SOIL SURVEY OF THE FAYETTEVILLE AREA, ARKANSAS

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DESCRIPTION OF THE AREA.

The Fayetteville area comprises the northern part of Washington and the southern part of Benton counties, the two northwest counties of the State of Arkansas. The southwest corner of the area approaches within 1½ miles of Indian Territory. Its southern boundary is parallel 36° north latitude and its eastern boundary meridian 94° west longitude. The area is rectangular, having a width north and south of 20 miles and a length east and west of 28 miles, and contains 364,416 acres, or 569.4 square miles.

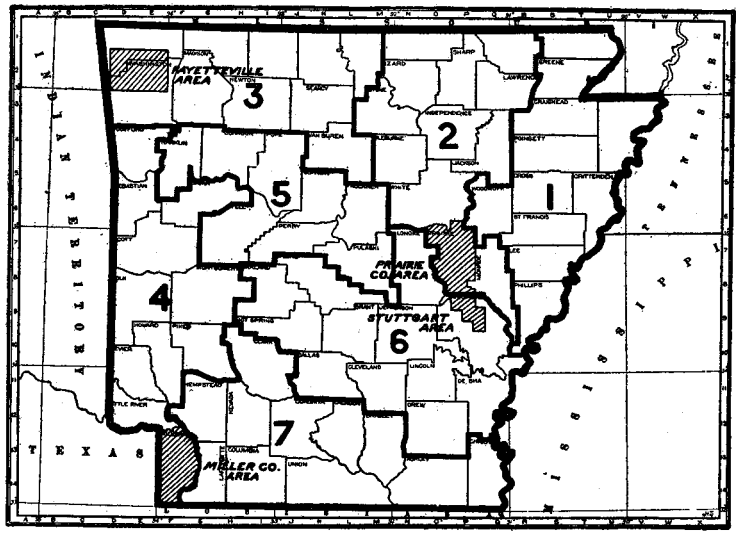

FIG. 20.—Sketch map showing location of the Fayetteville area, Arkansas.

The principal part of the area lies within the limits of the Ozark Plateau, but the little mountains and hills of the southeastern part are outliers of the Boston Mountains to the south. The Ozark Plateau in earlier geological time consisted of a broad, gently rolling plain which stretched far away to the north. Gradually the agencies of weathering and erosion changed this plainlike surface to its present condition. Wherever the underlying limestone was nearly uniform in composition a level or gently rolling soil surface resulted

from its disintegration. Such an area begins near the center of the survey at its southern boundary, extends in a northeasterly course to Johnson, where it greatly broadens to the westward, and thence reaches to the northern boundary. Similar smaller areas occur west of Wedington Mountain, including Norwood Prairie, where the topography ranges from gently to moderately rolling, and northwest of the Illinois River system, including Lindsley Prairie, Gentry, and the general region between Springtown and Osage Mills.

Between the areas mentioned, and including the extensive upland region north of Goose Creek traversed by the Illinois River and its tributaries, the topography is much more diverse. There the underlying limestone from which the soils have been derived contained a great deal of chert or "flint," which, being much more resistant to the processes of disintegration than the strata of purer limestone, remains in the form of ridges. In places these ridges form a parallel series, giving rise to a sawtooth topography, but more often there is little regularity to their occurrence, and their indiscriminate arrangement of cross ridges and knobs, with the narrow, sinuous valleys between, makes the surface features extremely "choppy." So narrow and steep-sided are these elevations that continued erosion has prevented the accumulation of a deep soil, and large areas of stony loam result.

Similar topographic conditions obtain in the northeastern part of the area between Frisco Springs and Habberton. In both of these regions, notwithstanding their general roughness, the range in elevation rarely exceeds 250 feet—1,000 to 1,250 feet above sea level—and for the most part the difference is between 50 and 150 feet. In the extreme northeast corner of the area beyond White River similar ridges occur, but the range in elevation is somewhat greater and the country is more rough and rugged.

In the southeastern fifth of the area surveyed the topographic features are very different from those already described. This region is occupied by a northerly fringe of the Boston Mountains, which, with the series of small and narrow mountains extending northwestward—Price, Webber, and Fitzgerald—form the watershed between the White and Illinois rivers. The rock formations are principally of sandstone, with some shale, and the topography is more roughly broken than on the limestone formation. The elevation ranges from 1,200 to 1,750 feet above sea level; and while there are valleys and moderately rolling areas of considerable extent, the numerous small mountains are the striking and picturesque feature of the topography. These mountains are generally longitudinal in form, but some of the smallest ones are conical. Always steep sided, their summits are either narrow and sharp or they spread out into level table-lands, thus forming flat-topped mountains. In the

latter case most of the lands are farmed. The valleys between these mountains are generally broad, the lower mountain slopes assisting to form a rather broad trough.

The Fayetteville area is well watered, and the regional drainage is well established. Rising upon the northern slope of the Boston Mountains, the White River enters the southeast corner of the area, and, receiving the waters of Middle and West forks, follows a wandering and erratic course to the northward along the entire east side of the area. The valleys of the West Fork, Middle Fork, and the White River as far north as its confluence with the West Fork are broad and well developed. Then the White River Valley becomes more narrow in its northeasterly course toward Habberton and thence to the elbow northwest of that point, where it enters a deep-carved gorge in the cherty hills. From thence northward valley land occurs only in small scattered areas, and the river is often skirted by precipitous bluffs.

The Illinois River, with its source at the northern base of the Boston Mountains, enters the area near Vineygrove, flows northward through a gently rolling country for 5 miles, and then enters the cherty limestone formation, through which it has cut a deep and well-defined valley. Turning southwest near Robinson the valley broadens to the width of a mile in several places, still flanked on each side by steep bluffs of cherty limestones. Through these bluffs are cut the very numerous streams of which Osage and Clear creeks are the most important. The almost numberless fingerlike branches, which extend back from the creeks and end in little gullies, and the upper courses of the creeks themselves are all intermittent, being dry much of the year, but very swift at every rain. A notable feature of most of the area is the excellence of its water supply, springs being very abundant; but in a few untimbered and "flatwoods" areas there are no streams or springs, the water disappearing in underground channels.

The early settlers of the Fayetteville area came from more eastern States between the late twenties and 1850. The majority were from Tennessee, but a few came from Georgia, Alabama, and the Carolinas, while there were scattering representatives of many of the older States. Later settlers came from Missouri, Illinois, Kentucky, and other more northern States, until at present the population is very cosmopolitan.

The area is now well settled, excepting steep and rugged sections unsuited to farming, and small towns and villages are frequent. Fayetteville, with 6,000 population, is the county seat of Washington County, and located there are the State university and the experiment station. Johnson, Springdale, Lowell, Gentry, and Farmington are also important railroad towns.

The transportation facilities of the area are moderately efficient. The Frisco system crosses the eastern part from north to south, connecting with St. Louis and Texas points. The Kansas City Southern Railroad crosses the northwest corner of the area and passes a short distance from the western boundary, connecting Kansas City with Port Arthur. The St. Paul branch of the Frisco traverses the southern part of the area, and the Rogers Southwestern, now under construction, is to connect the two main systems near the northern boundary.

In nearly all stony sections of the area the highways are in a deplorable condition. Little care is given them; hence the roads wash badly and are covered with loose stones—a condition which makes the conveyance of farm products expensive. On the Clarksville silt loam fairly good roads are maintained with very little effort.

The markets for apples are nearly all south and northwest, Kansas City, Sioux City, Denver, Council Bluffs, and Texas points being the principal markets. No apples are shipped northeast unless the New York crop fails. It is thought now that Texas and Oklahoma will be the best markets in the future for the apple crop of this region. The small fruits are shipped north early in the season, anticipating the local supply there, and later to southern points after the local supply has been consumed. Cattle and hogs, the two principal products of general farming shipped out of the area, go mostly to Kansas City.

CLIMATE.

The climatic conditions of the Fayetteville area are exceptionally favorable. The elevation of the region effects a salubrious temperature, free alike from severe cold or intense heat. The winter mean temperature for the period 1891 to 1903 was 38° F., the spring mean 58° F., the summer mean 76° F., and the fall mean 60° F. For the ten-year period ending with 1903 there were only three years, 1896, 1901, 1902, containing any considerable number of days with a maximum temperature of 100° or above, while in the same number of years a temperature of 100° was not attained at all. The minimum temperatures vary less from year to year, a temperature of 10° or below being registered from two to fourteen days of each year of the ten-year period. Especially noticeable is the absence of murky or oppressive weather during the summer months, and yet the growing season is sufficiently long to make possible not only a great diversity of crops, but also the practice of very favorable double rotations, as corn and cowpeas, the same season.

The ground freezes to a depth of a few inches for short periods during the winter, and the average total annual snowfall is 8.7 inches.

The following table shows the weather records available at Fayetteville and Monte Ne:

Normal monthly and annual temperature and precipitation.

Month.	Monte Ne.[a]		Fayetteville.		Month.	Monte Ne.[a]		Fayetteville.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° F.	Inches.	° F.	Inches.		° F.	Inches.	° F.	Inches.
January	35.3	2.69	35.9	2.47	August	77.9	3.34	76.3	3.89
February	36.7	1.86	39.3	2.45	September	70.3	3.38	.....	.....
March	47.2	3.77	48.4	3.95	October	59.5	2.75	.....	.....
April	58.3	4.18	58.9	3.80	November	48.0	2.22	.....	.....
May	66.5	5.94	66.5	5.78	December	38.0	2.38	.....	.....
June	73.3	4.25	73.7	4.34	Year	57.3	41.17	.....	.....
July	76.9	4.41	77.4	4.74					

[a] This station is given as Silver Springs in the Weather Bureau Report, but the place is now known locally as Monte Ne.

The rainfall for any considerable term of years is sufficient and well distributed for favorable crop production, though occasional years are either too wet or too dry for the best results. This is shown by the fact that the precipitation includes the broad range in annual mean from 28.9 to 66 inches. Crop injury from drought could be much lessened by cultivating more thoroughly to conserve moisture.

The average dates of last killing frosts in spring and first in fall for Fayetteville are April 13 and November 4, respectively, as shown by the following table:

Dates of first and last killing frosts.

Year.	Fayetteville.		Year.	Fayetteville.	
	Last in spring.	First in fall.		Last in spring.	First in fall.
1897	Apr. 11	Oct. 29	1902	Mar. 31	Nov. 15
1898	Apr. 7	Nov. 1	1903	Apr. 30	.....
1899	Apr. 9	Nov. 2	1904	Apr. 17	.....
1900	Apr. 13	Nov. 8	Average	Apr. 13	Nov. 4
1901	Apr. 19	Nov. 3			

AGRICULTURE.

