estimate from the local farm bureau, an average of from 40 to 45 bushels is produced. White and yellow dent corn are grown exclusively. A general preference is shown for the yellow corn, with Reids Yellow Dent, 16 to 20 row, holding first place. Other popular varieties grown are Silver King, Little Iowa, Silver Mine, Minnesota 13, and Murdocks Yellow Dent. The slower heavy soils and the climatic conditions have necessitated selection of early-maturing varieties.

Most of the seed planted now is selected from the crib and is more or less mixed. A comparatively small number of the farmers test seed corn before planting. Corn is generally planted from the 1st to the 10th of May. Most of the land is plowed in the fall, from 4 to 6 inches deep, depending on the soil type. The corn is practically all check rowed. In the spring the land is double disked and gone over with a spike-tooth harrow before planting. The first cultivation is from 3 to 4 inches, the later ones from 1½ to 2 inches deep. A small acreage is drilled and is used for silage and fodder. The crop is harvested from about the middle of October to the last of November. The bulk of the crop is husked in the field and hauled to the crib, where it is generally handled with a power elevator. Probably 5 per cent is shocked and hauled out to be fed. A common practice is to fence off small portions and hog down, very little being fed to cattle in the field. The larger part of the crop is used to feed hogs, cattle, and work stock. The surplus, which is sold to local elevators, is husked at the crib and shelled by power outfits moving from farm to farm. There is a tendency to sell most of the corn on tenant farms rather than feed it. Occasionally, in wet seasons, considerable damage is done by cutworms, wireworms, and the root louse.

Oats are second in importance to corn as a cash crop and also in acreage. The 1920 census gives the production for the county as 3,112,637 bushels, with an average of 34.9 bushels per acre. Ordinarily the yields range between 40 and 50 bushels per acre. Early and late oats hold about an even place in acreage. The predominating early varieties are Iowa 103, Kherson, Early Champion, and Iowa 105. Of the late varieties, Silver Mine, Swedish Select, and Green Russian are the most popular. The crop is sown from the middle to the end of March and is ready for harvesting about the 10th of July. Most of the crop is sown on corn stubble, practically all being broadcast. The usual method in planting is to sow, disk, and drag, or to disk, sow, disk, and drag, the latter being preferred. Between 75 and 90 per cent of the acreage of corn is sown to oats. The climatic conditions as a rule are very favorable, but occasionally a hot period during the time the heads are filling lightens the crop appreciably. Until recently smut has caused considerable damage to the crop, but it now has been practically eradicated through treatment of seed with formalin solution. Chicago and St. Paul are the principal markets.

Wheat is now relatively unimportant and only a small part of the local requirement is produced. Spring wheat is grown almost exclusively, principally because of the uncertainty of the fall-sown crop on account of winter killing. According to the Iowa Agri-

cultural Year Book, the acreage of spring wheat in 1918 was 4,028 acres, compared with 393 acres of winter wheat. However, the winter wheat shows an average of 4 bushels more per acre than the spring wheat, the average yield of which is 17.3 bushels per acre. The winter varieties grown are Turkey and Iowa 104. Marquis and Little Bluestem are the common spring varieties. The crop usually follows oats or corn, and most of it is grown on the lighter and more sandy soils in the east-central and western parts of the county, near the river. It is generally sold from the thrashing machine.

Sugar beets became a crop of recognized possibilities in 1910. The beets are grown almost exclusively on the heavier black Webster soil. The silty clay loam, which has from 2 to 4 inches of loam on the surface, and the loam type are particularly adapted to this crop, where properly tilled. Recently rather large areas of Peat soils have been successfully planted to sugar beets, yielding from 10 to 14 tons per acre, but the sugar content is not as high as in beets grown on other soils. The average yield is about 10 tons per acre. The crop is cared for by foreign labor, mostly Russian and German. The erection of a 1½ million dollar refining plant at Belmond will undoubtedly increase the present acreage materially. The beets are now shipped to a factory at Mason City.

Barley was grown on 1,839 acres in 1919, with a total production of 40,279 bushels and an average yield of 21.9 bushels per acre. Both the 4-rowed and 6-rowed varieties are grown, the latter being considered the better. Barley is fed mostly to pigs. A very small part of the production is shipped to outside markets.

Hay and forage crops occupy an acreage next to oats. The total crop for 1919 is given as 93,973 tons grown on 45,403 acres. About one-sixth of this was wild hay, most of which is cut from untilled depressed areas of Webster silty clay loam. As late as 1900 the wild-grass hay tonnage for the county was nearly twice that of tame-grass hay. The former has rapidly decreased with artificial drainage of the farms.

Timothy and clover mixed constitute the chief hay crop at present. Oats are nearly always used as a nurse crop. A common practice in recent years has been to add some alsike and sweet clover seed to the mixture of timothy and red clover. Part of the hay crop is baled and shipped, but most of it is used on the farm. Considerable timothy is grown separately, both for seed and hay. Where timothy is grown for seed only, it is cut about the middle of July, generally later than oats, and thrashed from the shock. A comparatively small acreage is in clover alone. Seed is harvested from a considerable part of the crop. On the heavier soils that have been tiled little

trouble has been experienced in obtaining a crop. Heavy stands have been difficult to obtain because of winter killing.

Pastures are generally permanent. Most of the pastures are located on poorly drained Webster soil, which, because of an abundant moisture supply through the dry season, furnishes an excellent growth of blue grass, the principal pasture grass.

Millet is grown on a small acreage, some sorghum is raised for forage and hogging down.

Alfalfa has received practically no attention until within the last few years. It is being successfully grown and gives 3 cuttings, averaging 3 to 3½ tons per acre for the season. Northern-grown seed, mostly the Grim variety from the Dakotas and Minnesota, is generally used.

Sweet clover grows luxuriantly along the roadside over the entire county. It is grown on a few farms for hay and pasture.

Potatoes are a crop of minor importance, being grown on 1,051 acres in 1919 with an acreage yield of 42 bushels. Small fields of 1 to 3 or 4 acres are most common. In normal seasons enough are grown for consumption on the farm, with a surplus that nearly supplies the local market. Early Ohio, Rural New Yorker, Irish Cobbler, and Burbank are the most popular varieties. Potatoes for seed are raised commercially in small quantities. Sandy, loamy, and peat soils seem to produce the best yields. Potato blight and the potato leaf-hopper cause some trouble.

Trucking is not carried on to any extent. Enough vegetables are grown for home use, and occasionally a small quantity for market. Considerable sweet corn is raised over the county in small acreages.

Soy beans are being tried on quite a number of farms. They are planted with the corn by means of a special attachment on the corn planter. The crop is used for forage and silage, being cut, bundled, and shredded with the corn. This makes a very nutritious feed mixture. Ito San, Manchu, and Black Eyebrow seem best adapted to the locality. The medium green and yellow are particularly desirable for silage purposes.

Fruit is grown in a small way on practically every farm. Generally orchards are limited to 10 to 20 trees, but a very few contain several acres. Insufficient care of trees and the lack of windbreaks greatly cut down the yield of fruit. Plums, cherries, and a few pear trees are found, but the apple is principally grown. The orchards in the more rolling sections of the county are the most successful. Local markets are mainly supplied from outside sources, several cars of apples being shipped in every year. Strawberries, gooseberries, raspberries, blackberries, and grapes are raised, but in quantities that hardly supply the local demand. Many farmers buy quantities of commercial canned fruits in the fall for winter use.

