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SOIL SURVEY

OF

MILAM COUNTY, TEXAS

BY

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By WILLIAM T. CARTER, in Charge, and M. W. BECK, U. S. Department of Agriculture, and E. H. TEMPLIN, and H. W. HAWKINS, Texas Agricultural Experiment Station

COUNTY SURVEYED

Milam County is in east-central Texas. Cameron, the county seat, is about 190 miles south of the Texas-Oklahoma State line, approximately the same distance west of the Texas-Louisiana border, and about 160 miles northwest of the Gulf of Mexico. The county is irregular in outline and roughly rectangular in shape. The longest sides are formed by approximately parallel lines 30 or 35 miles long and extending in a northeast-southwest direction. The shorter side on the northeast is bordered by Brazos River and that on the west by a northwest-southeast line and two shorter lines of different bearings. A line drawn diagonally across the county connecting its corners farthest apart would measure about 50 miles. The county has an area of 1,022 square miles, or 654,080 acres.

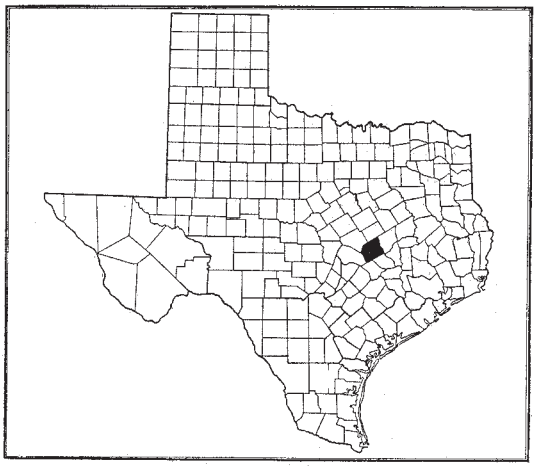

FIGURE 1.—Sketch map showing location of Milam County, Tex.

Milam County is in the coastal plain. Approximately the northwestern two-fifths lies within the black-prairie region and the remainder in the east Texas timber country. A line separating these two regions would start at the northeast corner of the county about 3 miles west of Brazos River and extend in an irregular southwesterly direction, passing near Cameron and leaving the county just south of Thorndale.

The black-prairie region is a rolling prairie dissected by numerous shallow valleys. Where uncultivated it supports a scrubby scattered growth of small mesquite trees and thorny shrubs. The east Texas timber country is a rolling or gently rolling region. Uncleared areas are covered with a rather heavy forest growth consisting mainly of oak trees. Broad flat bottoms occur along Brazos, Little, and San

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Gabriel Rivers, and some rather wide strips of creek-bottom lands occur in various places. Uncleared bottom lands are covered with a heavy forest growth of elm, hackberry, ash, pecan, and other trees.

A few small, rounded, stony hills are in the southeastern part of the county in a general line reaching from near the county line south of Rockdale in a northeasterly direction and passing near Milano and thence just north of Gause. The most prominent of these is Sugar Loaf Mountain a few miles north of Gause and Gee Mountain about 8 miles southeast of Rockdale. These hills are in general rather stony and rugged.

The general slope of the county is to the southeast. The highest points are along the western and northern borders where the elevations are a little more than 500 feet above sea level at Buckholts, Davilla, Lilac, and Thorndale, and at the extreme southwest corner of the county. The elevation at Cameron is about 400 feet and at Port Sullivan is nearly 300 feet above sea level. The elevation on Little River where it enters the county is about 400 feet and where it joins Brazos River is about 275 feet. The lowest elevation in the county, about 250 feet, is where Brazos River leaves the county at the southeast corner.

Milam County is extremely well drained, as the creeks and branches reach into all parts and remove surface water rapidly. In some rather large flat areas drainage is slow, but on many valley slopes and on much of the rolling upland run-off is sufficiently rapid to cause erosion. Bottom lands are subject to occasional overflow.

The supply of drinking water is adequate in many parts of the county except in very dry seasons. Wells of good water are obtained in most parts of the sandy timbered region at a depth of not more than 100 feet. On old stream terraces abundant and excellent drinking water is obtained at a depth ranging from 15 to 30 feet. In the black-prairie region water is scarce as a rule, and only moderate quantities are obtained in wells in depressions and near streams. These wells fail entirely in dry seasons. Little and San Gabriel Rivers furnish considerable drinking water during dry seasons, when well water becomes exhausted. Most farmers in the black-prairie region and many in the sandy timbered region construct dams across depressions and catch rain water in such reservoirs for the use of livestock.

Milam County was organized in 1836. The first settlers came from the older Southern States, the earliest mainly from Tennessee as members of Robertson's colony. They located in a settlement on Brazos River in the southeastern part of the county. The first town was located at this point and was called Nashville. Some parts of the county have been taken up and are occupied by people of German and Bohemian ancestry. Negroes constitute a considerable percentage of the population, particularly in the wooded areas, and some parts of the county are occupied by negro landowners.

According to the census, in 1920 the population of Milam County was 38,104. Census reports show that the population has been about the same for more than 20 years. The population classed as rural in 1920 was 33,806, or 88.7 per cent of the total, and the number of persons to the square mile was 35.3. A considerable proportion of the rural population lives in small towns throughout the county.

The densest population is in the black-prairie region in the northern and western parts of the county, and near railroads in the timbered region. Settlement is thin in some places in the southern part, especially in sections in which there are large areas of deep sand. The river bottoms are farmed by people who live on adjacent uplands. Cameron, the county seat, with a population of 4,298, is the largest town in the county. The more important smaller towns are Rockdale, Thorndale, Milano, Gause, Minerva, Burlington, Benarnold, and Buckholts. A number of important villages and business centers not on the railroads are shown on the accompanying map.

Several railroads cross Milam County, and afford connections with the principal markets of the country. They are shown on the map accompanying this report.

Public roads extend to nearly all parts of the county, and four important State roads pass through it. The roads are farthest apart in the southeastern part. About 400 miles of the important roads are graveled and well improved, and dirt roads are graded and kept in fair condition. As a rule dirt roads are good in dry weather but are difficult to travel for a few days after heavy rains. Very large deposits of gravel occurring throughout the county furnish ample supplies of road-building material. Several good bridges across Brazos River give road connections with counties to the east. The improvement of the roads is proceeding rapidly.