Before the civil war the Fayetteville area was in a pioneer condition. For thirty years settlers had been arriving slowly and making a beginning in agriculture. Much of the land was timbered, and the facilities for bringing it to a condition for planting were very meager. Wheat was the principal crop then, the land being prepared in a hit-or-miss fashion with a bull-tongue plow, and the seed sown be-

tween the stumps and among tufts of wild grass a foot or more high. Under such conditions a yield of from 8 to 15 bushels was generally obtained. Corn was the crop of next importance, followed by oats, both being planted in the same primitive manner, and as a result the yields were not very large.

The wheat was ground in local mills and that not needed for home consumption was hauled by teams to Fort Smith, 60 miles from Fayetteville, and intervening points; also, in some cases, to Little Rock, 125 miles distant. The corn and oats were fed at home, principally to hogs, but also to mules and cattle.

The hogs subsisted largely on mast and were finished on corn. They were collected in droves and driven to Little Rock. Furs and hides were taken at the same time. The scrubby long-horned cattle sold were mostly collected by drovers from Missouri. There was not a great proportion of prairie, but cattle could subsist through the winter in the open woods.

After the St. Louis Railway was built southwest to Monett, Mo., most of the live stock was driven to that point and thence shipped by rail to St. Louis.

A few seedling apples were grown and hauled mostly to Texas points. There was very little hay and rye. Irish and sweet potatoes, beans, peas, etc., were grown for home use.

Under these early conditions people obtained an easy living by working about three months in the year, by fishing, and by hunting the abundant game.

During the war the area was overrun by both armies, the houses and fences burned, and the stock driven away, thus leaving the country extremely desolate and poverty stricken. By 1870 some improvement in condition had been effected. Corn, wheat, oats, and a little rye were the leading crops, all of which were consumed at home, those who did not feed stock selling to those who did. The stock was then driven to the nearest railroad station, first to Springfield, Mo., and later to Neosho and Pierce City.

The nearest approach to a total crop failure in the history of the area occurred in 1875. Few farmers had sufficient corn for their own use, and a crop failure then was a serious matter, for, there being no railroad, a supply could not be procured, and people suffered. The crops in White River Valley, upon which dependence was usually placed when the yields were poor elsewhere, were also a failure that year.

After the crop failure of 1875, however, a steady development of the agricultural interests followed until 1880–81. In that year the extension of the Frisco Railroad from Monett, Mo., was built through the area, and since then the growth of agriculture has been very rapid. Until about the year 1885 general farming prevailed, but since then

the fruit industry has been much specialized, and will be discussed in a separate chapter.

The character of the principal products of general farming in the area depends upon two things: First, the recognized adaptability of certain soil types to particular crops; and, secondly, the adherence of many to a system of extensively producing low-priced products on soils poorly adapted to such practice.

On the bottom lands corn is the leading money crop, followed in importance by wheat or grass, depending more upon the individual preference of the farmer than upon the recognition of soil adaptation. In general, however, the sale of hay is slowly but gradually superseding that of wheat, and with a few farmers it is the principal money product. The hay crop varies widely in character and value. The best farmers grow a good grade of mixed hay, mainly timothy and redtop, but sometimes with clover or orchard grass admixed. Owing to cultivation methods used with preceding crops and the length of time left in sod the fields often become weedy, wild sedge grass sometimes reappears, and the quality of hay steadily deteriorates. The oat crop is practically all fed out on the farm, little of it being thrashed. Such character of crop production in the bottoms is suitable to the conditions, and has been attended with sufficient profit to make the farmers there generally prosperous.

On the uplands apples, peaches, and berries are the principal sources of income, an attempt being made to get a living in off fruit years by farming the same crops as grown in the bottoms. Others follow the valley practice on soils ill adapted to such methods with very mediocre success, while still others have no money crop of importance and drift along from year to year. On the prairies in the western part of the area wild hay is still gathered in large quantities and sold for a low price.

Large quantities of cowpeas are sown broadcast and cured for hay. Millet and sorghum are grown to some extent as forage crops, and nearly everyone grows a small area of the latter for sirup. Small apiaries are numerous, and a little honey is sold.

The best farmers on both lowlands and uplands, simply by keen business observation of the ever-present demands for products which may be marketed from the farm, seek to supply the demand and sell a higher priced product. Thus many farmers are now doing, and for the last several years have done, remarkably well by feeding their crops at home and selling hogs and mules. There is almost no well-developed dairying. A few farmers are able to supply the local markets with milk and butter. The butter made on farms during the summer season is sold in lots of 5 to 20 pounds or more to the local merchant for 10 cents a pound. The merchants pack that obtained from all sources into large crocks and ship it to creameries in Missouri,

Kansas, and Iowa, where it is reworked and put upon the market. Beef is an important product with only a few farmers, and the number is rapidly decreasing. All beef cattle are sold off the grass, and the low price obtained at present hardly warrants their production. Cattle ticks have caused much trouble and have been a source of considerable loss, but it is expected that these will soon be under control.

There is practically no recognition of the adaptation of soils to general farm crops aside from the common distinction between uplands and bottom lands.

The most common rotation, where any definite system is followed, is corn succeeded by oats, wheat, and grass. Cowpeas are often sown in the corn, enough picked for seed, and the remainder plowed under with the cornstalks. The above rotation is often varied by growing corn or wheat two years in succession, or by omitting part or all of the oats. Unfortunately the great majority pay no attention to rotation, and farm in a hit-or-miss manner, growing corn or wheat for several years in succession on the same field.

Agricultural methods, as related to cultivation and cropping, range from crude to moderately well developed, the former prevailing on about 50 per cent of the farms, the latter on 5 per cent, and the remainder on an intermediary scale which decreases rapidly in number with the near approach to the 5 per cent limit. Certainly not more than 5 per cent of the land is properly prepared before planting. Good plows are coming into use gradually, but they are still the exception, and thus land can not be plowed as well as it should be. Most of the land is plowed from 4 to 6 inches deep, but much better results are obtained when plowed to a depth of 6 or 7 inches. Many sow seeds on the furrows, or at best after going over them once with a spike-toothed harrow, but the best farmers now use a spring-tooth harrow, and in addition a roller or drag to crush the clods. When this is done better moisture conditions are maintained—an important factor in the yields obtained.

Corn is sometimes cultivated six or seven times, and it well repays such working, but the greater part is not cultivated more than two or three times, and many fields are overrun with weeds.

The supply of farm manure is very small, and even this is so poorly cared for that much of it goes to waste. The greater part is subjected to several months' rain and consequent drainage before it is hauled to the fields, where it is spread on the poorest local spots, there seldom being enough to apply to an entire field. The principal part of all farm crops are grown with neither commercial fertilizers nor yard manure, except as above noted, but a low grade of the former is sometimes applied to wheat at the rate of 150 pounds or less per acre.

All the best farmers grow cowpeas in the corn, thus keeping the soil much more productive, and a few grow clover successfully. The complaint is often heard that clover can not be grown, but the principal cause is the failure properly to prepare the soil before sowing the seed.

Most farms are equipped with drills and reapers, and the grain is thrashed by local power outfits. Much of the hay is placed in stacks in the field.

The supply of labor is sufficient for the area. Men receive from $12 to $18 a month and board during the summer. The price of labor has advanced steadily in the last few years. The price of day labor has advanced from 50 cents a day and meals to 75 cents and $1. During the berry-picking season many of the farmers from adjoining counties come into the area with their families and camp near the berry fields, and the men come again later to pick apples. The labor is drawn mostly from within or near the area, and is generally efficient.

It is estimated that 75 per cent of farm owners live on and till their farms, though the percentage varies somewhat in different sections. Very few tenants pay cash for the use of the farms they work. The share system followed varies in minor details, but the prevalent arrangement is that the tenant furnishes everything and receives two-thirds of the output. If the owner furnishes part of the stock, tools, or seed, he receives a little more than one-third. Probably not more than 40 per cent of the farms of the area are encumbered.

Farmers are generally prosperous, nearly all property incumbrances are steadily reduced, and so there are remarkably few foreclosures of mortgage. The demand for short loans of money is now strong at 10 per cent, farm mortgages are mostly at 8 per cent, eastern loan companies placing 50 per cent of real-estate value on a basis of $30 per acre at that rate. Most of the farms range in size from 40 to 200 acres, though a few are somewhat larger. The census of 1900 gives the average for Washington County as 106 acres, and this is probably representative for the area surveyed.

The selling price of farm lands until a few years ago was commensurate with their value for general farming. The rapid development of the fruit industries, however, caused a corresponding increase in the prices of land, an increase which was unwarranted as far as general farming was concerned, because the methods of farm practice and the consequent income derived from farm products were such that profitable returns could not be made. After a successful year with fruit there has been a tendency to abandon general farming and even to raise insufficient supplies for home use. If the fruit crops were profitable every year, this would be practicable, and then the crops from lands better suited to general farming than to fruit

growing would find ready home markets. The uncertainty of the fruit crop, however, makes it imperative that enough general farming be done by the average farmer to furnish him his necessary living expenses. Then the occasional profitable crops of fruit will be clear gain, and the prices of land will reach a higher, more stable basis than is possible under the present methods of farm management.

Based upon the prevailing agricultural methods and conditions as already touched upon, the following suggestions for improvement in the agriculture of the area are offered:

(1) Methods of cultivation are very inadequate. Good turning plows should be used and the land plowed to sufficient depth to cover completely all crops or weeds growing on the surface, and to afford a good seed bed. Then the clods should be thoroughly crushed by spring-tooth, disk, or cutaway harrows, followed where necessary by a plank drag or roller and smoothing harrow.

(2) Tilled crops should be cultivated sufficiently to keep down all weed growth and to regulate and conserve moisture for the crops' needs.

(3) Crops should be harvested at the proper stage of ripeness. Less than 10 per cent of the hay crop was cut the present season before it was far advanced in the woody stage, although the rainfall at that period was only slightly above normal. The corn crop in an autumn of very favorable weather was not cut until nearly all its forage value had been wasted, and, in fact, no attempt was made to save a considerable part of it. Straw stacks are left in the fields where thrashed, those of as many as three seasons often standing side by side. If not wanted for feed, these should be hauled to the stable, mixed with the manure as rapidly as possible, and then returned to the land to increase its productiveness.

(4) Manure, both solid and liquid, should be scrupulously saved and applied to the land as soon as possible, and covered at once to prevent loss. The time has passed when crops can be grown on any of the upland types with a reasonable rate of profit without paying attention to increasing the productivity of the soil. This can be cheaply accomplished by carefully saving all animal manures, and by growing and plowing under crops of cowpeas, clover, or hairy vetch, accompanied by an application of lime; or even more profitably by harvesting and feeding these crops and returning the manure to the soil. When lime is used in connection with the green crops it should be so applied as to be mixed with the soil as thoroughly as possible, thus coming into contact with the greatest possible amount of vegetable matter being turned under. In view of the very limited present supply of stable manure, and the fact that leguminous crops increase only the humus and nitrogen content of soils, it seems

probable that the use also of commercial fertilizers, composed principally of potash or phosphoric acid, or both, will be an essential aid to increasing the productivity of the soil. By such methods not only will the crop yields be increased, but the profits even more so, for the cost of labor per unit of product will be greatly lessened, and the value of farm lands will steadily be increased.