The systems of farming are quite uniform over the county. Extensive rather than intensive methods are practiced. Crop rotation is practiced to some extent on every farm. On the heavier soils, which lie more or less flat, a rotation of corn and oats with an occasional seeding to timothy and clover is the general practice. More timothy and clover are used on the more rolling soil types. On many tenant farms corn and oats have been grown alternately, or corn year after year, with no change or inclusion of legumes or green-manure crops. Wheat is occasionally worked into the crop rotation on lighter and more sandy soils.

The adaptation of certain crops to particular soil types is generally recognized, but is not carried into the system of farming except in a general way. The staple farm crops are grown on all types over the county. The black, heavy prairie soils, where well drained, are recognized as the strongest corn land because of their high plant-food and organic-matter content. These soils, together with Peat, Muck, and occasionally the Clarion soils, are used for sugar-beet production. The Clarion loam also produces excellent corn and forage crops. Wheat is grown principally in the southwestern and eastern parts of the county, on the sandier and more rolling Carrington types. The narrow bottom or Wabash types are almost wholly used for pasture because of frequent overflows. There is not, however, a marked difference in the types of farming followed on the different soils of the county.

Ordinary farm machinery is used on all soils over the county. The farm equipment usually consists of the latest labor-saving machinery. There were 167 silos in the county in 1918, with many new ones under construction. Fifteen thousand three hundred and twenty-eight tons of silage was put up.

New and larger houses have nearly displaced the smaller houses of the earlier settlers. Nearly all the farmhouses are of wood. Power elevators, gasoline engines for pumping, trucks, and tractors are used over the entire county.

Plowing is still done mostly by horses, although an annually increasing acreage is being broken by tractors. Both the 4 and 5 horse hitches are used in plowing, 5 horses where the heavier soil types are worked. Fall plowing is quite generally practiced when possible, for the wet condition of much of the land will permit only very shallow plowing in the spring, particularly in wet seasons. The usual depth of fall plowing is from 4 to 6 inches. The heavier soil types, if plowed when too wet, bake on drying, the soil particles becoming cemented together into adobelike clods that seriously interfere with the further preparation of the seed bed and with subsequent cultivation. Care must also be taken on these types to prevent the forming of a hard and impervious plow sole, by changing

the depth of plowing each year. Such troubles have been reported by a number of farmers on the Webster soils.

Artificial drainage is necessary over a large part of the county to insure maximum production. Large open ditches or 42-inch concrete tile mains are used to conduct the excess water to the natural stream courses. Laterals of various sizes, depending on the water to be carried, extend back in all directions to the low and depressed areas. In the flat fields tile laterals are placed from 4 to 6 rods apart. In the smaller and heavier pockets it is necessary to lay them as close as 50 feet to provide adequate drainage.

Very little lime has been used on the soils of the county. The local farm bureau reports that six carloads of crushed limestone were used in 1918, mostly in the southeastern and southwestern parts of the county. Many of the soil types would be benefited by liming, but a large percentage of the black silty clay loam of the Webster series is slightly calcareous at the surface, and here application of lime would not be profitable.

According to the United States Census $4,891 was expended for fertilizers on 48 farms in 1919. Both acid phosphate and complete commercial fertilizers are used. Barnyard manure is applied mostly to corn land. The quantity produced is insufficient to maintain the supply of organic matter in the soil, except possibly on the heavy Webster soils that have been in cultivation only a comparatively short time.

Weeds of many varieties give considerable trouble, particularly in wet seasons. The weeds reported most frequently are quack grass, cocklebur, foxtail, morning-glory, Russian thistle, burdock, pink smart-weed, and wild mustard. These occur in widely scattered localities and generally only in small patches in the fields.

There was a rapid increase in the number of farms in the county from 1880 to 1900, but the individual acreage reached its maximum in 1900. The United States census shows 785 farms in 1880, and 1,885 in 1900. The average size of the farms increased from 140 acres in 1880 to a maximum of 195.1 acres in 1900. The number of farms reported by the 1920 census is 1,927, and the average size is given as 178.8 acres. The Iowa Agricultural yearbook for 1918 reports the total area occupied by buildings, feed lots, and public highways as 17,340 acres, and the total acreage in pasture is given as 70,670. The waste land that can not be utilized for any purpose is 5,935 acres. The majority of farms vary in size from 120 to 200 acres.

Farms operated by tenants have increased rapidly in number, as many of the owners have moved to town. The 1920 census shows 45.5 per cent operated by owners, 53.3 per cent by tenants, and 1.2 per cent by managers.

Most tenants prefer the share rent system, cash rent being paid for pasture land. On the share rent basis the owner generally receives one-half of the crops, delivered at the elevator. The work stock and farm implements are furnished by the tenant. In addition cash is paid for pasture land. Where farms are rented for cash the ordinary rates range from $7 to $15 per acre, depending on location of farm and the character of drainage and general improvements. For a few of the very highly improved farms a rental as high as $20 per acre is paid. Pasture and hay land rent for $5 to $7 an acre.

Recently sufficient farm labor has not been available, particularly during the harvest time and the corn-husking season. Most of the farm help is hired by the year. At the present time (1918) from $40 to $50 per month is paid, including board and washing. A few farms are reported paying as high as $60 to $65. During the grain-harvest season the wages range from $3.50 to $5 per day; for corn plowing $3 to $3.50; haying $4 to $4.50; and for thrashing from $4.50 to $5. Corn huskers are paid from 6 to 7 cents per bushel.

The price of land is quite variable over the county. An unprecedented rise in values took place between March 1 and September 1, 1918. Some farms sold during the latter part of that season brought twice the price asked in March. All improved lands increased in value from $50 to $100 an acre. The most highly improved farms lying close to the larger towns can now (1919) be bought for $325 to $400 an acre, well-improved farms 6 to 8 miles from town for $225 to $275 an acre, and poorly drained upland, with practically no improvements, and some of the lighter sandy soils for $160 to $200 an acre. The average value of well-improved land is between $250 and $300 an acre.

SOILS.

The material from which the soils of Wright County are derived is drift of the Wisconsin glaciation. This deposit consists of more or less finely ground rock, sand, gravel, and bowlders formed by the action of the ice on the underlying limestone, sandstone, and shale formation. The till plain, which comprises the smoother parts of the area, is covered by material spread out and packed by the glacier in its passage over the region. This drift approaches a loam in texture. The morainic hills in the eastern part of the area are composed of more variable materials. The finer materials predominate, but pockets of sand, gravel, and bowlders occupy the crests of the highest elevations. Beds of gravel outcrop in places on the steeper slopes. The unmodified drift is a yellow or gray compact mass quite retentive of moisture. Limestone fragments and finer particles from the same source form a large proportion of the material.

It is now believed that the characteristics of the soil in its present stage of development have been determined to a greater extent by the soil-forming processes, which have resulted in the accumulation of organic matter and in the weathering, leaching, and oxidation of the material near the surface, than by original differences in the character of the material.

