Series 1933, No. 32 Issued June 1940

Soil Survey

Davis County Iowa

By
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and
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United States Department of Agriculture

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
In cooperation with the
Iowa Agricultural Experiment Station

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SOIL SURVEY OF DAVIS COUNTY, IOWA

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Area inspected by T. D. RICE, Inspector, District 3

United States Department of Agriculture, in Cooperation with the Iowa Agricultural Experiment Station

COUNTY SURVEYED

Davis County is in the southeastern part of Iowa, about 70 miles southeast of Des Moines (fig. 1). Its southern boundary coincides with the Missouri State line, and it is the third county west of the Mississippi River. It is rectangular in shape and contains 15 civil townships, 5 of which coincide with the United States townships. The total area is 501 square miles, or 320,640 acres.

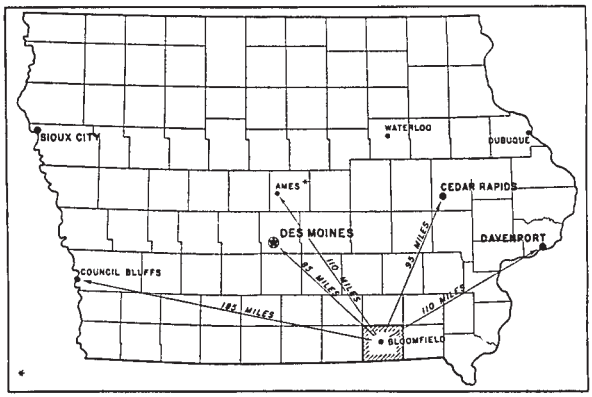

FIGURE 1.—Sketch map showing location of Davis County, Iowa.

Geologists tell us that the land included in this county was once a nearly level plain, of which only remnants remain. Streams drain all parts of the county and, with their tributaries, have thoroughly dissected all but comparatively small areas of the original flat surface. A thin mantle of loess covers the upland interstream divides, but on the lower slopes all, or practically all, of the loessial materials have been removed by the normal processes of geologic erosion. Glacial drift materials, now exposed on these stream valley slopes, are principally of Kansan age.

The general slope of the land is to the southeast and east. So thoroughly has the land been dissected that surface drainage is excessive over much of the county, run-off is rapid, and much soil material is removed annually from the steeper slopes by erosion. The practically

[1] The Soil Survey Division was transferred to the Bureau of Plant Industry, July 1, 1939.

level ridge tops, ranging from one-eighth to 1 mile in width, which have not yet been penetrated by the minor stream branches, are the only upland areas not affected to some extent by accelerated erosion. These flat ridges, for the most part, are poorly drained because of their almost level relief and the heavy impervious character of the subsoils.

In approximately the southern five-eighths of the county the general direction of stream flow is southeastward, and across the northern part it is northeastward. The Des Moines River cuts across the extreme northeastern corner and, together with Soap Creek, a tributary crossing the northern part, drains about three-eighths of the total area. The Fox River carries the drainage of the central part, and the South Wyacondah River, Carter Creek, and Fabius Creek most of that of the southern part. All drainage waters eventually reach the Mississippi River. Most of the tributary streams are short, ranging from 1 to 8 miles in length. All the main streams, with the exception of the Des Moines River, are deepening their channels.

Alluvial lands are developed along all streams but are most extensive along Soap Creek, the Fox River, and the Des Moines River. They are largely first bottoms or overflow land. Artificial channels through the bottoms of the Fox River, the South Wyacondah River, and Fabius Creek have greatly reduced damage to crops from overflow, as they carry away floodwaters and prevent overflow, except in periods of abnormally heavy and continuous rainfall. Second bottoms, or terraces, which are inextensive, occur principally along Soap Creek. They are nearly level and lie well above overflow.

The most strongly rolling areas are in the northern part of the county, along Soap Creek and the Des Moines River and their tributaries. Most of the forests grow on these slopes. They include chiefly oak, together with some hickory, elm, walnut, ash, boxelder, plum, wild cherry, and crab apple. A sparse growth of trees is scattered along the bottom lands, mainly along and near the stream channels. Nearly all of the large timber has been removed, but a small quantity still is being cut and worked into rough lumber for local use. Much of the forest growth is cut for fuel and fence posts. Areas of light-colored soils on the slopes and upland divides indicate the land that originally was forested.

The lowest elevation is in the valley of the Des Moines River, less than 630 feet above sea level, and the highest, near West Grove, is about 950 feet.[2] Elevation in other parts of the uplands[3] are Bloomfield, in the central part of the county, 845 feet above sea level; Drakesville, in the northwestern part, 891 feet; and Pulaski, in the southeastern part, 833 feet.

Davis County is a part of the territory originally purchased from the Sac and Fox Indians in 1842. During the following year the land was opened and the first settlement within the present county boundaries was made.

The total population of this county, as reported in the 1930 Federal census, was 11,150, all classed as rural. Bloomfield, the county seat,

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[2] AREY, MELVIN F. GEOLOGY OF DAVIS COUNTY. Iowa Geol. Survey 20: [487]–524, illus. 1910.

[3] GANNETT, HENRY. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. U. S. Geol. Survey Bull. 274, ed. 4, 1072 pp. 1906.

had a population of 2,226 in that year; Pulaski, 376; Floris, 209; and Drakesville, 190. Other towns of importance as shipping points and trading centers are Monterey, West Grove, Belknap, and Bunch. Practically all of the people are American born.

Most of the public roads follow land lines. In only a few places are the highways diverted, because of rough or hilly slopes, to follow stream valleys or ridge tops. United States Highway No. 63 traverses the county from north to south near the center, passing through Bloomfield, and a paved State highway crosses from east to west, also passing through Bloomfield. Some of the secondary roads are graveled, but most of them are dirt roads. Practically all of them are graded and kept in good condition.

Rural schools adequately serve all sections. They are located at about 2-mile intervals, which makes them accessible to all farm homes. Grade and high schools are located in the larger towns, but there are no consolidated schools. Churches of different denominations are scattered over the county, except in the northern and northwestern parts. Telephone lines reach most sections. The Iowa State Yearbook of Agriculture reports radios in 451 country homes in 1935. There are a few power lines, principally in the central and southeastern parts, but on only a comparatively small number of farms is electric power used.

Railroad transportation is adequately provided by a branch line of the Chicago, Burlington & Quincy Railroad from Fort Madison, extending through the southeastern part of the county to Bloomfield; a branch of the Wabash Railway from Moulton, Iowa, to Ottumwa, Iowa, serving the west-central part and territory north of Bloomfield to the northern county line; and a line of the Chicago, Rock Island & Pacific Railway, crossing the northern part. Large trucks do much hauling of freight. Cattle, hogs, and sheep for sale are transported by truck and are marketed mostly at Ottumwa, but a small number are shipped to Chicago by rail. Wool is shipped direct to the commission dealers or sold to local agents, as there is no cooperative wool-marketing organization in the county. Most of the poultry and eggs are marketed locally, but local dealers also maintain routes over which poultry and eggs are collected at the farm homes for sale outside. Cream routes serve the eastern side of the county, collecting cream at the farms for a creamery at Keosauqua, Van Buren County.

Part of the county is underlain by coal beds,[4] and a number of slope and shallow shaft mines were operated at one time, principally along Soap Creek in the northeastern corner, where layers of coal outcrop in places on the steeper slopes. The coal veins range from 2 to 5 feet in thickness and differ much in quality. The better beds lie at a depth ranging from 100 to 250 feet. No commercial mines are now operating.

The greater number of dug wells range from 15 to 30 feet in depth, but a few are as deep as 50 to 60 feet. Most of the drilled wells are from 70 to 100 feet deep, and the city well at Bloomfield is 1,817 feet deep. The water supply for farms is pumped largely by hand, and gasoline engines are used for pumping on some farms. A compara-

[4] See footnote 2, p. 2.

tively small number of windmills are scattered over the county, chiefly in the central and southeastern sections.

CLIMATE

The climate is suited to the growing of all crops common to the Corn Belt. The summers are hot and the winters moderately cold. No climatic station is maintained by the United States Weather Bureau in this county, and the following data are compiled from records of the station near Bonaparte, in Van Buren County, which adjoins Davis County on the east.

The highest temperature recorded is 112° F. in July, and the lowest is −31° in February. The mean annual temperature is 50.2°. The rainfall normally is well distributed. Droughts are usually of short duration and cause only slight damage to crops, but occasionally they are very severe and reduce crop yields as much as 50 percent. The mean annual rainfall is 34.19 inches, with about 50 percent falling during the growing season. Precipitation in the winter is mainly in the form of rain, with some sleet. The average annual snowfall is only 20.3 inches. Southwesterly winds prevail in summer and northwesterly winds in winter.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Bonaparte (near), Van Buren County, Iowa*

[Elevation, 563 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1901)	Total amount for the wettest year (1898)	Snow, average depth
	°F.	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	27.8	66	−24	1.16	1.30	0.93	4.6
January	22.1	70	−26	1.27	1.05	3.33	5.7
February	26.3	70	−31	1.20	1.17	1.00	4.9
Winter	25.4	70	−31	3.63	3.52	5.26	15.2
March	37.3	88	−11	2.04	2.50	5.08	2.4
April	50.6	91	8	3.07	1.34	3.71	1.2
May	61.7	95	25	4.00	1.30	6.11	.1
Spring	49.9	95	−11	9.11	5.14	14.90	3.7
June	70.1	102	38	5.06	2.26	9.01	.0
July	74.2	112	45	3.91	.94	3.15	.0
August	72.9	106	37	3.69	.31	10.55	.0
Summer	72.4	112	37	12.66	3.51	22.71	.0
September	65.9	103	26	4.44	2.46	7.30	.0
October	53.6	96	15	2.50	.90	4.09	.3
November	39.4	80	−6	1.85	.82	1.21	1.1
Fall	53.0	103	−6	8.79	4.18	12.60	1.4
Year	50.2	112	−31	34.19	16.35	55.47	20.3

The average length of the frost-free season is 167 days, which is sufficiently long to mature corn and other crops commonly grown. The average date of the last killing frost is April 25, and of the earliest October 9. The latest recorded killing frost was May 25,

and the earliest, September 18. Crops rarely are damaged by hail but occasionally are damaged by windstorms. The grazing season usually extends over a period of about 250 days. Pastures are injured in some seasons by droughts, which generally occur during the latter part of the summer. In normal seasons the early fall rains stimulate the growth of pasture grasses, so that they afford excellent grazing until late in the fall.

Table 1, compiled from the records of the United States Weather Bureau Station at Bonaparte, Van Buren County, gives the normal monthly, seasonal, and annual temperature and precipitation, which represent climatic conditions similar to those in Davis County.

AGRICULTURAL HISTORY AND STATISTICS

Agriculture has been the chief industry since the first settlements were made, although hunting and trapping were important means of livelihood for the early settlers, who traded furs and hides for household commodities. The early agriculture consisted only in raising sufficient livestock, grain, and garden products to supply home needs, as the lack of transportation facilities prevented the marketing of surplus crops. The early settlements were made along streams, generally in forested areas which provided building materials, fuel, and water. A luxuriant growth of native grasses covered the prairies, and this furnished abundant feed for cattle.

Most of the land was occupied by 1870, following the advent of the railroads and the consequent influx of settlers from the Eastern States. By 1880, 93.7 percent of the county was in farms, with a total of 2,328 farms, averaging 129 acres each. Since 1880 farming has changed to a very slight extent, as the growing of grains and hay and the raising and feeding of livestock have been the principal agricultural pursuits since the first settlements were established. Corn has been the principal crop for more than half a century. In 1879, 64,551 acres were planted to corn, which produced an average yield of 32.3 bushels an acre. Fifty years later (1929) corn was grown on 50,621 acres, and that harvested for grain yielded an average of 29.7 bushels an acre.

Table 2 gives the acreages of the principal crops grown in 1929 and 1934 as reported by the Federal census.

TABLE 2.—*Acreages of the principal crops in Davis County, Iowa, in 1929 and 1934* [1]

Crop	1929	1934	Crop	1929	1934
Corn:	*Acres*	*Acres*		*Acres*	*Acres*
Harvested for grain	44,373	6,190	Potatoes	292	170
For other purposes	6,248	31,370	Clover seed	4,273	-------
Wheat threshed	2,380	1,364	Timothy seed	9,164	-------
Oats:				*Trees*	*Trees*
Threshed	21,752	716	Apples	15,943	13,842
Cut and fed unthreshed	596	741	Peaches	3,960	4,716
Soybeans	4,824	20,018	Pears	2,066	1,920
All hay	52,118	54,407			
Alfalfa	720	734		*Acres*	*Acres*
Timothy and/or clover	47,992	34,836	Strawberries	47	8
Sweetclover	106	153			
Small grains for hay	149	659		*Vines*	*Vines*
Other tame and wild grasses	247	324	Grapes	10,895	8,437
Legumes for hay	2,904	17,701			

[1] Figures for orchard fruits, small fruits, and grapevines are for 1930 and 1935, respectively.

Of the various grain crops, oats occupied the second largest acreage, even in the seventies. The average acre yield in 1929 on 21,752 acres was approximately 23.2 bushels. Wheat once was an important crop, but the present production is very small. It is used to a very limited extent as a cash crop and is sold to local elevators for shipment. The average acre yield in 1929 was 13.5 bushels and in 1934 was 11.8 bushels.

