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

SOIL SURVEY OF THE PIKEVILLE AREA, TENNESSEE.

BY

HENRY J. WILDER AND W. J. GEIB.

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[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURE.

MAP.

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LOCATION AND BOUNDARIES OF THE AREA.

The Pikeville area lies in the east central part of Tennessee, approximately 50 miles north of Chattanooga. It is included between the parallels of 35° 30′ and 35° 50′ north latitude, and meridians 85° and 85° 20′ west longitude. In all, 440 square miles were surveyed, and this area comprises the chief part of Bledsoe and lesser parts of Van Buren, Cumberland, and Rhea counties.

The chapter on geology is based upon, or taken from, the report contained in the Pikeville Folio of the United States Geological Survey, 1895.

The historical matter has been compiled from information obtained from old residents, as nothing has been published which can be said to apply specifically to the area surveyed.

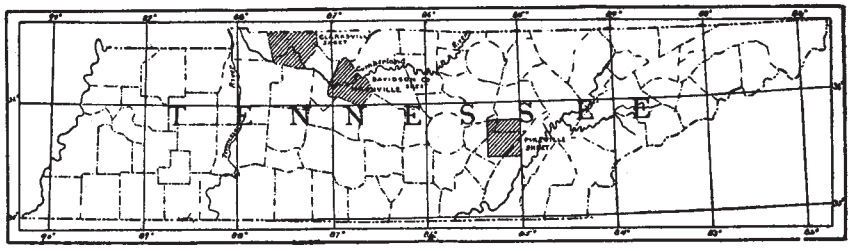

FIG. 1.—Sketch map showing position of the Pikeville area, Tennessee.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The first white settler within the limits of the present area was Valentine Spring, who came from Virginia early in 1804 and settled about 5 miles south of Pikeville. He was followed by others, and 9 acres of land were cleared during the first year and planted to corn.

These early settlers found the area occupied by the Cherokee, Choctaw, and other Indians, though tradition says that the common hunting grounds of the Shawnees, Cherokees, and other southern Indians included all of this region. These tribes, generally speaking, were not troublesome, and they gradually migrated across the Tennessee River, where they formed what was then called the "Indian Nation." There they remained until 1836, when they were removed to the Indian Territory.

Canebrakes grew luxuriantly in the Sequatchie Valley, as well as in some of the upland glades, and furnished pasturage for cattle and horses. Wild game was abundant, and formed the principal supply of food.

The original timber growth of the area was varied. In the valley it included white oak, yellow poplar, beech, sycamore, black walnut, and hickory; on the northwestern slope of Walden Ridge, yellow poplar and chestnut, with lesser amounts of white oak and chestnut oak; and on the southeastern slope of the Cumberland Plateau, scrubby white, chestnut, and post oaks. On the tops of Walden Ridge and the Cumberland Plateau the chief growth consisted of chestnut, chestnut oak, black oak, post oak, blackjack oak, scrubby white oak, and hickory, while the valleys were forested with yellow poplar, hickory, and white oak.

Lumber was sawed by hand by means of whipsaws. In this way four or five hundred feet of boards could be sawed by two men in one day, but as more settlers came sawmills were introduced.

Corn, wheat, and oats were the chief crops, and as the area developed cattle, horses, sheep, and hogs were raised in large numbers. Of these, hogs received by far the most attention, and until about 1850 farmers united in herding and driving their hogs to Georgia. Corn was carried in wagons to feed these large droves when forage along the road was insufficient for their sustenance. Hogs were sold all along the way, and the journey was continued until the entire drove had been disposed of. Such a trip would consume a month or more. This method of marketing hogs, which had declined steadily for a few years preceding the war, ceased with that event.

Cattle were driven to North Carolina and Virginia, and in addition buyers often came from those States and bought steers, for which they paid from $7 to $10 only, at 3 years of age.

The remoteness of the area from markets in the early days made it difficult either to obtain supplies or to sell produce. Merchandise was hauled from Baltimore with 6-horse teams. After Nashville was established and the Cumberland River was made navigable, merchandise was shipped up the Mississippi and Cumberland rivers to that city, and from there it was hauled by teams to the districts farther inland. Cotton, flax, and wool were grown, and most of the clothing was manufactured at home.

CLIMATE.

No weather records are available for Pikeville or for any station in the Sequatchie Valley. The nearest point at which observations have been made is Farmingdale, which is situated about 16 miles north of Pikeville on the Cumberland Plateau, and the records taken there extend over but eighteen months for temperature and about three

years for precipitation. These records of course are not sufficient to establish normals.

The observations of the voluntary station of the Weather Bureau at Erasmus, which is located a few miles north of the area, have been taken for six years, and it is believed that the normals from this station are fairly applicable to the upland portion of the area surveyed.

The average dates of the first killing frost in autumn and the last killing frost in spring are, respectively, October 14 and April 22.

The elevation of Erasmus is about 1,850 feet above sea level, and the temperature averages low as compared with the Sequatchie Valley, which has an elevation of 872 feet at Pikeville.

Normal monthly and annual temperature and precipitation.

Month.	Erasmus.		Farmingdale. [a]		Month.	Erasmus.		Farmingdale. [a]	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° F.	*Inches.*	° F.	*Inches.*		° F.	*Inches.*	° F.	*Inches.*
January	36.7	5.55	.....	5.52	August	71.8	4.76	72.5	3.84
February	34.3	4.42	35.0	4.11	September	65.7	2.96	67.0	2.33
March	47.0	7.48	44.1	8.94	October	56.6	3.55	53.3	1.58
April	51.7	6.10	55.9	3.40	November	44.9	4.14	43.4	6.33
May	62.7	4.00	64.0	2.34	December	35.7	5.56	34.4	3.49
June	70.2	5.50	67.6	8.41	Year	54.2	59.74	.....	52.94
July	72.8	5.72	71.2	2.64					

[a] The figures given for this station are averages for one year and not normals.

PHYSIOGRAPHY AND GEOLOGY.

The Pikeville area is divided naturally into three sections. The Sequatchie Valley extends in a perfectly straight line from northeast to southwest across the area mapped. It varies in breadth from 3 to 4 miles, and is bounded on each side by escarpments 1,000 feet high. This valley is flanked on the west by the Cumberland Plateau, which occupies one-half of the entire area, and on the east by Walden Ridge.

The Cumberland Plateau has an altitude varying from 1,700 to 1,900 feet. Above this general level rise small, isolated hills from 100 to 500 feet higher. These appear as hills rising above a level plain. The streams that drain its surface have their sources within a short distance of the Sequatchie Valley and flow westward in shallow channels.

Walden Ridge has the same topographic characteristics as the Cumberland Plateau, but it is somewhat higher, having an altitude between 1,900 and 2,000 feet above sea level. Its streams rise near the brink of the escarpment to the Sequatchie Valley and flow southeastward in shallow channels.

The position and form of the Sequatchie Valley are directly dependent upon the geologic structure of the region. The hard rocks forming the surface of the plateaus on each side formerly arched continuously across, so that a long, narrow ridge then occupied the position of the

present valley. The hard rocks are underlain by limestones, which are easily removed by solution. When the agents of erosion had worn down the top and sides of this ridge through the covering of hard rocks, so that the waters had access to the underlying limestone, erosion was then more rapid upon the limestones than upon the sandstones of the adjacent plateaus, and hence the surface was more rapidly lowered, and in time a valley was formed.