The soils of Wright County were developed under the influence of a native vegetation consisting of a heavy growth of grasses. This vegetation was favored by a smooth but not flat topography and a rather high moisture supply. The original constructional surface of the region, with its poorly drained areas unfavorable to tree growth, and its heavy grasses that spread fires, prevented the encroachment of forest.

The heavy growth of grasses, flourishing upon soils generally retentive of moisture, resulted in the accumulation of large quantities of organic matter. This was in the form of finely divided carbonaceous material, chiefly derived from decomposed grass roots and intimately mixed with the mineral constituents of the surface soil. The percentage of the organic matter and the depth to which it affected the color and physical structure was determined very largely by average drainage conditions. On flats and in sloughs the black organic matter extends to a depth of 20 to 30 inches, while on the high, well-drained ridges it does not affect the soil below a depth of a few inches. The accumulation is also shallow in sandy spots where the drainage is excessive. Muck and Peat represent extreme conditions with respect to accumulation of organic matter. The development of the upland soils is determined partly by the topographic position. On the flat or undulating areas the average moisture content was formerly high, and the ground-water level was within 2 or 3 feet of the surface and in places higher. Consequently there was a large accumulation of carbonaceous material in the surface soil and upper subsoil, while the lower subsoil almost escaped leaching and oxidation, resulting in a deep black soil filled with organic matter over a light-colored or mottled calcareous subsoil. These are the characteristic features of the soils which have been classed with the Webster series. Similar conditions in the sloughs and depressions and on the poorly drained terraces give rise to the soils of the Fargo series.

Where the topography ranges from gently to sharply rolling the better surface drainage, the more vigorous movement of the soil water, and deeper aeration have resulted in leaching and oxidation to a depth of 3 or 4 feet. Soils of this group are represented by the Carrington series and occur along the better drained stream valleys and over the morainic hills. The typical profile has a dark-brown surface horizon with a fine granular structure, ranging in depth from

8 to 18 inches. This is underlain by a horizon of dark brown, usually very thin or only a few inches in thickness. The lower subsoil is brown or yellowish brown, heavier in texture than the upper horizon, and usually friable and coarsely granular. The carbonates have, as a rule, been removed to a depth of more than 3 feet below the surface.

To this group of soils belongs the Waukesha loam of the terraces. It has a profile similar to the Carrington in general appearance and differs from that series only in topographic position and origin. Although it is composed of materials of alluvial deposition, its composition is probably not greatly different from that of the Carrington soils.

The Buckner series, which also belongs to this group of soils, has dark-brown soils underlain by brown subsoils of a similar texture to a depth of more than 3 feet. The friable uniform subsoils distinguish these soils from the Waukesha series, which have heavier subsoils.

The soils of the Clarion series belongs to a stage of development intermediate between the Webster and the Carrington groups. The topography ranges from undulating to gently rolling. The series occupies the more gentle slopes near the small streams and poorly drained areas within areas of the Carrington soils. The better drainage as compared with the Webster soils has resulted in more or less leaching to a depth of 3 or 4 feet. The surface soils are dark brown to black. The upper subsoil grades downward from a dark brown into a brown, and the texture is heavier than that of the surface soil, being a silty clay loam. The unweathered lower subsoil is grayish brown to gray, approaching the color of the glacial drift from which it is derived. It has sufficient carbonates to effervesce with acid, and streaks of lime and lime concretions are common.

The terrace soils of the Bremer series have also been developed under conditions of poor drainage. The surface soils are almost black and usually have a fine granular structure. They are underlain by a mottled gray, yellow, and brown subsoil somewhat heavier as a rule than the surface soil. The carbonates have been largely removed to a depth of more than 3 feet, and in this respect they differ from the Fargo soils, which have a higher percentage of lime in the subsoil.

The soils of the O'Neill series are dark brown to black. The subsoils are light textured and give excessive drainage to the soil. These soils are leached of their lime to a depth of several feet.

The soils of the Wabash series were for the most part originally forested, but owe their dark color to being made up of recent alluvial deposition of material from other dark-colored soils. These soils

occur on the first bottoms. They are subject to overflow and are for the most part poorly drained.

The soils of this area have been differentiated into series on the basis of color, structure, and the general appearance of the soil profile. The series is further differentiated into types upon the basis of texture.

The following table gives the names and the actual and relative extent of the soil types mapped in this county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Webster silty clay loam	108,736	29.5	Peat	2,432	0.7
Webster loam	92,288	25.1	Fargo silty clay loam	1,984	0.5
Carrington loam	81,216	22.1	Wabash silty clay loam	1,856	0.5
Clarion loam	51,264	13.9	Waukesha loam	960	0.3
Wabash loam	6,848	1.9	Bremer silt loam	704	0.2
O'Neil loam	4,608	1.2	Fargo loam	384	0.1
Buckner loam	4,416	1.2	Gravel pits	192	0.1
Carrington sandy loam	3,648	1.0			
Carrington fine sandy loam	3,520	0.9	Total	368,000	.....
Muck	2,944	0.8			

CARRINGTON SANDY LOAM.

The surface soil of the Carrington sandy loam, to a depth of 10 inches, is a brown to dark-brown sandy loam. The subsoil is a coarse yellowish-brown sandy loam, having a grayish cast and containing considerable silty material. Many small pieces of rock, coarse sand, and gravel are incorporated in both the surface soil and subsoil.

There is a considerable variation in texture over this type. The more gentle slopes contain a higher percentage of organic matter and are of a more loamy character. Along the tops and sides of the ridges and knoblike crests of the hills the surface covering is generally a sandy to fine sandy loam underlain by loose, calcareous, gravelly material. Small rock fragments, assorted gravel, and occasional bowlders are scattered over the surface and embedded in the soil layer.

The Carrington sandy loam is practically all found in the southeastern corner of the county, in Blaine and Vernon Townships, where it occupies the conspicuous extended chain of hills in this moraine section. A few smaller ridges and knolls covered with this soil are scattered throughout the county, many of them too small to justify separate mapping. Two miles northwest of Dows, in section 26, Blaine Township, a prominent hill of glacial origin—

a kame—has a gravelly surface soil underlain at a depth of 15 to 18 inches by a coarse calcareous gravel.

The Carrington sandy loam is easy to till under a wide range of moisture conditions. Because of the loose structure crops are frequently damaged in droughty periods.

All the staple crops are grown, including corn. Clover and forage crops do well and are particularly needed to help maintain the supply of organic matter in the soil. Average crop yields are slightly less than on the Carrington loam.

The surface soil is acid over most of the type, except on the narrow areas along the crests of the ridges and their immediate slopes, where calcareous material is encountered within 10 to 30 inches of the surface. On the lower slopes an alkaline reaction is rarely obtained. Lime and phosphatic fertilizer should prove profitable where used in growing clover and other legumes. Rye is an excellent nurse crop for clover.

Because of its loose and porous nature, this soil should have particular care after planting. A dry mulch should be maintained over as much of the growing period as possible.

Seasonal variations have considerable influence on production, the higher yields being obtained in the more moist seasons.

The selling price of the land ranges from $150 to $250 an acre.[1]

CARRINGTON FINE SANDY LOAM.