Hay, consisting mostly of timothy, is a very important crop. Timothy seed also is harvested from a large acreage. The census reports 47,992 acres devoted to timothy or mixed timothy and clover in 1929 and 34,836 acres in 1934, more than the total acreage in corn harvested for grain in each of these years. Meadows of timothy and clover are used for both pasture and hay. The acreage of alfalfa has slowly increased from only 8 acres in 1899 to 734 acres in 1934. The acreage is restricted by the expense of liming, which is necessary to obtain a stand. For the most part, the upland soils range from moderately to extremely acid, and liming is essential where legumes are to be grown. Recently a State law has been put into effect that enables farmers to purchase lime and pay for it over a period of years. The county issues warrants bearing 3½ percent interest to finance the purchase, and the farmer reimburses the county, the payments being made semiannually or annually, as are property taxes.

Very little fruit is grown commercially, although both tree and small fruits do well. Apples and peaches are the principal orchard fruits. The largest acreages of orchards were reported in 1900, when 108,446 apple trees and 23,568 peach trees were growing on the farms. The number of trees has decreased to 13,842 apple trees and 4,716 peach trees (1935), mainly in small farm orchards ranging in size from 1 to 10 acres. Plums, pears, and cherries are grown, principally for home consumption. Strawberries, blackberries, and raspberries are grown in small patches.

A large acreage of hilly land kept in permanent pasture particularly adapts this county to the production of livestock, and the farms are well stocked with hogs, cattle, and sheep. Normally the grazing season is long and the winters short—important factors in livestock raising. In the fall cattle are generally turned into the cornfields, which provide considerable feed. Large numbers of breeding animals are kept on most farms. The value of all livestock on farms is given as $3,259,502 in 1930. The beef cattle are chiefly Aberdeen Angus, Shorthorn, and Hereford. Unfavorable market prices and lack of feed during 1934 and 1936 caused an appreciable reduction in the numbers of all livestock, particularly hogs. Poland China and Duroc-Jersey are the leading breeds of hogs, the latter on the lowlands. A few Hampshires and Chester Whites are raised by some farmers. Table 3 gives the numbers of livestock and chickens in 1920, 1930, and 1935, as reported by the Federal census.

TABLE 3.—*Numbers of livestock and chickens in Davis County, Iowa, in stated years*

Year	Cattle	Hogs	Horses	Mules	Sheep	Chickens
1920	32,429	39,799	10,863	867	74,385	286,762
1930	27,652	32,909	7,168	676	85,747	256,619
1935	23,108	14,833	5,921	494	65,248	158,043

The dairy herds in general range from 5 to 10 head. Most of the cattle are grade animals, but a few are purebred. In recent years more attention has been paid to the use of better sires and to building up the herds. The Jersey breed greatly predominates, and Guernseys are next in number. Only a few Milking Shorthorns and Holstein-Friesians are kept.

Sheep have proved very profitable and are raised on most farms. From 25 to 30 ewes are kept on the average-sized farm. The Merino, an excellent wool producer, is the principal breed, but a few Shropshires and Hampshires are raised. The early settlers from Pennsylvania and Ohio brought many sheep with them. Headed timothy furnishes much of the winter feed for sheep.

A number of horses and mules are raised, primarily to furnish power for farm operations. Tractors are used on the more level farms where the tillable acreage justifies their use. The 1930 census reported 265 tractors on farms. Saddle horses are bred in considerable numbers throughout the county, as the raising and breeding of saddle and trotting horses was introduced by the early settlers from Kentucky and Tennessee.

Poultry raising is an important source of revenue on the farms. In 1929 the value of poultry raised and chicken eggs produced was $817,442. Most of the flocks are mixed, although the tendency in recent years is to keep pure breeds. Leghorn, Plymouth Rock, and Rhode Island Red are the favored breeds.

Very little commercial fertilizer is used. Only 81 farms reported its use in 1929, with a total expenditure of $4,054. Several carloads of lime are shipped in and used annually. Phosphates are used to some extent on cornland.

Extra farm labor is employed mostly during grain harvest, for haying, and for picking corn. Most of the labor on the average farm is supplied by the farm family. The census reports $126,069 spent for farm labor in 1929 on 737 farms, or 37.8 percent of the total number of farms. Farm labor is plentiful at present, and competent help may be obtained at reasonable wages. Farm help hired on a monthly basis is paid from $25 to $40, with board and room furnished. Wages at harvest and haying time range from $1.50 to $2.50 a day. Corn pickers receive from 3 to 6 cents a bushel, depending on seasonal price conditions.

A considerable expenditure is made annually for feed. In 1929, $306,723 was spent on 1,184 farms, an average of $259.06 a farm reporting such expenditure.

The number of farms gradually decreased between 1880 and 1935. They increased in size, however, from 129 acres in 1880 to an average of 155.7 acres in 1935. Most of the farms range in size from 80 to 200 acres, although a few are as small as 10 acres and a few as large as 500 acres. Improved land in farms, which includes cropland and plowable pasture, represented 69.6 percent of all land in farms in 1935, or an average of 108.3 acres a farm. The average land value, including buildings, in 1935 was $30.18 an acre.

Indication of the trend of farm tenure in this county is shown in table 4, compiled from the Federal census reports for the years 1880 to 1935, inclusive.

TABLE 4.—*Number and tenure of farms in Davis County, Iowa, in stated years*

Year	Farms	Operated by—			Year	Farms	Operated by—		
		Owners	Tenants	Managers			Owners	Tenants	Managers
	Number	*Percent*	*Percent*	*Percent*		*Number*	*Percent*	*Percent*	*Percent*
1880	2,328	75.5	24.5	-------	1920	2,089	74.4	24.3	1.3
1890	2,331	75.2	24.8	-------	1930	1,952	63.9	33.9	2.2
1900	2,553	70.9	28.4	0.7	1935	1,978	60.0	38.8	1.2
1910	2,238	73.7	25.4	.9					

Most of the land used for crops is rented on a share basis, and a cash payment is made for pasture and hay land. On the share-rental basis the landlord receives one-half of the corn and two-fifths of the small grain. Hay and pasture land is paid for at the rate of $1.50 to $2.50 an acre, with an average of $2. The tenant furnishes all farm machinery and power for farming, and he delivers the grain to the elevator. On the livestock farms the share rental requires the landlord to furnish one-half of all the livestock; the tenant furnishes all labor and farming equipment; and all money from the sale of livestock or farm products is divided equally. The landlord pays for repairs on buildings and fences, and he is required to furnish a well of adequate capacity for farm needs. On the few farms rented for cash, the tenant pays from $1 to $6 an acre, depending on the amount of tillable land, its productivity and location.

Machinery, such as plows, harrows, disks, corn planters, cultivators, is used on every farm, but only a few farmers own corn pickers and combines. Threshing machines generally are owned by groups of farmers, but some of the threshing is done by privately owned machines.

Most farms are moderately well equipped with buildings, including barns, hog houses, cattle sheds, and poultry houses. Much repairing and painting has been done of late, as buildings generally were in a run-down condition, although most of the farms in the better sections are kept in fair repair. In all sections of the county some farms have been abandoned, principally in the more rolling areas, where fields have suffered severely from sheet and gully erosion.

SOIL-SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. Soil reaction,[5] and the content of lime and salts is deter-

[5] Soil reaction refers to the degree of acidity or alkalinity and is expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity, and lower values indicate acidity.

mined by simple tests.[6] Drainage, both internal and external, and other associated features, such as relief, or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics soils are grouped into mapping units. The three principal ones are (1) series, (2) type, and (3) phase. In places two or more of these principal units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a map but must be mapped as (4) a complex.

The most important group is the series which includes soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions and range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The soil series are given names of places or geographic features near which they were first found. Shelby, Clinton, and Wabash are names of important soil series in Davis County.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, a class name, such as sand, loam, silt loam, silty clay loam, or clay, is added to the series name to give the complete name of the soil type. For example, Wabash silt loam and Wabash silty clay loam are soil types within the Wabash series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, which differs from the type in some characteristic that may have practical significance. Differences in relief, stoniness, and the degree of accelerated erosion are frequently shown as phases. For example, within the normal range of relief for a soil type, there may be areas that are adapted to the use of machinery and the growth of cultivated crops and others that are not. Even though there may be no important difference in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such an instance the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

[6] The total content of readily soluble salts is determined by the use of the electrolytic bridge. The presence of lime ($CaCO_3$) is detected by effervescence upon application of dilute acid.

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The soil surveyor makes a map of the county or area, showing the location of each soil type, phase, complex, and miscellaneous land type, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS

The soils of Davis County are typical of the Prairie soil region of southern Iowa. They differ widely in color, texture, structure, content of organic matter, and other important characteristics. As previously stated, soils are grouped, on the basis of these characteristics, into classification units. Each soil, besides its internal characteristics, has its particular physiographic position, degree of slope, and kind of vegetation. Because of these internal and external characteristics, each soil differs in its suitability for certain crops and in its productivity.

The dark well-developed soils are smooth in texture and rich in organic matter. They are suited to the production of cultivated crops, and more than 75 percent of their total area is used for this purpose. The surface soils are nearly black, owing to their high content of organic matter. The texture of the surface soils ranges from silt loam to silty clay loam, and they are everywhere mellow and easily tilled. The subsoils are variable in texture from series to series, but in general they are heavier than the surface soils. These soils are now represented by the areas of the Grundy, Shelby, and Edina soils of the upland and the Bremer soils of the terraces. The Wabash soils of the better drained stream bottoms also belong with the group of dark productive soils.

All the soils of the flat uplands, however, do not have the favorable characteristics of the dark soils. Where the land is level and both surface and internal drainage are slow, the soil has undergone marked changes. The surface soils contain much less organic matter and are extremely acid. Below the dark-gray surface layer a very acid gray or white horizon is developed in most places. A tough heavy clay subsoil underlying the acid gray layer prevents the ready penetration of plant roots and retards drainage. Soils of this character are included in the Putnam, Marion, and Calhoun series. These gray-layered soils generally are regarded as poor soils for corn. They are more productive of small grains and hay crops, although they are not so productive as the dark upland soils.

As a general rule, gentle slopes with dark soils mark the first break from the flat divides. The dark surface layer, characteristic of Prairie soils, becomes thinner as the slope becomes steeper. Under the forest growth, which normally occurs on the lower slopes, the surface layers are naturally less dark and are not so deep. The extensive areas of light-colored soils, which occur on the lower slopes, have been grouped with the Lindley and the Clinton series.

The various topographic features with coextensive types of soil have largely determined the present land use in the different parts of the county, subject, of course, to the limitations imposed by the general climatic and economic conditions. A large part of this county is not well adapted to the production of corn. A considerable area, because of steepness and susceptibility to erosion, is unsuited

to cultivation, and other extensive areas can be cultivated only with difficulty and risk of damage by erosion. Large areas are used only as pasture. The rough land, as a whole, does not have a high carrying capacity for livestock, and in wooded areas the grass cover is very thin.

A general appraisal of the soil resources shows that the county has certain soils well suited to the production of crops, and other soils that provide pastures, which range in quality from good to poor. The soils of these two general groups do not occur in large continuous bodies but form an intricate pattern of irregular strips. A large proportion of the farms contain soils adapted to both cropping and grazing. The type of farming adopted must be designed to utilize the pasture land in connection with cropland, and the farmers have turned to the raising of beef cattle as the enterprise best suited to this purpose. The amount of corn that can be grown is limited and is barely sufficient to finish the beeves for market. It prohibits the buying of feeders for fattening.

Dairying is not developed to a great extent in this part of Iowa, for two reasons, both of which are closely related to the character of the soil. The better land is needed for corn, and, owing to the comparatively small production of oats, the concentrated protein feeds needed in dairying are lacking. A second difficulty in dairying is the lack of good pastures.[7]

In this report the individual soils are placed in groups on the basis of their natural characteristics, with special emphasis on their topographic position and drainage conditions, which largely coincide with differences in productivity and suitability for use. The four broad groups are: (1) Dark-colored soils of the well-drained uplands; (2) light-colored soils of the well-drained uplands and terraces; (3) soils of the flat imperfectly drained uplands and terraces; and (4) soils of the bottom lands and low terraces.

These groups correspond rather closely to the use now being made of the soils. Each group includes soils that are somewhat similar in agricultural value and are used for particular purposes more extensively than the soils of the other groups. The content of organic matter (indicated by the color), topographic position, and drainage conditions are the principal features taken into consideration in this grouping.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Davis County, Iowa*

Type of soil	Acres	Percent	Type of soil	Acres	Percent
Grundy silt loam	57,920	18.1	Marion silt loam	1,024	0.3
Shelby loam	63,552	19.8	Calhoun silt loam	3,200	1.0
Edina silt loam	448	.1	Bremer silt loam	320	.1
Judson-Wabash silt loam	576	.2	Wabash silt loam	35,200	11.0
Lindley loam	78,016	24.3	Wabash silty clay loam	5,184	1.6
Clinton silt loam	35,264	11.0	Wabash fine sandy loam	320	.1
Jackson loamy fine sand	192	.1	Sharon silt loam	10,496	3.3
Putnam silt loam	28,928	9.0			
			Total	320,640	------

[7] HOLMES, C. L. TYPES OF FARMING IN IOWA. Iowa Agr. Expt. Sta. Bull. 256, pp. [116]–166, illus. 1929.

In the following pages the various soils are described in detail and their suitability to different crops is discussed; their distribution is shown on the accompanying soil map; and table 5 gives the acreage and proportionate extent of each soil type.