Telephone lines throughout the county give good connections between all the towns and to many farms. Rural mail routes serve most sections. There are many rural schools, and some consolidated schools give good facilities for instruction. Rural churches are situated throughout all parts of the county.

Local markets absorb some of the farm produce, but most of it is shipped out. The shipped products consist mainly of cotton, small quantities of melons, vegetables, poultry products, and hogs.

The soils of the county constitute the most valuable resource, but there are other natural resources. Considerable petroleum is produced in the south-central and southwestern parts. In several small oil fields shallow wells produce small quantities of oil by pumping. Much of this oil is refined at Minerva. Some of the products are used locally and some are shipped to outside markets. Most of the present oil production is near Rockdale and Minerva.

Considerable coal is mined throughout the southern part of the county near Rockdale. In places a very good grade of lignite is so near the surface that steam shovels remove the surface earth and lift the coal into cars. The coal beds are several feet thick and are rather extensive. It is said that in some years Milam County leads all counties in the United States in the quantity of lignite coal mined.

Clay suitable for brickmaking is found in Milam County, principally in the central and southern parts. Bricks of good quality were formerly manufactured, but the industry now receives little attention.

Three cottonseed-oil mills are in the county, at Cameron, at Rockdale, and at Thorndale. A cotton compress also is located at Cameron. Cotton gins are established at various convenient centers.

CLIMATE

The climate of Milam County is temperate and healthful. The summers are long, with rather high temperatures much of the time, but are tempered by cooling southerly breezes which prevail day and night. The winters are short and mild, but there are occasional cold spells with freezing temperatures. The cold waves come suddenly and are accompanied by rather heavy north winds. They represent the southerly extension of cold waves and blizzards in the Northwest. These cold spells, which are called northers, are sometimes accompanied by chill rains. The northers last only a few days and are succeeded by periods of cool, pleasant weather. In only two months, January and February, is there much freezing weather, but the winter temperatures vary considerably from year to year. Occasionally light snows fall.

The climatic data given here are taken from records of the Weather Bureau station at Temple, Bell County, about 30 miles northwest of central Milam County, and probably represent rather closely conditions in this county. The temperatures for Milam County are very slightly higher than at Temple, and the precipitation is a very little greater.

The average date of the last killing frost is March 13 and of the first is November 16, giving an average frost-free season of 248 days. The latest killing frost recorded was on April 30 and the earliest was on October 22.

Milam County lies near the western edge of the humid region. There are occasional periods of scant precipitation, but as a rule rainfall is sufficient to enable the maximum production of most crops. In some years rainfall is unusually high. The moderate rainfall in fall and winter, when the rate of evaporation is comparatively low, enables the soils to absorb and store a large quantity of water. March, April, and May are ordinarily the months of greatest rainfall. Hence, the soils usually have a store of moisture sufficient to enable crops to make good yields, though the summer heat, together with lack of summer rainfall, causes such crops as corn to suffer in some years.

The soils are such that with proper management, such as deep plowing and frequent cultivation, they can withstand the effects of short summer droughts. The deep soils with heavy clay subsoils store a large reserve of soil water for the use of growing crops. Cotton, the chief crop, has apparently adapted itself to climatic conditions here and seems to require less rain during summer than it does in the humid region farther east. In fact this crop here seems to do best and produce most profitably under comparatively dry summer conditions, provided the soil has collected a good store of moisture during winter and spring. Structurally the soils lend themselves well to such management as is required to put them in condition to prevent loss of soil moisture. In the sandy soils the subsoils are, in general, heavy and of good moisture-holding capacity. The sandy surface layer constitutes a mulch and assists in conserving the subsoil moisture. The heavy soils crack badly in dry seasons and allow considerable loss of moisture by evaporation, but this condition can be overcome to a large extent by cultivation. The

heavy soils are structurally suited to thorough cultivation and pulverization with tillage implements.

Hailstorms sometimes occur locally in the summer and do some damage to crops in small areas. Heavy windstorms seldom occur, and property loss from high winds or electric storms is rare.

Table 1, compiled from the records of the Weather Bureau station at Temple, gives the normal monthly, seasonal, and annual temperature and precipitation. These records cover a period of 33 years, 1891 to 1923, inclusive.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Temple, Bell County, Tex.*

[Elevation, 630 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year, (1917)	Total amount for the wettest year, (1902)	Snow, average depth
	° F.	*° F.*	*° F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	50.6	90	9	3.18	0.05	3.22	0.8
January	47.5	85	4	1.88	1.16	.30	Trace.
February	51.3	94	−4	2.04	.77	.99	.4
Winter	49.8	94	−4	7.10	1.98	4.51	1.2
March	59.7	100	19	2.40	.37	2.37	Trace.
April	67.5	100	30	4.06	2.74	2.89	0
May	74.3	102	39	4.25	2.89	5.67	0
Spring	67.2	102	19	10.71	6.00	10.93	Trace.
June	80.0	111	49	3.09	2.35	1.91	0
July	82.7	110	56	2.15	2.06	20.42	0
August	81.7	110	50	2.04	.85	.00	0
Summer	81.5	111	49	7.28	5.26	22.33	0
September	76.9	103	43	2.45	1.86	5.03	0
October	68.3	100	26	2.58	Trace.	2.48	0
November	57.7	94	19	3.00	1.94	13.90	0
Fall	67.6	103	19	8.03	3.80	21.41	0
Year	66.5	111	−4	33.12	17.04	59.18	1.2

AGRICULTURE

Old records indicate that about 1744 a Spanish missionary found a large settlement of friendly Indians located along San Gabriel River on territory situated in what is now southwestern Milam County. Later a mission was located along San Gabriel River in the vicinity of its junction with Brushy Creek. Here a dam was constructed across San Gabriel River, and a large area of bottom land was irrigated and farmed under the supervision of Spanish missionaries. No information is available as to what crops were grown, but probably corn was the chief crop. Few signs of the mission and farms remain to-day, but it is interesting to know that farming was carried on on Milam County soils about 90 years before permanent settlement began. The missions and farms were aban-

doned after a few years, owing to depredations of hostile Indians and ravages of disease.