The Carrington fine sandy loam is a brown to dark-brown fine sandy loam to a depth of 18 to 20 inches, where it passes into a light yellowish brown fine sandy loam, which becomes coarser with depth. The content of organic matter in the surface soil is low compared with the other soils of the area, as shown by the color. The surface soils are acid except on the gravelly ridges. Gravel and small bowlders are found on the surface and throughout the soil section. Most of the bowlders have been removed from the cultivated fields.

Numerous small outcrops of gravelly materials mixed with bowlders of assorted sizes appear at the sharper breaks and knolls along the hill crests. Gray calcareous sand particles, loose or cemented to rocks and pebbles, are always present in these gravel beds.

This type occupies broken hills and ridges north and east of Elm and Cornelia Lakes, and the higher hills along the Iowa River from 5 miles south of Belmond to where the stream leaves the county about 1 mile north of Dows. It also occurs in small disconnected strips and scattered areas north of Rowan.

This soil should be handled in the same manner as the Carrington sandy loam.

[1] Land prices given in this report pertain to the year 1919.

CARRINGTON LOAM.

The surface soil of the Carrington loam is a dark-brown, mellow, friable loam, 12 to 16 inches deep, with an average depth of about 14 inches. This is underlain by a yellowish-brown silty clay loam to clay loam, faintly mottled with gray and yellow in the lower depths. Coarse sand particles and occasional glacial pebbles are scattered through the subsoil layer. In places a gritty, coarse clay loam is encountered at a depth of 28 to 30 inches, and iron stains are found here and there.

The Carrington loam is most extensively developed in the morainic areas in the eastern half of the county, where the topography is gently rolling to rolling. Other areas are found in the western part, along the Boone River and extending back along its tributaries.

The soil of this type is somewhat variable in texture and depth. In the morainic region the surface soil is shallower, lighter in color, and contains a higher percentage of fine sand than where found on the gentle slopes along the smaller stream courses. Numerous outcrops of calcareous sand and gravel occur along the tops of ridges and knolls. Many narrow draws and depressions lying between these hills and occupied by heavy black silty clay loam are included in this type.

In the southwestern part of the county, along the steeper slopes of the Boone River, erosion has exposed large patches of yellowish-brown, gritty, clayey drift material. The Boone River, in forming a large bend about 2½ miles northwest of Woolstock, has cut into the upland, leaving a perpendicular wall of this till, 30 to 40 feet high and about 2 miles in length. These steeper eroded hillsides have little value except as pasture land. Many of them are wooded and support a natural growth of bluegrass.

A variation occurs in sections 23, 25, and 36 in Troy Township, along the east bank of the Boone River. Here the soil is a whitish-gray silt loam at the surface and passes into a tenacious grayish-brown subsoil containing many yellow mottlings and some iron stains. The subsoil has an impervious structure resembling hardpan. These areas are small, flat, and scattered, and contain a total of about 25 acres. Because of their small area and close association with the Carrington loam they were included with this type.

In Belmond Township, and in small, widely separated areas on some of the flat, gently sloping hillsides, the surface soils contain a higher percentage of silt and less fine sand than the typical Carrington loam. The texture here approaches a silt loam.

The surface drainage and underdrainage are excellent over most of the Carrington loam. On a few of the broad, flat tops, and gentle slopes of the hills artificial drainage is beneficial. Very few gullies

have been formed by erosion. The areas of this type vary considerably in elevation, but lie higher than any other soils in the county except the Clarion loam east of Clarion.

Nearly all this type is under cultivation. The rougher and more rolling areas adjacent to the streams are usually kept in grass. Forest areas are confined to narrow slopes along watercourses and are not extensive.

This soil type does not contain as much organic matter as the black Webster soils, but has better natural drainage, is very productive, and is one of the most desirable types in the county for general farming. The soil is mellow, easily worked, and warms up early in the spring. It has excellent moisture-holding capacity. Only small parts of the type on the more sandy knolls are affected by drought.

The usual staple farm crops do well on this type. Wheat growing in the county is largely confined to this soil. Raising and feeding of beef cattle and hogs is carried on extensively, and some horses and sheep are raised for sale. Most of the apples and other fruits raised are produced on this type.

The crop yields are comparable with those on the Webster soils. The corn crop may be somewhat lighter in dry years but will outyield the soils in the flatter areas in wet seasons. Wheat yields 15 to 30 bushels, with an average of about 20 bushels per acre. Spring wheat is grown almost exclusively. Small grains mature from 5 to 10 days earlier than on the heavier prairie soils.

Barnyard manure is applied on corn land. Some green-manure crops are turned under to help maintain the organic matter supply. Little commercial fertilizer is used.

The surface soil over the greater part of the Carrington loam is acid. Applications of limestone would be beneficial, particularly to clover land. Deeper plowing and more frequent raising and turning under of leguminous crops to supplement the organic matter obtained from the application of barnyard manures would increase the productivity of these soils.

The land values on the Carrington loam range from $175 to $300 an acre, depending on location, improvements, and general condition of the farm.

WEBSTER LOAM.

The surface soil of the Webster loam is a black, friable, heavy loam from 10 to 16 inches deep. The subsoil to 20 to 22 inches is a very dark brown to black plastic loam, and below this a yellowish-brown, crumbly silty clay loam, highly mottled with yellow and olive gray. The subsoil is strongly calcareous and contains many lime nodules. It is very heavy and plastic, but is gritty in the lowest depths, where

considerable coarse sand and occasional pebbles are incorporated. The underlying drift material, occurring below the 3-foot section, is a yellowish-brown to gray, mottled clay loam, highly calcareous and containing much coarse material. This type has developed under conditions of restricted drainage which have favored the accumulation of large quantities of organic matter in the surface soil and prevented the rapid leaching and oxidation of the subsoil.

The surface soil in the flatter areas is high in silt and clay, and frequently approaches a silty clay loam in texture. Where the surface relief is broken with low, moundlike elevations, much coarse material is present in both surface soil and subsoil.

Within areas of the Webster loam are many large irregular-shaped depressions and formerly ponded areas occupied by the Webster silty clay loam. These two types, differentiated on the basis of texture and drainage, merge so gradually in places that the boundaries between them must often be more or less arbitrary.

This type covers the greater part of the western half of the county. In the southern half of the county it extends eastward over the Wall Lake region to the morainic divide coming down from the east-central part of the county. Smaller disconnected areas are found in the northeastern corner of the county and throughout the morainic region, generally bordering ponded areas or poorly drained flats.

Natural drainage is poorly developed, owing to the flat topography, the only adequately drained parts being the low mounds and ridges interspersed throughout the area. The run-off was very slow until large ditches were dug to drain the numerous swales and depressions in which water collected.

This type forms some of the most desirable land in the State. The soil is very retentive of moisture, and droughts have never caused a crop failure. Excess of rainfall during the growing season is likely to cut down the crop yields materially. The soil is later than the Carrington type, there being a difference of 5 to 10 days in maturity of crops.

Most of the type is in cultivated crops or tame grasses. In the northeastern and northwestern parts of the county, on some of the poorly drained areas, the original prairie grasses flourish. The only forest areas are artificially planted windbreaks and woodlots.