DARK-COLORED SOILS OF THE WELL-DRAINED UPLANDS

This group includes soils that have adequate drainage, but are retentive of sufficient moisture for the use of crops in normal seasons. The dark color, common to these soils, indicates a large content of organic matter. The water-holding capacity is due mainly to the favorable texture and structure of both surface soil and subsoil. These soils vary to some extent, however, with respect to their water-holding capacity. Grundy silt loam, developed from loess on the nearly flat upland, ranks highest among the soils of this group in average production. Shelby loam occupies gentle to steep slopes bordering streams and drainageways and is subject to erosion when cultivated. The parent material is glacial drift of the Kansan stage. The thickness of the dark-colored surface soil is proportional to the steepness of the slope and the extent of erosion. The value of this soil for farming is variable, depending on the degree of slope and the thickness of the dark-colored surface soil. Edina silt loam, which has been developed on the flat or depressed upland, originally was poorly drained, but the greater part of it has been improved by tiling and ditching and now produces fair crops. The Judson-Wabash complex occurs mainly on the slopes and bottoms of drainageways, and drainage ranges from fair to good. The better drained areas are very productive, especially of corn.

Grundy silt loam.—Grundy silt loam is a valuable soil for general farming and ranks highest among the upland soils in the production of corn. It occupies level areas or gentle slopes between the Putnam soils of the flat interstream divides and the Shelby and Lindley soils on the lower slopes. Areas of this soil occur in every township but are more numerous and extensive in the central and southern parts of the county. Although it occurs in ragged and narrow strips, this soil has a total area of 57,920 acres.

The 6- to 15-inch surface soil of Grundy silt loam consists of dark grayish-brown silt loam which, when moist, appears almost black. Under virgin conditions the topmost 2- or 3-inch layer of soil is held together by a network of grass roots and is rich in partly decayed grass roots and humus. The material is loose and falls apart into fine granules of fairly uniform size. The underlying layer is slightly heavier in texture and lighter in color, and the soil material is a mass of granules larger than those in the layer above. The undisturbed mass is moderately dark grayish brown, but the pulverized material is brown. Below a depth of 24 inches the material is yellowish-brown clay mottled with gray and with iron stains of a rust-brown color. The substratum, below a depth of 42 inches, continues to be heavy textured but is more silty and friable than the material above.

Surface drainage over the greater part of this soil is good, owing to the gently sloping relief, but in a few flat areas run-off is slow. The heavier clay subsoil restricts the downward movement of water, making internal drainage slow to poor. In flat areas artificial drainage is necessary, in order to obtain maximum crop yields.

The range in thickness of the surface soil depends on the degree of slope. In places a shallow light-gray subsurface layer is developed, generally on flat or depressed areas. As the gray layer becomes more distinct, the soil grades into Edina silt loam. Soil boundaries between Edina silt loam and the flatter areas of Grundy silt loam are necessarily somewhat arbitrary, and areas of Edina silt loam too small to map separately are included with Grundy silt loam.

Grundy silt loam is the most productive upland soil in the county. Where drainage is adequate, excellent yields of all the crops commonly grown are obtained. Corn yields from 30 to 60 bushels an acre, depending largely on the management of the soil. Oats yield from 30 to 65 bushels, and hay from 1 to 1½ tons. Where legumes are grown the field should be limed, as the surface soil is very acid, in most places requiring 3 or more tons of limestone to neutralize the acidity. The subsoil generally is less acid than the surface soil, but no free lime occurs in the subsoil.

A 4-year rotation used on the better farms consists of corn, 2 years, followed by small grain seeded down with timothy and clover. Where the soil is deficient in humus and yields are low in normal seasons, a 3-year rotation should be used. A legume or a mixture containing legumes seeded with small grains is most effective in building up the organic-matter content. Sweetclover and alfalfa are especially valuable, as the roots penetrate deeply the heavy clay subsoil, thereby helping the drainage by allowing better penetration of water, increasing oxidation, and increasing the available supply of plant nutrients. The plowing under of sweetclover is especially valuable in improving the tilth and fertility of the soil. Where legumes, particularly alfalfa and sweetclover, are grown, lime must be applied to these soils. Red clover at one time grew readily without liming, but it is now very difficult to grow unless lime is applied. Excessive acidity and a lowered state of fertility are the main reasons for this.

Sweetclover is the most useful crop for supplying organic matter, as the luxuriant growth of the plant provides a maximum quantity of green manure. Lime must be used in order to grow sweetclover on this soil, and the seed should be inoculated. Many areas of this soil have been farmed for 60 years or more, and inadequate rotations have reduced the fertility, principally through depletion of the supply of humus and phosphorus. Because of the limited amount of land suitable for growing corn on many farms, and the adaptation of Grundy silt loam to this crop, this soil should be improved by the incorporation of barnyard manure and green manures and by suitable rotations. Additions of phosphate also have proved very beneficial.

Shelby loam.—Shelby loam is developed on slopes bordering streams and drainageways in all parts of the county. It occupies an intermediate topographic position between the Grundy and Putnam soils of the comparatively smooth interstream divides and the soils of the stream bottoms. The relief ranges from gently to moderately rolling. Shelby loam is not uniform over any considerable areas. Differences in the degree of slope and in the character of the parent material have produced marked differences in the soil covering. All the slopes are eroded to some extent and, in places, are very much gullied. The thickness of the dark surface soil is in most places proportional to the steepness of the slope.

The parent materials from which Shelby loam is derived differ so greatly in character that the soil as mapped may be regarded as a complex of several types of soil that would be separated on a soil map of larger scale than the one used in this survey. The parent material is principally glacial drift of the Kansan stage of glaciation. The composition of this drift was variable originally, and long exposure to weathering has produced additional differences in the material. Successive and irregular layers of various types of till have been exposed along the hillsides, and, consequently, areas of soil varying in character have developed. In addition to the soil-forming materials derived by the weathering of glacial drift, silt was washed down from the silt loam soils on the higher land and has been mixed with the surface layers on the slopes.

The surface soil, to a depth ranging from 5 to 10 inches, consists of dark grayish-brown mellow loam. This is underlain by dark grayish-brown gritty clay loam or silty clay loam, which passes, at a depth ranging from 10 to 15 inches, into reddish-brown or yellowish-brown gritty clay loam or clay. The soil parent material or glacial till, consisting of a mixture of sand, clay, and boulders, lies at a depth ranging from 18 to 24 inches. Yellowish-brown, reddish-brown, and gray colors are intermingled in many places. The greater part of this soil is not calcareous, and, where the parent materials are thoroughly leached, the surface soils may be deficient in lime, but in small areas, streaks and seams of white limy material are present at a depth of several feet, and in a few places they are near the surface.

The lower layers and underlying drift contain a high proportion of sand and gravel and in places small granite boulders. The content of coarser materials and boulders increases with depth.

On the soil map, areas of Shelby silt loam, too small to show separately, are included with Shelby loam. The surface soil of these areas consists of a 12- to 18-inch layer of dark grayish-brown silt loam, and the underlying layers are similar to those of typical Shelby loam.

Much of Shelby loam at one time under cultivation has been returned to pasture, because of severe erosion. The gentler slopes are well adapted to general farming, and they produce fair to good crops where proper rotations are practiced.

Corn, the principal crop, produces from 20 to 40 bushels an acre in favorable seasons, but on some gently sloping fields that have been systematically seeded down and well managed, from 50 to 60 bushels have been obtained. Oats vary greatly in yield, depending on seasonal conditions. From 25 to 45 bushels an acre are harvested in a normal season, but in years of severe drought very low yields are obtained. Small grains and hay are better adapted to this soil than is corn. The principal hay crop is timothy and clover, or timothy alone. Many fields are left in timothy for 8 to 10 years. Some timothy seed is harvested, as it is a more profitable cash crop than is hay.

In the higher part of the areas of Shelby loam, strips of heavy brown or reddish-brown clay, too narrow to indicate separately on the soil map, wind around the hillsides at a certain level. Their presence reduces the value of the land, as this soil is difficult to man-

age and is unproductive. The clay, known locally as push soil, resembles gumbotil, the most strongly weathered upper layer of the glacial till. The position of the gumbotil can be traced by the poor growth of crops and native grasses. In cultivated fields the injurious effects of drought are noted first on this soil. Poorly drained spots on the hill slopes occur where seepage waters ooze out over the nearly impervious clay. Tiling above the seepage areas, in order to carry off the water before it comes to the surface, may correct this condition.

Improvement in the productivity of Shelby loam will require the addition of organic matter and the use of measures for the control of erosion. The steeper slopes and severely eroded areas should be kept in permanent pasture or in forest, and exposed clay spots should be manured before seeding down. Pasture mixtures of lespedeza, timothy, and Canada bluegrass have made a good growth on this soil. Lime should be used where legumes are seeded or used in a grass mixture. Corn should not be grown more than once in a rotation. A 3-year rotation, with clover seeded in the small grain, would be most desirable, and the second crop of clover should be plowed under to improve the productivity of the soil. Contour plowing and cultivating would lessen sheet erosion, and terraces, where needed, are valuable in aiding the control of erosion.

Edina silt loam.—Edina silt loam occurs mainly within a radius of 6 miles of Bloomfield. Most of the areas are small, ranging in size from 10 to 100 acres. The Edina soils are derived from loess, and the predominant texture of the surface soil is silt loam. Edina silt loam differs from Grundy silt loam in having a light-gray silty subsurface layer, ranging from 3 to 6 inches in thickness, between the dark surface soil and the heavy layer below. The soil occupies the flatter parts of the interstream divides where drainage is slower than in areas of the Grundy soil. The surface soil of Edina silt loam is darker than the surface soil of the Putnam soils, and the light-gray silt layer between the surface soil and the subsoil generally is not so thick or so well developed as in the Putnam soils. The Edina soil is not so productive as is Grundy silt loam, but it is considered superior to Putnam silt loam.

The surface layer of Edina silt loam is dark grayish-brown friable silt loam to a depth of 10 or 12 inches. Beneath this is a 3- to 6-inch floury but compact silt loam subsurface layer that is light gray or almost white. The next lower layer is heavy gray clay faintly mottled with brown. This material changes, at a depth of about 21 inches, to gray clay heavily mottled with brown and some yellowish brown. Below a depth of 36 inches the subsoil is yellowish-brown silty clay heavily mottled with gray, yellowish brown, and many rust-brown iron stains. The clay subsoil below the light-gray silt layer is very tough and plastic and is called a claypan. It is nearly impervious and bakes hard when dry.

In places where Edina silt loam merges with Grundy silt loam, the light-gray intermediate silt layer almost disappears, showing from barely a trace to a 2- or 3-inch band of the whitish-gray silt material. Boundaries between these soils necessarily are somewhat arbitrary. When the soil is wet, the shallow light-gray layer is not distinguishable.

Natural surface drainage is poor because the land is almost level, and the silt layer and heavy clay subsoil retard the downward movement of water, making internal drainage poor. Tiling these areas does not drain the soil efficiently because the tile, when laid in the clay subsoil below the frost line, is sealed by the finer clay particles, and the outflow of drainage water is prevented.

Edina silt loam is not so productive a soil for corn as is Grundy silt loam, principally because of slower internal drainage. It will produce from 25 to 40 bushels of corn an acre, or from 8 to 10 bushels less than the Grundy soil. Small grains are not so adversely affected as corn. Oats will produce from 30 to 50 bushels an acre in normal seasons, the yield depending largely on the management and the condition of the soil. Timothy does well. This soil is strongly acid, and lime must be applied where sweetclover or alfalfa are to be grown. Red clover seedings will thrive only under extremely favorable conditions on the average farm, but it grows luxuriantly where lime is used. Inoculated sweetclover does well where the land is properly limed. Farmers report that the sweetclover roots penetrate the gray silt layer and extend deep into the heavy clay subsoil, and this feature greatly improves the drainage and allows better aeration and oxidation of the subsoil materials.

Judson-Wabash silt loam.—Judson-Wabash silt loam is not a distinct and uniform soil but is a complex of two soils—Judson silt loam and Wabash silt loam. This complex soil is formed along several small streams that penetrate into the upland, where a considerable amount of silt washed from the upland soils slumps down the slopes, and on this colluvial wash a soil similar to Judson silt loam is developed. In the bottoms of the drainageways this silty material is more thoroughly worked by the streams and deposited on flat bottoms or very gentle slopes. Here drainage is more restricted and the soil has the gray or mottled subsoil characteristics of the Wabash soils. The two narrow strips of soil developed on the colluvial wash with the intervening narrow bottom are, together, barely wide enough to be shown on a small-scale soil map. Therefore, these two soils and the gradations between them are mapped as a complex under the name Judson-Wabash silt loam.

On the slopes, which range from gentle to steep, the thickness of the surface soil ranges from 12 to 30 inches, depending on the amount of colluvial material that has been deposited. The surface soil consists of very dark grayish-brown or almost black mellow silt loam. Below the silty surface layer the color changes slightly to dark grayish brown and the texture from silt loam to silty clay loam. At lower depths the color changes to brown, and some mottling with gray may be seen in the subsoil on the lower slopes. The soil within the drainageway has the characteristics of the Wabash soils; namely, a black silt loam surface soil with a lower layer of gray or mottled silty clay loam.

Areas of soil that differ considerably in texture and color are included with this soil, as it was not practical to separate them on a small-scale map. In places, sand has been washed down and incorporated with the silty material, producing patches of loam or fine sandy loam; and lighter colored soil materials from adjacent slopes, which formerly were forested, are deposited over other small areas.

In a few depressed pockets the soil is silty clay loam and is almost black.

Drainage ranges from fair to good. The areas are not flooded so frequently as are those of Wabash silt loam, and excess water drains off in a short time.

Although this soil may be wet in the spring, it is one of the best soils in the county for corn. Oats, winter wheat, barley, and clover are used to supplement corn, and occasionally the fields are seeded to a mixture of timothy and clover.