SOILS.

The soils of the Fayetteville area have been formed from sediments laid down during the Devonian and Carboniferous ages. Of these geological formations the former, consisting of the Sylamore sandstone and Chattanooga shale,[a] has had only a limited influence on small soil areas near stream courses. During the deeper submergence at the beginning of the Carboniferous age the depositions were of a limy character and gave rise to the Boone formation. The lower part of this deposit, which consists of gray, even-bedded limestone nearly free from chert,[a] has had little effect upon the superficial soil covering, but overlying this are extensive beds of cherty limestones from which the surface soils of a large part of the area have been derived. As a result of slow disintegration and comparatively rapid erosion, varying amounts of chert are present on or near the surface. The chert when first exposed is of a light-gray color, but upon weathering rusty streaks and splashes soon denote the presence of iron and its characteristic stains. The amount of chert present at the surface depends largely upon the topography, level areas often being free from it, while at the other extreme the surface is a mass of chert with little interstitial soil.

Following the Boone formation in geologic age are a series of sandstones and shales whose variance in texture indicates corresponding changes in the depth of the waters and distance from shoreline in which deposition was made. The oldest of these is the Batesville sandstone, which consists of thin-bedded, soft, yellowish, coarse-grained sandstones. Then followed the Fayetteville formation, which consists of black or dark-gray carbonaceous shales; the Wedington, which includes heavy bedded sandstones from 50 to 150 feet thick, and the Morrow formation, which is composed principally of sandstone and shale beds of much finer texture than the most recent of the consolidated sediments constituting the sandstones of the Winslow formation.

Nine types of soil, exclusive of Meadow and Rough stony land, were mapped in the Fayetteville area. These types are grouped into two very distinct series of upland soils and a bottomland series, which is related to both the preceding.

[a] See Fayetteville folio of the United States Geological Survey.

Four-fifths of the soil areas have been derived from limestone, which gives rise to all the Clarksville series, the associated type, Gasconade silt loam, and part of the Rough stony land. These soils occupy a formerly extensive plain which has been much modified in surface features, as explained under the head "Description of the area." A striking characteristic of this class of soils is their high silt content, the predominant surface soil of the series being a silt loam. These soils may be made productive, and in general are well drained, while if properly managed they maintain a favorable supply of moisture for growing crops.

The other upland series is derived from the sandstones and shales in the southern part of the area. Of these rocks the Fayetteville formation with its accompanying Wedington sandstone member is of the most importance in soil derivation, followed by the Morrow formation. These soils are well-drained loams or fine sandy loams of the Upshur series, which in places are free from stones, and, again, are very stony and rough.

The third important class of soils, which includes the principal part of the bottom-land series associated with the two preceding series, consists of the loam, silt loam, and clay loam of the Wabash series. These are universally recognized in the area as the best soils for general farming purposes. In derivation the alluvial soils of the bottoms are miscellaneous, but are composed primarily of the wash from the upland limestone and sandstone formations. Where the former prevails the silt loam results, while the latter gives rise to the loam or clay loam.

The following table gives the names and areas of the several types of soil shown by different colors on the accompanying map:

Areas of different soils.

Soils.	Acres.	Per cent.	Soils.	Acres.	Per cent.
Clarksville stony loam	145,472	39.9	Upshur loam	12,160	3.3
Clarksville silt loam	90,880	24.9	Wabash clay loam	11,584	3.2
Upshur stony loam	23,232	6.4	Wabash loam	6,464	1.8
Rough stony land	21,632	5.9	Meadow	1,536	.4
Wabash silt loam	19,264	5.3	Total	364,416	.....
Upshur fine sandy loam	17,472	4.8			
Gasconade silt loam	14,720	4.1			

UPSHUR LOAM.

The typical surface soil of the Upshur loam is a brown, reddish-brown, or grayish-brown medium to heavy loam, from 8 to 12 inches deep. This material is often silty, but not sufficiently so for a silt loam. The subsoil consists of stiff reddish-brown, dull red, or, less

often, brown or grayish-brown clay loam, which may or may not grade into a clay of similar color at depths ranging from 20 to 36 inches.

The somewhat inclusive range of texture represented in the surface soil of this type is due primarily to the degree of local erosion which has taken place, and this in turn has followed with varying degrees of definiteness the topographic features of this formation. On slopes of gentle outline, where the soil creep has been slow, the lower parts are often much heavier in texture than the upper parts, on account of the downward transfer of the finer soil particles; yet the greater degree of the same erosion process occurring on steeper slopes often removes all or the principal part of the surface soil, thus exposing or bringing within the reach of the plow the stiff subsoil and giving to the upper slopes a texture even heavier than that of the lower slopes. The type is generally free from stones, except near the boundaries with the Upshur stony loam and on included areas of that type which were too small to be separated in mapping.

A variation of the type occurs between Springdale and Fitzgerald Mountain. The medium to dark-gray soil consists principally of silt and fine sand, yet in such proportions as to constitute neither a silt loam nor a fine sandy loam. Nor is the type uniform. Little mounds of fine sandy loam are occasional at one extreme of texture, while a similar number of small depressions approach the Gasconade silt loam. The subsoil is drab or mottled silty clay loam. This phase should be artificially drained and supplied with humus.

The typical Upshur loam is not difficult to cultivate if worked under proper conditions of moisture. If plowed when too wet, clods are formed which are somewhat troublesome, and, unfortunately, as viewed from crop returns, these clods, in the farming practice followed, are seldom reduced to a pulverulent condition; but if thoroughly worked under proper moisture conditions, the type may be readily maintained in a mellow state. It is only on the small eroded places where the stiff subsoil is exposed that the soil structure presents any material difficulties of tillage.

The Upshur loam is found only in the southeastern part of the area. While the topographic features of the type within itself range from gently to moderately rolling, its relative topographic position is midway between the Wabash types of the bottom lands and the Upshur stony loam and Upshur fine sandy loam of the upper slopes and old plateau level.

Adequate surface drainage is generally established by the rolling character of the topographic features, but small local areas need artificial drainage. This necessity for the construction of drains is ac-

centuated by the stiff and heavy texture of the subsoil, which, in such cases, does not permit a sufficiently rapid percolation of the excess moisture.

The Upshur loam has been derived from fine-textured sandstone and lesser amounts of shale, modified in some degree by the processes of local erosion. Along the bases of the old plateau escarpments supplementary material has been added by the washings from the Upshur stony loam and the Rough stony land, but these types are derived from the same class of rocks.

The Upshur loam is a good general farming soil, and satisfactory yields of corn, oats, wheat, and grass may be readily obtained where the type is efficiently farmed. It may be maintained in a productive state somewhat more cheaply than the Upshur fine sandy loam. Where well drained and of suitable exposure the type is at least moderately well adapted to the production of apples, but this can not be said of any of the lower parts of the type, and portions of orchards which can never succeed are sometimes seen located in hollows with poor water and air drainage. The well-drained portions of this type produce excellent yields of strawberries, but they are not quite as early as those grown on the Upshur fine sandy loam.

Corn yields from 15 to 60 bushels, with an average of 25 bushels; oats, 10 to 35 bushels, averaging 20 bushels; wheat, 7 to 20 bushels, averaging 11 bushels; potatoes, 50 to 100 bushels, averaging 75 bushels, and hay, one-half ton to 1½ tons, averaging three-fourths ton per acre.

The cultural methods employed on the Upshur loam are generally very inadequate. The texture of the soil is such that clods result from working it in an unfavorable state of moisture, and although a moderate amount of disking, rolling, and harrowing before planting would put the soil in good tilth, this is seldom done, and the rough and cloddy condition of the fields makes impossible the most profitable crop returns. The abandonment of hit-or-miss cultural methods and attention to thorough preparation of this soil can not be too strongly urged. Very light dressings of stable manure are sometimes applied to small fields of this soil type, and a little more often scattering poor spots, due to destructive erosion, are manured, but such applications are at best spasmodic, and large areas are farmed year after year without the use of fertilizer.

Such methods of management have brought this land into poor agricultural condition, and yet this is naturally a strong soil, which may be readily and economically brought to exceed its former productiveness by the adoption of a crop rotation, as mentioned under the head of "Agriculture," and the application of a moderate amount of fertilizer. The selling price of the Upshur loam ranges from $15

to $100 an acre, depending on accessibility and improvements, the higher price generally including a considerable area of orchard.

The following table shows the average results of the mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Upshur loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15706, 15708	Soil	1.5	2.6	3.6	22.3	6.4	48.1	14.9
15707, 15709	Subsoil	1.2	2.2	3.1	20.4	4.7	43.4	25.5

UPSHUR FINE SANDY LOAM.

The surface soil of the Upshur fine sandy loam consists of a yellowish-brown fine sandy loam from 8 to 15 inches deep. The representative texture ranges from heavy to light fine sandy loam, but occasional small areas of loamy fine sand are also found. This variation in texture follows somewhat closely the processes of erosion, the degree of which has depended primarily upon the attending topographic character of the type. The finer particles of silt, and clay in lesser amounts, have been washed from the steep little slopes of knolls and small hills, leaving there a more sandy surface soil and by their accumulation giving to the lower slopes, depressions, and valleys a character of medium to heavy fine sandy loam. This change in texture is nearly always accompanied by a corresponding change in color from yellow or light brown to dark brown.

The typical subsoil consists of a medium clay loam or a stiff, fine sandy clay of a reddish-brown, dull-red, or drab-brown color, but sometimes such material is separated from the surface soil by a layer of heavy fine sandy loam which grades into the typical subsoil at depths ranging from 20 to 30 inches, while in a few scattered areas north and northeast of Fayetteville the heavy lower subsoil is replaced by a yellow fine sand.

The surface soil is generally mellow and easy to work, but in small areas there are sufficient iron salts present to cause the soil particles to cement together, forming a crust or hardpan. This most often happens in the lower part of the surface soil, and where found the color is a rusty brown or dull red. This hardpan feature is objectionable for all crops not possessing a strong taproot, thus being injurious to at least all general farm crops now grown in the area. Fortunately such areas include only a minor part of the type.

The Upshur fine sandy loam is located mostly in the southeastern part of the area. The most extensive occurrence lies between Wyman

and Johnson, where the topographic features are diversified. This area, in general moderately rolling, includes not only occasional small steep slopes, but also gently rolling areas of considerable size between them.