Corn is particularly suited to the Webster loam. It is grown more extensively and can be grown continuously for longer periods on this land than on other types. The yields range from 40 to 80 bushels per acre, with an average of about 50 bushels. Oats ordinarily produce from 40 to 75 bushels per acre, and timothy and clover 1¼ to 1½ tons per acre. Some clover and alfalfa are grown and do well when the soils are well drained. Alfalfa yields from

3 to 3½ tons per acre. Very little wheat is grown. Sugar beets occupy a large acreage on this soil. They yield from 10 to 16 tons per acre, averaging about 12 tons. Potatoes do well in the more loamy places, but the tendency is to grow too much vine.

An alternation of corn and oats largely comprises the present rotation. An occasional seeding to timothy and clover is coming into practice on many farms. On some tenant farms corn has been grown in the same fields for a period of years. Soy beans are grown occasionally in the corn when it is to be hogged down or used for silage. Fruit growing is confined to a few trees on the individual farms.

Farms on this soil type are well improved. Rents ordinarily range from $7 to $15 an acre, depending on drainage, productivity of the farm, and improvements. The price of land varies from $225 to $350 an acre. A few highly improved farms located near Eagle Grove and Clarion sold recently (1919) for $400 an acre.

Drainage is the first improvement needed to produce maximum crops. The tile laterals are usually placed from 4 to 6 rods apart. Care should be taken to get sufficient fall in both laterals and mains to carry away promptly the excessive rainfall.

Fall plowing should be practiced where possible, to allow earlier work in fields. A system of crop rotation to include timothy, clover, and other legumes, should be followed. Where good drainage is established, alfalfa will make an excellent growth and yield. The return of all the stable manure produced, supplemented by systematic turning under of green-manure crops, should keep up the fertility of the soils without the use of commercial fertilizers, except where special crops are grown.

WEBSTER SILTY CLAY LOAM.

The Webster silty clay loam, to a depth usually ranging from 12 to 24 inches, is a black, sticky clay loam. This is underlain by a layer of dark-brown or mottled gray and brown, tough clay loam or clay having a thickness of a few inches. The lower subsoil is the parent material or glacial till, which has been modified only to a very slight extent by leaching or oxidation. In texture it is usually a clay loam, and in color gray or a gray mottled with yellow or brown. Where the lighter color prevails, the lower subsoil contains much white, silty, floury material, and the structure is quite friable. When dry it has a whitish-gray color and is either granular or chalky. In places a heavy mottled or olive-gray clay subsoil extends to a depth of 3 feet or more. A characteristic feature of the lower subsoil of this type, whatever its color or texture, is the presence of a large amount of lime. This lime has not accumulated in the subsoil, but

is lime of the original drift which has not been leached out. In places the surface soil is sufficiently calcareous to effervesce with acid, but as a rule the lime is not abundant in the material within 20 inches of the surface. Lime concretions and small shells are abundant in the newly drained soil.

The local variations that occur in the type are due mainly to different conditions of drainage. As a rule the lower areas that have the most restricted drainage have accumulated a larger amount of organic matter, and the black color of the soil extends to a greater depth, in some places to more than 3 feet. Small spots of Peat and Muck, too small to indicate separately, have been included on the soil map within areas of this type. In some of these low areas the soils are heavier in texture than on the surrounding higher land, owing to washing in of fine material. These clay areas, too small to map, are scattered throughout the type and are locally known as "gumbo."

In the narrow draws and sloughlike areas of the morainic region the subsoil below 30 inches usually consists of layers of coarse gravelly material, grayish in color. The depth of the black surface and subsurface layer varies from place to place, ranging from 15 inches to 3 or 4 feet.

The interstream area between Eagle Creek and White Fox Creek, in the southern part of Dayton and the northern part of Woolstock Township, mapped as Webster silty clay loam, while lying flat, contains a higher percentage of silt and sand in the surface layer and consequently is slightly lighter in texture than the typical soil.

The Webster silty clay loam usually occupies depressed areas on the flat interstream divides, which were formerly in a swamp condition or covered at times by shallow water. They also occur in the morainic area, lying in undrained sloughs and flats between the hills.

The drainage is naturally poor but has been improved by ditching over the greater part of the area. Large open drainage ditches, 8 to 15 feet deep, furnish outlets for the tile drains. Owing to the impervious character of the subsoil these lateral drains should not be more than 40 feet apart.

When properly drained and handled this is one of the most productive soils in the county. It has a higher plant-food reserve than any other type. Puddling and baking, with consequent clod formation, will result if the ground is plowed when wet. In dry seasons, if the surface is not stirred frequently, large cracks develop in the fields with injury to crops. While the greater part of the soil is under cultivation, a considerable area is yet undrained and is used for hay and pasture land. Practically all the wild hay produced in the county is harvested from this type.

Grain farming is mostly practiced where this type is well drained. The soil is particularly adapted to corn because of the high humus content. Early-maturing varieties are desirable, the growing season being shorter than on higher lying and better drained types. Short-strawed varieties of oats are preferred, as they are less likely to lodge.

Corn yields vary greatly on this type, depending on the seasonal conditions, extent of drainage, and care given the crop. The yields range from 25 to 70 bushels per acre. Oats yield from 25 to 50 bushels, and hay from 1 to 2½ tons per acre. Sugar beets are grown in many places where the surface has a shallow loamy covering. They yield from 10 to 15 tons per acre.

The Webster silty clay loam is generally associated in the farms with the Carrington and Clarion types or the Webster loam. It brings about the same prices as the Webster loam. The untiled and undrained areas, where there is a possibility of drainage, sell for much lower prices, ranging from $150 to $225 an acre.

The most important factor in the improvement of this land is drainage. Deeper fall plowing and generous applications of barnyard manure will greatly improve the physical condition and tilth of the soil.

Narrow strips of land containing a concentration of salts, mostly calcium carbonate, occur in some depressions in this type, along the margins of Muck and Peat beds and the edges of areas formerly ponded. Corn and oats usually fail on these patches, while other crops are not seriously affected or may even thrive. This alkali condition can be remedied by thorough drainage. Stover and straw are beneficial when plowed under deeply, and heavy applications of barnyard manure markedly improve the affected areas.

CLARION LOAM.

The Clarion loam in its principal characteristics represents a transition between the Carrington loam and the Webster loam. The local variations in the type itself are due to the different conditions of drainage under which the soil has been developed. In low or nearly flat areas, where little aeration or oxidation could take place, but where conditions were favorable for the accumulation of organic matter, the type has a black soil, 12 to 20 inches deep, underlain by a gray, highly calcareous subsoil, and the soil profile approaches that of the Webster loam. Occasional iron stains and numerous lime concretions are found in the lower subsoil. On the higher, gently rolling areas, where drainage has been better, the surface soil has a dark-brown color and is shallower, ranging from 6 to 12 inches. The upper subsoil is a dark-brown clay loam, which passes gradually

into a brown, more friable clay loam. At depths of 20 to 30 inches the slightly oxidized glacial till is encountered. It is a light-brown, yellowish-brown, or grayish-yellow, friable clay loam or silty clay loam. In the rolling areas the upper two layers are not essentially different from the corresponding horizons of the Carrington loam. The difference between the two types is the presence of lime in the subsoil of the Clarion loam, an indication that leaching and oxidation in the Clarion have not reached to a depth of 3 feet.