LIGHT-COLORED SOILS OF THE WELL-DRAINED UPLANDS AND TERRACES

The soils of this group differ so widely in appearance and agricultural relationships from the dark-colored soils that they form a distinct group. Their essential feature is the light-brown or grayish-brown surface soil, which is lacking in the store of organic matter that characterizes the other soils. These soils have been developed in areas where trees rather than grass composed the native vegetation, and it is to this fact that they owe their light color, as organic matter could not be accumulated in the soil under forests. Two soils, Lindley loam and Clinton silt loam, occupy gently to sharply rolling slopes along streams. Lindley loam is developed over glacial drift, and Clinton silt loam over loess. On account of the less favorable relief, or lay of the land, only a small part of these soils is cultivated. The more rolling and broken areas are used for pasture or woodland. The smooth parts are used to some extent for growing the crops common to this section. Jackson loamy fine sand is a comparatively unimportant soil of the terraces that has a light-colored surface soil. This soil lacks organic matter and is not highly productive.

Lindley loam.—Lindley loam is a forested soil that occurs in narrow strips, ranging from one-sixteenth to one-fourth mile in width, along the valley slopes in all parts of the county. It is the most extensive soil in this county. It occurs in close association with Clinton silt loam, which lies on the ridge tops and upper slopes.

The 6- to 8-inch surface soil consists of brownish-gray friable loam containing considerable silt. The thickness of the surface soil depends on the degree of slope and the amount of erosion that has taken place. The subsoil, between depths of 8 and 30 inches, is reddish-brown or yellowish-brown clay loam containing much coarse grit, some gravel, and a few boulders. Below a depth of 30 inches it is yellowish-brown clay loam or silty clay, strongly mottled with gray. The coarser gritty materials increase in quantity with depth. Rust-brown iron stains are numerous in the lower part of the subsoil.

The surface soil varies considerably in texture, in places consisting of smooth grayish-brown silt loam containing considerable very fine sand; in some small areas coarse sand and gravel are abundant, and the texture is clay loam; and in bare spots on hillsides the material is reddish-brown gritty silty clay, on which even weeds establish themselves with great difficulty.

Only a small part of this soil is cropped, and much of it is not arable. The original forest cover was largely oaks, hickory, and elm.

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Most of the original timber has been removed, but a considerable part of the land is covered with a scattered forest growth and an undergrowth of hazel brush. The forest growth furnishes a considerable quantity of fence posts, mine props, and rough lumber. The cut-over land, where stumps have been left to sprout and brush has spread over large areas, is most valuable as sheep or goat pasture.

A network of short drainageways covers the hill slopes, and many gullies have formed, because of excessive run-off. Trees, such as black locust, should be planted in order to check further cutting of gullies.

Crop yields, on the average, are low on this soil, as it is deficient in organic matter and very erodible. Small grains and hay crops do fairly well in places where an appreciable amount of surface soil remains. This is a poor soil for corn because of the low content of humus and plant nutrients, and corn yields range from only 15 to 30 bushels an acre. Oats do fairly well in favorable seasons and yield from 20 to 35 bushels. Hay and pasture grasses are best suited to this soil.

Only the more gentle slopes should be left in cultivation. The organic-matter content needs to be increased if this soil is to be made more productive, and this can be accomplished by growing and turning under clover. Lime should be applied before the clover is seeded, as normally the soil is strongly acid. The use of phosphate has proved beneficial.

Clinton silt loam.—Clinton silt loam is a light-colored soil developed under forest cover. Most of it occurs on the slopes of narrow ridges ranging from one-sixth to one-fourth mile in width, principally in the northeastern quarter of the county and in the northwestern part along Soap Creek. The soil is derived from fine loessial materials.

The surface soil is grayish-brown smooth silt loam to a depth of 8 or 10 inches. When dry it has a light grayish-brown appearance, but when wet it is grayish brown or dark grayish brown. The material in this layer changes to yellowish-brown silty clay loam that passes, at a depth of about 18 or 20 inches, into yellowish-brown clay, slightly mottled with gray, and containing some rust-brown and orange-brown iron stains. The lower part of the subsoil, below a depth of 42 inches, becomes lighter in texture and is grayish brown. Both surface soil and subsoil have been thoroughly leached of lime carbonate and are acid in reaction. In most places the surface soil requires from 3 to 4 tons or more of limestone to correct the acidity.

Areas of Clinton silt loam range from rolling and hilly to undulating and gently rolling on the wider ridges and hilltops. In this county this soil occupies the upper part of the slopes and narrow ridge tops, above the lower and steeper slopes where Lindley loam has developed on outcrops of glacial till. Most of Clinton silt loam is gently rolling and includes little waste land.

The original forest cover consisted principally of white oak, red oak, and hickory, but most of the forest has been removed and the land is now used for the production of cultivated crops or hay.

The surface soil varies considerably in depth. As the slope increases, the surface-soil layer, as a rule, is thinner and in places is entirely lacking, thereby exposing the yellowish-brown unproductive subsoil. Grass and hay crops are difficult to maintain on these denuded areas.

External drainage is adequate and on the steeper slopes is excessive. Internal drainage is slow because of the characteristically heavy silty clay or clay subsoil, which retards the downward movement of water.

This soil is best suited to the growing of small grains. Corn, over a period of years, produces an average of about 25 bushels an acre, but where the better areas of this soil have been seeded down systematically and the organic matter is maintained, from 40 to 45 bushels an acre may be produced in favorable seasons. Oats yield from 30 to 60 bushels, and barley yields from 20 to 40 bushels. It is important that small grains be sown early, so as to escape the periodic summer droughts. Timothy and clover are the principal hay crops and yield from 1 to 1½ tons an acre. Red clover alone does well on this soil in favorable seasons. Where red clover and timothy are grown together, the clover is cut for hay the year following the seeding, and the timothy is cut for hay or seed. It is considered more profitable to grow timothy for seed than for hay. Sorgo produces well and is grown both for feed and for the production of sirup. Some farmers use mixtures of redtop, lespedeza, and timothy successfully as pasture mixtures. Because land suitable for growing corn is so limited on so many farms that include some Clinton silt loam, the soil is cropped too heavily. Corn should not be grown more than 1 year in the rotation. Clover, or clover and timothy, should be seeded with small grain and left for 1 or 2 years. Red clover is excellent as a source of organic matter and is needed to build up this soil. Where a crop of red clover is plowed under, there is a very noticeable increase in the corn crop following. By the use of all available barnyard manure, supplemented by red clover for green manure, the present productivity of the Clinton soils can be greatly increased.

Jackson loamy fine sand.—Jackson loamy fine sand occupies only two areas, totaling 192 acres; one lies about 3 miles northeast of Floris in the Soap Creek bottoms, and the other is in the extreme northeastern corner of the county along the Van Buren County line south of the Des Moines River. This soil occupies flat terrace benches well above normal overflow.

The surface soil is grayish brown and ranges in texture from loamy fine sand to very fine sandy loam containing considerable silt. The subsoil, between depths of 10 and 24 inches, is fine clay loam containing a high proportion of very fine sand. Below this and continuing to a depth of 40 inches is light-gray silty clay loam or silty clay containing some very fine sand. Natural drainage is good in the typical areas, but the very sandy spots are not retentive of moisture, and crops suffer in dry seasons.

All this land is cultivated. Yields are slightly higher than on Calhoun silt loam, with which this soil is closely associated. Yields of corn range from 20 to 35 bushels an acre, and of oats from 25 to 40 bushels. Grasses and legumes are not grown to a great extent, but they should be grown more often, in order to increase the supply of humus.

SOILS OF THE FLAT IMPERFECTLY DRAINED UPLANDS AND TERRACES

The soils of the nearly level areas on the loess-covered uplands and the imperfectly drained terraces have several characteristics

in common and require similar methods of management. These soils were developed under conditions of excessive moisture, and although drainage conditions have been improved by ditches and tiling, some effects of the former conditions still remain. The comparative lack of organic matter in the surface soils and the poor internal drainage caused by the impervious subsoils present difficulties in the management of these soils. Putnam silt loam, which occurs on the flat upland, has a moderately dark grayish-brown surface layer, a gray subsurface layer, and an underlying dense, almost impervious, clay layer. Marion silt loam on the loess-covered flat-topped ridges of the upland and Calhoun silt loam of the stream terraces have lighter colored surface layers than Putnam silt loam, but the lower parts of the profiles of all these soils are somewhat similar. The light-gray subsurface layers are underlain by heavy compact layers. As these soils occupy topographic positions above the adjacent land, they have fair surface drainage, but, on account of their impervious subsoils, internal drainage is slow. These soils return low average yields.

Putnam silt loam.—Putnam silt loam is extensively developed in this county. It occupies the flat interstream divides, principally in the southern half, the largest areas being in the southeastern quarter. Typical Putnam silt loam differs from Edina silt loam mainly in having a lighter colored surface layer.

The 5- to 12-inch surface layer of Putnam silt loam is moderately dark grayish-brown smooth friable silt loam. Beneath this is a 5- to 12-inch layer of floury silt loam ranging in color from light gray to almost white. Numerous iron pellets and soft iron accumulations are present in this material. The material is firm in place but falls apart readily when exposed. The gray layer is abruptly underlain by heavy almost impervious grayish-brown clay containing mottlings of dark gray, yellowish brown, and black. Below a depth of 36 inches the material is yellowish-brown silty clay mottled with yellow and gray. Rust-brown stains are abundant in the heavy layers, especially so between depths of 30 and 40 inches.

The thickness of the surface soil varies considerably, in places being only 5 or 6 inches, and the intermediate gray silt layer is mixed with the surface soil in places where the land is plowed deeply. The color of the surface soil also varies from grayish brown on the more level and narrower divides to dark grayish brown where the bodies are larger and a slight slope allows better surface drainage. The light-gray distinctive intermediate silt layer reaches its maximum development in thickness and whiteness in level areas, which are the most poorly drained.

Putnam silt loam is closely associated with the Edina and Grundy soils on the flat to gently rolling uplands and with the Shelby and Lindley soils on the slopes. It was not developed under a forest cover. Much of Putnam silt loam as mapped is somewhat darker in the surface layer than typical Putnam silt loam and is transitional in this respect between Putnam silt loam and Edina silt loam.

Natural drainage is very poor, owing to the characteristically flat surface and heavy impervious subsoil.

Nearly all of this land is in cultivation. Corn yields are less than on the Grundy and Edina soils, owing to the less efficient drainage and the effect of the thick acid gray layer. Some oats, barley, soy-

beans, sorghum, and corn are grown. In favorable seasons corn yields from 25 to 40 bushels an acre, but in wet or extremely dry seasons yields are very low. Oats yield from 25 to 45 bushels an acre. Timothy is grown on a large acreage for seed or hay. In many places timothy is left in meadow from 8 to 10 years. Recently soybeans have been tried successfully and are grown by many farmers. Clover and legumes are very hard to grow because of the high acidity of this soil and its poor drainage. Seedings winter-kill badly and also drown out during rainy periods in spring and fall. In growing corn on this soil a common practice is to ridge the rows. This procedure seems to aid the plant in withstanding both wet and extremely dry conditions.

Natural drainage is inadequate and must be improved if productivity is to be increased. Tile drainage is unsatisfactory because of the heavy claypan subsoil. To get the tile below the frost line it must be laid from 15 to 20 inches deep in the heavy clay subsoil, and at this depth the fine clay particles fill the pores of the tile and tend to seal it, rendering this type of artificial drainage ineffective. Small open ditches are used in places to remove the water, but most of the land remains undrained and is farmed in its natural state. The rotations best adapted for this soil comprise small grains and hay crops. According to reports of farmers, red clover is grown successfully where the land is adequately limed and inoculated.

Marion silt loam.—Marion silt loam is a very light colored soil locally known as white oak land or talcum powder soil. It occurs in narrow disconnected strips and bodies on the flatter part of the highest ridge tops, mainly in the extreme northwestern corner of the county. A light grayish-brown floury surface layer, with an underlying layer of almost white or light-gray silt, and a heavy gray subsoil, characterize this soil, which has developed from loess under a forest or brush cover.

The 5- to 8-inch surface layer is light grayish-brown silt loam, beneath which is a light-gray or nearly white layer, 6 or 8 inches thick, which is more loose and floury than the overlying material. Numerous brown or black iron pellets are distributed throughout the upper two layers, and many cultivated fields are covered with these small shotlike concretions. The subsurface layer is similar to the light-colored layer under the Edina and Putnam soils. Below the light-colored layer is light grayish-brown silty clay that is underlain, at a depth of about 20 inches, by dark-gray or grayish-brown compact clay slightly mottled with yellowish brown. Below a depth of 28 inches the material becomes slightly lighter colored and more friable, and below a depth of 4 feet it passes into yellowish-brown silty clay mottled with gray and brown. Orange and black iron stains are numerous below a depth ranging from 20 to 30 inches, and they increase in number with depth.

Marion silt loam occurs in association with Clinton silt loam, generally occupying more level and less well drained areas. It differs from the Putnam and Edina soils in its lighter colored surface soil, which is nearly white when dry.

Owing to its level surface and heavy impervious subsoil, this soil has poor natural drainage, and crops suffer under extremely wet or dry conditions. It is not adapted to growing corn and is best suited

to small grains and hay. As it occupies flat areas on cleared ridge tops in wooded country, where the amount of tillable land is small, it is cropped heavily, frequently to corn, which yields from 15 to 20 bushels an acre in favorable seasons. Oats yield from 15 to 40 or more bushels, depending on seasonal conditions and the fertility of the soil. Timothy and redtop do best as a hay crop. The soil is strongly acid and in most places requires from 4 to 6 tons of limestone an acre to correct the acidity.