Other scattered areas are commonly found on flat-topped hills and little mountains throughout this region, and in a few instances the type occupies lower slopes between the Upshur stony loam of the upper slopes and the valley soils.

Surface drainage is generally well established, a resultant of the diversified surface features, but there are minor depressions on some of the flat uplands which would require artificial drainage if crops were to be successfully grown. The character of the subsoil is such, excepting the few sandy spots, as to afford growing crops a good supply of moisture in a dry season.

The Upshur fine sandy loam is derived from fine-grained brown, yellow, or gray sandstone, and in certain areas partly from shale. An occasional feature of these sandstone formations is the presence of limestone lentils, whose decay has caused a greater coherence of the fine soil particles, thus imparting to the type a heavier texture than it elsewhere possesses.

The Upshur fine sandy loam, debarring the local areas of hardpan above mentioned, is well adapted, where the topographic position is suitable, to the production of small fruits, peaches, and apples. As a strawberry soil this is undoubtedly the best type in the area except those of limestone derivation, when both yield and quality of fruit are considered. The mellow character of the surface soil allows a free and favorable root growth and at the same time is sufficiently open to prevent injury from excess of moisture, while the subsoil is so retentive of the water supply as to sustain the crop through a considerable period of drought. The type is also exceptionally well adapted to peaches, but on some of the more exposed positions on flat-topped mountains injury is often done the trees by high winds. Moderate yields of the general farm crops are also readily obtained, and there is no type in the area better for the production of potatoes.

Corn yields from 10 to 50 bushels, with an average of 22 bushels; oats, 10 to 30 bushels, averaging 18 bushels; wheat, 5 to 20 bushels, averaging 10 bushels; potatoes, 50 to 100 bushels, averaging 75 bushels; and hay, one-half to 1 ton, averaging two-thirds of a ton per acre. A few tomatoes are also grown, yielding the same as potatoes. Mixed hay yields from 500 pounds to 3,000 pounds per acre, averaging a little less than 1 ton.

The Upshur fine sandy loam is the most easily tilled type of the area and so does not suffer as much from the inadequate working it

receives as do some of the heavier types, but an increase in the amount of cultivation given at present would be attended with profitable returns.

The fertilizer practice followed on most of the type is conspicuous only by its absence, but fortunately an occasional man has proved that a crop of clover or cowpeas grown between two crops of wheat may triple his yield of wheat the following season. Such experiences prove, notwithstanding the expressions frequently heard that neither clover nor cowpeas will do well in this area, that the productiveness of this type may be largely increased with very little expenditure. The success of alfalfa in several instances shows that this valuable crop may be very profitably grown on well-drained areas of this type where the subsoil is not too stiff, if proper care is exercised in fitting the land before sowing the seed.

Much of this type is in a poor agricultural condition as a sequence of having been farmed exhaustively for a variable but always considerable number of years. The location of the type, too, has an important influence upon its selling price. On flat-topped semimountains, to which the roads are steep, stony, and in extremely poor condition, this soil may be purchased at from $5 to $50 an acre, depending upon improvements, and where planted in orchards a much higher price is often asked. More accessible areas are held at from $20 to $50 without orchard, or $50 to $100 with orchard.

The following table gives the average results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Upshur fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
14727, 15710	Soil	0.9	1.5	8.8	36.5	11.9	30.4	9.4
14728, 15711	Subsoil	.7	1.4	6.1	27.6	8.1	33.6	21.9

UPSHUR STONY LOAM.

The surface soil of the predominant part of the Upshur stony loam consists of yellowish-brown fine sandy loam from 8 to 20 inches deep. The subsoil to a depth of 36 inches consists of dull red, reddish-brown, or grayish-brown fine sandy clay or clay loam. A loamy phase comprising about 30 per cent of the type consists of brown or grayish-brown medium to heavy loam from 6 to 12 inches deep, overlying stiff dull red, brown, reddish-brown, or grayish-brown clay loam. Throughout the type from 15 to 60 per cent, with an average

of 30 per cent, of fine-grained sandstone and other rock fragments are found upon the surface and mingled with the surface soil. The subsoil may be nearly free from rock fragments, but considerable quantities of them are often present. Barring the obstruction of stones, all the type is easily cultivated except local areas of the loamy phase where the surface soil has been wholly or partially removed, thus bringing the more intractable subsoil within reach of the plow. Local areas are too stony for profitable cultivation, but where of sufficient extent to make it possible these have been mapped as Rough stony land.

The Upshur stony loam is principally located in the southeastern part of the area, where it occurs as very irregular bodies associated with the Upshur fine sandy loam, Upshur loam, and Rough stony land. The topographic features are moderately to steeply rolling, and a large part of the type is found on lower slopes leading to the Rough stony land of the upper slopes. Surface drainage is rapid and is often attended by injurious washing of the slopes. Almost no effort is made at present to stop this, and many fields are in bad condition. The subsoil is retentive of moisture and where properly managed the type is not easily affected by drought.

The Upshur stony loam has been derived from sandstone, except for scattered spots of a black shale, and the stony content of the soil consists of fragments of this derivative rock.

The least stony parts of the type are fairly well adapted to the production of the general farm crops of the area, and in favorable positions apples and peaches do well. The rougher parts of the type, however, are so stony as to make cultivation expensive. Such areas can be used to advantage for the tree fruits where one does not care to do very much tilling in his orchard; but when used in a system of general farming under the present stage of agricultural development they can be utilized to the best advantage as permanent pasture.

Corn yields from 10 to 50 bushels, with an average of 20 bushels; oats, 10 to 30 bushels, averaging 15 bushels; wheat, 5 to 20 bushels, averaging 10 bushels; and hay, one-half to 1 ton, averaging two-thirds of a ton per acre.

The cultural methods followed on the Upshur stony loam are generally crude, and the suggestions for improvement in culture and fertilizer practice made for the Upshur loam and the Upshur fine sandy loam apply with equal force here.

The Upshur stony loam is seldom sold in tracts by itself, but usually is included with areas of other types. Under such conditions its selling price ranges from $5 to $50 an acre, with a possible average of $20 an acre.

The following table gives the average results of the mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Upshur stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15712	Soil	2.0	3.3	3.1	12.9	11.5	49.7	16.6
15713	Subsoil	1.0	3.0	1.8	11.9	6.0	39.2	37.4

WABASH CLAY LOAM.

The surface soil of the predominant part of the Wabash clay loam consists of dark-gray to black silty clay loam from 8 to 18 inches deep. In places, however, most noticeably in the areas northwest from Fayetteville, the textural range extends from a heavy silt loam to a silty clay. This range is coincident with the surface features. The type is frequently marked by little mounds rising from 1 to 3 feet above the general surface level. These mounds have an average diameter of about 20 feet and are oval or circular in shape. On the mounds the soil is generally a silt loam and between them a silty clay; but along their lower slopes, especially where the type is tilled, the soil from the mounds has been worked into the little hollows and mixed with the soil there, thus forming a silty clay loam. The subsoil is a gray or yellow-gray, plastic, heavy silty clay loam, silty clay, or the former grading into the latter at an average depth of 20 inches.

The structural attributes of the Wabash clay loam are variable. Stiff and intractable on the lower lying portions, it requires careful handling to obtain favorable results, and because of failure to comply with requisite methods of treatment much of the type is used at present only as pasture. The higher parts of the type—the difference in elevation may be only 2 or 3 feet—are moderately mellow and with efficient handling may be cultivated with ease.

At the south boundary of the map, just west of the Frisco Railroad, a ring of soil closely resembling this type, and included with it because of its limited occurrence, surrounds some Upshur stony loam near the top of a mountain. This is an odd occurrence, not only on account of the topographic position, but also from the fact that the lighter-textured Upshur series occurs just below it on the same slope. This occurrence is referred to the geological formation which here has a lower member of limestone sufficiently near the surface to affect the soil formation.

The four principal areas of the Wabash clay loam are all located in the southeast part of the area surveyed, in the vicinity of Harris,

along West Fork of White River, southeast from Fayetteville and near Farmington. Other scattering areas occur in the vicinity of Vineygrove.

The topographic features of the type, which are comparatively uniform for this section when contrasted with the much higher uplands, consist of level or slightly rolling bottom lands, much better drained than the Meadow and not subject to such destructive washing.

The higher parts of the Wabash clay loam are moderately well drained, and only suffer from excess of moisture in abnormally wet seasons. The lower parts of the type will not produce profitable tilled crops in wet seasons until artificially drained. In the few instances where tile-drains have been constructed excellent crops are produced, and thus the first essential for the successful management of this soil is practically illustrated. At the present prices of such land it would not pay to incur great expense to install drains, but the length of season here leaves considerable spare time in the fall after the proper time for gathering crops when open drains could be dug by the farm labor available at practically no expense; or tile-drains could be constructed for the actual cost of the tile, which can be procured here cheaply. There is no question that such drainage is at present practicable and profitable, excepting only a few areas where the type is so nearly level that skilled labor might be necessary successfully to adjust the tiles, if open drains were not desired.

The Wabash clay loam has been derived primarily from the washings from the adjoining uplands of fine-grained sandstone and shale, but this material has been modified by the addition of much fine material in the form of clay and silt brought originally from the uplands. Slight traces of white alkali are sometimes seen in small, poorly drained spots, but these are not sufficiently alkaline to be troublesome. The type is locally designated as "prairie," because of the absence of original timber growth.

The Wabash clay loam is particularly well adapted to the production of grass, and in somewhat lesser degree to corn, where drainage conditions are adequate. Where too poorly drained at present for growing these crops successfully this soil should be seeded to some of the best pasture grasses and used as permanent pasture. The type is seldom well enough drained for alfalfa, and under no circumstances should it be planted to apple or peach trees.

At present much of the Wabash clay loam is used as pasture, and on the tilled portions under ordinary management wheat yields from 5 to 15 bushels, with an average of 10 bushels, and corn from 20 to 60 bushels of shelled grain, with an average of 35 bushels per acre. In a favorable season the yield of hay may average 2 tons, but in wet years the grass is often badly choked with weeds, and the stand is

then destroyed. Where artificially drained, corn yields an average crop of 50 bushels of shelled grain, and hay 2 tons per acre.

The Wabash clay loam requires working under favorable conditions of moisture, as well as thorough tillage throughout the season. The soil is greatly benefited by applications of manure containing a great deal of litter, thereby improving its physical condition as well as increasing the supply of fertilizing constituents, and for the same reason cowpeas or clover should be included in every rotation. Applications of lime would also assist in keeping the soil in a more porous condition. If well drained and kept in good physical condition by such methods as outlined above this soil would give excellent results with only very small applications of fertilizers.