The position and direction of the streams of this area were determined while a ridge still occupied the position of the Sequatchie Valley. This ridge formed a divide which turned the waters toward the northwest and southeast. As the ridge was removed and a valley was eroded in its place, the streams retained their original position, heading upon the immediate edge of the eroded valley.

All the rocks appearing at the surface within the limits of the Pikeville area are of sedimentary origin. They consist of sandstones, shales, and limestones, which present great variety in composition and appearance. The materials of which they are composed were derived from the waste of older rocks or the remains of plants and animals which lived while the strata were being laid down. Thus, some of the great beds of limestone were formed largely from the shells of various sea animals, and the beds of coal, which are being worked at present in the Cumberland and Walden plateaus, are the remains of a luxuriant vegetation which probably covered low, swampy shores. The rocks of the area disclose a record of almost uninterrupted sedimentation from earliest Silurian to late Carboniferous time. Their composition and appearance indicate the nearness to shore and the depth of water in which they were deposited. The Pikeville area was near the eastern margin of the ancient sea in which these sediments were laid down, and the materials from which its rocks are composed were therefore derived largely from the land to the eastward.

Beginning in the Sequatchie Valley, which has a minimum elevation of 850 feet above sea level, the geological record of the district may be readily traced. The Knox dolomite, which consists of massively bedded and somewhat crystalline gray, magnesian limestone, comes to the surface in a belt about 2 miles wide through the center of the Sequatchie Valley. The limestone contains a large amount of silica in the form of nodules or layers of chert or flint. That part of the rock which consists of the carbonates of lime and magnesia is dissolved upon weathering, leaving behind the chert, usually embedded in red clay. These chert outcrops occur chiefly upon low, rounded hills which rise from 50 to 350 feet above the Sequatchie River. The area occupied by this geological formation includes three distinct soil types—the Clarksville loam, the Hagerstown loam, and one phase of the Hagerstown stony loam. The Hagerstown loam is derived from the purest parts of the Knox dolomite, the Clarksville loam from

sedimentary deposits overlying the same formation, and the Hagerstown stony loam from the most impure portions of the dolomite.

The Knox dolomite is succeeded on each side by a narrow band of the Chickamauga limestone, the three belts together forming the greater part of the Sequatchie Valley. This formation is mainly a blue, thin-bedded, flaggy limestone which contains many fossils. On the east side of the valley the last-described formation passes gradually into the Rockwood formation, of which the base consists of calcareous shales, together with thin beds of hard blue limestone. On the west side of the valley this formation is absent by reason of the fault of the Sequatchie anticline.

Overlying the Rockwood formation is a thin stratum of shale which appears to represent the whole of the deposition that took place in this region during the Devonian period.

The Fort Payne chert consists of a narrow band of very siliceous limestone, which rests upon the Chattanooga black shale and forms, with the underlying Chattanooga and Rockwood formations, a narrow ridge or line of knobs parallel with the plateau escarpment.

The Bangor limestone forms the lower slopes of the escarpments and the floors of all the caves. This is a massive, blue, crinoidal limestone, although it presents many local variations from this type. Chert is more or less abundant throughout the formation.

The soil types as mapped do not conform to these geological formations. While one geologic division in the valley includes three types of soil, near the foot of the escarpment one type of soil—the Hagerstown stony loam—often includes no less than four geological formations.

The calcareous shales at the top of the Bangor limestone indicate a change in the conditions of sedimentation, shoaling water, and an increase in quantity of sediment. During the deposition of the succeeding formation the sea bottom was lifted, so that the water became shallow over a wide area, while an abundant supply of mud and sand was washed in from the adjoining land. These conditions were unfavorable for the animals whose remains are so abundant in the preceding formation, and instead of limestone a great mass of shale and sandstone was deposited. The surface also stood above sea level at various times, long enough at least for the growth of the luxuriant vegetation which formed the coal beds. All of this deposition was included in the Lookout sandstone, which consists of conglomerate sandstone, sandy and clayey shale, and coal. It seems that the sediments which make up this formation were deposited upon a somewhat uneven sea bottom, in broad, shallow troughs extending in a northeast-southwest direction.

Above the Lookout conglomerate lies the Walden sandstone, which consists of another series of coal, shale, sandstone, and conglomerate, but this is more uniform than the preceding formation. The Walden

sandstone may be divided in most places into four members. At the base a bed of shale contains the principal coal seam of the region. This is overlain by a variable thickness of coarse white or yellow sandstone, which sometimes contains a few conglomerate pebbles. This sandstone forms the surface of the plateaus over a considerable portion of the area, and was observed also forming the roof of one of the small coal mines. Above this middle sandstone are sandy shales, which, in turn, are overlain by heavy, coarse sandstone, generally conglomeritic. The two upper members of the Walden occur chiefly along the eastern side of the Walden and Cumberland plateaus. They form also the broad, rounded hills which were described as rising above the general level of the plateaus.

At the close of the Carboniferous period this region was elevated permanently above sea level, so that the constructive process of deposition was stopped and the destructive process of erosion was begun.

SOILS.

The soils of the Pikeville area have been classified in seven types, exclusive of areas mapped as rock outcrop. More than half the area is occupied by one sandy loam type, while the stony loams cover a larger area—about 20 per cent—than any of the remaining types.

The following table shows the area of each of the established types:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
De Kalb sandy loam	163,392	58.1	Rock outcrop	14,016	4.8
De Kalb stony loam	32,128	11.4	Hagerstown sandy loam	5,760	2.3
Hagerstown stony loam	27,392	9.7	Clarksville loam	1,280	.5
Hagerstown loam	20,352	7.2	Total	281,344	.....
De Kalb clay loam	17,024	6.0			

HAGERSTOWN LOAM.

The soil of the Hagerstown loam consists of brown or yellowish-brown, mellow loam, from 9 to 12 inches deep. This material is underlain by stiff loam or light clay loam, red or yellow in color, to a depth of from 24 to 30 inches, where it passes into stiff red clay. The middle layer of yellow loam sometimes is absent, and in this case the soil is underlain at a depth of from 12 to 15 inches by stiff red clay loam.

The surface soil of this type is generally uniform, excepting that a slight wash has left the heavy red subsoil nearer to the surface on some of the steep hills, and the eroded soil has consequently accumulated to a greater depth at the foot of the slope.

On some of the slopes, through negligence, gullies have been allowed

to form, but the liability to wash is not a serious disadvantage with this soil, as it may be easily prevented by careful methods of tillage.

Traces of cherty limestone may be found in both soil and subsoil, and the underlying bed rock of limestone sometimes protrudes through the surface, but this is never of sufficient extent to be a serious impediment to cultivation.

Low, cherty hills of small area sometimes occur in this type. In such cases the slopes usually are covered with angular fragments of chert, which are seldom more than 2 inches in diameter. The tops of these hills may be cherty, but more often they have the typical soil of the Hagerstown loam to a depth of from 8 to 16 inches, overlying a mass of cherty fragments. An example of this kind may be seen just west of Hall Creek. Again, some of the highest hills in the valley, not far east of the Sequatchie River, are so covered with fragmentary chert, impure limestone, quartzite, and sandstone that cultivation is difficult, dry weather has a serious effect, and crop yields are very low. The two phases just described are much inferior in crop-producing power to the average of this type, but the irregular and intermittent manner of their occurrence makes it impossible to designate their location on the map.