Tiling has not proved successful, as the fine clay particles soon fill the pores of the tile and retard the movement of water. Shallow open ditches are used in some places to carry away excess surface water. Plowing under green-manure crops and applying barnyard manure will increase the content of humus and improve crop yields.

Calhoun silt loam.—Calhoun silt loam is developed on flat terraces ranging from 10 to 25 feet above overflow. It is most extensive along Soap Creek and less extensive along the Fox and Des Moines Rivers. The areas range in size from about 10 to 100 acres. This soil is similar in its profile to Marion silt loam of the uplands, and it differs from that soil principally in its position on terraces. The Calhoun soils are characterized by gray surface soils and heavy tough impervious subsoils, with an intermediate very light gray or almost white silt layer.

The surface soil, to a depth ranging from 6 to 8 inches, consists of gray smooth silt loam that appears light gray or almost white when dry. This layer is underlain by a floury very light gray or almost white layer of silt loam ranging from 6 to 10 inches in thickness. Below this and continuing to a depth ranging from 20 to 24 inches is an impervious gray clay that changes to brownish-gray or dull-gray clay highly mottled with orange-brown iron stains. Below a depth of 34 or 36 inches the subsoil is less mottled and more gray.

Natural drainage is poor, owing to the level surface and heavy nearly impervious subsoil. Most of the land is cultivated, and much of it is planted annually to corn, although this is a poor soil for corn, yields of which range from 15 to 30 bushels an acre. Small grains and hay are best suited to this soil. Oats yield from 20 to 40 bushels, and hay from 1 to 1½ tons.

As the light color of the surface soil indicates, the soil is low in organic matter. Barnyard manure and green-manure crops are needed to increase the fertility. Red clover does well where the soil is limed. It is reported by farmers that the roots of alfalfa and sweetclover do not penetrate the highly acid intermediate silt layer and heavy dense subsoil, and these crops cannot be successfully grown.

SOILS OF THE BOTTOM LANDS AND LOW TERRACES

This group includes the Wabash and Sharon soils of the first bottoms along the streams and the Bremer soils on low poorly drained terraces. The Wabash soils are dark-colored soils developed from sediments washed down from the uplands and deposited in flood plains during periods of high water. The parent materials of the Wabash soils have been derived mainly from the dark-colored soils of the higher levels. Sharon silt loam has been developed in the first bottoms from lighter colored sediments. Bremer silt loam occurs on low terraces above the normal limits of overflow by the streams. The soil

naturally is highly productive, but average crop yields are reduced because of poor drainage during seasons of heavy rainfall.

Bremer silt loam.—Bremer silt loam occurs in only a few isolated areas, ranging from 5 to 20 acres in size, along several of the larger streams. Most of this soil occupies low terrace benches that are above normal overflow. The land in general is flat. In places where there is an almost imperceptible slope toward the bottoms with which it merges, the soil boundaries between the terraces and bottom lands necessarily are more or less arbitrary.

The 8- or 10-inch surface soil is very dark grayish-brown friable silt loam that is almost black when wet. Underlying this is dark grayish-brown silty clay loam extending to a depth ranging from 20 to 24 inches, and below this is grayish-brown or dark-gray silty clay mottled with some yellow, brown, and gray. Rust-brown iron stains are numerous in the subsoil and increase with depth. Natural drainage is fair over most of the land but is poor in flat or depressed areas.

Most of the land is cropped, and corn is grown continuously on much of it. Corn yields range from 25 to 50 bushels an acre and oats from 20 to 45 bushels. Small grains are apt to lodge in some fields because of the high organic content of the soil. Hay crops do well. The soil is moderately acid, and lime is needed where legumes are grown. Although red clover will grow on this soil without liming, best results are obtained with lime. Better rotations, with less corn and more leguminous crops, would greatly benefit this soil.

Wabash silt loam.—Wabash silt loam occurs on the first bottoms of all the large streams and their tributaries, and it is the most extensive bottom-land soil in the county. This soil was formed from the periodic deposits of silt laid down by run-off and floodwaters of many streams. The land is subject to overflow after heavy rains, but the higher lying parts back from the streams are overflowed for only short periods.

The surface soil, to a depth of 6 or 8 inches, is dark grayish-brown or almost black silt loam. Below this, and continuing to a depth of 18 or 20 inches, is dark-brown silt loam. The next lower material is dark-brown silty clay loam mottled with gray and rust-brown and black iron stains, which are most concentrated at a depth of about 30 inches. This layer continues to a depth of more than 3 feet. This soil includes the textural variations common in bottom-land soils. Small bodies of silty clay loam occur in depressions and flats, generally at the back of the wider bottoms or in old channels and cutoffs. Near the stream channel the soil is sandier and ranges from loam to sandy loam in texture. Within areas of Wabash silt loam are a few narrow ridges, mostly along old stream channels, in which the subsoil consists of yellow or grayish-yellow sand. These areas are too small to separate on the soil map, but they would be mapped as Cass loam if they were more extensive.

Surface drainage is adequate in most places. The stream channels of the Fox and South Wyacondah Rivers and Fabius Creek have been straightened and deepened and carry away floodwaters so rapidly that these streams overflow their banks only after long-continued periods of excessive rainfall.

The areas of Wabash silt loam are nearly flat. Streams issuing from the uplands have cut small channels through the bottoms in many places. Trees grow here and there throughout the bottoms along many of the streams, mostly near the stream channels. The native trees are mainly post oak, cottonwood, ash, red haw, and willow.

Corn is grown almost continuously on this soil, and when the crop is not damaged by overflow, yields are high, in favorable seasons ranging from 40 to 60 bushels an acre. Most of this cultivated land is on the wider stream bottoms, and small strips are cultivated along the smaller tributaries, where cropland is needed on the adjacent farm.

Wabash silty clay loam.—Wabash silty clay loam is an extensive first-bottom soil along the larger streams. The largest areas are along the Fox and Des Moines Rivers and Soap Creek, and small areas are in the bottoms of several small streams.

The surface soil is very dark grayish-brown or black silty clay loam. It is underlain, at a depth of 8 or 10 inches, by dark-gray or almost black silty clay which changes, at a depth ranging from 20 to 24 inches, to dark-gray or gray silty clay containing rust-brown and black iron stains. Below a depth of 34 inches the substratum is yellowish-brown silty clay loam or silty clay, mottled with brown, gray, and many rust-brown iron stains. In periods of prolonged drought, large cracks open in this soil, causing it to dry rapidly.

The greater part of the area of this soil is used for pasture or hay meadows. On the comparatively small part that is cultivated, corn is grown almost continuously, the yields varying greatly according to seasonal conditions. In wet seasons the yields are low. The average yield is about 25 bushels an acre, but yields of 50 bushels or more are obtained in favorable seasons. From a few of the most poorly drained areas wild hay is cut.

In its natural state this land supports a luxuriant growth of bluegrass and a few scattered trees, and buckbrush and weeds form an additional cover. Livestock find good grazing in these bottoms throughout the entire season.

Drainage is restricted on this soil, owing to the heavy waxy subsoil. Very little of the land is tiled, but open ditches would be beneficial in carrying off surplus water from some of the level depressed areas. Some bodies of Wabash silty clay loam have an almost imperceptible slope toward the stream, and this results in fair surface drainage.

As the black color indicates, the content of organic matter is high. Most of this soil is neutral to moderately acid, and red clover does well on the better drained areas. The growing and plowing under of sweetclover where the drainage is adequate will improve the tilth of the soil.

Wabash fine sandy loam.—Wabash fine sandy loam is a first-bottom soil of minor importance and small extent. It occurs in two areas; one is a comparatively narrow strip, ranging from 100 feet to one-fourth mile in width, adjacent to and along the Des Moines River channel in the northeastern corner of the county, and the other is along Soap Creek in the northwestern corner, beginning at the

entrance of the creek from Appanoose County and extending down the valley about one-half mile.

The surface soil is dark-brown friable fine sandy loam, underlain, at a depth of 16 inches, by dark-brown or brown silty clay loam containing considerable fine sand. At a depth of 24 inches this material changes to grayish-brown or yellowish-brown silty clay loam mottled slightly with light gray.

Variations in texture of the surface soil and subsoil include small areas of loam, sandy loam, and loamy sand. Most of the sandier textured areas are nearest the river bank and on a few billowy ridges from 12 to 18 inches high. The subsoil, although heavy for the most part, is more sandy in areas where the surface soil contains more sand, and in small spots it consists of fine sandy loam or fine sand. A rather large proportion of this soil is in farm lots and grass crops. Corn, oats, and rye are the principal cultivated crops.

Sharon silt loam.—Sharon silt loam is developed extensively in the first bottoms of Soap Creek and its tributaries, and it occurs in smaller areas along small streams flowing into the Des Moines River in the extreme northeastern part of the county. One area is along the South Wyacondah River 5 miles south of Bloomfield. The largest bodies of this soil are along Soap Creek and range from one-fourth to 1 mile in width. The strips developed along the smaller creeks and tributaries are continuous and range from 100 feet to about one-fourth mile in width. These small streams cut through areas of Clinton silt loam and Lindley loam and deposit light-colored silt sediments on the bottoms. Light-colored surface soils, with subsoils heavier in texture than the surface soils, are characteristic of the Sharon soils.

The surface soil is grayish-brown, yellowish-brown, or moderately dark grayish-brown friable silt loam containing various quantities of fine sand, which results in considerable variation in the texture. At a depth of 12 to 14 inches the surface soil is underlain by light yellowish-brown silty clay loam that becomes slightly lighter in texture below a depth of 24 inches, where considerable fine sand is incorporated with the heavier materials. A few orange-brown iron stains are present at a depth ranging from 30 to 36 inches.

Here and there areas of very fine sandy loam, loam, and fine sandy loam, that are too small to map separately, are included with this soil as mapped. In some small areas dark grayish-brown silty clay loam underlies the light-brown silt loam at a depth ranging from 6 to 24 inches. If these areas were of sufficient extent, they would be mapped as Ray silt loam.

The surface of the land is flat, with an almost imperceptible slope toward the stream channel. Flooding during periods of high water reduces crop yields.

Most of the larger bodies of this soil are in cultivation, and the narrow strips along the smaller creeks and tributaries are used as pasture land. Because of the lack of good farming soils on the adjacent uplands, Sharon silt loam is cropped wherever sizable areas occur. Corn is the principal crop, and occasionally a small-grain crop is grown. Corn yields from 20 to 40 bushels an acre, and small grains do well, especially oats, which yield from 25 to 45 bushels an acre.

PRODUCTIVITY RATINGS

Comparative ratings of the soils of Davis County according to their productivity for the principal crops grown in the region are given in table 6.

TABLE 6.—*Productivity ratings of soils of Davis County, Iowa*

Soil [1]	Crop productivity index [2] for—								General productivity grade [4]	Land classification [5]
	Corn	Oats	Wheat	Clover and timothy	Soybean hay [3]	Alfalfa		Pasture [3]		
						With lime	Without lime			
Judson-Wabash silt loam.[6]	90	70	60	95	90	90	50	110	1	Excellent cropland.
Wabash silt loam [6]	80	75	65	80	80	80	20	105		
Grundy silt loam	85	80	60	80	85	85	------	90	2	Good cropland.
Bremer silt loam	80	75	60	75	75	70	20	90		
Wabash silty clay loam [6]	60	50	70	80	70	80	30	105	3	
Shelby loam	50	50	50	55	50	50	20	65	5	Fair cropland.
Clinton silt loam	55	60	60	50	50	60	------	60		
Edina silt loam	55	55	40	60	50	40	------	50		
Sharon silt loam	45	50	40	30	20	25	------	65		
Wabash fine sandy loam	45	40	30	35	30	40	------	45	6	Poor cropland.
Putnam silt loam	40	45	40	50	40	30	------	35	7	
Calhoun silt loam	35	40	35	40	30	30	------	40		
Lindley loam	35	40	25	30	25	35	------	35		
Marion silt loam	35	35	25	30	20	25	------	30		
Jackson loamy fine sand	30	30	25	25	25	20	------	20	8	
Judson-Wabash silt loam (poorly drained).	------	------	------	------	------	------	------	110	8	Pasture land.
Wabash silty clay loam (poorly drained).	------	------	------	------	------	------	------	110		
Wabash silt loam (poorly drained).	------	------	------	------	------	------	------	110		

[1] The soils are listed in the approximate order of their general productivity under the average current practices, the most productive first.
[2] The soils are given indexes that indicate the approximate average production of each crop in percent of the standard of reference. The standard represents the approximate average yield obtained without use of amendments on the more extensive and better soil types of the regions in which the crop is most widely grown.
[3] Owing to limited data, these ratings are estimates only.
[4] This classification indicates the comparative general productivity of the soils under dominant current practices. Refer to text for further explanation.
[5] This is a general classification to indicate the physical suitability of the soils for farming or grazing uses. In the actual delineation of land classes on a map other considerations, such as the pattern of distribution of soil types, are important.
[6] Applies to better drained areas. Poorly drained areas are used largely for pasture.

The ratings compare the productivity of each soil for each crop to a standard of 100. The standard represents the approximate average acre yield of the crop obtained without the use of amendments on the more extensive and better soils in the regions where the crop is principally grown. A rating of 50 indicates that the given soil type is one-half as productive for the specified crop as are those soils that carry the standard index. Unusually productive soils or the soils on which amendments, such as fertilizer, have been used may yield larger crops than are represented by the standard and carry indexes above 100.

The following tabulation sets forth the yields that have been established as standards of 100. These yields represent long-time average yields of crops of satisfactory quality on the better soils without the use of amendments.