The first permanent settlement in Milam County was made about 1836. The first settlers and those who followed for many years located in the sandy timbered region near streams where water was easy to obtain and wood was available for fuel, for building, and for fencing. The first industries in the county were farming and stock raising. The sandy uplands and bottoms were first cultivated to cotton, corn, and vegetables. Large areas of land were farmed with negro slave labor before the Civil War. Cotton was hauled to Houston and marketed but later was marketed at points along the Houston & Texas Central Railroad when that line was extended northward from Houston, passing a few miles east of Milam County. Cattle ranching on the black-land prairies was an important industry from before the Civil War to about 1880, when barbed wire came into use for fencing. After that date the black lands were taken up and utilized for farming. The settlement of these lands proceeded rapidly until practically all of them was in farms. The settlement and development of the sandy timbered lands and bottom lands took place more slowly, even though farming was first carried on in those districts.

At present 68.4 per cent of the land in Milam County is classed as improved land by the census. It is estimated that 85 per cent of the land of the black-land section is improved and only about 33 per cent of the timbered sandy lands.

The construction of railroads across the county between 1874 and 1891 gave a marked impetus to settlement and agricultural development. Cotton early became the chief cash crop and still holds that place. Corn has been a crop of great local importance since the first settlement of the county. Some oats have been grown for many years by a few farmers, and small acreages of wheat have been produced at various times.

At one time wheat produced for home use by some farmers on the prairies was milled in small mills at Cameron and Davilla and in Bell County. Many cotton gins in the county were equipped with corn-grinding machinery, and here meal was ground for local use. Vegetables and fruits have long been grown successfully by many farmers for home use and local markets. Sorghum has for many years been a common forage crop.

About 1900 the boll weevil became so damaging to cotton, especially in the timbered sandy country, that the yields of this crop were greatly reduced. The devastation of weevils, together with the low prices of cotton, was an important contributing factor to the development of truck farming and fruit growing. These industries became rather important around Milano, Rockdale, Minerva, and Hoyte. Large shipments of tomatoes, watermelons, cantaloupes, potatoes, sweetpotatoes, and peaches were made. Unsatisfactory marketing conditions tended to discourage the growing of these crops. Some good-sized commercial peach orchards were in the vicinity of Rockdale at that time.

By 1915 the ravages of the boll wevil had become less pronounced, and as cotton production became more certain and prices became higher many truck farmers drifted back to cotton production.

To-day cotton is again the most important crop. With the development of general farming, ranching disappeared on the prairies. Now a few animals are raised on the farms and in a few large pastures.

At present cotton is grown on about 60 per cent of all improved land, and corn, the crop next in importance, on about 20 per cent. In addition forage crops, consisting mainly of sorgo (sweet sorghum), millet, and Sudan grass, are grown on every farm. Some oats and grain sorghums also are grown by many farmers. Some truck farming is still carried on in certain localities. The products are hauled to adjoining prairie-land towns in trucks and marketed there. Local requirements are filled by small market gardens near towns. Fruits and berries are produced in small orchards for home use. Milk is produced mostly for home and local use, but small quantities of cream are shipped by a few farmers. An important industry in the vicinity of Milano is the growing of tomato, sweet-potato, onion, pepper, and cabbage plants for sale.

Table 2 gives the acreage and production of the leading crops, as reported by the last five decennial censuses and the 1925 farm census, and shows the general trend of agriculture in Milam County in the last 45 years.

TABLE 2.—*Acreage and production of the leading crops in 1879, 1889, 1899, 1909, 1919, and 1924*

Year	Cotton		Corn		Coarse forage		Oats		Wheat	
	Acres	*Bales*	*Acres*	*Bushels*	*Acres*	*Tons*	*Acres*	*Bushels*	*Acres*	*Bushels*
1879	37,473	10,844	32,725	386,792	--------	--------	1,946	50,168	593	3,241
1889	67,271	28,891	39,291	887,000	--------	--------	2,836	59,650	82	751
1899	147,683	66,555	71,151	1,448,060	697	1,720	2,855	77,910	2,044	23,900
1909	162,778	46,290	75,122	1,624,621	2,076	3,632	2,207	57,933	6	50
1919	195,356	46,894	67,455	2,041,394	8,868	16,260	7,597	293,754	1,650	21,097
1924	223,418	63,284	44,872	751,111	--------	--------	1,043	31,359	--------	--------

Significant features brought out by these figures are the steady increase in the acreage of land devoted to cotton and the wide fluctuations in the average yields of that crop. The variations in yields are largely the result of climatic conditions and insect pests.

Cotton is not only the main crop produced, but it has received more attention than any other crop. Mebane is the principal variety, though Kasch, an improved strain, is popular. Rowden is grown to some extent, and in the last few years Lone Star has been produced with very good results. Acala, a successful variety in some parts of the State, has not attained such success in the county, especially in the sandy region, as to make it a generally grown variety.

The prevailing length of staple is slightly longer than 1 inch. As a rule the most productive soils give the longest staple and best grades of cotton. The average yields from year to year range from one-fourth to nearly one-half bale to the acre. In wet seasons cotton suffers more on many of the sandy soils than on the heavy rolling uplands, as the soils in the latter position are very retentive of moisture. Cotton root rot does more damage on rolling, calcareous prairie soils than on flat upland soils and heavy alluvial soils. It appears to be least destructive on sandy upland soils. Boll weevils have not

injured the crop seriously for several years. Some damage, usually only in wet seasons, is done by the bollworm and cotton army worm or leaf worm. During cold springs the cotton louse sometimes injures the young plants.

Cotton is usually planted early in April if moisture conditions allow, but it may be planted as late as the 1st of June and make a good crop. However, the early-planted cotton has a better chance to make good yields and is more apt to escape insect pests and unfavorable climatic conditions. Cotton may be planted earlier on the rolling black lands than on the sandy lands.

Corn is the crop second in acreage. It is grown on most farms, generally in small fields. According to census figures for 1919 about 20 per cent of all improved land in the county was planted to corn. Practically all the corn produced is used locally, and in many years not enough is grown to satisfy local needs. As a rule the corn crop is neglected, not only in preparation of the land but also in subsequent cultivation. Much of the land, especially that on river bottoms, is capable of producing 50 or 60 bushels to the acre. According to the census, the average yields range from 11.8 to 30.2 bushels to the acre. Moisture and rainfall are usually favorable for a good growth in the early part of the season, but in early summer just before the grain has matured droughts of sufficient length to damage the crop often occur. Some years ago a number of farmers built silos and stored some corn and sorghum silage for stock feed, but very little silage is put up at the present time and the silos have fallen into disuse. Corn is usually planted about the first of March, though plantings as late as June have produced fair yields. The principal varieties grown are Surcropper and several strains of white and yellow dent. Surcropper is considered the best variety, especially for a late crop. The best soils for corn are Trinity, Catalpa, and Bell clays, and the poorest are the deep sandy soils.