The value of the Wabash clay loam seems to depend primarily upon how well the owner understands handling it, and thus ranges in price from $10 an acre unimproved to $50 an acre in farms of 100 acres with good buildings.

The following table gives the average results of the mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Wabash clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
14860	Soil	0.4	1.0	1.5	10.5	9.3	49.9	27.4
14861	Subsoil	.7	1.9	1.7	9.2	9.8	46.0	31.6

WABASH LOAM.

The surface soil of the Wabash loam consists of grayish-brown to black silty loam, or loam, from 8 to 12 inches deep, containing in local areas a noticeable content of fine sand. The soil is generally mellow, moderately loose, and easy to work when properly handled, being much less exacting in this respect than the Wabash clay loam. The subsoil is a grayish-black to black heavy loam or silty clay loam, though occasionally its color is drab or grayish-brown, showing more or less hydration.

The Wabash loam is located in the southern part of the area, where it is often the companion type of the Wabash clay loam. It occupies the higher parts of the valley land, while the lower parts are Wabash clay loam; but the latter type is often not developed in sufficient areas to map.

The Wabash loam is a valley soil and its topographic features range from level to gently rolling. The type is better drained than the Wabash clay loam, but in places artificial drainage would be beneficial. This type has been derived from the alluvial wash from

fine-grained sandstone and shale of the uplands. The native vegetation consisted principally of tall and luxuriant wild grasses, and now if the soil is not farmed a rank growth of the wild grasses springs up.

The Wabash loam is naturally a productive soil, and is well adapted to the production of corn, grass, and alfalfa where drainage is not defective. Oats also do fairly well. Corn yields from 20 to 60 bushels of shelled grain, with an average of 30 bushels; wheat, 10 to 20 bushels, averaging 15 bushels; hay, 1 to 2 tons, averaging 1¼ tons, and alfalfa, about 3 tons an acre in three cuttings. The soil should not be worked when too wet, but should be plowed deeply and pulverized thoroughly, and thus put in better mechanical condition than at present.

The type is valued at $20 to $50 an acre, according to improvements, and is a desirable soil for general farming.

The following table gives the average results of the mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Wabash loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
14858, 15714	Soil	0.7	1.0	1.7	26.4	11.1	45.4	13.1
14859, 15715	Subsoil	1.4	1.6	1.7	24.1	9.9	44.4	16.3

CLARKSVILLE SILT LOAM.

The surface soil of the Clarksville silt loam consists of silt loam from 9 to 14 inches deep, ranging in color from light gray to dark gray, with an occasional gray-brown variation. The soil structure is such that great care must be exercised in cultivation. When dry and well broken up the silty surface soil is very mellow, friable, floury, and easy to work, but when wet it becomes very compact, and upon drying remains hard and intractable until again worked under favorable conditions of moisture.

The immediate subsoil consists of a heavier reddish-yellow silt loam, which may either extend to a depth of 36 inches or be replaced by a silty clay loam at from 27 to 36 inches. The color range of the subsoil is considerable, and while this phenomenon has little or no effect per se on the productivity of the type, it is found in this case to accompany textural and structural characteristics which do exert a very direct influence on crop yields, and so is generally considered indicative of the degree of productivity.

The type has been farmed, for the most part, in an exhausting manner ever since it was first tilled, and after a series of years of such practice it is seen that the darkest gray surface soil is underlain by a

reddish subsoil, and that as the surface soil becomes lighter in color it is underlain by a corresponding lighter shade of red until, as the surface soil becomes a very light gray to white in color, the subsoil is also light gray, yellowish gray, or nearly white. This lighter colored soil, which is very deficient in organic matter, is locally designated as "rabbit-skin" or "doeskin" land, and it is the least productive of any of the type. In some instances this phase is underlain, at depths ranging from 1 to 5 feet, by a hardpan, which works considerable injury at the shallower depths if the seasonal rainfall departs far from the normal in either direction. This hardpan is variable in degree, and while it is a factor to be contended with, it is charged with many crop failures which were better ascribed to deficient cultural methods and lack of fertilization.

Large areas of the Clarksville silt loam are strikingly uniform, but a few variations are worthy of notice. In local areas the surface is marked with little moundlike elevations, on the tops of which the soil contains an appreciable amount of fine sand, which, in many cases, at least, has been derived from a very thin capping of sandstone, whereas in the adjoining depressions the soil is often a silty clay loam which has been formed by the accumulation of fine materials of washings on a surface from which the overlying layer of sandstone may have been absent. Whatever the former condition, there is at present no trace either of such capping or of its decomposition products. Of similar derivation, but not occurring as mounds, are certain areas of loam. These are most prevalent between Springdale and Lowell, and in a few instances, where the sandstone soil has been of sufficient depth and area, Upshur loam was mapped. Such areas are often locally termed "sandy" in distinction from the true silt loam. They are easier to keep in good tilth, and for general farming are considered preferable to the true type by those who do not understand how properly to care for the silt loam.

Along the general boundary between the limestone and sandstone formations are several long and narrow areas of brown or grayish-brown fine sandy loam, containing bits of fine-grained sandstone, overlying stiff red clay, or silty clay of limestone derivation. Such areas constitute the type Clarksville fine sandy loam, but they were not of sufficient extent to be separately mapped.

In the northern two-thirds of the area surveyed, where it occurs in extensive areas, the Clarksville silt loam is the most important soil type. It follows very closely the regional topography and occurs wherever there are nearly level upland areas of considerable size. The type is susceptible to destructive erosion, and wherever the characteristic saw-tooth gullies are formed to any great depth their steep slopes are occupied by the Clarksville stony loam, and wherever these gullies are numerous there are not sufficient level areas for the silt

loam to accumulate. Scattered through the formation, but most extensively along the western border, are level or "bumpy" areas known as "white-oak flats," owing to the predominance of the white oak tree.

The Clarksville silt loam is in general fairly well drained, and maintains a favorable supply of moisture for growing crops when properly handled. Many local areas are so level that there is practically no surface drainage except by downward percolation, and in such areas a hardpan sometimes forms as a result of the defective drainage, the iron salts acting as a cementing material. Fortunately such areas are not large, seldom exceeding a few rods in extent. North of a line drawn from Lowell to Colville the topography is very flat, and the depressions, although of slight depth, remain filled with water after each rain until it is taken up by surface evaporation. The soil is nearly a pure silt and becomes very compact when wet, yet if broken up when dried to the right stage it is mellow and floury.

The Clarksville silt loam has been derived in place from the limestones of the Boone formation, and nearly all of it is free from chert, but in small local areas and also where it adjoins the Clarksville stony loam from 5 to 30 per cent of "flint" may be found.

Much of the type was originally prairie, but where eroded white, post, black, and black-jack oaks were the principal growth. For corn, wheat, oats, grass, and forage crops the Clarksville silt loam is well adapted, but most of it has been farmed so exhaustively that poor yields of all these crops are generally obtained, corn as a rule giving the most satisfactory returns with the prevailing practice. This is distinctly the fault of farming methods, and not of the soil. While a few farmers are beginning to realize this and are improving their ways of management, many are still paying no attention to the maintenance of the soil's productiveness.

Wherever the topographic position is suitable with reference to water and air drainage the type is well adapted to apple production, and the red-subsoil phase is considered exceptionally so. It may be noted, however, that the red subsoil is almost never found in poorly drained areas. Peaches, strawberries, raspberries, and blackberries all do well, but for strawberries there is the objection that the silty dust in dry weather adheres to the berries badly, and it is difficult to keep the fruit clean unless the field is overgrown with grass and weeds, which is often the case. The quality of all fruits grown on this soil is excellent.

Corn yields from 10 to 60 bushels, with an average of 20 bushels; oats are mostly fed in the sheaf, but the probable yield is 10 to 30 bushels, with an average of 15 bushels; wheat 5 to 40 bushels, with an average of 10 bushels, and hay one-half ton to 2 tons, with an average of 1 ton per acre.

The cultural methods practiced on the Clarksville silt loam are nearly always inadequate and not infrequently crude. The physical characteristics of the type are such that much injury is wrought by the formation of clods whenever it is plowed or worked when too wet. Under such condition the plow smooths down the bottom of the furrow, packing the soil into a sort of temporary hardpan which will greatly lessen crop returns. The majority of fields do not receive sufficient cultivation during the crop season for proper aeration and control of moisture supply, and weeds often run rampant and are allowed to go to seed. This soil packs sufficiently after a rain so that it should be cultivated as soon thereafter as may be without the formation of clods, thus conserving moisture, keeping the soil mellow, and destroying the weeds.

Large areas of the Clarksville silt loam are farmed exhaustively year after year with little or no application of commercial fertilizer or stable manure. The most usual custom, however, is to apply the meager amount of stable manure available to the poor spots. Better farmers grow cowpeas or clover regularly, thus getting the ever important nitrogen cheaply. Within the last year or two the purchase of commercial fertilizer has become of some importance and its use has generally given at least satisfactory results in increased yields.

Corn, oats, wheat, and grass is the natural rotation here, but this is seldom definitely followed. Either corn or wheat is often grown two years or sometimes even longer in succession, and when seeded it is often left in meadow for several years.

Most of the Clarksville silt loam is in an altogether unjustifiable condition of low productiveness, and this in spite of the fact that it is easily brought to a very productive state which may be readily and economically maintained. The type is easily improved in great measure by growing leguminous crops, and clover or cowpeas should be included in every rotation. With present circumstances this type sells at prices ranging from $25 to $150 an acre, depending on condition and location. Wherever it sells for more than $100 an acre it is located near a town, or possibly near some successful orchardist, or already has an orchard of considerable extent approaching bearing age. Good farms, a few miles from town, without much orchard can be purchased at $40 to $75 an acre.

The following table gives the average results of the mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Clarksville silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
14874, 15696	Soil	1.0	1.4	1.0	6.8	15.0	65.2	9.3
14875, 15697	Subsoil	4	1.1	.9	6.1	14.9	55.0	21.4

CLARKSVILLE STONY LOAM.

The surface soil of the Clarksville stony loam consists of gray silt or silt loam from 6 to 12 inches deep. This is underlain by a lighter gray, yellowish-gray, or reddish-yellow, heavier silt loam which sometimes extends to a depth of 36 inches, but more often grades into a silty clay loam or silty clay at depths ranging from 12 to 30 inches. This lower subsoil is usually characterized by a deeper color of either red or yellow, the former being the more productive, as described under the Clarksville silt loam. The surface soil is generally loose, friable, and mellow, the stones in large measure preventing it from packing so readily as does the Clarksville silt loam under untoward conditions. The stone content of this type consists of chert fragments varying in quantity, as a rule from 20 to 70 per cent. Occasional pockets are nearly free from stones, while local steep areas may have little soil covering.