Crop:		
Corn	bushels	50
Oats	do	50
Wheat	do	25
Clover and timothy	tons	2
Alfalfa	do	4
Soybean hay	do	2½
Pasture	cow-acre-days [1]	100

[1] Cow-acre-days is a term used to express the carrying capacity of pasture land. As used here it is the product of the number of animal units carried per acre multiplied by the number of days the animals are grazed without injury to the pasture. For example, the soil type able to support 1 animal unit per acre for 360 days of the year rates 360, whereas another soil able to support 1 animal unit per 2 acres for 180 days of the year rates 90. Again, if 4 acres of pasture support 1 animal unit for 100 days the rating is 25.

Soil, although it is one of the important factors of agricultural production, is not the only one. Other factors commonly included are climate, slope, drainage, and management. In setting up productivity ratings for soil types, therefore, the combined effect of all the factors must be considered. An attempt is made to evaluate the influence of each of the factors of climate, slope, drainage, and soil characteristics under good current practices in establishing ratings. In Davis County the plowing under of barnyard manure produced on the farm and the use of occasional legumes in the rotation have been considered current practices rather than amendments. It has been assumed that some manure will be returned to the land and that all the upland types will be seeded to clover at intervals ranging from 4 to 7 years.

Crop yields themselves over a long period of years furnish the best available summation of the combined effect of the factors of production, and they have been used as a basis for the establishment of ratings wherever available. The acre yields of crops, from figures compiled by State assessors and the United States census and from the outlying cooperative fields and plots of the Iowa Agricultural Experiment Station, have been used as guides in establishing the productivity ratings. Yields by townships and counties do not give actual yields by soil types but require interpretation; consequently, all the ratings are based partly on inductive estimates. Some ratings are based entirely on estimates because of lack of definite information regarding crop yields. Nevertheless, it is felt that the ratings do present a fairly accurate picture of the relative productivities of the different soil types in the county.

Natural drainage in Davis County is not a limiting factor on many of the soils. Drainage is restricted in scattered small areas of three of the upland soils (Putnam, Edina, and Marion) and may be reflected in spotted stands of corn if the spring season is wet. Drainage is slow over the entire areas of these three soils, but improvement by artificial drainage would be very expensive and difficult. The rating given for each of the Putnam, Edina, and Marion soils refers to the typical soils and not to the occasional poorly drained spots that would be less productive.

A number of flat depressed areas of Wabash soils in the flood plains of the streams and depressed spots of Judson-Wabash silt loam at the heads of small drainageways in the upland have inadequate drainage. Two ratings have been given for each of these soils, representing the good and the poor extremes in drainage. Some

areas with intermediate drainage will fall between the two in productivity.

The soils are listed in the approximate order of their general productivity under current practices, and productivity grade numbers are assigned in the column "General productivity grade." The general productivity is based on a weighted average [8] of the indexes for the various crops, using the approximate acreage and relative value of the different crops grown as a basis for determination of the weights. If the weighted average falls between 90 and 100, the soil type is assigned a grade of 1, if between 80 and 90, a grade of 2, etc. Since it is difficult mathematically to evaluate either the exact significance of a crop in local agriculture or the importance and suitability of certain soils for particular crops, the weightings set up were used only as guides. Certain modifications based on personal judgment have been allowed in the general rating of the soils.

The column "Land classification" summarizes in a simple way the productivity and use capabilities of the various soils by placing them in a few groups on the basis of their relative suitability for farming and grazing.

Productivity rating tables do not present the relative roles that soil types play in the agriculture of a county, but rather indicate the productive capacity of each individual type. Total agricultural production of a soil type will depend on its extent and geographic distribution quite as well as on its actual productivity.

Economic considerations play no part in determining the productivity indexes, which are meant to refer to production of each crop or groups of crops. The indexes, therefore, cannot be interpreted into land values except in a very general way. The value of land depends on distance from market, the relative prices of farm products, and a number of other factors, in addition to the productivity of the soil.

LAND USES AND AGRICULTURAL METHODS

Land in cultivated crops in 1934 was reported as 119,528 acres, or approximately 37 percent of all land in the county. Land available for crops, however, which includes land on which crops were harvested or failed, idle land, fallow land, and plowable pasture, was 214,197 acres, or approximately 67 percent of all the land in the county. About 13 percent of the total area of the county, or 42,023 acres, is forested, consisting of woodland pasture and woodland not pastured.

Corn, the principal grain crop, occupied 31.5 percent of the cropland reported in 1934. Hay crops occupied the largest acreage, 54,407 acres, or 45.5 percent of the cropland. About 20 percent of the

[8] The weights in percentage given each crop index to arrive at the general productivity grade were, with a few exceptions, as follows:

Corn	35
Oats	15
Clover and timothy hay	20
Pasture	30

The acreages of barley, wheat, soybeans, and alfalfa are relatively small. Total acreages of barley and wheat were combined with that of oats, and the soybean acreage was combined with that of clover and timothy hay in determining the relative weights to be assigned the different crops in obtaining the general productivity grade.

cropland is annually sown to oats. Wheat, barley, rye, potatoes, and broomcorn make up most of the remaining cultivated crops.

Farming centers around the production of corn, oats, and hay for the feeding of livestock. The principal source of income is the raising and feeding of livestock, and there is some difficulty in producing enough feed for this purpose. Farmers bought more than $300,000 worth of feed in 1929, according to the 1930 Federal census. Practically all of the grain produced is used for feed, except wheat, which is grown on only a comparatively small acreage.

Corn is grown on practically all of the soils, but it is estimated that the Grundy, Shelby, and Wabash soils produce 90 percent of this crop. Although Putnam silt loam is not considered a good soil for corn, because of the restricted drainage, corn is grown to a limited extent on it. The practice commonly followed on this soil is ridging, which gives better drainage for growing corn.

Land planted to corn may be either spring- or fall-plowed. On flat or undulating land, such as the Putnam, Calhoun, Jackson, Bremer, and Marion soils, on the gentle slopes of the Grundy and Shelby soils, and on the bottom lands, fall plowing is practiced. Spring plowing is more desirable where the land occupies slopes of 5 to 7 percent or more, in order to reduce the loss of soil by sheet erosion during spring rains. Contour plowing and planting would greatly aid in the control of erosion on slopes of more than 3 percent. Winter cover is needed on slope or hill land to prevent damage from erosion caused by late fall and early spring rains.

Fields to be planted to corn generally are double-disked and harrowed in the spring. Most of the corn is planted in checkrows. That from small acreages is used for silage or for hogging down. Planting usually is done from May 1 to May 20. Ordinarily, corn is first cultivated with the harrow when it is about 1 inch high. Afterward, two-row cultivators, mostly horse-drawn, are used, the quantity of rain and the weed growth determining the number of cultivations. Corn is laid by between the 5th and the 15th of July, depending on seasonal conditions. Harvesting begins late in October, as soon as the corn is sufficiently dry to crib, and most of it is harvested by hand. It is stored in cribs, and most of it is fed to cattle and hogs. In some years a considerable quantity of corn is shipped in for feeding.

Strains of Reid Yellow Dent and Krug are the principal open-pollinated varieties grown. It is estimated that more than 50 percent of the farmers pick seed for the following year's crop from the fields before frost. Considerable interest has been shown in hybrid seed corn the last 2 or 3 years. Hybrids used are Iowa 13, Pioneer 307, Funks 235, and Pfister 360. A little white corn and some red 90-day corn is planted. In recent years, prices for hybrid seed corn have been $5 or more a bushel.

The hay crop is second in importance to corn. The total acreage from which hay was cut in 1934 was 54,407 acres, which is 45 percent more than all land in corn that year. Hay meadows are mainly timothy alone, but much mixed timothy and clover is grown. Only a small acreage is devoted to clover alone. It is becoming increasingly difficult to obtain stands of red clover, and liming is essential on all the soils in order to insure best results. Timothy seeded with

red clover provides shade for the young clover plants and allows the timothy to become established. The year after seeding, the crop is principally red clover, generally cut for hay, but thereafter the field reverts to timothy, which is cut for hay and seed. The land is often left in timothy from 8 to 10 years. Timothy seed was harvested from 9,164 acres in 1929. The heads are cut by headers and piled in cocks to dry, after which they are threshed. The timothy left standing is cut and used as winter feed for sheep. Davis County is said to produce annually more timothy seed than any other county in the State.

Soybeans are grown extensively for hay. Manchu, Illini, and some Peking are the principal varieties. Some soybeans are threshed, and the beans are marketed at processing mills, but most of the beans are used on the farm for planting or are sold in neighboring counties. When soybeans are grown on hill slopes where the soil covering is thin, severe erosion caused by fall rains generally takes place after the crop is removed in the fall. The ground is left bare, and the loose granular condition of the topmost 2 or 3 inches of the soil, resulting from the growing of soybeans, makes the soil highly susceptible to erosion. Soybeans, wherever possible, should be grown only on the flat to undulating parts of the field, in order to prevent washing of the soil by fall and early spring rains.

Alfalfa and sweetclover are successfully grown on the better land. Liming is necessary, however, to obtain a stand, as nearly all of the surface soils are extremely acid. Tests should be made of the soil before applying lime, in order to determine the quantity needed to neutralize acidity. All legumes should be inoculated. Well-drained fields should be chosen for the growing of legumes, particularly alfalfa.

Oats are the most extensively grown small grain and ordinarily follow corn in the rotation. The common practice is first to drag the field and then disk it, so as to cut the cornstalks and loosen the surface soil. The oats are sown broadcast or with a drill, at the rate of 2 or 2½ bushels an acre. When mature, generally in early July, the grain is cut with a binder, shocked, and left standing until cured and is then threshed from the shock. Most of the oats are fed, and only a small quantity is sold for cash. Iowa 103 and Iogold are the principal varieties grown. Yields range from 15 to 60 or more bushels an acre, depending on the fertility of the individual field and on seasonal factors. The average annual acre yield for the county as a whole is about 26 bushels.

Wheat is grown on the Wabash soils of the bottoms and on the Grundy, Putnam, and Clinton soils of the uplands. The total annual acreage sown to wheat normally ranges from 1,500 to 3,000 acres. The yield ranges from 15 to 35 bushels an acre, depending largely on seasonal conditions. In a normal season, about 22 bushels an acre is considered a good crop. Extremely hot weather when the grain is in the dough stage greatly reduces the yield; rust sometimes does severe damage; and in some years chinch bugs destroy part of the crop. Iobred, Iowin, and Turkey are the principal varieties grown.

Barley is grown to some extent, and all is fed to livestock on the farm. Some farmers use a mixture of barley and oats for feeding. Rye, millet, Sudan grass, and cane (sorgo) are minor crops. Sorgo

is grown for feed and sirup. It is more drought-resistant than other crops, and furnishes excellent feed for livestock. Hegari and Atlas are two of the popular varieties of sorgo. Sirup is made on many farms. The sorgo juice is mixed with clay, then allowed to stand until the clay settles out. This makes a lighter-colored sirup, which is clear and not so strong in flavor.

According to the 1935 Federal census, about 52 percent of all the land is in pasture, of which plowable pasture occupies 87,965 acres; woodland pasture, 39,593 acres; and other pasture, 38,802 acres. The pastures are mainly of bluegrass. A large proportion of the pasture land is on the Shelby, Lindley, and Wabash soils. Grass mixtures of alsike, redtop, timothy, and lespedeza are successfully used on some of the hill slopes. At present, pastures furnish fair grazing in spring and fall, when rains are frequent, but "burn out" during the dry summer months. A mixture of seed that has produced good pasture, according to the county agent, can be made from 6 pounds of timothy, 4 pounds of redtop, 3 pounds of alsike clover, 5 pounds of bluegrass, and 2 pounds of sweetclover. This mixture is sown at the rate of 10 or 12 pounds an acre. Where some of the surface soil remains, even though thin, a mixture of timothy, alsike clover, lespedeza, and Canada bluegrass makes a good pasture mixture that has been used successfully in other places on similar soils. Sweetclover can be used in the above mixture if the soil is sweet. Inoculated legumes are very valuable in a pasture, as they have the ability to supply nitrogen to the grasses.

Many hillsides support a cover of scattered trees, brush, and weeds, together with a thin stand of bluegrass. The brush should be cleared from such areas and the slopes reseeded with a suitable mixture of pasture grasses. In areas where the soils are low in organic matter, badly eroded, and run down, lespedeza has been successfully used by some farmers. On account of its drought-resistant ability and tolerance of acidity, it will thrive where red clover and other legumes will not grow. An early-seeding variety should be used so that frosts will not prevent the plants from reseeding.

Soils on slopes with a gradient in excess of 6 percent are subject to some erosion whenever they are cultivated. Much of this land must be cropped because of the lack of more suitable cropland. Special precautions must be taken to maintain fertility and favorable physical conditions of the soil on steeper slopes, if they are to be used for crop production. Such precautions have not been taken on many of the farms in Davis County. Many formerly cultivated fields have been allowed to deteriorate to the point where they are now of little use for cropping purposes. These fields should be retired to permanent pasture or woodland so as to prevent further damage.

Crop rotation of some kind is practiced on every farm. Corn-corn-oats or corn-oats, with an occasional seeding of timothy and clover, are the more common rotations. On farms that are run-down and on which crop yields are low, corn should not be grown more than 1 year in a rotation, and the soils should be limed and clover grown and plowed under systematically. Barnyard manure and the plowing under of green-manure crops are necessary to raise and maintain the level of fertility in the soils.

The Iowa Agricultural Experiment Station is conducting field experiments in nearby counties on soils similar to those in Davis County, on permanent fields that are laid out in $\frac{1}{10}$-acre plots. A definite rotation is carried out by the farmer cooperator, who plants and cultivates the crops on the plots along with his regular crops. The plots are established on soils that represent large soil areas in the county or in that section of the State.