The crop next in importance in acreage in Milam County is coarse forage, mainly sorgo, for which a little more than 2½ per cent of all the improved land is utilized. It is cut for hay, is allowed to mature and is then cut for fodder, or is cut and fed green. It yields well on all soils of the county, the highest yields being obtained on the strongest soils. The average yield is probably 2 tons to the acre. In past years considerable of the crop was used for manufacturing sirup in small mills on the farms, but now little sirup is made.

Oats are grown, in small fields as a rule, by some farmers on the heavier dark upland soils. Small patches are grown by a few farmers on some of the sandy soils to provide winter and spring pasturage, but these soils are too light for satisfactory production of small grains. The crop is used chiefly for feeding the farm livestock. On the heavier soils oats yield as high as 75 bushels to the acre in favorable seasons, but the general average is probably about 30 bushels. Red Rustproof (Texas Red) is commonly grown and appears to be the best variety for this region. Barley and rye were formerly grown successfully in small patches. The best soils for these crops, as well as for oats, are the dark-colored heavy upland soils, such as Houston black clay, Houston clay, and Bell clay.

Small fields of wheat have been grown with fair success at various times on the prairie lands, but very little is grown at present. Yields

ordinarily range from 10 to 20 bushels to the acre. It appears that wheat could be grown successfully in most years, but it is considered a less profitable crop than cotton.

For the last few years many farmers have been growing small quantities of grain sorghums. The production of these valuable crops appears to have been very successful, and they are being grown over most of the county. The favorite grain sorghums are kafir, milo, and hegari, but some feterita is also grown. Trouble with the midge may be experienced in rainy seasons. As a rule grain sorghums are more reliable than corn, and the grain has about the same feeding value. The sorghums grow well on all soils in the county. Yields on the strongest soils probably range from 30 to 40 bushels of grain to the acre. These valuable grains will probably be grown more extensively in the future, as they are able to withstand dry periods of summer much better than corn. An improved grain sorghum, Spur feterita, appears to be one of the best for this region.[1]

Many black-land farmers grow small acreages of millet for hay. It yields 1 or 2 tons to the acre. Small patches of Sudan grass, which furnishes good grazing and heavy yields of hay, are grown on most soils in the county. Some Johnson grass, cut for hay from bottom-land fields, gives good yields of valuable forage, but this grass is a serious pest in cultivated fields.

Alfalfa is grown on a few small areas. It does best on the calcareous alluvial soils, such as the Miller, Trinity, and Catalpa clays, in which moisture conditions as well as calcareous character are usually favorable. The Houston soils and Bell clay are also adapted to this crop, but hot dry summers usually damage it severely on these upland soils. The yield in favorable years on alluvial land is about 1 ton of hay to the acre at a cutting, and several cuttings a season are obtained. Sweetclover would do well on the calcareous soils, both alluvial and upland. It was seen growing in only a few places, but it appeared to be doing fairly well. It grows on rather thin soil, provides good pasturage and hay, improves the soil, and may be grown on steep slopes to prevent erosion.

Market gardening is carried on to a small extent on sandy soils in the vicinity of towns. Nancy Hall and Yellow Yam sweetpotatoes are the leading varieties, and yields range from 150 to 200 bushels to the acre on the Kirvin and Luverne fine sandy loams. Watermelons are produced most satisfactorily on Luverne fine sandy loam. Tom Watson and Reuter's Wondermelon are the most desirable varieties grown. Tom Watson is the better shipping melon. The average yield of good shipping watermelons is about 1 carload of 1,000 melons to 3 acres. Tomatoes are usually shipped by express. From 100 to 150 crates to the acre are produced. The principal varieties are Acme and Truckers Favorite. According to the 1920 census the value of vegetables produced in Milam County in 1919 was $322,562.

Most farmers devote small acreages to peaches, pears, plums, and berries. The sandy upland soils of the county are best suited to fruits, Kirvin and Luverne fine sandy loams being best suited for pears, peaches, plums, berries, and grapes. Norfolk fine sand is not

[1] CONNER, A. B., and DICKSON, R. E. SPUR FETERITA. Tex. Agr. Expt. Sta. Bul. 275, 28 pp., illus. 1921.

so well suited to peaches and pears as the soils mentioned, but it is well suited to plums and grapes. The heavy dark soils of the county are not naturally so well suited to tree fruits. As a rule little care is given to orchards. Some years the fruit crop, especially peaches, is injured or completely destroyed by late freezes.

Local authorities state that good crops of peaches are produced about three years out of five. The principal varieties are Elberta, Mamie Ross, Triumph, and Oldmixon Cling. Early peaches ripen early in May and others at intervals throughout spring and summer, well into August. Many small orchards of pears were noted in the sandy region, which seems to be well suited to pears. Pear trees do best on rather shallow Kirvin fine sandy loam. Blight affects the trees somewhat but seems less damaging here than in many other regions. The Kieffer and Le Conte are considered the best varieties by local growers. The Kieffer seems most desirable.

All the sandy soils seem especially suited to plums and grapes. A great many wild grapevines grow throughout the forests and attain very large size. A small wild grape, locally called the post-oak grape, also grows profusely. Small acreages of cultivated grapes are grown in home orchards.

Large numbers of thrifty native pecan trees grow on the alluvial soils. These produce good yields of nuts, small quantities of which are sold. The trees now remaining comprise rather extensive natural orchards in places, but over many large areas only a few individual trees were left in clearing the land for cultivation. Some people are improving the native trees by budding improved varieties on them. Some thrifty small orchards and individual trees were seen on flat areas of Wilson fine sandy loam in the sandy region and on Ochlockonee fine sandy loam, a noncalcareous creek-bottom soil, but the soils best suited to pecans are the calcareous alluvial soils, such as Catalpa and Trinity clays and the Miller and Yahola soils. The best native trees are on Catalpa clay along San Gabriel River. Here the soil is very calcareous, is well drained, and has a good supply of moisture. It is, though a heavy soil, of such structural characteristics as to be very permeable to water and easily penetrable by roots. Doubtless pecans can be grown very satisfactorily on all the alluvial soils and with some care on many upland soils. Plate 1, A, shows a large pecan tree on Catalpa clay 2½ miles south of Branchville.