In the northwestern part of the area the Clarksville stony loam is by far the most extensive soil type. There the Illinois River, its two main branches—Osage and Clear creeks—and their numerous tributaries, have cut deep courses. So readily does this soil erode that small branches soon have deep channels, and the numerous fingerlike feeders form a network over the country, carrying on the destructive processes at every rain and giving a deeply dissected and very "choppy" topography.

The area of second importance occurs along White River in the northeast part of the area surveyed. There, owing to the uneven resistance of the limestone to erosion, the general surface has been sharply dissected and the type is very roughly broken. Ridges and steep-sided gullies are literally covered with broken fragments of chert. In shape and size these irregular pieces much resemble anthracite coal of egg size, and in exposed places these are in such amounts that they could readily be scooped like coal in shovelfuls. Such areas are little more than a succession of steep-sided, narrow ridges and valleys, and the absence of any soil covering leaves exposed extensive masses of gray chert, underneath which the trees have their roots embedded in the soil, the stone content of the subsoil usually being much less than on the surface. Where such conditions have been even more accentuated and of sufficient area, as east of White River, the Rough stony land has been mapped.

The Clarksville stony loam is well drained, and on the numerous steep slopes surface drainage is so precipitous that the soil washes badly. The limestone disintegrates so unevenly that much of this type has a "sawtooth" topography, and erosion is very severe. This is the cause of the very high percentage of chert on the surface. Where not so steeply rolling the type is well drained, but is sufficiently retentive of moisture for successful cropping.

The Clarksville stony loam has been derived from the cherty limestones of which the surface rocks over large areas in this region consist. The most resistant parts of these rocks gave rise to the chert or flint which forms a predominant feature of this soil type.

The least stony parts of the type are only moderately well adapted to the general farm crops grown here. None of the small grains are profitable, but corn, clover, cowpeas, and the grasses may be grown with success. Large areas, however, of this type, wherever the topographic position is suitable, are well adapted to the production of apples and peaches, and also to small fruits where the fields are not too stony for proper and economical working. All the steep hillsides and ridges should be left in forest or seeded for permanent pasture, as long as the prices of land are not higher than at present. On the small proportion of this type now used for general farming corn is the principal crop, followed by grass and smaller amounts of oats, wheat, potatoes, and buckwheat.

Corn yields from 10 to 50 bushels, with an average of 15 bushels; oats, 10 to 25 bushels, with an average of 15 bushels; wheat, 5 to 20 bushels, with an average of 8 bushels, and hay, one-half ton to 1½ tons, with an average of three-fourths ton per acre.

The cultural methods practiced are practically the same as on the Clarksville silt loam, except that the steeper slopes require greater care to prevent destructive washing, and a little less care is required to prevent the surface soil from packing and forming clods. Otherwise the remarks made on cultural methods under Clarksville silt loam apply with equal force here. The same fertilizer practice obtains, too, as on that type.

The Clarksville stony loam has been farmed for the most part in the same careless manner as the Clarksville silt loam, and thus yields much less than it should. The price ranges from $5 to $15 an acre for unimproved land of this type, and from $10 to $80 where improved. The latter price holds only for well-improved farms with a considerable area of orchard. Farms principally of this type but including small areas of Clarksville silt loam, with moderate improvements and small orchards, can be bought for $25 to $50 an acre.

The following table gives the results of the mechanical analyses of fine earth of this type:

Mechanical analyses of Clarksville stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
14955	Soil	2.3	3.1	1.3	3.8	7.3	68.7	13.4
14956	Subsoil	1.6	2.8	.9	1.5	12.1	53.5	27.6

WABASH SILT LOAM.

The surface soil of the typical Wabash silt loam consists of rich, mellow, brown to dark-brown silt loam or dark-gray to black heavy silt loam, with an average depth of 12 inches. This is underlain by a brown silt loam of somewhat heavier texture, which may extend to a depth of 3 feet or more, or may grade into a silty clay loam at depths ranging from 24 to 36 inches.

This type occurs as well-drained limestone bottom lands, but in the southeast part of the area the adjoining uplands are of sandstone formation from which alluvial material has been carried to the bottoms and has effected some modification in the soils. There the representative soil is a mellow brown loam which contains enough silt and clay to constitute a heavy loam in many cases, and occasionally a clay loam, but in any case there is sufficient medium and fine sand present to obscure any appreciable amount of silt.

Two minor variations are characteristic of this type, but they do not occupy large areas. These are (1) "swags" of heavy plastic clay loam of a darker color than their surroundings, sometimes black, and (2) little sandy bars and islands. The latter consist in most cases of brownish-yellow, rich, medium sandy loam, containing an appreciable though not large proportion of silt, resting upon a subsoil of dark-brown or grayish-brown plastic clay loam or clay. Just west of Johnson and in other scattered areas the type contains some chert and limestone fragments. Where the subsoil is gravelly or underlain by a bed of gravel the type deteriorates much sooner than elsewhere, and is also more susceptible to drought.

The Wabash silt loam is easy to cultivate when in good condition, but its location in the bottoms causes it to become unworkable for a considerable period after a rain.

This type of soil is located along stream courses, but principally on the Illinois River and its tributaries. It is well drained, but subject to occasional overflow. The danger from this source is not sufficient, however, to deter farmers from assuming the risk in growing corn and the small grains. Wheat seldom suffers unless an overflow comes while it is in the milk stage, or unless the rise is so sudden that the current is very swift, in which case the crop is seriously injured, or even destroyed.

The Wabash silt loam has been derived from alluvial deposits brought from the limestone uplands. The original forest growth in these bottom lands consisted principally of a heavy growth of black oak, water oak, cottonwood, black walnut, and hickory.

The Wabash silt loam is exceptionally well adapted to corn and grass. Wheat gives excellent yields when not injured by excessive

overflows. Oats are more uncertain, as they do not fill well. The type is not adapted to orchards. The crops now grown and the estimated yields per acre are as follows: Corn, 30 to 60 bushels, averaging 40 bushels; wheat, 10 to 30 bushels, averaging 20 bushels; oats, 20 to 40 bushels, averaging 30 bushels, and hay, 1 to 3 tons, averaging 1½ tons.

The cultural methods followed do not differ from those already described for the preceding upland types, except as more attention has to be paid to working the soil under favorable moisture conditions.

Practically no manure or commercial fertilizer is ever applied to this soil, and in some cases it is farmed to corn or wheat for several years in succession. This process is bound to cause a decline in the yields and should be discontinued. Better farmers frequently use the suitable rotation of corn, oats, wheat, and grass. The grass is mowed from two to five years, and then sometimes pastured for a year or more.

The Wabash silt loam is recognized as a productive soil, and for general farming purposes is very desirable. For this reason it is seldom offered for sale, and then only in connection with other upland types. It is considered well worth $50 an acre for general farming, a price that would greatly exceed that of the upland types if they were not adapted to orcharding.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Wabash silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15716	Soil	0.0	0.7	0.4	3.6	4.8	69.7	19.8
15717	Subsoil	.1	.8	.4	2.8	2.4	69.3	23.9

GASCONADE SILT LOAM.

The surface soil of the Gasconade silt loam consists of medium to dark-gray heavy silt loam or plastic silty clay loam to an average depth of 10 inches. This is underlain to a depth of 36 inches by a drab or brownish-gray silty clay loam, grading into yellowish-gray or dark-gray silty clay. This subsoil is plastic when moist, but upon drying it bakes very hard. While the general surface features are very level, mounds a few feet in diameter and from 6 to 18 inches high often occur, giving a spotted appearance to the type. The soil

on these mounds is usually a light-gray silt loam, but in a few instances is a silty fine sandy loam, whereas between them it is a dark-gray or grayish-black silty clay loam. In larger depressed areas the soil is sometimes black.

The Gasconade silt loam is difficult to cultivate wherever the water table lies near the surface, because the lower portions are often wet and clammy. Where well drained this soil is readily handled.

The three largest areas of the Gasconade silt loam lie south of Gentry, on Lindsley Prairie, around Vineygrove, and northeast of Farmington. Other areas are scattered through the limestone formation, the most extensive being north of Lilburn.

As found on Lindsley Prairie the type is very flat and the drainage deficient. In the valleys it usually occupies slightly depressed areas where natural drainage is poor and the fall so slight that in many cases artificial drainage would be difficult and costly. Most of the Vineygrove and Farmington areas are moderately well drained.

The type has been derived from a gray limestone, but in some cases this has been slightly augmented by sedimentary material, principally of limestone origin. In the Farmington area a thin capping of sandstone overlies the limestone bed rock in many places, while in others the thin-bedded sandstone is broken with many local beds of limestone. In places the type is underlain by chert beds at depths ranging from 40 to 50 inches.

The native vegetation on this soil was a heavy growth of prairie grass. Where sufficiently drained, corn and the cultivated grasses grow well, but considerable areas on the prairie must be drained before it will pay to use them for cultivated crops. The best drained areas are now planted in corn, and later seeded in meadow, which is mowed until the grasses run out. Under such conditions corn yields from 20 to 50 bushels, averaging 35 bushels, and hay 1 to 2 tons, averaging $1\frac{1}{2}$ tons per acre. A large part of the type on the prairies is left in wild hay, which is the only crop ever obtained from it.

The type, while not as deficient in humus as the Clarksville silt loam, may often be benefited by its addition, and its physical condition could be greatly improved by growing cowpeas and applying lime. Clover can be grown successfully on the best drained areas, and strawberries do well. The type requires thorough tillage and aeration if good results are to be obtained, and much more attention should be given to such treatment. Practically none of the type is ever fertilized, and very little consideration is given to crop rotation.

The price of the Gasconade silt loam, depending on the condition of drainage and extent of improvements, ranges from $10 to $40 an acre. For the poorest drained areas there is almost no demand at any price.

The following table gives the average results of mechanical analyses of samples of this type:

Mechanical analyses of Gasconade silt loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15702, 15704	Soil	1.4	1.8	0.7	5.5	7.7	68.9	13.2
15703, 15705	Subsoil	.8	1.9	.7	5.4	6.6	64.5	19.5

MEADOW.

The Meadow of the Fayetteville area includes small areas along streams that are too poorly drained or too susceptible to overflow to be used for any tilled crops. In some cases the alluvial soil would be very productive if better drained, but in many places the soil has been washed away, thus leaving underlying chert beds, and again gravel and small chert fragments have been deposited on the surface by the swift-flowing waters during flood time. Such areas, depending largely upon the character of the surrounding fields, are used as permanent pasture or left in forest growth.

ROUGH STONY LAND.