The two soil profiles described as extremes of the type are the products of different stages of weathering and leaching. The type passes on the one hand into the Webster loam and on the other hand into the Carrington loam, but between the two are all gradations resulting from differences in the drainage.

Some variation in both soil and subsoil is due to differences in the composition of the original drift. Small quantities of coarse sand, pebbles, and small bowlders, composed of quartzite, granite, and limestone are scattered through the soil and subsoil but are usually more abundant in the lower subsoil. With this type, as with the Carrington soils, are included narrow strips on the crests of ridges and on steep hill slopes where the dark-colored surface soil has been eroded away so as to expose the light-colored calcareous parent till. Usually near the surface on such areas pockets or beds of sand and gravel are numerous.

The Clarion loam occurs in all parts of the county, but the areas of the type are larger and more abundant on the gentle slopes toward the streams. Areas with the dark-brown surface soil are also found on some of the morainic hills where erosion has not removed the surface soil faster than weathering could take place.

This type is highly productive. Before the Webster soils were drained it was the most valuable soil of the area. The high lime content of the subsoil indicates that it has not been leached but has all its original soluble constituents. Fertilizers are not used, as it has not been demonstrated that the application of any form of plant food is immediately profitable. Over the greater part of the area no lime is needed. It is possible, however, that the surface soil in some places is acid and the application of small quantities would be beneficial.

The system of farming on this type is similar to that followed on the Carrington loam. No systematic rotation of crops is practiced. Corn, the principal crop, is grown for years in succession in the same fields. Clover is less frequently grown than on the Carrington loam. Crop yields are slightly higher than on the Carrington loam, but lower on an average than on the well-drained Webster soils.

The price of this land at the time of the survey (1919) ranged from $225 to $300 an acre. A few well-improved farms with choice locations have sold for $350 to $400 an acre.

The following table gives the results of mechanical analyses of samples of the soil, subsurface and subsoil of the Clarion loam:

Mechanical analyses of Clarion loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
333710	Soil	1.2	4.9	4.1	20.5	18.4	34.6	16.4
333711	Subsurface	1.2	6.4	5.8	27.9	17.9	28.1	13.1
333712	Subsoil	2.1	6.8	5.9	22.7	16.4	30.3	15.8

FARGO LOAM.

The surface soil of the Fargo loam is a dark-brown to black loam 10 inches deep. The upper subsoil is a dark-brown clay loam to clay, considerably mottled with gray and faintly with yellow. Below 28 inches the subsoil is a grayish-brown or yellowish-brown clay loam to clay, mottled highly with gray and showing occasional iron stains. This lower stratum is highly calcareous and contains many small lime concretions. Coarse sand and gravel are found in small quantities throughout the soil profile.

This soil is developed on the terraces of the Boone River, 2½ miles below its point of entrance into the county. One other area is mapped, in the southeastern corner of the county in section 24, Vernon Township. The total area of the type is only 384 acres.

This type occupies a flat terrace bench. Owing to its heavy subsoil it is very retentive of moisture. The soil has a high content of organic matter and produces good yields.

Included with this type is a small area of Fargo very fine sandy loam. The surface soil is a dark-brown, mellow very fine sandy loam 18 inches deep, and the subsoil a dull-brown to dark-brown silty clay loam. The latter is noncalcareous, contains a relatively high percentage of fine sand particles, and is loamy. This soil lies on the east side of the Boone River, where it enters Hamilton County about 2½ miles west and south of Woolstock. It covers about 20 acres, is well drained, and is in cultivation.

FARGO SILTY CLAY LOAM.

The Fargo silty clay loam consists of 6 to 8 inches of black tenacious silty clay to clay loam, underlain by black clay loam containing gray mottlings. Below 22 inches the subsoil is a grayish-

brown to yellowish-brown clay loam having a grayish chalky appearance when dry. Calcareous nodules are found quite generally throughout the subsoil section. The surface soil usually gives an alkaline reaction. The black soil stratum in places occupies the entire 3-foot depth. The surface soil is not always uniform in texture, sand and gravel particles being incorporated in places.

The type usually occupies the flat and depressed areas at the back of the lower terraces abutting on the upland. Narrow strips lie along the Iowa River through its course in the county, but are nowhere continuous for any great distance. The largest area, covering about 200 acres, is situated on a small creek 2½ miles southwest of the point where the Iowa River leaves the county. Small areas are found west and south of Eagle Grove along Boone River.

The natural drainage is not sufficient for maximum crop production, and tile drains must be used to carry away the excess water. Many of these areas were formerly ponds, and a few are still undrained. The soil is very productive, crop yields being comparable with those on the strong upland soils. This type is usually farmed in fields with the sandier terrace types.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of this type.

Mechanical analyses of Fargo silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
333720	Soil	0.6	4.6	5.0	16.5	10.1	46.8	16.7
333721	Subsurface	1.2	5.2	5.0	12.8	11.1	43.8	20.7
333722	Subsoil	2.6	5.4	4.5	13.7	8.9	47.6	17.3

BUCKNER LOAM.

The Buckner loam consists of a brown to dark-brown loam, passing at 10 to 14 inches into a yellowish-brown sandy loam to fine sandy loam. The soil section contains coarse sand and small gravel at all depths, but in greater quantities in the lower part. Small pieces of white flint rock particles occur in the subsoil occasionally. No calcareous material is present.

The Buckner loam is underlain by gravel at 4 to 6 feet below the surface. Pockets of gravel occur here and there throughout the type under small depressed areas, and occasionally can be reached within the 3-foot section 10 to 20 feet back from the overflow lands.

Among the terrace soils the Buckner loam is second in extent of area, the O'Neill loam being first. It occurs along the entire course

of the Iowa River, beginning 5 miles south of Belmond, and north along the Boone River, beginning west of Eagle Grove. A small area is found 4 miles north of Woolstock and one to the west of Woolstock along Eagle Creek.

The areas of this type are disconnected bodies, irregular in shape, and with a wide variation in length and width. They extend back from the river a maximum distance to a point 1½ miles east of Cornelia Lake. Two benchlike elevations occur along the Iowa River, the first being about 10 feet and the second from 15 to 25 feet above first bottom or overflow. The surface is for the most part flat, with a gentle incline toward the stream, and is little modified by stream erosion. The drainage is excellent.

Nearly all the Buckner loam is in cultivation to staple crops. The subsoil is fairly retentive of moisture, and crops suffer from lack of moisture only in prolonged droughts. Only a few farms consist wholly of this type. The soil is mellow, easy to cultivate, and produces yields comparable to those on the adjacent upland types. Corn yields 30 to 50 bushels in normal seasons.

The foremost problem on the Buckner loam, as on all porous terrace types, is the maintenance of organic-matter supply. Much barnyard manure should be supplied to meet this deficiency and increase the moisture-holding power. Leguminous crops plowed under would be beneficial. Applications of lime should precede clover.

The price of farm land on the Buckner loam ranges from $150 to $250 an acre.