Small fields of sugarcane were formerly grown for sirup, but at present practically no sirup is produced in the county.

Peanuts do well on the sandy soils, but only small acreages are grown. At one time this crop was grown extensively on the sandy soils, and yields ranged from 40 to 60 bushels of nuts and about 1 ton of hay to the acre. Much of the crop was used for hay and pasturage. The prices became low, and commercial production was discontinued. Some farmers say that land on which peanuts grow blows very badly after the crop is harvested.

Broomcorn has been grown very successfully in various parts of the county, but none is grown at present.

Cowpeas grow well on practically all the soils. Blackeyed peas and cowpeas, which are grown extensively on sandy land farms, give satisfactory yields of seed and hay. Some are grown as a soil improver, and their beneficial effects are outstanding.

No large livestock ranches are in the county, though many farmers raise some cattle and hogs in connection with general farming. A few farmers have very large pastures and engage in stock farming. Some purebred Hereford and Red Polled beef cattle are raised. Some cattle of mixed breed and unimproved stock are grazed over the large uncleared timbered areas.

Most farmers raise a few hogs for home use. Surplus hogs come mainly from the timbered region, where the hogs run loose and forage on the acorns. Poland China and Duroc-Jersey are the principal breeds. The estimated value of animals sold and slaughtered in Milam County in 1919 was $946,036.

Most farmers have good milk cows and produce sufficient milk and butter for home use. A few farmers ship cream out of the county. Milam County soils are well suited to the production of stock feeds, and the production of milk and milk products is feasible. Creameries have been established but have not succeeded, probably on account of lack of interest. The value of dairy products in Milam County in 1919, excluding those for home use, was $268,178.

Very few sheep and goats are raised in the county, though these animals appear to thrive. Poultry is raised on all farms, and surplus chickens, turkeys, and eggs are sold to local buyers and shipped to outside markets. The value of poultry and eggs produced in 1919 was $390,708.

Although the importance of the adaptation of soils to crops is generally recognized by farmers in Milam County, the greatest effort and thought are given to the production of cotton. The procedure is to devote the most attention to cotton and after that to try to grow sufficient feed on each farm to carry the farm livestock through the year. The attention of most farmers to growing food for family needs is incidental and includes only such efforts as are necessary to maintain a small garden and a few fruit trees.

The Trinity, Catalpa, and Miller clays are considered the best soils for cotton, corn, and forage crops. The greater part of these soils is utilized for cotton. However, danger from occasional overflows reduces their value somewhat and causes Bell clay and Houston black clay, flat phase, which are only slightly less productive than the alluvial soils and are situated above overflows, to be held in somewhat higher consideration for these crops. As the Bell and Houston soils are flat, rain water does not run off readily and a great reserve of moisture is maintained for the use of growing crops. The Houston soils are considered well suited to all general farm crops and to small grains. The fine sandy loams of the Milam, Leaf, Luverne, and Kirvin series are the soils best suited to vegetables and fruits, and with care good yields of cotton and feedstuffs can also be grown. The Irving and Wilson soils are better suited to cotton, oats, and forage crops than to corn, fruits, and vegetables.

Although no definite crop rotation is followed, most farmers recognize the value of changing crops on the land. Many change the kind of crop grown according to convenience. On many farms cotton is grown for years on the same land. Where so much of the land is used for cotton every year it is not possible to change the crops so frequently as is desirable. Improvement in production of cotton is produced by planting this crop after corn, oats, or peas. Crop

rotation, with clean cultivation, appears to be one of the most satisfactory methods for overcoming the development of cotton root rot.[2]

In preparing the land for cotton the general practice is to bed the land in high ridges about 3 feet apart, using a lister or sweep. Many black-land farmers flat break the land and bed it later. Plowing is done in fall or winter. The usual practice is to rebed the land before planting. This breaks all the land and leaves the ridge or bed to be planted in the old middles between the rows of the previous year's crop. Bedding is a means of plowing the land quickly, but results are better where the land is flat broken before bedding.

Farm improvements on the black lands are for the most part very good, and many good homes and barns are located in the timbered region but there are also many small unpainted farm homes. Most of the tenant houses are small and poor. The work animals consist of good mules and horses of medium draft.

Within the last few years considerable interest in commercial fertilizers has been evidenced, particularly by farmers on the sandy soils in the central and southern parts of the county. With the production of special truck crops, some profitable use of commercial fertilizers was made, and results tended to encourage their use for general farm crops. Results have varied considerably, chiefly on account of variations in climatic conditions, and have not proved so satisfactory as to cause widespread and general use of fertilizers. In some wet seasons fertilizers have been of little value on account of the loss of much of the valuable constituents by leaching, and in some dry seasons results have been negative on account of insufficient moisture to cause the nutrient to be taken up by plants. On the whole, however, the careful use of commercial fertilizers on the sandy soils has proved fairly satisfactory in good seasons, and it is probable that their use will be gradually increased. For vegetables it seems that rather large applications of complete fertilizers or those high in nitrogen and phosphoric acid more nearly meet the requirements of crops and soils generally. For cotton and corn smaller amounts are used than for vegetables. Circular No. 31 [3] of the Texas Agricultural Experiment Station outlines commercial fertilizer requirements of soils similar to the soils of Milam County.

Farmers on the sandy soils realize the value of barnyard manure, but as a rule, owing to the small number of animals on these farms and the practice of keeping livestock in pastures most of the year, very little is conserved. It is used with excellent results by some truck farmers.

Erosion, which is rather severe on many sloping areas, causes a drain on the soils that is beginning to be noticeable. In places rather large gullies have formed in fields, and in many places the surface wash, although not so pronounced, brings about a constant lowering of soil productiveness. This is noticeable on even the strongest rolling black lands, and it is said that although there is little decrease in productiveness on the flat or smoother black-land soils, on slopes depletion of the soil has become very apparent during the last few

[2] TAUBENHAUS, J. J., and KILLOUGH, D. T. TEXAS ROOT ROT OF COTTON AND METHODS OF ITS CONTROL. Tex. Agr. Expt. Sta. Bul. 307, 98 pp., illus. 1923.