Throughout the Upshur series occur many steep areas where the processes of erosion have been so active that it has been impossible for a deep covering of soil to accumulate. Such areas include small isolated mountains and hills with precipitous sides. Wherever the tops of these elevations are in the form of low, small domes or narrow ridges the entire prominence is occupied by the Rough stony land; but where, as more often happens, the steep-sided little mountains break off into flat-topped table-lands the type gives way to other members of the Upshur series, principally the Upshur fine sandy loam and Upshur stony loam.

The surface-soil material of the Rough stony land consists for the most part of yellow or reddish-brown fine sandy loam, with only an occasional spot of loam. The subsoil as revealed in gullies is generally a reddish-brown clay loam or sandy clay. It is rarely possible to bore into the soil more than a few inches. The rock content, principally sandstone, includes ledges, bowlders, and stones in such amounts as to make impracticable any attempts at tillage, though patches of little consequence are in a few instances farmed.

In some of the roughest places a good quality of bituminous coal is mined for local consumption, but the thinness of the seams, only about 14 inches thick, will probably prevent any extensive development of this industry.

Areas of Rough stony land also occur associated with the Clarksville stony loam, but aside from the considerable area southeast of Monte Ne in only a few cases are they of sufficient extent to justify separation.

Most of the Rough stony land is best adapted to forestry purposes and now supports a moderately heavy growth of the hardwood trees, principally oak. Where not too stony, small local areas are sometimes used to advantage as permanent pasture.

FRUIT.

During the last twenty years the development of the fruit interests in northwest Arkansas has been phenomenal. The industry combines the production of berries, peaches, and apples, of which the last named is the most important. So rapid, in fact, and extensive have been the commercial plantings of apples that Washington and Benton counties contain more apple trees than any other similar area in the United States, and if these orchards are effectively managed by practicing well-defined principles of pruning, fertilizing, culture, spraying, picking, grading, and marketing there is no reason why there should not be a corresponding record of fruit output.

During the last decade the strawberry industry has grown enormously, and with many farmers this fruit is the leading money crop. During the current season, however, dissatisfaction with the prices obtained for fruit has occasioned frequent expression among growers that this year will mark the zenith of strawberry acreage.

The plants are set in the spring, by general custom, at a distance of 18 to 24 inches in rows 3½ feet apart. No fertilizer is used. Clean cultivation is practiced the first year, but in later years the matted rows are plowed out from one to three times, depending on the grower. The stand remains, as a rule, for four or five years, and often no plowing is given during the last year. No hand hoeing is done after the first year and so the fields often become very weedy. In such cases the old beds are often mowed soon after the fruit is picked, and sometimes the beds are burned over.

Under the prevailing methods low yields are obtained, and this is distinctly due to methods and not to want of adaptation of soils or climate. If soils and locations were properly selected, the land judiciously fertilized, and the plants given much additional care, the present yields could be obtained from a much smaller acreage and with a very much higher rate of profit.

All of the well-drained soils of the area are at least moderately well suited to the production of strawberries, but more attention should be given to the preparation of all the soils, except possibly the Upshur fine sandy loam. The land should be put in a fine and

mellow condition, and if weedy it is best to grow other crops until the weeds have been subdued. Greater care in setting the plants would bring much better results. A few of the best growers trim the roots to a length of 3 or 4 inches and remove all but two leaves. By thus lessening the amount of evaporation more of the plants live and a much better stand is secured. The growth, too, of the plants that live during the first season depends in large measure upon the care with which the transplanting is done, and too much emphasis can not be given to the importance of this feature.

Cultivation, especially the first season, should be very thorough, not only to destroy the weeds, but, that which is of equal importance, to control the moisture supply so far as possible, thus maintaining the most favorable conditions when either too wet or too dry. In later years cultivation should be sufficient to prevent crowding of the plants, and in the older beds this is most easily accomplished in part by cross plowing. Additional work with hand hoes would undoubtedly pay in many cases. Spraying is never practiced, but thus far injury from insects and fungi has not been serious.

The principal trouble with the strawberry business as at present conducted is due to planting a larger acreage than can be cared for properly. As an illustration, many a farmer has handled 10 acres of berries in such manner that the profit from them was highly satisfactory. So he would plant possibly 40 acres, expecting four times as much profit, but owing to lack of care he would receive no more gross income, and thus his rate of profit was only one-fourth as great. The grower who gives excellent care to a few acres of strawberries still finds them profitable.

Blackberries are an important crop, and red and blackcap raspberries are grown in considerable quantities in some sections. The former are planted in rows 6 to 7 feet apart and the latter generally 5 feet apart. The plants in the row range from 2½ to 4 feet when set, but they are allowed to run together, forming a dense mass by the second year. Some of the dead canes are removed annually, and the best growers cultivate carefully each season. No fertilizer is applied, and the statement is often heard that a blackberry crop increases the soil's productiveness.

The acreage of peaches in the area is probably less than one-tenth that of apples, but still many carloads are shipped whenever there is a good crop. The methods of cultivation and early orchard management in this area are so similar to those of apple orchards that they will not be described separately. The Elberta is the commercial variety, but a few other varieties of better quality are grown. A full crop is obtained once in three or four years. Many of the small and miscellaneous plantings of this fruit unfortunately consist of seedlings, and hence when a surplus is obtained no profitable market can

be had. It should be realized by those who grow only a few peaches that aside from the inconsiderable first cost of the tree the expense of producing good marketable fruit is no more than for seedlings.

The favorite distance for setting the trees is 16 by 16 feet, but in many orchards they are crowded in much nearer. During the early life of the trees farm crops are grown in the orchard, and this practice is often continued so late as to cause injury to the trees. The best growers cultivate early in the season, and then sow a cover crop, hairy vetch being well adapted to this purpose, though few farmers have adopted it. Many of the orchards are allowed to grow up in weeds. Apple trees are often set between the peach trees, which are removed when the apple trees have attained sufficient size. There is much less enthusiasm about increasing the plantings of peaches than of apples, as the element of risk is generally considered greater with the former, though some think there is a possibility of greater profits.

The steady increase of apple plantings prior to 1901 and the very rapid extension of young orchards following the profitable crop of that year has not only brought this area into prominence as an apple center, but it has also inaugurated the necessity for the majority of farmers who planted the orchards to learn how to manage them so as to produce good crops, if they are ever to receive profitable returns. The failure of most orchards to produce a paying crop in the four years following 1901 caused a decided lull in the extension of plantings in 1905 and 1906 and a great deal of uneasiness on the part of many growers.

The anxiety of the many to set out orchards at once was the principal reason why trees were hastily planted in the most convenient places regardless of site or soil and its preparation. Consequently some young orchards are now so located that suitable air drainage is impossible, and water drainage either impracticable or expensive, inasmuch as the trees will never be successful unless the soil is artificially drained, and in many cases it is a question whether this would prove profitable. Very fortunately, however, most of the upland soils are at least moderately well adapted to apple production, and good or excellent sites prevail. Hence the principal requisite for success lies at present in learning better methods of management.

In general practice, orchards are set in the spring in soil which has been plowed shallow, harrowed once, and planted in corn. Few realize how essential thorough preparation of the soil is and the importance it has on the early growth of the tree. The best growers plow from 6 to 8 inches deep and cultivate until the soil is uniformly mellow. The roots are then carefully pruned, the tops cut back a corresponding amount, the trees set to the same depth as they stood in the nursery, and the earth carefully sifted about the roots

and compacted so that they remain in their natural position and are not easily swayed by the prevailing southwest winds.

One large nursery and several small ones within the area furnish the principal part of the trees set, though an occasional orchardist grows and grafts his own trees.

The distance between trees varies greatly. In many orchards the trees are as close as 20 by 25 feet, and in some instances even 15 by 25 feet. The better orchardists plant not less than 25 feet apart each way, while the leading men now advocate 25 by 27 feet or 30 by 30 feet.

Fertilizer of any kind is seldom applied to orchards before they reach the bearing age, and very few receive any after that time. Cowpeas and clover grow luxuriantly, however, and the leading orchardists use them extensively for increasing the productiveness of the soil. Of these valuable crops the former is much the more popular. The cowpeas are most often sown broadcast to save time, but the most observing men drill them in rows 2½ to 3 feet apart. The best practice is to check row them so that the apple trees as well as the peas receive the most effective cultivation. In this way the best possible moisture conditions are maintained, and injury to the orchard in a dry season is much lessened. The State experiment station at Fayetteville has demonstrated that the peas should be sown the last of May for the greatest growth of vine and root nodules, but if sown two weeks later the yield of peas is greater. The amount of nitrogen gathered by the roots is greater when the peas are sown in rows than when broadcasted. The latter is the usual practice in the area. If the peas are to be broadcasted the soil should receive clean cultivation until the last of May before sowing. By this method the possible danger of cultivating so late as to effect a too late seasonal growth is eliminated.

Corn is a favorite crop for young orchards, as it necessitates cultivation, shades the trees, and is a salable product, but it should not be grown unless the land is very productive, a condition seldom found unless it has been manured. Where corn is grown a practice frequently seen, and a very commendable one, is to sow peas in the corn at the last cultivation, pick enough for seed, and disk or plow in the rest.

When the annual growth of the trees becomes too rank, as sometimes happens when cowpeas are grown continuously, clover has in some cases proved advantageous. The clover is mowed several times during a season and left on the ground as mulch. By thus checking slightly a very vigorous growth in orchards which were not bearing satisfactorily the yield of fruit has been materially increased.

When clover is sown a total row width equivalent to the spread of

the branches receives no seed, the clover gradually working its way into the vacant space. The clover is mowed and some of the best of it cured and fed to stock. The remainder and also the second crop is left as mulch. When clover is grown it is usually rotated with cowpeas. The prevention of cultivation is the principal objection to growing clover in orchards.

Some have followed the very profitable practice of pasturing hogs on the cowpeas or clover. This may be done safely where the trees have attained a growth of several years, provided that the hogs are not so numerous as to consume all the feed, and that there are no places in the orchard where water will stand, thus affording the hogs a wallow, from which they will come and injure the trees by rubbing on them.

Clean tillage is not in favor here because the hot sun "burns out" the soil and also leaves the trees exposed to the danger of sun-scald. Where crops are not grown the orchard is plowed once or twice early in the season and then allowed to grow up in weeds. The director of the experiment station has also shown that leguminous crops should be turned under in this climate only when the ground is moist, for if too dry much of the nitrogen is lost. No cereals should ever be grown in an orchard save as a cover crop to be turned under.

The principles of fertilizing are very little understood. The prevalent belief that orchards do not need fertilizing is well buttressed with the hope that it is unnecessary, and a great many orchardists are not only unwilling to fertilize their trees, but also insist on double cropping their orchards. In the early life of the orchard tilled crops may be grown and removed, provided the soil is in a condition sufficiently productive so that the trees will not suffer—a condition which very seldom occurs in this area after the trees have attained much size. Another way of stating it is that in most all double-cropped orchards the trees suffer, and this is one cause why paying crops of apples are so infrequent. If orchards are to be double cropped, they must not only be maintained in a very productive state, but also carefully watched lest the trees be deprived of moisture at a crucial time in their growth. Experience has shown that where cover crops only are principally grown the betterments derived from their use in combination with the mineral fertilizers may be very beneficial.