A variation quite different in character occurs 3 miles south of the Low Gap road. Extending from the Sequatchie River nearly to the east valley road is a low-lying, level area of perhaps 150 acres. The soil is heavy, stiff, soapy clay loam to a depth of 6 inches. The subsoil is drab-colored clay, even more soapy than the soil. The soil is greatly in need of drainage, and hence the action of frost causes it to heave seriously. This tendency has given rise to the name "crawfish land." Undrained this soil does not produce well, and is used chiefly for pasturage, but where ditched it is very productive. If thoroughly drained, which in this case could be done at a cost comparatively small, and carefully worked, this soil would produce excellent crops, and the improvement would pay well. Several other smaller areas of this character were noted in the valley.

Crossing the east valley road 2½ miles south of the Loyd Gap road is an area of about 200 acres of heavy red clay. This area has the same rolling topography as the surrounding Hagerstown loam, and although there is no evidence that extensive erosion has taken place here, the soil is similar to that of other smaller fields of Hagerstown loam which are known to have been eroded and afterwards reclaimed. This soil, although heavy and hard to till, is as productive as could be expected with the methods in use. Its chief need is much more thorough preparation for planting, and to accomplish this it should be worked only under favorable moisture conditions.

The Hagerstown loam is the most important soil type of the Sequatchie Valley. Beginning about 2 miles north of old Sequatchie

College it extends, in an irregular area which varies in width from 2 to 3 miles, through the center of the valley northward to Litton. At each end it gives way to the Hagerstown stony loam, and at intervals throughout its extent the cherty hills of that type are interspersed.

The moderately rolling surface features of the Hagerstown loam include many broad and nearly flat-topped hills, which have withstood the wearing-down agencies of erosion more successfully than the general level of the valley. The entire valley contains but limited areas of level land, and near the foot of the escarpment which borders the valley on each side the Hagerstown loam becomes more heavily rolling until it is superseded by the Hagerstown stony loam which lies along the base of the escarpment.

The roadbeds in the valley usually are worn down to the deep red subsoil of the limestone formation, which imparts to them its characteristic color.

The uneven topographic configuration of the Hagerstown loam secures for the main part of the type good surface drainage, but the imperviousness of its subsoil in small hollows, augmented in some cases by the proximity of the underlying limestone, accounts for the formation of the small sinkholes which are scattered throughout the valley.

This type of soil was formed by the decomposition of massively bedded gray limestone, and, to a lesser extent, of thin-bedded, flaggy, blue limestone, both of which belong to the Silurian, or possibly Upper Cambrian, period.

The Hagerstown loam is all used in the extensive system of general farming which is practiced throughout the area. Corn yields from 15 to 30 bushels, with a probable average of 22 bushels, per acre. Wheat yields from 5 to 20 bushels, with an average of 10 bushels, and the comparatively small amount of hay which is grown yields an average crop of 1 ton per acre. Oats, when grown on land in good condition, may make 50 bushels per acre, but under the prevailing methods of husbandry they usually are sown on fields which have been exhausted by successive cropping, and entire or partial failure is common. Consequently no estimate of average yield is given.

The Hagerstown loam is naturally excellent soil. It is well adapted to general farming, and under more intensive methods of management than it receives at present its productiveness could be largely increased.

In the table on the following page is given the texture of both the soil and subsoil.

Mechanical analyses of Hagerstown loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10168	1 mile E. of Pikeville.	Heavy mellow loam, 0 to 8 inches.	1.36	0.60	2.30	2.76	16.14	15.14	40.76	22.26
10170	2 miles S. of Pikeville.	Brown heavy loam, 0 to 8 inches.	.92	.80	2.14	3.50	15.06	14.00	40.18	24.14
10172	2 miles SW. of Melvine.	Brown medium loam, 0 to 10 inches.	1.64	1.10	2.00	2.10	16.06	11.84	41.00	25.70
10171	Subsoil of 10170...	Red clay loam, 8 to 36 inches.	.45	.78	2.50	2.52	11.48	11.12	38.74	32.78
10169	Subsoil of 10168...	Red clay loam, 8 to 36 inches.	.43	.60	1.90	2.16	11.78	11.56	37.48	34.20
10173	Subsoil of 10172...	Red clay loam, 8 to 36 inches.	.62	1.00	1.90	1.40	12.50	8.24	35.50	39.34

CLARKSVILLE LOAM.

The soil of the Clarksville loam is a rich medium loam that becomes slightly heavier with depth. This is underlain by a heavy loam, or rarely by a light clay loam. Along the immediate banks of the Sequatchie River the soil is a sandy loam, and at the base of the slope of the adjoining upland it is in some places a clay loam, but each of these occurrences is at most but a few rods in width. With the exception of the sandy loam next the river the soil is colored dark brown, or nearly black, to a considerable depth with organic matter.

The Clarksville loam occupies level areas along the Sequatchie River. The highest point of these bottom lands is always immediately along the stream course. The small branches which flow into the river have cut through this dike, and when the water in the river is abnormally high it sets back in these branches and overflows the bottoms. This happens each year in early spring, and rarely during the summer season. These bottoms are seldom more than one-fourth of a mile wide, and often are too narrow to appear on the map.

The soil is alluvial in origin, and represents the material laid down by the Sequatchie River and its branches in flood time. These lowlands were formerly covered with a luxuriant growth of cane, and along the banks of the streams the natural forest growth of sycamore, gum, and willow is still found.

The Clarksville loam is considered the most valuable soil of the area for the production of corn and hay, and it is best adapted to these crops. When manured it is said to yield as high as 50 to 75 bushels of shelled corn per acre, and 1½ tons of hay at the first cutting. Wheat yields from 15 to 20 bushels per acre, but is not a safe crop

because of the liability to overflow. The highest yields of sorghum in the entire area are obtained on the sandy spots of this formation.

The results of mechanical analyses shown in the following table indicate the texture of this soil and its subsoil:

Mechanical analyses of Clarksville loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10152	Pikeville	Light mellow loam, 0 to 9 inches.	1.03	0.08	0.56	1.58	14.50	15.08	42.68	24.84
10153	Subsoil of 10152...	Light clay loam, 9 to 36 inches.	.55	.24	1.00	1.78	18.70	16.94	35.44	25.54

HAGERSTOWN STONY LOAM.

The Hagerstown stony loam of the Pikeville area includes three distinct phases, which will be described in the order of their productiveness. This classification also coincides with the degree of impurity of the limestone from which the soil is derived.

In a cave a few miles above the head of the Sequatchie Valley the river of that name sinks beneath the surface; flows several miles underneath a spur of Walden Ridge, and, just within the limits of the area surveyed, gushes from an opening in the solid limestone rock which forms the basal material of the surrounding mountains.

The uneven topography at the head of this valley and the incomplete disintegration of the limestone have left there many tilted ledges, between or around which fertile soil has accumulated.

The soil of this phase of the type to an average depth of 8 inches consists of brown or reddish brown loam, which in places contains considerable fine sand, but never enough to constitute a sandy loam. This soil is underlain either by a red clay loam, which grades into heavy red clay, or by a heavy, yellowish-brown loam, or light clay loam, which grades into heavy red clay loam at a depth of 24 inches. Scattering nodules of chert occur throughout the soil and subsoil, and occasionally they are found in small beds or layers.