[3] FRAPS, G. S. STANDARD FERTILIZER FORMULAS AND THEIR USE. Tex. Agr. Expt. Sta. Circ. 31, 7 p. 1923.

years. Considerable attention is given to terracing the land in order to retard erosion. The extension service of the Agricultural and Mechanical College of Texas is carrying on a strong campaign in terracing the soils of the county, and the county agent estimates that about 14,000 acres have been terraced in the last few years, with generally satisfactory results.

A few farmers are paying more attention to the selection of good seed than formerly. The principal concern is to obtain good cottonseed, and considerable seed of improved strains is bought from seed producers outside the county.

Farm labor is usually rather plentiful. Much of the labor is performed by the farmer and his family, but it is necessary to hire considerable extra help for chopping and picking cotton. On some of the larger farms laborers living on the farm work a small acreage on a share basis and also work by the day for the owner. Regular monthly labor is paid at the rate of $20 or $25 with board, and day labor at $1 or $1.50 or sometimes more. The price paid for picking cotton varies considerably but ranges from about 75 cents to $1 a hundred pounds of seed cotton. Laborers are mainly Mexicans and negroes.

According to the census, 78.3 per cent of the land area of the county was in farms in 1920. In that year there were 5,606 farms in the county, each tenancy being enumerated as a farm. The average size of the farms was 85.7 acres, and of the land in farms 68.4 per cent, or 58.6 acres to the farm, was classed as improved land. Most of the farms range in size from 20 to 100 acres, but a few comprise more than 1,000 acres. Most of the smaller farms are farmed by tenants. Several large individual holdings of several thousand acres each are operated by tenants under close supervision of managers or owners.

In 1920, 68.2 per cent of the farms were operated by tenants, 31.6 per cent by owners, and 0.2 per cent by managers. The percentage of tenants has increased steadily since 1880, when it was 39.2 per cent.

Farm lands are usually leased on a share basis. Much of the land, probably the greater part, is leased on the half-and-half basis, whereby the owner furnishes land, work animals, seed, and implements and receives one-half of all crops produced. Most tenants of this class are negroes and Mexicans. In the "third-and-fourth" system, which is also in use, the owner furnishes land and buildings, and the tenant furnishes work animals and implements and assumes all expense connected with growing the crop. Under this system the owner receives one-fourth of the cotton produced and one-third of the corn and other products.

Land prices have increased steadily since the early settlement of the county. They reached a rather high point in 1919 when cotton brought a high price. At present very little farm land is changing hands and the farmers on the strongest soils seem to have little desire to sell their land. Prices differ according to the kind of soils, the size of the farm, the character of improvements, the distance from towns and neighbors, and proximity to good roads. It is estimated that prices of the black lands range from about $75 to $150 an acre and of the extensive alluvial lands from $40 to $100 an acre. There are few improvements on bottom lands, except fences. In the sandy

timbered region unimproved uncleared land commands from $10 to $25 an acre and improved land from $25 to $75 an acre.

SOILS

Milam County lies within the coastal plain. The soils of the northwestern two-fifths of the county are black and heavy, and those of the remainder are light in color and more or less sandy. The northwestern part, or the black-prairie region, is part of a belt of blackland country extending from Red River southwestward nearly to the Rio Grande. It is from 25 to 60 miles wide and includes parts or all of about 30 counties in Texas. The southeastern part, or east Texas timber region, comprises a wide belt of timbered sandy land occupying a large part of Texas east of Milam County. The black-prairie region is underlain by calcareous deposits of a marly character and the timbered country mainly by noncalcareous beds of sand and clay with some associated layers of calcareous materials in places.

Although the parent material exerts a great influence on the character of the exposed surface material, other factors, such as climate and drainage, govern, to a considerable extent, the process of soil formation and determine largely the predominant characteristics of the soils. In the humid regions rainfall is sufficient to remove the readily soluble material entirely from the soil, but in arid regions where rainfall is scant or absent and the temperature is high they are not entirely removed and may be brought to the surface by evaporating soil water and left as a deposit on the surface. In semiarid and subhumid regions where rainfall is moderate, the easily soluble salts have been removed from the surface soil and subsoil, but lime may be found in the subsoil.

Milam County lies in the humid region. The soils formed from the noncalcareous beds are prevailingly sandy on the surface, with clay subsoils, but the soils formed from calcareous deposits are deep, dark colored, and heavy, with less lime carbonate in the surface soils than in the subsoils. In the prairie region of Milam County, especially that part where the Houston soils prevail, the calcium carbonate of the parent marl has not yet been leached from the soil. The soils are limy, therefore, though some may not contain enough lime carbonate in the immediate surface soil to cause effervescence with acid.

The soils of the black-prairie region have been formed by the weathering of the calcareous clays and marls. The first effects of weathering on these marls is shown in the development of a yellow color, which appears as mottling. Near the surface the yellow increases until it predominates, and the bluish and grayish shades of the original material disappear. In a short time organic matter begins to accumulate and soon produces a deep-black or very dark or grayish-black soil. In flat situations the dark color continues to a depth of several feet with little change. The surface 10-inch layer is very slightly darker than the material below. The subsoils of grayish and yellowish or brownish calcareous clays merge below in many places through a thin layer of yellowish clay into the partly weathered marl. This passes through several feet of mottled yellow and gray clay and marl into bluish-gray marl of laminated or shaly structure.

On gently sloping areas where erosion has proceeded at almost the same rate as soil formation, the dark surface layer is not so thick as on the flat areas. Here the change into subsoil and then into parent material takes place nearer the surface. In some places where the slopes are rather steep, erosion goes on faster than soil formation and the dark surface soils are absent, owing to the lack of time for organic matter to accumulate in the surface soil. In such areas the surface soil is brown. In a few small spots where erosion is very severe the yellow partly weathered marl is exposed. On the flat areas where soil development has gone on for a long time without erosion, the surface soil contains little or no lime carbonate, according to the test with hydrochloric acid, and effervescence does not take place at much less than 3 feet. Here the surface soil is inclined to be hard and crusted over when dry and is rather intractable under cultivation. A zone of incipient lime-carbonate accumulation or segregation is noted in such places at a depth of about 3 feet. This zone consists of small, white, hard lime concretions which reach down through the yellow material into the partly weathered marl. There are also numerous soft lumps of white lime. A peculiarity of the gently sloping areas is the presence of small brown or yellowish spots, where the subsoil comes to the surface. These increase in number with increasing steepness of the slopes. These spots represent partly weathered limy material, and plants grow well on them.