A sandy variation of the Buckner loam, occurring in several small areas 5 miles south of Belmond, consists of 10 to 14 inches of brown sandy loam to loam, grading into a yellowish-brown fine sandy loam, becoming lighter in color with depth. Considerable coarse sand and occasional small gravel are present in the lower subsoil.

This variation occupies a very slightly higher position than the typical Buckner loam, with which it is closely associated. This soil is all under cultivation. It has the same agricultural value and the same selling price as the typical soil.

O'NEILL LOAM.

The surface soil of the O'Neill loam consists of a dark-brown friable loam 12 inches deep. The subsoil is a slightly lighter brown sandy loam to fine sandy loam to a depth of about 28 inches, where it passes into a brown to reddish-brown fine sandy loam, containing much coarse material and pebbles. At from 30 to 40 inches stratified noncalcareous gravel and sand are encountered. Some gravel is found in both the surface soil and upper subsoil layers.

Practically all the O'Neill loam occurs along the upper course of the Iowa River and the West Branch in a rather continuous body 7 miles long and about 1½ miles wide. It is intersected by the windings of the river channel. It has a flat, benchlike surface and lies 10 to 15 feet above overflow. Beginning 1 mile north of Belmond and extending northward nearly 2½ miles between the Iowa River and the West Branch lies an older terrace bench 15 to 20 feet above the normal terrace level. The soil covering here is shallow, about 12 to 15 inches thick, and is underlain by coarse gravel. Several large commercial gravel pits are in operation on this terrace as far south as Belmond. A few small isolated benches are found along Boone River south of Eagle Grove and to the east along Eagle Creek.

The internal drainage is good to excessive, owing to the porosity of the soil material. No streams issuing from the uplands cross the type to give it surface run-off, the rainfall escaping through percolation downward. In prolonged dry weather the type is somewhat droughty.

It is all under cultivation except the town site of Belmond and 150 to 200 acres which have been stripped of their surface covering in the removal of gravel. Corn yields from 25 to 45 bushels per acre in seasons of normal rainfall, and oats from 25 to 40 bushels. Timothy and clover give good returns. Potatoes and truck crops ordinarily yield well.

Land values range from $175 to $300 an acre, according to the distance from town and the improvements.

This soil is acid throughout the 3-foot section, and applications of lime would be beneficial, particularly to clover. Turning under green manures should be practiced to supplement the available barnyard manure.

BREMER SILT LOAM.

The Bremer silt loam is a dark-brown to black friable silt loam to a depth of about 14 inches, here changing to a brown to dark-brown plastic clay loam mottled with gray, and below 26 inches to a yellowish-brown clay loam mottled with gray and yellow. The lower layer contains fine particles of granite, gneiss, and quartz, and occasional small pebbles. The surface soil in places is relatively high in sandy material and approaches a loam in texture.

This soil occupies low terraces on the east side of the Iowa River 1 mile south and 1¾ miles north of Belmond. The largest and most representative area consists of a strip 2 miles long and one-half mile wide along a small creek south of Dows.

This type is all in cultivation. The soil is mellow, easily tilled, and productive, and excellent yields are obtained. Internal drainage is somewhat imperfect. It can be improved by laying tile drains.

WAUKESHA LOAM.

The surface soil of the Waukesha loam is a brown to dark-brown light-textured loam, 14 inches deep. This is underlain by a sandy clay loam which when moist is yellowish brown and when dry reddish brown. Considerable coarse sand, small gravel, and pieces of granite rock are scattered throughout the soil section. Very small pieces of a white rock, resembling limestone, are also present, but negative results were obtained in tests for lime.

Much assorted gravel is found in the lower subsoil, the texture being a gravelly loam to clay loam. This soil differs from the O'Neill loam in having more clay incorporated with the sand and gravel in the subsoil and on that account being less porous and droughty.

This type occupies the higher benchlike terraces along the lower courses of the Boone River only, and occurs in disconnected areas. The original level surface has been modified by action of the drainage waters from the adjacent uplands and is now gently undulating to undulating. The coarse material in the soil permits a rapid absorption of rainfall and gives good internal drainage.

All the type is under cultivation. The common staple crops are grown, with normal yields comparable to those on the upland types. Because of the loose structure of the soil, crop yields are affected by prolonged droughts, but these are of rare occurrence. Green manures should be used in addition to stable manure to increase the organic-matter content, which is low.

WABASH LOAM.

The surface soil of the Wabash loam is prevailingly a dark-brown to black friable loam ranging from 15 to 20 inches in depth. The subsoil is usually heavier than the surface soil, being a dark-brown silty clay loam containing some fine and coarse sand. The entire soil section is quite variable, owing to the alluvial origin of the materials. Most of the surface soil is reworked annually during the spring overflows. Consequently, small scattered areas of fine sandy loam containing varying amounts of coarse material are frequently encountered. Bodies of silty clay loam too small to separate are included with this type.

The Wabash loam occupies the flood plains of the Boone River, the West Branch of the Iowa, and the Iowa River. Narrow strips are also found along Otter, Eagle, and White Fox Creeks.

In only a few places is this soil under cultivation. Forest trees are thinly scattered over the flood plains, the growth being heavier close to the stream courses.

A luxuriant growth of bluegrass over most of this area furnishes excellent pasturage. Flowing wells can be obtained at most points in this type.

WABASH SILTY CLAY LOAM.

The surface soil of the Wabash silty clay loam consists of 8 inches of dark-brown to black heavy silty clay loam, having a faint grayish cast. The subsoil is a dark-brown tenacious clay loam to clay, mottled with gray.

This type occupies poorly drained draws and depressions throughout the Wabash loam areas. The total extent is small, and agriculturally the type is unimportant. Shallow water covers the smaller areas during the spring season. Along the upper course of Otter Creek, where the stream channel is only a few feet deep, calcareous material is encountered within the 3-foot section. Practically all of this type is used as pasture land, but a little wild hay is cut from a part of it.

PEAT.

The Peat soil to a depth of 10 to 18 inches consists chiefly of decomposed vegetable matter, forming a loose, spongy mass. The surface is light brown to reddish brown when dry, but dark brown under normal conditions. The underlying subsoil is a layer of black tenacious silty clay loam, varying from 10 inches to 2 feet in thickness. This is underlain generally within the 3-foot depth by a grayish sandy clay to clayey sand. Both subsoil layers are highly calcareous. Small white shells and lime particles are present on the surface of the shallower beds.

The natural development of the Peat is in shallow undrained basins, ponds, or lakes, in which a dense growth of sedges, rushes, and other aquatic plants abound. The decay and accumulation of the plant leaves and fibrous roots form a loose, porous, semidecomposed vegetable mat. In this raw stage it is of no agricultural value.

The Peat areas in the county have nearly all been drained, many of them only a short time. In some of the large areas the accumulations are 4 to 5 feet deep near the center of the basin. As a rule, the depth does not exceed 20 to 24 inches, and in many areas of smaller size the layer has a thickness of only 6 to 14 inches. A considerable proportion of silt and clay is found mixed with the vegetable matter in the smaller areas.