The rough and uneven surface features of this district generally secure good drainage, but sink holes sometimes exist similar to those occurring in areas of the Hagerstown loam.

In productiveness this soil is surpassed only by the Clarksville loam and by the best yields of the Hagerstown loam. It is used for general

farming, and good crops of corn and hay are produced. Exact crop yields are hardly ever obtainable, not only for this type, but for nearly all the soil types of the area, because farmers rarely know the exact number of acres under cultivation, or the yield obtained therefrom.

The second phase of the Hagerstown stony loam is extremely complex in derivation. Broadly speaking, it occupies the lower slopes of the escarpments and the foothills which lie along their bases in some places, and by its position forms a general boundary soil between the limestone soils of the valley and the sandstone soils of the upper slopes of the escarpments on each side of the valley.

Near the contact with the Hagerstown loam, or with the Hagerstown sandy loam, this soil, for a distance of several rods, does not differ essentially in soil texture from those types, but from 35 to 70 per cent of stones are present. As the base of the mountain is approached the slope becomes steeper, and the overplaced soils derived from the wash of formations higher on the slope gradually grow deeper until they predominate and so determine the soil type. Under these conditions the underlying geological formations are not represented by any surface soil as a decomposition product.

The Hagerstown stony loam extends farther up the slope of Walden Ridge than on the corresponding slope of the Cumberland Plateau, and the soil on the slope of the latter is, in places, more sandy than on the corresponding slope of Walden Ridge.

The soil of this phase of the Hagerstown stony loam may be described as fine sandy loam, or light loam, from 8 to 20 inches deep. This soil is brown or yellowish brown in color. The subsoil consists of red clay loam derived from Chickamauga limestone. The stones on the surface are of heterogeneous origin, but impure limestone, quartzite conglomerate, and sandstone are the most abundant.

This general slope, which forms the approach to the foot of the mountain proper, is marked by an irregular series of small, steep knobs and narrow ridges, the soils of which present a peculiar phenomenon. The southern slopes of these hills have a much greater amount of cherty fragments than the northern slopes. In some cases the surface is a mass of chert several inches deep, entirely devoid of soil covering, and in others the chert forms from 70 to 90 per cent of the surface material. Such areas support a scrubby growth of post oaks, and are worthless for any known purpose. The northern slopes have a strong, black, loamy soil to a depth of 20 inches or more, which grades into a loose mass of cherty fragments. These outlying hills represent no less than three geological formations—the Fort Payne chert, the Chattanooga, and the Rockwood formations. The original timber growth on these north slopes was yellow poplar and chestnut, with lesser proportions of white and chestnut oak. These areas, although steep, generally are tilled and are considered productive.

Twenty bushels of corn per acre is probably an average yield under present methods.

The fact that the northern slopes of many of these small hills are more productive than the southern slopes, coupled with the fact that the general escarpment of Walden Ridge, which slopes to the northwest, is more productive than the escarpment of the Cumberland Plateau, which slopes to the southeast, explains the ground for the local belief that there is some mysterious virtue in the direction *per se* of the slope of a hill. The difference in the degree of productivity of the two escarpments is due in large measure to the fact that on account of the more gentle lower slope of Walden Ridge, and its much more extensive dissection by "gulfs," the underlying limestone soil has not been buried so deeply by the sandstone debris from the upper slope.

However the disparity in soil texture and the consequent productiveness of the different slopes of the small hills in some parts of the valley may be accounted for, the fact that hills of the same formations in other parts of the valley have the same soil, regardless of direction of slope, would seem to furnish sufficient proof that the direction of the slope of these hillsides is not the determining factor of their productiveness.

The third phase of the Hagerstown stony loam occupies a considerable area of cherty hills along the Sequatchie River in the southern part of the area. The soil consists of heavy fine sandy loam or light loam, from 6 to 12 inches deep. The subsoil varies from a yellowish-red clay loam to a stiff red clay. Soil and subsoil both contain from 20 to 65 per cent of chert, the amount of which varies greatly within narrow limits. The series of low hills occupied by this soil rises from 50 to 200 feet above the Sequatchie River. The steepness of the slopes of these cherty hills renders them liable to wash when farmed carelessly, but this may be avoided readily by the exercise of a little caution.

Because of its uneven surface features and its liability to wash slightly, this soil is held in much lower esteem than it deserves. The greater part of it, if properly farmed, would produce nearly as much as the Hagerstown loam, as may be proved by the returns of a few fields which are favored with good cultivation, but much of it has been abandoned and allowed to grow up in forest.

The best disposition, perhaps, which may be made of these hills is to convert them into permanent blue-grass pastures. The possibility of doing this profitably has been proven, and the advantage which would accrue to the valley if this should be done can hardly be overestimated. The fact that it requires a little time to get this grass well established probably has militated against its use, as practically no attention is paid to any crop which does not return some yield the first year.

The three phases of the Hagerstown stony loam are all adapted to general farming when their surface is not too broken or too stony to be worked to advantage. This type unquestionably offers the best opportunity of any soil in the area for the production of apples, because much of it can be bought for from $4 to $6 an acre. Apple trees thrive on it, and the fruit is of excellent quality. The only handicap to the profitable development of this industry is the excessive freight rates, made possible by the secluded location of the area and the consequent lack of competition in transportation.

The texture of the first phase of this type is similar to that of the Hagerstown loam. The texture of the fine earth of the soil and subsoil of the second and third phases of this type is shown in the following table:

Mechanical analyses of Hagerstown stony loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10178	2 miles NE. of Sequatchie College.	Light loam, 0 to 12 inches.	1.27	1.86	3.04	1.76	4.96	6.36	54.56	27.16
10180	3 miles N. of Pikeville.	Fine sandy loam, 0 to 12 inches.	1.77	1.78	2.08	1.44	4.94	5.36	53.10	30.80
10179	Subsoil of 10178...	Red clay loam, 12 to 36 inches.	.36	.88	1.30	1.04	3.46	5.72	39.18	48.46
10181	Subsoil of 10180...	Brown clay loam, 12 to 36 inches.	.18	.60	1.20	.78	3.00	3.86	37.04	53.40

HAGERSTOWN SANDY LOAM.

The Hagerstown sandy loam consists of fine or medium sandy loam 12 inches deep, yellow or light brown in color. The subsoil is heavy red clay loam to a depth of 36 inches or more.

This type does not occur in large areas, but often lies in strips between the Hagerstown loam and the Hagerstown stony loam. Near its boundary with the latter type sandstone fragments are often scattered over the surface. It is also found in small, isolated areas in the Hagerstown loam.

The topography of the Hagerstown sandy loam is always rolling, and this feature secures for the type adequate drainage.

The soil is of heterogeneous origin. That near the foot of the escarpments is derived largely from the material washed down their slopes and spread over the red clay loam of the limestone formation, while in other places it is derived from the disintegration of sandstone débris overlying the residual limestone.

The Hagerstown sandy loam is used for general farming, and produces yields somewhat lower than the Hagerstown loam. It is the best type of upland soil in the area for the production of sorghum, and is excelled in that respect only by the small sandy spots of the Clarksville loam. An average yield on land which has received fair care is 100 gallons of sirup per acre.

This is the best soil in the valley for the production of peaches and small fruits. It is likewise best for trucking, but in this respect it can not compete with the best phases of the De Kalb sandy loam, whenever that type shall be developed. This is a fair corn soil, but is more liable to suffer from drought than either the Clarksville loam or the Hagerstown loam. Hay, for the same reason, would undoubtedly be an uncertain crop. But few attempts have ever been made to grow it.