Another important requisite for the best results with apple orchards is careful, efficient, and wise pruning, and this statement is made unreservedly, notwithstanding the frequent expressions of the unwisdom of so doing. Men coming here from a more northerly latitude have sometimes trimmed neglected orchards so severely as to ruin or greatly damage the trees, and this may be one cause why 90 per cent of the present orchards suffer from the other extreme—lack of pruning. Many orchards have received so little

pruning that at present they form a wilderness. After being allowed to grow in this condition for a time much injury from sun-scald follows excessive pruning. The superfluous branches should not all be removed at once, but the operation should be extended over several years, so that there may be no great gaps in the foliage. Because of the long season of rather intense sunlight the head should be left more dense than in the north, but there is no argument in favor of the impenetrable wilderness head nor of a mass of branches touching or nearly reaching the ground when not sustaining a heavy load of fruit—conditions which are by far too common.

This region has, until the last few years, been remarkably free from fungi and insect pests, but these are rapidly increasing and have come to be a very serious problem which must be met. Codling moth, tent caterpillar, the borer, and cankerworm are the principal insects, and apple scab and bitter rot the most important fungus diseases. Of these the codling moth and bitter rot probably cause the most damage. The much-dreaded San Jose scale has now appeared to a limited extent near the border of the area.

The percentage of growers who spray is very small. Nearly all the insecticides and fungicides used are in liquid form. During the present season the loss from bitter rot has been tremendous, and as prices at picking time were not very high the entire crop of fruit was shaken from some orchards and sold as evaporating stock. Just beyond the limits of the area surveyed, Professor Scott, of this Department, has clearly demonstrated this season that this disease may be prevented by spraying first six weeks after the petals fall, and following this with four or five applications at intervals of two weeks.

It is unnecessary to mention the details of spraying here. This matter as well as others concerning local orchard interests has been excellently presented by Prof. Ernest Walker, horticulturist of the experiment station at Fayetteville, in Bulletin No. 91, entitled "Suggestions upon the Care of Apple Orchards," and bulletins of this Department concerning diseases of both tree and fruit are available.

The varieties of apples grown in the Fayetteville area are fortunately much fewer than in many other apple sections. The Ben Davis is the leading variety, constituting probably 75 per cent of all plantings until within the last three years. This variety is at its best here. It colors well, ships well, is of better quality than where grown in the North, and is very prolific. It has been the most profitable variety, but when prices are as low as $1 a barrel, as during the present season, it is almost impossible for a grower to sell Ben Davis unless he has other varieties of better quality to be included in the same lot. In recent years this has caused the trial of several new varieties, and

although none of them bear as prolifically as the Ben Davis under the prevailing amount of care and attention given, or under gross neglect, they are replacing that variety to some extent. With increased care given in the way of fertilizing, tilling, pruning, and spraying, the difference in productivity between the Ben Davis and other varieties of better quality is somewhat lessened.

Of other varieties the Jonathan is undoubtedly the most important, and its high quality has done much for the reputation of the Ozark region. At present this is the variety most in favor for future plantings. The Winesap is also increasing in favor. The Arkansas Black, Mammoth Black Twig, and Gano have been extensively planted, but they are not sufficiently productive. The Shannon, Golden and Missouri Pippins, and Yellow Transparent are all well represented, but they do not ship well enough or bear satisfactorily. The plantings of Rome (Beauty), Collins Red, Ingram, Black Ben Davis, York Imperial, and Given are increasing. The Red Astrachan is the most important early variety.

The apple crop is usually sold in the orchard, the buyer doing the grading and packing. Small lots are hauled in bulk or loose in barrels to dealers, who assort and pack them. Almost no packing is done by the grower. There is usually only one grade barreled. The culls are sold as evaporator stock. The disposal of culls as evaporated apples has grown to be a very important industry. There are several large evaporators within or near the area, and many orchardists have small plants at home. It is said that present market demands do not care for a graded product and so only one grade is made. It would seem that a demand might be created, at least in the course of time, for a high quality pack, so that choice fruit would bring good returns, and this is proved by the profitable production of better evaporated stock just beyond the area. The chops are either wasted or made into vinegar. A large vinegar plant just north of the area consumes large quantities of poor stock and waste.

The fruit industries of the area have effected some degree of organization which has assisted greatly in marketing the products. Nearly all berries and peaches are sold cooperatively by associations of growers. Nongrowers are not admitted to membership. According to the regulations of most associations each member has to buy one share of stock. These organizations are regularly incorporated under the State laws of Arkansas, and some of them own railway side tracks, sheds, evaporators, etc. Each member must bring all berries and peaches to the association, which has refrigerator cars in which to ship, but apples may be sold independently, and large quantities of them are so disposed of. These associations also buy outright of nonmembers, and local dealers handle the rest of the product.

Briefly, then, the Fayetteville area, because of its adaptability to apple production, rose to the front rank in extent of plantings after a few very profitable years. So enthusiastic did orchardists and a great many of the farmers become that plantings advanced beyond a healthful rate of growth for the best development of the industry. This was not because the soil, climate, and other conditions were unfavorable for the foundation of an extensive industry, but because, firstly, men became so anxious to start large orchards at once that they set them anywhere regardless of soil or environment; and, secondly, because men who possessed no understanding of or particular liking for the growing of apples rushed into the business, not realizing that the setting of the tree was only the beginning and that success could come only to him who understood or was determined to learn the details of the business from the setting of the tree to the marketing of the fruit. Failure to realize that successful orcharding requires hard and constant study has brought disappointment to many.

SUMMARY.

The Fayetteville area is located near the northwest corner of Arkansas, along the southern border of the Ozark Plateau. Into the limestone plateau extends a northerly fringe of the Boston Mountains, occupying approximately the southeast fifth of the area.

The climatic conditions of the region are particularly favorable for the development of the important fruit industry, and also exceptionally pleasant from a residential viewpoint. The principal part of the area is well drained by the Illinois and White river systems, and has an excellent water supply.

The area is not densely populated, but with the exception of the most hilly and stony sections farmhouses are frequent and there are many small settlements. There are several towns of importance located on the railroads, and for some distance from these the farming areas are thickly settled. The location of the State university and experiment station within the area adds much to its attractiveness. According to the census of 1900 approximately one-half of the lands within the area were improved, but since then this percentage has been increased.

The principal products of the uplands are apples, peaches, and berries. General farming occupies a secondary place, but may be said to be the means of subsistence, fruit being the money crop. In the lowlands general farming leads, corn, hay, and wheat being the principal sources of income, while oats and forage crops are grown to some extent. With some farmers hogs, mules, and cattle are important products.

The leading crop rotation practiced consists of corn, oats, wheat, and grass. Cowpeas are often sown in the corn. Many farmers are negligent in the matter of crop rotation, and there should be much improvement in this respect. Labor conditions are generally satisfactory.

Nine types of soil were mapped in the Fayetteville area besides Meadow and Rough stony land. The limestone soils are all silt loams with heavy silt loam or silty clay loam subsoils. Wherever the topography is much broken, varying amounts of chert are present. Where well drained—as most of the upland portions are—these soils are well adapted to the production of apples, peaches, and berries, and when well farmed satisfactory yields of the staple farm crops are obtained. The Clarksville silt loam ranges in price from $25 to $150 an acre, depending on location, buildings, and amount of orchard; the Clarksville stony loam $5 to $15 unimproved, and $10 to $80 improved; and the Gasconade silt loam from $10 to $40 an acre. The limestone bottomland, the Wabash silt loam, is perhaps the best type in the area for general farming and is worth $50 an acre for that purpose, but because of its nonadaptation to fruit it can be bought for less than some of the upland fruit soils.

The sandstone uplands are loams and fine sandy loams overlying clay loams or fine sandy clays. The Upshur loam is a good soil for general farming, and where favorably located it is well adapted to the tree fruits and berries. It may be bought at prices ranging from $15 to $100 an acre.

The Upshur fine sandy loam is one of the best types in the area for the production of strawberries. Peaches and apples also do remarkably well when the topography and drainage are favorable, and selected positions within this type furnish conditions almost ideal for these crops. The yields of farm crops are only moderate, and the soil must be fertilized to obtain profitable returns, but it responds quickly to fertilizers. Part of the type is somewhat inaccessible, and this lowers its value. Such areas range in price from $5 to $50 an acre. Accessible areas bring from $20 to $100 an acre, depending upon improvements and the amount of orchard.

The Upshur stony loam is adapted in part to tree fruits, general farming, and permanent pasture, depending upon position and stone content. Its price ranges from $5 to $50, averaging possibly $20, an acre.

The Wabash clay loam and Wabash loam are bottom-land soils derived principally from sandstone wash. They are both excellent types for corn, grass, and forage crops, and in well-drained fields the other cereals are sometimes grown to advantage. In general these types are not adapted to the tree fruits, but strawberries and the cane

fruits do well where drainage is good. These types may be purchased for from $10 to $50 an acre.

It would be easily possible to improve the management of the farming lands of the area in certain respects. The methods of cultivation are generally inadequate. Few of the soils receive sufficient preparation before planting, and in many instances increased tillage would profitably enlarge the crop returns. Crops are not harvested at the proper stage of ripeness, and in some cases there is much wasted. The former happens in the hay harvest, and the latter with corn, particularly, and in lesser degree with the cereals. At least one-half of the feeding value of the corn fodder is wasted because of failure to gather properly or in due season, and large amounts of straw are lost. Stable manure is very valuable, particularly on the upland soils, but few farmers exercise any care in saving it.

The Frisco and the Kansas City Southern railroads furnish fairly efficient transportation facilities, but there is some criticism of freight rates. In some parts of the area long hauls to and from the nearest station are necessary.

There are more apple trees in the two counties of which this area is a part than in any other similar area in the United States. The small-fruit interests are also very extensive, strawberries being the most important.

The soils and climate are well adapted to strawberries, but growers are inclined to have a larger acreage than they can properly care for, thus obtaining a smaller profit than they should.

Blackberries and raspberries, both red and black cap, are grown in considerable amounts, and for the most part successfully.

Peaches are an important crop and, on the whole, have proved profitable. This fruit is not looked upon with as much favor as the apple, and plantings are being increased much less extensively.

Apples are by far the most important crop, and those who have studied this branch of the fruit business so thoroughly as to master its details have succeeded and by their success have fully demonstrated the possibilities of profitable orcharding in this region.

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