On the virgin dark prairie soils the surface, especially on the flat areas, is marked with shallow depressions and low irregular hummocks. These depressions and elevations are but a few feet across.

The black prairie lands in natural condition are covered with a scattered growth of small mesquite trees, chaparral, and pricklypear, together with an abundance of grasses, among which buffalo and grama grasses predominate. In places there are a few elm and other trees.

The basal beds of the timbered country, occupying about three-fifths of the area of Milam County, are noncalcareous sandy or clay beds, differing to some extent lithologically. These differences cause variations in soils. Much of the region comprises rolling sandy uplands, badly dissected by small streams.

The deep sand deposits in the southern part of the county have given rise to deep, loose sandy soils. Over most of the sandy region, however, the dominant soil consists of loose sandy material ranging from a few inches to 2 feet in thickness. This rests on heavy clays, predominantly red, which merge at a depth of several feet into lighter-textured and lighter-colored sandy clays underlain by stratified layers of clay and sand. On flattish areas percolating rain water has washed some of the fine soil particles down into the subsoil, thus causing the development of a more sandy surface layer and a heavier clay layer beneath, except in those places where there was so much sand and so little clay that the transposition has not amounted to much.

Surface features have exerted much influence on soil character. Oxidation has been proportional to aeration, and this has been governed by freedom of water movement which is influenced greatly by the relief. Thus soil variations are very closely related to the relief or

degree of slope. On the highest broad drainage divides are the largest areas of deep sands and rough stony lands.

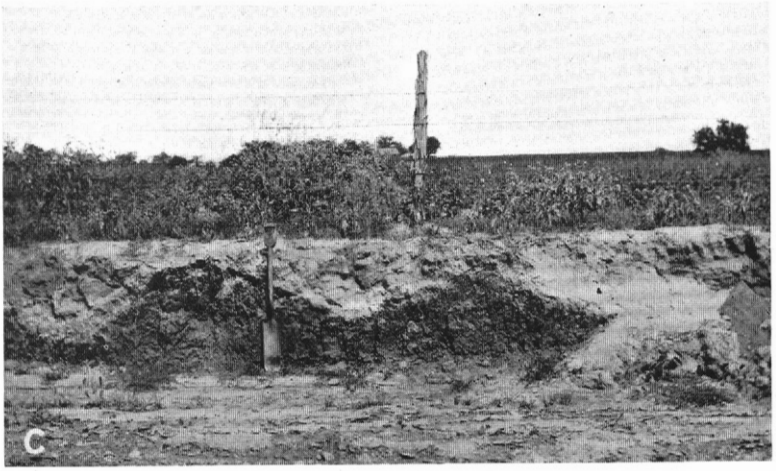
On the rolling areas the typical soil consists of a shallow sandy layer over heavy clay. Where the slope is sharp erosion has removed much of the surface material, with the result that the soil is rather shallow and shows some of the reddish color of the subsoil. On moderately steep or gently sloping areas, the typical sandy virgin soil is gray to a depth of about 2 inches, then is yellowish down to the heavy clay subsoil. The subsoils here are generally red or bright red. Where the slope is very gentle and uniform, drainage is less rapid and oxidation has been comparatively slow. Here the subsoils are yellow, with faint gray mottles in the lower part. As the slope becomes more gentle the grayish mottles become more abundant and appear nearer the subsoil. In flat or nearly flat areas the upper part of the subsoil in many places is mottled gray and red, the red color decreasing with depth. In such positions and near the heads of many draws the basinlike areas are occupied by dark-gray soils with tough heavy dark-gray subsoils.

Some areas of soils derived from mixed calcareous and noncalcareous deposits occur along the border where the black prairies join the sandy timbered lands. Here the soils are dark, resembling the prairie soils, but they contain little or no lime carbonate. The subsoils of these soils show more reddish and yellowish color than the subsoils of the prairie soils and contain only a little lime carbonate. The native vegetation is of the prairie type, but some encroachments of oak and other trees occur in places. Many very small isolated patches of these dark semiprairie soils occur in the timbered sections of the southern and central parts of the county.

The large areas of recent-alluvial soils belong to two general groups: (1) Those soils consisting of very recently deposited alluvium, occupying the present flood plains along streams and from time to time receiving additional accumulations of sediments from overflow waters; and (2) old-alluvial soils which lie on high stream terraces and remnants of very old stream deposits which lie on some of the highest uplands as a thin veneer spread over the older formations. The recent-alluvial soils of the present flood plains comprise dark calcareous soils composed of sediments washed partly from limy uplands.

The older alluvial soils of the terraces and old stream deposits which lie above present overflow and resultant sedimentation consist of sandy or clayey deposits which are of sufficient age to have developed characteristics resembling those of the soils on the older formations. These soils comprise dark calcareous and noncalcareous soils, underlain by calcareous clays and gravel beds in calcareous fine earth, and some gray, brown, and reddish noncalcareous sandy soils resting on noncalcareous clays which lie over limy beds of gravel. The parent material of these sandy soils has probably been washed from areas of sandy soils lying near the headwaters of Little River. The old stream terraces range from a few feet to 150 feet above the bordering flood plains of streams. Some isolated remnants are far from any present stream way. Such ancient terrace remnants occur on the high divides, the highest of which is between Cameron and Buckholts and in the vicinity of Friendship School. In such places

A, Large pecan tree 2½ miles south of Branchville on Catalpa clay; B, beds of bluebonnets on Houston black clay



A, Cotton on Houston black clay; B, soil profile of Susquehanna fine sandy loam; C, wavy subsoil of Kirvin fine sandy loam

the soils are underlain by beds of gravel resting on marl. The gravel consists largely of chert which has washed from formations farther west. As the superficial old fresh-water deposits have been eroded the chert has been exposed and spread over areas of the black Houston soils.

On the basis of color, origin, and structure the soils are grouped into series. The series are divided into soil types on the basis of difference in the texture of the surface soil. The soil type is the unit of soil mapping. The soils of the county are classified in 18 series, including 30 types and 2 phases, in addition to the miscellaneous classification of rough broken land.