Two variations of the Hagerstown sandy loam will be described. The two narrow bands of this type along the Caney Fork River at the extreme northwest corner of the area are not typical, in that the soil is light sandy loam, or sand, and the subsoil is the same material. If these areas had been of sufficient extent they would have been mapped as Hagerstown sand.

The second variation lies along the road from the old Sequatchie College to Roberson Crossroads. The soil here is lighter than in the true type. It consists of 12 inches of very light sandy loam underlain by similar material slightly heavier, which at 24 inches grades into red clay or clay loam. Sandstone fragments are scattered over the surface, and quartzite, and sometimes beds of shale, are found in the subsoil. This area is often steeply rolling, and cuts and gullies show impure limestone to be the underlying formation.

This land is poorly farmed, and produces no more than 10 bushels of corn as an average crop. This is little indication of its possibilities, however, as the method pursued in its management is to raise corn year after year, without fertilizer of any kind, until the crop secured will no longer pay for the labor of planting and harvesting it, and then to let the land lie fallow for several years. This section is held in low esteem and is considered worth only $3 to $5 an acre, but improved methods of management would probably secure fair yields from this soil.

The texture of the fine earth of typical samples of this type of soil is shown in the table following.

Mechanical analyses of Hagerstown sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10174	1 mile N. of Sequatchie College.	Light sandy loam, 0 to 8 inches.	1.37	0.70	1.30	2.16	27.30	24.86	30.60	12.90
10176	Fraley Gap road..	Fine sandy loam, 0 to 10 inches.	1.53	.24	.90	1.34	14.36	15.76	48.00	18.90
10175	Subsoil of 10174...	Red clay loam, 8 to 36 inches.	.27	.40	2.70	3.20	19.40	13.60	33.54	27.08
10177	Subsoil of 10176...	Heavy clay loam, 10 to 36 inches.	.32	.26	.88	1.36	13.70	13.30	42.90	27.40

DE KALB STONY LOAM.

The De Kalb stony loam, because of the position it occupies, is a variable soil, but an average soil section consists of from 6 to 20 inches of light-brown or yellowish sandy loam, which contains from 30 to 60 per cent of sandstone, quartzite, and conglomerate sandstone fragments, underlain by solid ledges of sandstone or by broken masses of this rock.

The type occupies the steep upper slopes of the escarpments which lie on each side of the Sequatchie Valley and ascend to a height of 1,000 feet in from 1 to 1½ miles. Near the crests of these escarpments perpendicular cliffs of sandstone are exposed for a height varying from 50 to 200 feet. On the slopes many small benches have formed where the soil which has washed from the steepest places has accumulated to a greater depth, and in such places the soil of medium sandy loam is sometimes underlain by a reddish-yellow clay loam to a depth of 36 inches, while the rock fragments are not sufficient to make tillage impracticable.

The steepest slopes are covered with a stunted forest growth which consists mostly of black, post, and chestnut oak, with lesser amounts of white oak and chestnut. The timber growth becomes gradually heavier as the base of the mountain is approached, where the underlying limestone comes nearer to the surface, and once in the coves at the foot of Walden Ridge, where the type gives way to the Hagerstown stony loam, different species of trees are found.

Large areas on these slopes have been mapped as rock outcrop, and there are many small areas included in the De Kalb stony loam which would have been so mapped had their extent warranted it. The soil is derived from the disintegration of coarse sandstone and conglomerate of Carboniferous age. As fast as these rocks decay their parti-

cles are carried down the precipitous slopes, and little soil is allowed to accumulate, save where it lodges on the benches above mentioned.

The surfaces of the Cumberland Plateau and Walden Ridge are marked by many small hills and knobs, which should be classed as De Kalb stony loam. Only a small proportion of these, however, are of sufficient extent to appear on the map. The scattering areas which have been designated consist of a very light sandy loam, which contains from 40 to 70 per cent of broken masses of sandstone, and often have outcrops of sandstone rock on their steepest slopes. Such areas are worthless for agricultural purposes and are too poor to grow trees of any value. They naturally support a thin, scrubby growth of blackjack oak, which seldom acquires a growth of trunk of more than 5 inches in diameter.

Very little of the De Kalb stony loam of this area should ever be tilled. On the lower mountain slopes the benches are farmed, and produce light crops of corn, oats, and rye, but in all not more than 5 per cent of the type is under cultivation, and it is doubtful if the tillage of this is economical.

Mechanical analyses of representative samples of the fine earth of this formation are given in the following table:

Mechanical analyses of De Kalb stony loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10164	2½ miles west of Pikeville.	Medium sandy loam, 0 to 7 inches.	2.41	1.92	1.68	1.12	7.94	17.02	52.88	16.80
10166	2½ miles east of Pikeville.	Light sandy loam, 0 to 8 inches.	2.28	.78	1.10	2.98	16.30	11.72	45.10	21.58
10167	Subsoil of 10166...	Heavy sandy loam, 8 to 36 inches.	.74	1.10	1.12	5.00	21.48	12.10	36.12	23.06
10165	Subsoil of 10164...	Heavy sandy loam, 7 to 30 inches.	.97	1.90	2.10	1.00	5.80	13.00	52.34	23.50

ROCK OUTCROP.

Along the escarpments of the Cumberland Plateau and Walden Ridge are many cliffs, ledges, and other areas too stony to be suited to any agricultural purpose. Similar areas of lesser extent occur along the gorges of Bee and Richland creeks. The location of such areas has been indicated on the map by means of symbols, or if too small to appear on the map they have been included in the De Kalb stony loam or De Kalb sandy loam.

DE KALB SANDY LOAM.

On large level areas and on broad-topped hills this type consists of medium to heavy sandy loam from 8 to 20 inches deep, underlain by a heavy yellow loam or clay loam, which is oftentimes silty in local areas. The depth of the subsoil varies within wide limits, but is always determined by the nearness of the underlying bed rock of sandstone. The proximity of this rock, moreover, is directly dependent upon the surface features of the soil-type areas. In this, its typical development, the soil is free from stones.

The De Kalb sandy loam occupies nearly all of the upland portion of the Cumberland Plateau and of Walden Ridge.

Lying at an approximate elevation of 1,000 feet above the Sequatchie Valley, these two plateaus have the appearance of plains above whose surface a succession of narrow ridges and round-topped hills rises from 100 to 500 feet. This broken surface configuration has an important effect upon the soil, for it allows the underlying rock, which, even on the level places, is at no great distance beneath the surface, to outcrop extensively on any but the gentlest slopes, and the steeper hillsides are often strewn with sandstone fragments, though their occurrence is most irregular. Such areas vary in extent from a few rods to a few acres, and may be surrounded by a band of sandy loam quite free from stones. The tops of these elevations sometimes are strewn with rock fragments, but more often their surface soil is free from stones.

The occurrence of solid ledges of sandstone bed rock at a depth varying from 6 to 36 inches is general, though most often it is found between 18 and 30 inches. In such case the surface soil, which is about 10 inches deep, is underlain by yellow clay loam or heavy yellow loam to within 6 inches, or slightly less, of the bed rock, where it grades into medium and coarse sand derived directly from the underlying rock.