As can be seen from tables 7 and 8, these experiments include trials with phosphates, complete commercial fertilizer, and muriate of potash, with and without lime and manure. A field man from the experiment station makes the application of lime and fertilizers, harvests the crop, and carefully records yields, seasonal factors, and conditions under which the crop is grown.

Average acre yields of corn, oats, winter wheat, and timothy and clover hay, alone or mixed, and increases due to fertilizer treatment on Iowa Agricultural Experiment Station fields on Grundy silt loam, are given in table 7.

TABLE 7.—*Average acre yields* [1] *of crops and increases due to fertilizer treatment on Iowa Agricultural Experiment Station fields* [2] *on Grundy silt loam*

Series and treatment	Corn		Oats		Timothy and clover hay, alone or mixed		Winter wheat	
	Average yield	Increase from treatment	Average yield	Increase from treatment	Average yield	Increase from treatment	Average yield	Increase from treatment
13-plot series:	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Tons*	*Tons*	*Bushels*	*Bushels*
Check [3]	55.9	-------	44.7	-------	1.23	-------	22.2	-------
Manure	60.0	4.1	48.3	3.6	1.32	0.09	24.6	2.4
Manure+limestone	67.5	11.6	51.4	6.7	1.66	.43	28.0	5.8
Manure+limestone+rock phosphate	71.5	15.6	58.1	13.4	1.89	.66	32.7	10.5
Manure+limestone+superphosphate	72.2	16.3	64.5	19.8	2.21	.98	34.8	12.6
Manure+limestone+complete commercial fertilizer	71.0	15.1	61.0	16.3	2.26	1.03	34.5	12.3
Limestone	62.2	6.3	52.4	7.7	1.82	.59	28.6	6.4
Limestone+rock phosphate	64.1	8.2	55.8	11.1	2.01	.78	29.4	7.2
Limestone+superphosphate	64.0	8.1	56.6	11.9	2.04	.81	30.3	8.1
Limestone+complete commercial fertilizer	64.5	8.6	57.2	12.5	2.04	.81	33.3	11.1
9-plot series:								
Check [3]	51.3	-------	42.6	-------	1.25	-------	21.5	-------
Manure	55.1	3.8	47.6	5.0	1.60	.35	26.2	4.7
Manure+limestone	59.6	8.3	50.8	8.2	1.68	.43	27.0	5.5
Manure+limestone+rock phosphate	59.7	8.4	50.1	7.5	1.92	.67	31.7	10.2
Manure+limestone+superphosphate	61.4	10.1	51.0	8.4	1.98	.73	32.3	10.8
Manure+limestone+superphosphate+muriate of potash	63.5	12.2	49.8	7.2	2.19	.94	33.7	12.2
Manure+limestone+complete commercial fertilizer	62.6	11.3	54.1	11.5	2.03	.78	31.1	9.6

[1] 13-plot series: Corn yields averaged from 41 crops on 6 fields, oat yields from 21 crops on 6 fields, hay yields from 16 crops on 5 fields, and winter wheat yields from 6 crops on 3 fields. 9-plot series: Corn yields averaged from 24 crops on 6 fields, oat yields from 9 crops on 6 fields, hay yields from 8 crops on 5 fields, and winter wheat yields from 6 crops on 3 fields. Table includes 1935 data.

[2] 13-plot series includes Farson fields, series 2 and 4; Agency field, series 1; West Point field No. 1, series 1; and Mount Pleasant fields, series 100 and 200. 9-plot series includes Wapello field, series 1; Cedar field, series 1; Corydon field, series 1; Libertyville field, series 1; Milton field, series 1; and Denmark field, series 3.

[3] The yields given for the checks are the average of the yields on all check plots on all fields.

Table 8 shows the average crop yields and increases due to fertilizer treatments on Clinton silt loam on four different experiment fields in Van Buren, Des Moines, Dubuque, and Jefferson Counties.

TABLE 8.—*Average acre yields*[1] *of crops and increases due to fertilizer treatment on Iowa Agricultural Experiment Station fields*[2] *on Clinton silt loam*

Treatment	Corn		Oats		Timothy and clover hay, alone or mixed	
	Average yield	Increase from treatment	Average yield	Increase from treatment	Average yield	Increase from treatment
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Tons*	*Tons*
Check [3]	42.3	----------	34.9	----------	0.97	----------
Manure	48.9	6.6	44.1	9.2	1.21	0.24
Manure+limestone	56.6	14.3	53.9	19.0	1.64	.67
Manure+limestone+rock phosphate	58.0	15.7	56.7	21.8	1.67	.70
Manure+limestone+superphosphate	58.9	16.6	55.5	20.6	1.86	.89
Manure + limestone + superphosphate + muriate of potash	61.6	19.3	61.1	26.2	1.93	.96
Manure+limestone+complete commercial fertilizer	59.2	16.9	58.7	23.8	1.73	.76

[1] Corn yields averaged from 14 crops on 4 fields, oat yields from 9 crops on 4 fields, and hay yields from 7 crops on 3 fields. Includes 1935 data.
[2] Burlington field, series 1; Keosauqua field, series 1; Julien field, series 1; Lockridge field No. 2, series 1.
[3] The yields given for the checks are the average of the yields on all check plots on all fields.

The older experimental plots were laid out under both livestock and grain systems of farming, but the newer fields are under the livestock system only. Under this system, barnyard manure is applied at the rate of 8 tons an acre once in a 4-year rotation, and the crop residues are plowed under. Limestone is applied in sufficient quantity to neutralize the acidity of the soil. Tests are made of the lime requirement once in a rotation, and additional lime is applied every fourth year if needed. Under the grain-farming system, organic matter is supplied by plowing under crop residues, and in some experiments the second crop of clover is turned under but no barnyard manure is applied. The first crop of clover is used for hay, and the second crop is left for seed or is plowed under.

Rock phosphate and superphosphate were applied once in a 4-year rotation at the rate of 1 ton an acre prior to 1925. During the years 1925 to 1932, inclusive, 1,000 pounds of rock phosphate was used in the 4-year rotation, and since then only 500 pounds has been used. Superphosphate (16 percent) was applied at the annual rate of 200 pounds an acre at first. In 1923 the application was reduced to 150 pounds and was made 3 years out of 4, being omitted the year in which a legume crop was produced. Since 1929, 120 pounds of 20-percent superphosphate an acre has been used.

In the earlier experiments, a mixed commercial fertilizer, 2–8–2,[9] was used at the rate of 300 pounds an acre annually and disked in, but this was changed in 1923 to a 2–12–2 mixture applied at the rate of 200 pounds an acre, the equivalent of 150 pounds of superphosphate. Since 1929 a 2–16–6 mixture has been used at the same rate. Potash, in the form of muriate of potash, was applied at the rate of 50 pounds an acre during each of 3 years in a 4-year rotation.

The experimental fields first established consist of 13 plots in each series, including 3 check plots, and the newer fields have 9 plots, 3 of which are check plots.

The results of experiments in the use of fertilizers and limestone on Clinton silt loam and Grundy silt loam can be applied to these

[9] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

soils in Davis County. The experiments cited in table 7 were carried out on fields representative of Grundy silt loam in nine counties—Henry, Mahaska, Lee, Louisa, Van Buren, Wapello, Wayne, Jefferson, and Ringgold.

The value and effectiveness of lime, manure, and either rock phosphate, superphosphate, or complete commercial fertilizers are shown in the results of table 7. Lime showed the greatest return under both livestock and grain systems of farming. Appreciable increases in yields of corn, oats, winter wheat, and hay crops were obtained with lime and manure. Both raw rock phosphate and superphosphate gave marked increases in yield on the 13-plot series but only slight increases on the 9-plot series. In both series superphosphate seemed to be slightly more effective than raw rock phosphate. Potash used in addition to lime, superphosphate, and manure gave no significant increases in yield, and complete commercial fertilizers, when used with manure and lime, were not consistently superior to superphosphate. Superphosphate and rock phosphate seemed to be more effective in the livestock system than in the grain system of farming.

The Clinton soils are low in organic matter, as their light color indicates. The addition of organic matter in the form of barnyard manure, as shown in table 8, produced approximately a 15- to 25-percent increase in yields of corn, oats, and hay. Limestone applied with manure gave large additional increases, more than doubling the increase when manure alone was used. Rock phosphate and superphosphate increased yields only slightly when used with manure and limestone. Complete commercial fertilizer showed only a small increase in yield where used with the phosphates, manure, and limestone. Potash used in similar combination gave a moderate increase with all crops grown.

In this section of the State, acidity is high in both the surface soil and lower layers of almost every soil. Some areas of Lindley and Shelby soils, where lime carbonate may be present in the subsoil, are not acid, but these areas generally are eroded or so steep that they are unsuited to cultivation. All crops, particularly legumes, respond markedly to applications of limestone.

The incorporation of barnyard manure or green manures in these soils is an important practice in building up the organic content and furnishing additional plant nutrients. With the use of limestone and green-manure crops, crop yields can be increased and soil fertility built up to and maintained at a high level.

Rock phosphate and superphosphate may be used to advantage on most crops. To determine which might be the most effective, field tests should be made by applying the phosphates in small strips across the field. Muriate of potash may be used economically on some soils, but extensive applications should not be made before field tests are tried and the value of such applications determined.

Complete commercial fertilizer can be used with good returns on some soils, but experiments indicate that, under average conditions, phosphate gives as good results. Prior to the use of complete commercial fertilizer, field tests comparing it with phosphate are desirable.

Practices recommended for the control of erosion in Davis County include improved rotations, contour tillage, and contour strip crop-

ping where necessary, improvement of pastures, liming, and the use of legumes as green manures.

Additional information on soil management, soil erosion, and the results of field experiments with fertilizers is given in Iowa Agricultural Experiment Station Bulletins 269 and 280 and Special Reports 2 and 3. Bulletin 331 gives recommendations for pasture mixtures.

MORPHOLOGY AND GENESIS OF SOILS

Davis County is in the Prairie soil region of the United States. The normal profile for this region, however, has developed in only a very small proportion of the area of the county. Variations from the normal profile are associated with differences in relief and soil parent materials. Flat upland areas where drainage is restricted are occupied by Planosols; the steeper slopes by immature or imperfectly developed soils. The soil parent materials include deposits of loess, drift, and alluvium.

The soils of this county have developed from the various parent materials under the influence of a midcontinental climate characterized by high summer and moderate to low winter temperatures. The mean annual precipitation for the county is 34.19 inches, most of which falls during the warmer months. The climatic and topographic features, combined, favor a heavy growth of tall prairie grasses on the smooth upland areas. The character of the profiles developed on the nearly level areas has been determined largely by conditions of soil moisture. On smooth upland areas, drainage is restricted, and the soils have developed surface horizons overlying rather definite claypans. Drainage conditions have greatly influenced the accumulation of organic matter, level areas with slow drainage having the thick dark A_1 horizon of the Grundy soils, whereas still more deficient drainage may result in the development of the Edina profile with a thinner A_1 horizon.

The silt loams of the Putnam, Marion, and Calhoun series, developed on nearly level areas, may be classed with the light-colored Planosol group. These soils are characterized by grayish-brown surface layers, lighter gray subsurface layers, and heavy, almost impervious, clay layers. The distinguishing features of these soils have been produced by seasonally poor drainage conditions. Putnam silt loam has a moderately dark grayish-brown surface layer and a gray or light-gray subsurface layer. The heavy layer is tough gray clay mottled with brown and rust brown. The soil occupies flat interstream divides and was developed under a grass vegetation from Peorian loess. Marion silt loam developed from similar material but under a forest cover. The surface layer is light gray, and the subsurface layer is almost white. The underlying layer is brown compact clay. This soil occurs in narrow strips on the flat ridge tops, within or bordering the wooded valleys, where the forests have invaded flat areas. Calhoun silt loam has a profile similar to that of Marion silt loam, but it is developed on flat terraces.

Three kinds of unconsolidated material—loess, glacial drift, and alluvium—constitute the parent materials from which the soils are derived. These parent materials differ in composition and method of accumulation.

Loess, probably of Peorian age, is the parent material of the soils on the flat or slightly undulating upland. The areas covered by loess are comparatively narrow and winding and represent remnants of a once extensive plain. Loess has a comparatively uniform texture, generally including a large proportion of silt. Presumably, the loess was calcareous when deposited, but in southern Iowa it has been completely leached of carbonates. The loess capping the divides is coextensive on the soil map with the areas of Grundy, Putnam, Edina, Clinton, and Marion soils.

Grundy silt loam is representative of the dark-colored Prairie soils developed on the flat or undulating upland divides, where drainage was somewhat imperfect. Following is a description of a representative profile of Grundy silt loam, as observed in a pit in the NW¼ sec. 1, T. 69 N., R. 14 W.:

1. 0 to 1½ inches, dark grayish-brown (when dry) to black (when moist) silt loam, with a dense mat of interlaced grass roots.
2. 1½ to 12 inches, dark grayish-brown (when dry) to almost black (when moist) granular silt loam that breaks into small aggregates ranging from one-sixteenth to one-eighth inch in diameter, the finer aggregates predominating. Some loose silt is present in this layer.
3. 12 to 15 inches, grayish-brown silty clay discolored somewhat by infiltration of organic matter.
4. 15 to 26 inches, grayish-brown silty clay mottled slightly with rust-brown iron stains. Organic infiltrations have darkened this layer perceptibly. The material breaks into aggregates ranging from one-eighth to one-fourth inch in diameter. When crushed between the fingers, the soil is light brown. The aggregates appear to be brown outside and yellowish brown within. Iron stains are numerous.
5. 26 to 44 inches, grayish-brown silty clay mottled with gray, yellow, and black, and containing rust-brown iron stains. The yellow mottling is very prominent. This material breaks into aggregates coarser than those in the layers above, having a maximum size of about three-eighths of an inch. Some dark organic infiltrations have penetrated this layer along cracks and insect burrows. Black and rust-brown iron concretions are numerous and become more abundant with depth.
6. 44 to 65 inches, gray or dark-gray silty clay loam mottled with yellowish brown and light gray. Black and orange-brown iron stains and concretions are prominent. The material in this layer has no definite structure, and it contains considerable very fine sand.