The Peat is widely distributed over the county, in areas ranging in size from one to several hundred acres. The two largest areas are located 1½ miles west of Dows and one-half mile east of Wall Lake. Patches too small to map occur in wet draws and small depressions on many farms in the heavier black soil areas.

Narrow strips containing alkali concentrations occur along the margins of many of the Peat areas. Thorough drainage by means of tile, deep plowing, and heavy applications of manure, are effective means of correcting this alkali condition.

Millet and timothy give good yields on both deep and shallow Peat, producing from 1 to 2½ tons of hay per acre. They are the most profitable crops on the newly drained land. Some farmers grow flax as the first crop and obtain a fair yield.

Corn and small grains do not do so well. Corn makes a rapid growth for a few weeks, then becomes stunted in growth and produces small nubbins. This is usually caused by the presence of alkali salts which, if concentrated, cause the leaves to turn yellow when the plant is about 1 foot high and checks further development. Small grains usually lodge before the grain can ripen. Sugar beets are being grown successfully on beds that have undergone considerable decomposition. The beets grow very large and yield from 15 to 18 tons per acre. Potatoes are grown on a few acres, generally for home use. Weeds cause considerable trouble where grain is grown.

The plan of seeding the land to timothy and alsike clover after draining, and pasturing heavily for several years before growing crops has been found to give the best results. Thorough drainage is, of course, the first essential in reclamation. Deeper plowing will hasten the decomposition by permitting deeper weathering and oxidation. Applications of phosphate and potash might be profitable when special crops are grown.

MUCK.

The surface soil of Muck is in general similar to that of Peat, the chief difference being the more advanced stage of decomposition of the vegetable matter in the case of Muck. The material, when dry, is loose and fluffy, and the color generally black. Considerable mineral matter, mostly silt and clay, is incorporated around the edges of the Muck deposits, having been washed in from higher adjacent soil areas. A covering of Peat 2 to 3 inches deep is present on some of the smaller spots. An alkaline reaction is obtained in many cases from the surface soil of beds that have been recently drained. Fine lime particles and white shells lie scattered over the surface of some areas. The subsoil below 18 to 20 inches is a black, sticky, calcareous silty clay loam to clay, which passes at 34 to 40 inches into a dull-grayish clay loam to clay. Occasional pockets of sand are encountered in the lower depths of the 3-foot section.

Since the separation of Muck and Peat is based upon the state of decomposition of the vegetable matter, the distinction is necessarily arbitrary in many cases. Where the vegetable matter is so finely

divided that the fibrous material and plant tissues can not be identified, the classification Muck has been given. Black Peat is the name locally applied to Muck.

Muck is developed in small areas scattered over the entire county. It occupies low, formerly ponded areas and undrained sloughs where water now stands from 4 to 15 inches deep the entire year. Where these inundated beds occur, marsh symbols are used to indicate the condition. Many of the Muck areas have been drained and are under cultivation. The poorly drained areas all support a more or less dense growth of water-loving grasses, cane, and rushes.

Muck gives fair crops of corn on well-drained fields that have been in cultivation several seasons. Timothy and clover yield well. Sugar beets are grown successfully on a number of small areas. These soils are especially adapted to onions, celery, and truck crops.

Where crops are injured and retarded by concentrations of alkali salts, manure should be applied after adequate drainage has been established.

SUMMARY.

Wright County is situated just north of the center of the State of Iowa and has an area of 575 square miles, or 368,000 acres.

The land surface is that of a broad, level drift plain, broken in the eastern half by scattered hills. The county varies in elevation from 1,008 to 1,240 feet above sea level.

A belt of high morainic hills, beginning in the north-central part of the county and extending in a general southeasterly direction, forms a drainage divide between the Iowa River on the east and the Boone River on the west side of the county. These two rivers, with their few tributary streams, constitute the drainage system. Over most of the county the drainage is sluggish to poor.

The first settlement in the county was made in 1854 near the present town site of Woolstock. The 1920 census gives the population of the county as 20,348. A little more than 64 per cent of the population is classed as rural.

Good railroad facilities are supplied over the county, giving direct communication with Chicago, St. Paul, Omaha, and Sioux City markets.

Eagle Grove, Clarion, Belmond, Dows, and Goldfield are the principal trading centers. Local shipping points are conveniently distributed over the county.

The mean temperature for summer is 70.5° F., and for winter, 17.5° F. The mean annual rainfall is 32.36 inches. This is normally distributed so that all staple crops of the region thrive. The growing season extends over an average period of 152 days.

The principal industry in Wright County is agriculture. It consists mainly of grain farming combined with the raising and fattening of live stock. The chief crops are corn, oats, and hay. Hog raising is the most important live-stock industry. Many carloads of cattle and a few of sheep are shipped in annually and fattened for market.

There were 1,927 farms in the county January 1, 1920, having an average size of 178.8 acres. In recent years tenant farms have rapidly increased in number. At present only 45.5 per cent of the farms are operated by owners.

Substantial homes and auxiliary farm buildings are found in the county. Rural mail and telephone service is good. Excellent rural schools are accessible to all communities.

Farm lands bring a cash rent of $7 to $15 an acre and sell for $160 to $400 an acre, depending on improvements and location.

The soils of Wright County are classed in nine series and are represented by 16 types, including Peat and Muck. They are prevailingly dark brown to black in color, and loams in texture. The Carrington, Webster, and Clarion series occupy the upland division.

The Carrington loam is one of the more extensive types in the county. It is particularly adapted to corn and oats. Timothy, clover, wheat, and barley are also grown. The Carrington sandy loam and fine sandy loam occur in the morainic region in areas of Carrington loam. These soils are rather loose and open, lighter colored, contain less organic matter, and are generally less productive than the heavier types.

The Webster soils, which are first in extent, are black in color, productive and durable. They occupy the broad, level prairies and all require artificial drainage for maximum production. When well drained they are the strongest and most productive soils in the county. The silty clay loam lies in the flat, poorly drained depressions, many of which were formerly sloughs or ponded areas. The Webster loam is gently undulating to gently rolling and has better natural drainage. These soils are characteristically calcareous.

The Clarion loam is a heavy, dark-brown to black, mellow soil, very productive, and better drained than the Webster soils. The soil profile is similar to the Carrington loam to a depth of 30 to 34 inches, where a yellowish-gray calcareous layer is encountered.

The alluvial second-bottom, or terrace, types are included in the O'Neill, Buckner, Waukesha, Fargo, and Bremer series.

The O'Neill loam, Buckner loam, and Waukesha loam have a rather loose, open structure, and crops thereon are subject to injury in prolonged droughts. All staple crops are grown and in normal seasons give good yields, though slightly lower, than yields on the upland types.

The Fargo loam and Fargo silty clay loam occupy flat or depressed terrace positions and are naturally poorly drained. When handled properly they are strong and productive.

The Bremer silt loam is inextensive, lies flat, and has a heavy subsoil. In productiveness it is comparable to the Webster loam.

The Wabash loam is the only first-bottom type in this county. It is subject to overflow annually and is practically all used for pasture.

The Muck and Peat soils occur in formerly ponded areas, sloughs, and old lake beds. They consist of partially decomposed vegetable matter. When drained and properly handled for a few years they can be made to produce excellent crops.