West of Bee Creek this soil is lighter and poorer than the average of the type. Sandstone bed rock lies from 10 to 27 inches from the surface, the soil is less loamy than is typical, and the prevailing timber is a scrubby growth of blackjack oak. Outcrops of sandstone are frequent, but they are too small to be indicated on the map. South of Hale Chapel a considerable area of this type is marked by many narrow ridges, upon the tops and slopes of which are many outcrops of sandstone. The soil on these ridges is very poor, and supports a sparse growth of scrubby oak.

At the crest of the escarpments on both plateaus, and for some distance back therefrom, the soil is very thin, and small exposures of outcropping sandstone are frequent. This is because the crests are in reality divides, the drainage on one side rushing down a steep

declivity to the valley below, and on the other side descending slowly westward across the plateau to the Cumberland River, and to the eastward across Walden Ridge to the Tennessee River.

The De Kalb sandy loam is well drained. On the level and more gently rolling areas, where the soil has accumulated to a considerable depth, the retentive nature of the subsoil enables it to resist drought well, but the agricultural value of the narrow ridges and knolls upon which the soil is very thin is largely dependent upon a plentiful rainfall.

This soil is derived from the coarse-grained sandstone of which the main surface levels of both plateaus are composed.

Only a small portion of this type is tilled at the present time. Thousands and thousands of acres are used as common pasturage, the stock feeding on the wild sedge grass. The practice of burning over the mountain land each year by men from the valley, whose only interest in it is transitory, can not be too strongly condemned when viewed from the standpoint of possible agricultural development. This type of soil is valued at prices ranging from 50 cents to $5 an acre, according to the improvements which have been made upon it.

Corn, the principal crop grown, yields from 5 to 30 bushels, with a probable average of 10 bushels per acre. A very few thrifty farmers raise an average crop of 20 bushels per acre, and in one instance, at least, 55 bushels have been obtained. Such latitude in the yields is highly suggestive as to the methods employed, and this matter will be treated further under that heading. Almost no hay is grown, though rye is sometimes cut early for this purpose. When rye is allowed to mature and is thrashed, it yields from 4 to 15 bushels per acre, but the average yield is not over 7 bushels per acre. Small quantities of wheat are grown, and the average yield is 5 bushels per acre. When 100 pounds of low-grade commercial fertilizer are applied, this yield may be increased to 10 or 12 bushels per acre. Small fields of buckwheat are grown, but the yield is low. Potatoes yield from 30 to 160 bushels, with an average of 70 bushels per acre, and this without the use of manure or commercial fertilizer. Cabbage, tomatoes, turnips, beans, and strawberries are grown for home use, and small quantities of these are marketed. Cabbages are the chief money crop. Sorghum is grown to some extent for home use.

The possibilities of the De Kalb sandy loam are not appreciated. It is the best soil in the entire area for the production of potatoes, early truck, and small fruits. If properly managed, corn could be produced advantageously. Leguminous crops would be very successful on this soil, and should be a part of a regular rotation where the surface is not too steeply rolling or the soil too shallow. In a few instances the soil on the hillsides upon which cowpeas have been grown has become so mellow that it has washed badly. This experience has

created a hasty, erroneous, and therefore most unfortunate conclusion that cowpeas should not be sown on this soil. Cowpeas would be highly beneficial on the level portions of the type, and clover, which grows readily, should be sown whenever and wherever possible. Such treatment, consistently carried out, could not fail to be highly profitable on the level and gently rolling portions of the type. The narrow ridges and knolls, which have outcrops of the sandstone bed rock on their steep slopes and rock fragments strewn on portions of their surface, are worthless for any agricultural purpose.

The following table shows the results of mechanical analyses of representative samples from this type:

Mechanical analyses of De Kalb sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10158	3 miles S. of Morgan Springs.	Light sandy loam, 0 to 8 inches.	2.28	0.16	0.80	3.72	33.80	12.30	31.80	17.30
10162	Near Herbert.....	Heavy sandy loam, 0 to 8 inches.	1.95	.24	.46	.38	14.40	23.42	40.00	20.64
10160	⅛ mile W. of Morgan Springs.	Heavy sandy loam, 0 to 12 inches.	3.99	.70	7.84	15.48	14.40	4.68	33.10	23.70
10163	Subsoil of 10162...	Light clay loam, 8 to 36 inches.	.61	.16	.32	.44	14.06	21.92	41.90	21.14
10159	Subsoil of 10158...	Yellow clay loam, 8 to 36 inches.	.37	.16	.78	3.62	26.90	9.84	33.80	24.82
10161	Subsoil of 10160...	Medium clay loam, 12 to 36 inches.	.89	.24	6.20	18.08	11.40	3.66	27.54	32.40

DE KALB CLAY LOAM.

The surface soil of this type consists of fine sandy or silty loam from 10 to 18 inches deep, while the subsoil varies from a silty loam to a clay loam. The proportion of silt present is variable, but is usually sufficient to determine largely the character of the type. The deep yellow color which is natural to both soil and subsoil is changed to yellowish brown for a few inches at the surface by the accumulation of organic matter.

This soil occupies the valleys, and sometimes the valley slopes, and the lowest of the hills which rise from the general level of the Cumberland Plateau and Walden Ridge. When this territory was first settled these valleys were devoid of timber growth, and were covered with tall grass. Because of this characteristic these lowlands were called "glades," a term by which they have been known to the present time, and the stream which drained the most extensive of these

glades was called Glade Creek. The soil is deepest in the little valleys, where it has undoubtedly accumulated from the wash of the adjacent slopes. The surrounding hills are all of sandstone formation, and this soil, on some of the low hills above mentioned, is underlain by sandstone bed rock at depths ranging from 18 to 36 inches.

Insufficient drainage is the natural sequence of the physiographic position which a great part of this type occupies. In their natural condition all of the low-lying parts of this soil are too wet, and consequently too soggy for crop production, and failure to supply artificial drainage explains why the major part of this soil is uncultivated. Areas which have sufficient slope to need no artificial drainage, and fields limited in extent, which have been drained in some measure by a few of the most enterprising farmers, are satisfactorily productive when the methods employed are taken into consideration, and they indicate what could be done with this type of soil. The greater proportion of this type lies in such a position that open drains sufficient to make the soil productive could be constructed at very little expense. Furthermore, the ground is frozen so little during the winter months that ditches might be dug at almost any time, and in this way their construction would cost absolutely nothing, as the time so improved would be deducted from the bountiful supply of spare time at that season.

The De Kalb clay loam is derived in part from sandstone, the particles of which are bound together with a cement containing more argillaceous material than is typical with the Walden sandstone, and in part from fine material washed down the adjacent hillsides, or transported by the streams in time of high water as alluvium. The same crops are grown on this soil as on the De Kalb sandy loam, but when drained the yields are much greater than on that type. The fact is, however, that not over 2 per cent of this soil has ever been drained, and hence 98 per cent of it supports a rank growth of sedge grass, as the level portions will produce no tilled crop until drained. Drained fields produce an average yield of 30 bushels of corn per acre, and 50 bushels have been obtained under favorable conditions. When well farmed, hay yields 1½ tons per acre as an average crop. The cultivated hillsides yield from 15 to 30 bushels of corn per acre. Whenever this soil shall be drained and carefully tilled it will produce excellent crops of corn and grass, and then it should be used either for raising stock for market or, if trucking or other special industries should be developed on the adjoining De Kalb sandy loam, for growing these same crops for the support of the teams necessary to work such special crops.