Although the Grundy profile is comparatively uniform over the county, it varies somewhat in both surface soil and subsoil characteristics. The thickness of the surface layer varies with the steepness of the slope. No free carbonates are present within the profile. The soil on slopes is highly erodible, owing to the heavy character of the subsoil, which restricts the downward movement of water in the sloping areas. The subsoil is less gray and more yellowish brown, indicating less restricted drainage than prevails over most of the soil.

In level or slightly depressed areas on the prairies, conditions of excessive moisture have resulted in the development of a soil profile differing from that of the Grundy soils. The dark layer is similar in appearance but is not so thick and is slightly heavier textured in some places. Beneath the dark surface horizon is a layer of gray or nearly white platy floury silt loam. The other horizons are similar to those of the Grundy soils. The dark soils underlain by gray layers are classified as Edina silt loam.

Clinton silt loam has developed from Peorian loess under a forest cover. This soil occupies the gentle to steep slopes of narrow inter-

stream divides. In general it occurs below areas of Grundy silt loam and Putnam silt loam, between these soils and the soils developed from glacial drift and alluvium at lower levels. It is characterized by a grayish-brown A horizon and a brown or yellow B horizon. The material below a depth of 18 inches becomes faintly mottled with gray or rust brown but does not have sufficient gray color or mottling at any depth to indicate poor drainage. The soil has been leached of carbonates to a depth of many feet, and the surface soil in most places is strongly acid.

The glacial till deposits that underlie the silty deposits may be referred to the Kansan stage of glaciation. Kansan drift consists of boulder clay or till, with pockets and lenses of sand or gravel. When deposited, the mass of till contained a large proportion of limestone and finely divided calcareous material. It is thought that the recession of the ice sheet left the greater part of the Kansan drift deposit spread out as a smooth plain. The agencies of weathering immediately began to oxidize and leach the material, so that now three different layers of till are exposed in Davis County. The upper part is the thoroughly leached and oxidized heavy clay, to which the name gumbotil has been given. Its maximum thickness is 11 feet, but in many places it was partly or entirely removed by normal geological erosion before deposition of the loess. This material is very slowly affected by soil-forming processes and outcrops in comparatively narrow bands on the hillsides as tough plastic clay, locally known as push land. Fortunately for the farmer, silty material from the higher lying loess soils slumps down and covers the heavy clay over many of these outcrops. Beneath the gumbotil is a grayish-yellow, grayish-brown, or buff zone that has been leached of its carbonates. The upper part is reddish brown or brown, and this coloration is more pronounced in places where the gumbotil is absent. The third zone is oxidized but unleached and consists of grayish-yellow or gray till which in some places is lighter in color than the material in the zone above. It is calcareous throughout and contains seams and concretions of lime.

These three zones of Kansan till, differing in composition, are exposed erratically on the slopes, and soils with slightly different characteristics have developed on the different materials. As the bands of soil derived from them are narrow, especially where the slopes are steep, it was not practical to show them separately on a soil map of the scale used in this survey. They have all been included as part of the Shelby and Lindley loams.

Shelby loam, where it has developed on the smoother parts of the Kansan till, assumes the normal profile of the region. It has developed under prairie conditions and is characterized by a dark grayish-brown surface soil underlain by a yellowish-brown well-oxidized horizon that grades into the well-oxidized and leached second zone of the till.

Following is a description of a profile of Shelby loam, which occupies the second largest area of the soils in the county, as observed in a pit in the SW¼ sec. 29, T. 68 N., R. 14 W.:

1. 0 to 5 inches, dark grayish-brown friable loam containing considerable fine sand. The material is uniformly fine granular.

2. 5 to 9 inches, dark grayish-brown friable loam containing considerable sand and some small pieces of rock. When crushed between the fingers the soil aggregates are brown or yellowish brown.
3. 9 to 20 inches, yellowish-brown clay loam, with a reddish cast, containing much fine grit. This layer is uniform in color.
4. 20 to 40 inches, yellowish-brown silty clay loam or silty clay, containing much coarse sand and small gravel. This layer is uniform in color except for some shadings of faint gray that are not true mottlings. Orange-brown iron stains are numerous.
5. 40 to 68 inches, pale yellowish-brown silty clay mottled with gray. This layer contains much coarse sand, some gravel, and a few small boulders and rock fragments. Rust-brown iron stains and concretions are present.

Light-colored soils developed under forest cover on the Kansan till, mostly in the northern part of the county, are members of the Lindley series. They occur on the steeper stream slopes, below and in close association with Clinton silt loam and other soils developed from loess, which lie above on the undulating to gently rolling narrow ridge tops. The Lindley soils are moderately to strongly acid and are normally low in organic matter.

Soils developed from alluvial deposits include the first-bottom soils, together with a few small disconnected bodies of terrace soils occupying flat benches bordering the upland slopes. Recently deposited alluvium is distributed along nearly all of the streams. It consists mainly of dark material that has been washed from the dark upland soils farther upstream and deposited during periods of overflow. The soils developed from this material are classed in the Wabash series. Some light-colored alluvium, mainly along streams cutting through the light-colored Lindley and Clinton soil areas, has been given the name Sharon silt loam. Both the first-bottom and terrace soils are predominantly silt loams.

SUMMARY

Davis County is in southeastern Iowa, adjoining Missouri, and is the third county west of the Mississippi River. It lies about 70 miles southeast of Des Moines. The county has an area of 501 square miles, or 320,640 acres.

The land included in this county was once a nearly level plain, of which only small remnants of the original remain. Streams have penetrated all parts and, together with their tributaries, have thoroughly dissected nearly all of the surface. Narrow flat to undulating divides ranging from ¼ to 1 mile in width and moderately gentle but rather short slopes are characteristic features of the relief.

The flat to gently rolling divides are covered with a mantle of loess ranging from 2 to 7 feet in thickness. On the slopes the original thin covering of loess has been removed almost wholly, and drift materials are exposed.

Drainage is mainly to the southeast over the southern half of the county and to the east and northeast in the northern part. All the drainage waters find their way to the Mississippi River. The altitude of the county ranges from about 630 to 950 feet above sea level.

The first settlement was made in 1843, and the county was organized soon afterward. The population in 1930 was 11,150, all classed

as rural. Bloomfield, the county seat and largest town, had a population of 2,226 in that year, and Pulaski, the next largest town, 376.

Railroad facilities are amply provided by branch lines of three railroads. Two paved highways cross near the center of the county, one east and west and the other north and south. Nearly all of the secondary roads are of dirt construction.

Farm products, consisting mainly of cattle and hogs, are trucked to Ottumwa principally, and a few are shipped to Chicago.

The climate is typical of the Mississippi Valley region, being characterized by moderately cold winters and hot summers. Rainfall is normally well distributed over the growing season, which is sufficiently long to mature all the crops commonly grown.

The principal agricultural pursuits are the raising and feeding of livestock, which require the growing of corn, oats, and hay for feed to supplement the pastures. A large percentage of the land is hay land and pasture land. The sale of livestock and poultry products is the chief source of income. It is reported that more timothy seed is grown in this county than in any other area of similar size in the United States.

The 1935 census reported 1,978 farms in the county, averaging 155.7 acres in size; and improved land, including cropland and plowable pasture, as 108.3 acres to the farm. Land is rented almost entirely on the share-rent basis. In 1935, 60 percent of the farms were operated by owners, 38.8 percent by tenants, and 1.2 percent by managers.

Most of the soils are dark-colored, having developed under prairie conditions. The northeastern quarter and a part of the northwestern quarter of the county include large areas of light-colored soils developed under forest and brush cover.

Grundy silt loam, on the gently rolling uplands, and Edina silt loam, on the flat divides, have dark surface layers and heavy subsoils, and they are the best soils of the uplands for the production of corn. Clinton silt loam, developed under forest cover, on the gently rolling uplands and ridge tops, is light-colored. It is best suited to the production of small grains and hay. Calhoun silt loam, a light-colored soil occurring on terraces, although cropped to corn and small grain, is best suited to hay and small grain. Bremer silt loam, a dark-colored soil occupying terraces, produces fair to good corn, small-grain, and hay crops where drainage is adequate. Wabash silt loam and Judson-Wabash silt loam, where drainage is adequate, produce the highest yields of corn in the county. Jackson loamy fine sand, a light-colored soil on the terraces, is not productive for crops.

The dark Shelby loam, the second most extensive upland soil in the county, occupies gently rolling to strongly rolling slopes and is developed under a grass cover. Lindley loam, which occupies steeper slopes, is a light-colored soil that originally was heavily forested and still supports considerable second-growth forest. It is the most extensive soil in the county. The gentler slopes produce fair crops of small grain, but most of this soil is best suited to forest and grass. Putnam silt loam and Marion silt loam are light-colored soils occupy-

ing level upland divides and have developed under conditions of restricted drainage. They are characterized by an almost white silt layer lying between the surface soil and the impervious claypan.

Wabash silty clay loam, a dark-colored poorly drained bottomland soil, is a good soil for corn and wheat when drained. Most of it is now undrained and is used as hay and pasture land. The light-colored Sharon silt loam and the dark-colored Wabash fine sandy loam are both first-bottom soils subject to periodic overflow. They are used mainly for pasture. Where not damaged by floods, the Sharon soil produces fair small-grain crops.

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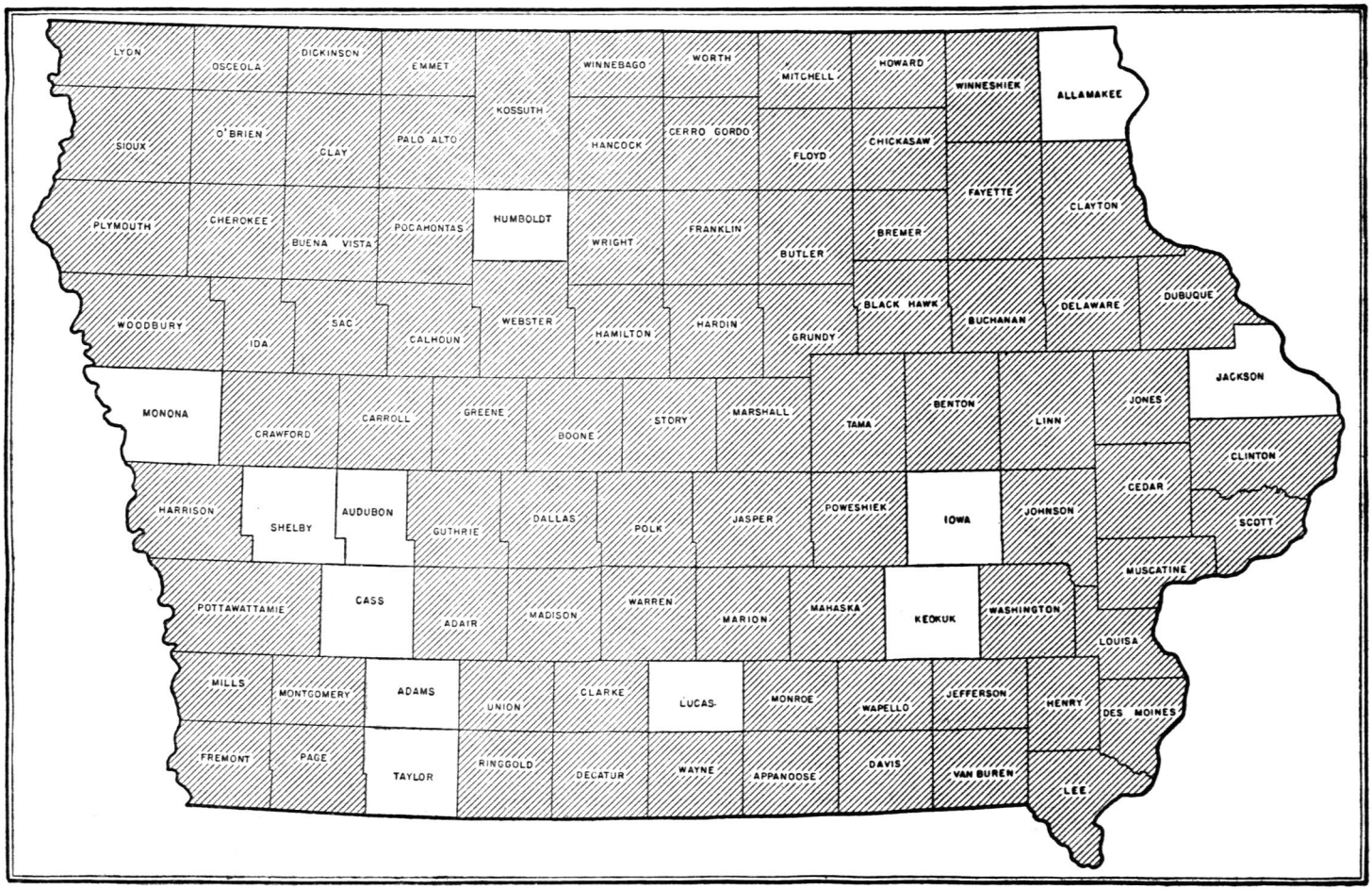

Areas surveyed in Iowa shown by shading.

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Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;

(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov.

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