The texture of the soil and subsoil of typical samples of the De Kalb clay loam is shown in the table following.

Mechanical analyses of De Kalb clay loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10154	1 mile S. of Glade-creek.	Heavy loam, 0 to 10 inches.	2.39	0.38	0.72	2.08	6.58	14.82	48.60	26.86
10156	1 mile NW. of Morgan Springs.	Brown heavy loam, 0 to 10 inches.	3.79	.24	5.80	16.82	14.22	4.92	30.50	27.20
10155	Subsoil of 10154...	Clay loam, 10 to 36 inches.	.70	.14	.86	3.10	7.30	11.40	45.68	31.34
10157	Subsoil of 10156...	Yellow clay loam, 10 to 36 inches.	.49	.30	5.80	15.58	11.08	2.78	29.86	34.60

AGRICULTURAL METHODS.

There are some farmers, both in the Sequatchie Valley and on the mountain areas, who make an effort to keep abreast of the improvement of methods in modern agriculture, but, unfortunately for the area when considered as a whole, such men form but a small proportion of the entire farming population. The conditions of climate are so favorable that it has always been easy "just to get a living," and this, in a measure, explains why intensive methods of cultivation never have been developed. The fact that it has been possible "just to get a living" by the pursuit of methods of cultivation both crude and wasteful demonstrates beyond doubt that vigilant attention to improvement of methods would effect an era of prosperity such as never can come until the present customs shall have ceased to exist.

The only soils in the area which are difficult to work, in so far as their texture is concerned, are the few hillsides of the Hagerstown loam which have had their stiff subsoils exposed by erosion, the very small patches of the "crawfishy" phase of the Hagerstown loam, and the lowest-lying portions of the De Kalb clay loam. Of these, the last may be improved easily by draining, and the two preceding are both limited in extent and susceptible to special methods of treatment.

The importance of thoroughly preparing land before planting is little understood, and thereby much loss is entailed. There has been marked improvement in the efficacy of plows used during the last few years, but the importance of plowing different types of soil to depths varied to suit the needs of each is not appreciated. For example, much of the Hagerstown loam is inclined to pack somewhat beneath the plow. The chief part of the soil is plowed shallow, with little regard to moisture conditions, and this leaves an undesirable crust or temporary hardpan, which makes crops more susceptible to injury,

either from drought or from excess of rain. The increased number of efficient cutting harrows gives much promise of better preparation of seed bed, but many farmers do not seem to understand that even a good implement will not bring land to a proper condition of tilth unless it is used with sufficient thoroughness. It is believed that very few realize that careful and efficient preparation of the land has a most important influence upon the crop yield.

The Hagerstown loam in this area, under the existing climatic conditions, should be plowed slightly deeper each year until a deep seed bed is acquired. The plowing should be done only when the conditions of moisture are favorable, in order to avoid the formation of an impervious crust at the bottom of the furrow. The soil then should be fitted thoroughly for planting, after which, in the case of tilled crops, it should be kept, by careful cultivation, mellow and free from weeds throughout the growing season.

Deep plowing, however, for such soil as the De Kalb sandy loam would be manifestly inadvisable.

One suggestion might be in place here: When corn is ripe it should be harvested and placed in barns where the winter elements may not have full sweep at it, for cattle turned out to forage during the winter months in cornfields where the stalks of the preceding season have been left standing will hardly demonstrate the profitable extension of the chief industry here—growing beef for market.

During the period of this survey a considerable portion of the wheat for next season's crop has been drilled directly upon the freshly turned furrow. In other cases drills have been run through corn stubble which has been left from 1 to 2 feet high. Sometimes land is a little better prepared by going over it once with a drag. Such methods are not universal, but it is believed that they illustrate the management of at least one-half the land in the Sequatchie Valley. The methods of cropping which have been practiced certainly bear testimony, even if in a negative way, to the natural productivity of the valley.

The practice of pasturing stock in common for several months of the year, coupled with negligence in the matter of saving manure dropped about the farm, indicates, in large measure, why many valley farmers who keep from 40 to 100 head of cattle have comparatively little manure to spread upon their fields.

Until a few years ago much land in the valley was cropped year after year with no application of manure or commercial fertilizer. Such is still the custom to a lamentable degree, but decreased crop yields have brought more attention to the necessity of maintaining in some way the productivity of the soil. The waste of manure in the area is little short of tremendous, and too much stress can not be laid upon the need of improvement in this matter. For several years cheap grades of commercial fertilizer have been applied by many to

wheat fields at an average rate of 150 pounds per acre, and while this expense has been more than balanced, in general, by increased yields, the fact that there are few farmers in the Sequatchie Valley who do not lose the equivalent of many tons of such fertilizer each year by wasteful practices has much import as to the success of farming.

The few farmers who systematically manure their land for wheat easily lead in crop yields throughout their rotation, and it was noted that those who are most careful in saving manure are also the most regular in the rotation of crops. A particular instance may be cited wherein a 23-acre field of Hagerstown loam yielded but 60 bushels of wheat the first year after purchase, eighteen years ago. A medium dressing of stable manure only once in five years, accompanied by careful rotation and cultivation, effected a yield of 437 bushels of wheat from this field three years ago.

Much of the Hagerstown loam should produce, under proper methods of cultivation, an average yield of 40 bushels of corn per acre, whereas its average yield is undoubtedly below 25 bushels. Corn has been grown on the same field year after year; in fact, it might almost be said, for decade after decade.

Red clover and cowpeas both grow well, and one of them should form a part of every rotation throughout the area. The tendency of the latter to loosen the soil causes steep hillsides to wash more readily, and this fact seems to have caused many to desist from sowing them altogether. There is neither ground for this nor question as to their efficiency in improving the level land of this area. The true cause of difficulty with cowpeas in this area on land at all subject to washing lies not in the cowpeas, but in the failure to follow them immediately with some kind of sod to bind the soil together and to make use of the nitrogen stored in the roots instead of allowing it to wash away with the loosened soil.

The cropping methods followed on that part of the De Kalb sandy loam which is cultivated are generally primitive. The first year after clearing this type brings an average yield of 20 bushels of corn per acre, but cropped continuously with the same grain, the yield decreases steadily until the land is considered "worn-out" at the end of five or six years. A new field of a few acres is then cleared and the old one is abandoned. Scattered over this extensive type on both plateaus are a few farmers who have not been bound by methods so primitive. These men, at least, have obtained a good living, and afford some indication of the possible development of the mountain areas.

The most common rotation practiced in the valley, when rotation is given any consideration, is corn followed by wheat. Clover and timothy are sown with the wheat, mowed once after the wheat is harvested and for two or three years thereafter, and then pastured for two or three years. The best rotation practiced is by the few who

understand how to grow cowpeas successfully, and consists of corn followed by cowpeas and wheat. Clover and timothy are sown with the wheat, and the field is left in grass for three years. On the Cumberland Plateau and Walden Ridge, with few exceptions, little attention is given to rotation of crops.

AGRICULTURAL CONDITIONS.

The Sequatchie Valley and the adjoining plateaus constitute an area unique both in its situation and its consequent development. Shut in by mountains on three sides, the valley has been the natural outlet toward Chattanooga for the greater part of the area. The distance from that point, the nearest town of importance, has been sufficient, however, to prevent any but the most necessary relationship. The influence of this isolated geographical position, augmented by the natural productivity of the valley and the adaptability of the area as a whole, because of its variety of soil and open climate, to be self-supporting, explains why the area has always been nearly self-sustaining and practically independent of the outside world. These conditions also explain why agricultural development has been so slow, and why methods of farming which have been abandoned decades ago in more progressive areas are still practiced here.

Adherence to conservative methods, whereby succeeding generations have been able to secure a good living, has tended, however, at the cost of development, to create and foster a stable financial condition. This has given a substantial tone to the general appearance of the valley, and those farmers who have managed their land with a view to keeping it in good condition, and who have given some attention to agricultural methods approved by modern experience, are almost universally prosperous.

The dwellings are comfortable, and most of them are painted. The barns compare favorably with those of any other section in the same latitude, but the area is far enough north to have much weather during the winter when stock should be sheltered in warm barns and be fed with care in order to get the greatest profit. The majority of the barns have neither doors nor floors, and few are sufficiently tight to prevent snow from drifting in. Many of these barns are constructed of hewn logs, and a covered place for the preservation of manure is practically unheard of. The costly waste which results from this cause is not even considered. There is seldom a supply of water at the barn, and the stock wanders to the nearest stream or sink hole to drink.

The tenure of farms in this area is exceptional and well-nigh Utopian. Over 90 per cent of the land is free from all incumbrance, and in this connection the character of the inhabitants is most suggestive. There never has been any "floating population." Farms have been handed down from father to son for generation after generation. Frugality

has been general, methods have been conservative, and hence the years have been few which have not seen some addition to the material well-being of the community.

Under these conditions the safe extension of credit on personal security has been general. Farmers seldom borrow any money, however, excepting to buy cattle, which will constantly increase in value, and when the cattle are sold their obligations are redeemed. Composed of families who have lived here for successive generations, the entire community seems like one large family. Each one knows his neighbor's financial standing, and it seems largely a matter of community pride to aid one another with small loans whenever necessary.

The system of renting land has been transformed within the last few years. Formerly the landowner furnished nothing but the land, and received one-third of the crop as rent. Under this system corn or wheat was grown year after year on the same field until the soil became so exhausted that it was not worth while to work it, and this method still prevails on the plateaus.

About fifteen years ago the price of land began to advance, and a few years later this tendency was precipitated into a "boom" by the inauguration of a coal and coke company which was to operate within the area. This caused landowners to advance the price of rent until the majority of the renters could not get a living, and so left the area. Prices have reached a state of equilibrium again, and land is valued at one-third more than before the boom. At present where land is rented the owner furnishes the stock and tools and receives two-thirds of the crop; or he furnishes nothing and receives one-half of the crop. Land is also rented by a system wherein the owner retains oversight of its management.

On the plateaus many thousands of acres of land have been bought by organized companies as a speculation on the development of mineral interests. Such land is rented at a nominal price, or a tenant is given the right to farm as much land as he chooses as a recompense for guarding the timber. In addition, the mineral rights have been sold on large tracts at prices ranging from 50 cents to $1 an acre. Such ownership would naturally retard agricultural development, but land is so plentiful and the population so scattered that it will be a long time before any such influence can be felt, and that only upon the influx of large numbers of settlers, a movement which does not seem near at hand.

In the central part of the valley, where there are few cherty hills, farms varying in size from 50 to 500 acres, with an average of 150 acres, are the rule. At each end of the valley farms are larger, but chiefly on account of cherty hills, of which but a small proportion is tilled. In such areas farms contain on the average 400 acres, one-half of which is tilled.

The labor problem has never been serious in this area. Removed from outside influence, this is a purely local question which has adjusted itself, and hence it is generally possible to secure satisfactory help at a reasonable price. From $10 to $12 a month and board is paid to farm hands to work from March 1 to December 1. The average length of day under this arrangement is from sunrise to sunset. Day laborers are paid 50 cents a day, including meals, except during the harvest season, when they receive 75 cents a day and meals. A custom still prevails in the valley whereby farmers pay help 50 cents a day by the year or by the month, and agree to furnish them with bacon at 10 cents a pound and corn at 50 cents a bushel, irrespective of market prices.

There is but one principal product sold from the Sequatchie Valley. Beef cattle account for 90 per cent of the entire income. Two grades of cattle are sold—steers 3 and 4 years old, to which the greater part of the corn crop has been fed, and steers 3 years old which have not been fed grain. The former are shipped to the Cincinnati market, and the latter to Kentucky and Virginia to be pastured on bluegrass and fed on distillery by-products.

Home-grown pork forms almost the entire supply of meat for local consumption, and until a few years ago considerable numbers of hogs were shipped, but the ravages of cholera prevented shipment for a time and now only a few are exported from the immediate locality. Nine-tenths of the hogs of the entire area are "razor backs," the best of which dress 250 pounds at an age varying from 2½ to 3 years.

A few sheep are kept for home use. Until recently the wool was carded in a local mill and spun and woven into cloth at home. The present low price of cloth is less than the cost of home manufacture, and so the wool, with the exception of what is spun into yarn at home for knitting, is sold.

Small amounts of wheat are sold at local mills, but the amount is gradually decreasing, and it will be fortunate indeed for the farmers when they realize that they should grow none.

Corn and hay are bought and sold within the area, but neither is exported in significant quantities. A considerable amount of sorghum is grown for home consumption, but none is exported.

On the plateaus vegetables are the chief money crop for many farmers. Occasionally a few sheep, a few hogs, and a few unfattened cattle are sold. Railroad ties are also cut, hewn, aud delivered at the valley stations. The price received for ties at present is 35 cents each.

The adaptation of soils to crops has received almost no attention. With few exceptions the same crops have been grown on every soil type throughout the area.

A single line of railway from Pikeville to Chattanooga affords the principal means of transportation to and from the area. Absence of

competition has resulted in high freight rates. The only alternative for valley farmers is to haul freight to and from Dayton, a station on a competing line of railway about 1 mile from the southeast corner of the area. As Dayton is 16 miles from the valley, and as it is necessary to cross Walden Ridge to get there, this station does not cause very close competition, but cattle from the valley destined for Northern markets are shipped from there, and it is the most convenient station for the farmers on Walden Ridge.

The public highways on the limestone foundation of the Sequatchie Valley are serviceable, but the precipitous branches which rush down the steep escarpments on each side at the times of freshets often wash gullies in the roadbeds. Few of these branches are bridged, and their beds, ordinarily dry, are often filled with large, round stones, which are troublesome at the highway crossings.

The chief roads on the plateau escarpments are kept in fairly good condition, but they are so steep that 1,000 pounds constitutes a good load for an average pair of horses. On the plateaus the main roads are easily kept passable because of the nearness of sandstone bed rock. Many of the roads, however, are little more than bridle paths.

Nearly all the products of the area are consumed at home, with the exception of cattle. The best grades of cattle are all shipped to Northern markets, principally to Cincinnati, but a few to Louisville, Ky. The cheap grades of cattle are sold at Chattanooga. For the last two years the Texas fever has caused some loss of cattle, and hence the Government quarantine has prevented shipment to Northern markets unless marked as "Southern cattle," and this has had some effect in lessening the nnmber handled. A few hogs are shipped to Cincinnati, but most of them, as well as the few sheep not kept at home, are sold at Chattanooga.

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