The Houston soils are characterized by brown, black, or grayish-black calcareous surface soils merging below through grayish calcareous clay into yellowish or brownish calcareous clay subsoils, beneath which is laminated marl lying at a depth ranging from 3 to 6 feet. These soils are residual and were formed by the weathering of marls. Houston black clay (the well-known black waxy land of Texas), with a flat phase and a gravelly phase, Houston clay, and Houston clay loam were mapped.

The Wilson soils are the dark-colored flat soils of the black prairies. They resemble the Houston soils to some extent. The surface soils are gray or grayish black, and the subsoils are gray and merge, at a depth of 4 or 5 feet, into marl. The surface soils and subsoils to a depth of about 3 feet are noncalcareous, but below this depth there are numerous lime-carbonate concretions and the lower part of the subsoils is slightly calcareous. These soils are not so dark as the Houston soils, as a rule, and they differ markedly in being more compact and less friable. Wilson clay, Wilson clay loam, and Wilson fine sandy loam were mapped.

The Crockett soils are characterized by dark-colored or brown noncalcareous surface soils, underlain by brownish, reddish-brown, or yellow subsoils which, as a rule, show no evidence of the presence of lime carbonate. The subsoils merge below into stratified sandy clay which in a few places shows a small content of lime carbonate. These soils resemble the Houston soils somewhat in surface features. Crockett fine sandy loam and Crockett clay loam were mapped.

The Susquehanna soils in the virgin state are characterized by gray or grayish-brown surface soils which merge below into pale-yellow material. The subsoils are red clay with mottles of gray. The gray color increases with depth, and the red decreases. The subsoil finally merges into yellow and gray stratified sandy and clayey beds. The dense, impermeable clay subsoil allows only slow oxidation, with the resultant slow and uneven development of the red color. Susquehanna fine sandy loam and Susquehanna gravelly fine sandy loam were mapped.

The Luverne soils, where uncultivated, have gray or grayish-brown surface soils, which pass at a depth ranging from 2 to 4 inches into pale-yellow material of about the same texture. The subsoils are red and, although rather heavy, are crumbly, and dry masses break into small clods. With increase in depth the red color becomes lighter and the lower part of the subsoils is yellowish red or reddish yellow and is somewhat more sandy and friable than the upper part.

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The parent material is more or less stratified noncalcareous sand and clay. Luverne fine sandy loam was mapped.

The distinctive characteristics which identify the Kirvin soils are brown, reddish-brown, or red surface soils underlain by heavy red subsoils which become lighter in color and texture with increasing depth. The subsoils merge through yellowish-red or reddish-yellow clay into parent material consisting of stratified layers of noncalcareous sand and clay. The surface soils are coarser in texture than the subsoils, and the line of contact between the loose surface layer and the heavier subsoil is sharp. The subsoil is rather heavy but in exposed banks the material dries out and breaks into large and small clods. The Kirvin soils are associated with the Luverne soils but differ in having redder surface soils and somewhat heavier subsoils. Kirvin fine sandy loam and Kirvin stony fine sandy loam were mapped.

The surface soils of members of the Tabor series are gray or grayish brown, merging at a depth of a few inches into pale-yellow material. The subsoils consist of yellow or mottled yellow and gray, rather heavy clay which passes, at a depth between 3 and 5 feet, into the parent material consisting of more or less stratified noncalcareous and unconsolidated beds. Tabor fine sandy loan was mapped.

The Norfolk soils have gray, loose surface soils, underlain at a depth of a few inches by pale-yellow material. The yellow subsoils are characteristically sandy and friable and pass at a depth of several feet into sand or sandy clay parent material consisting of noncalcareous and unconsolidated beds. Norfolk fine sand was mapped.

The Bell soils have black or dark-gray surface soils underlain by dark-gray subsoils which pass below into yellow clay overlying gravel beds. The material from the surface down is calcareous. These soils consist of old alluvium washed out of areas of limestone soils. Bell clay was mapped.

The Lewisville soils have brown surface soils underlain by brown or yellow subsoils which pass below into yellow clay resting, at a considerable depth, on gravel beds. The surface soils, subsoils, and gravel beds are highly calcareous. The Lewisville soils occupy the better-drained positions of the old stream terraces on which the Bell soils occur and are formed of the same soil materials. Lewisville clay was mapped.

The Irving soils occur on old stream terraces and have been developed from the weathering of the very old alluvial deposits. The surface soils are dark gray or black and the subsoils are dark gray. Below a depth of several feet is yellow calcareous clay which rests on beds of gravel in calcareous fine earth. The Irving soils are flat and poorly drained. They are much like the Bell soils in surface appearance but differ in that they contain no lime carbonate to a depth of about 3 or 4 feet and in that the soils pack and crust on drying and are more intractable. These soils closely resemble the Wilson soils in structural characteristics but differ in having been derived from alluvial deposits and in that the water table lies nearer the surface. Irving fine sandy loam and Irving clay loam were mapped.

The soils of the Milam series have brown or reddish-brown surface soils passing down within a few inches into pale-yellow or reddish-yellow material. The soils contain no carbonate of lime and rest on noncalcareous heavy red clay subsoils which become lighter red or yellowish with increasing depth. Below a depth of several feet is gravel embedded in calcareous fine earth composed mostly of sand. The Milam soils represent the weathered product of old alluvial deposits which now lie high above overflow in the form of flat or undulating terraces. Milam fine sandy loam and Milam gravelly fine sandy loam were mapped.

The Leaf soils somewhat resemble the Milam soils in surface appearance and occur in close association with these soils on terraces. The Leaf soils have been derived from the same kind of material as the Milam but under somewhat poorer drainage. The surface soils are grayish or grayish brown, passing at a depth of a few inches into yellow material. The subsoils are rather heavy, dense clay, mottled with red and gray. The gray color increases with depth and the red decreases. The entire soil is devoid of lime carbonate, but the underlying clay rests at a depth of several feet on beds of gravel embedded in calcareous fine earth. The Leaf soils are intermediate in position between the Milam and Irving soils. The Milam soils occupy the best-drained areas and the Irving the poorest. The Leaf soils consist of partly weathered material in which drainage and aeration are too poor to allow the development of the solid red color which characterizes the subsoils of the Milam soils. The Leaf series is represented by Leaf fine sandy loam.

The Trinity series comprises soils with calcareous black or very dark grayish-black surface soils and subsoils. These soils consist of recent alluvium and are subject to periodic overflow and accumulation of soil material from sedimentation of overflow waters. The soils are composed of material washed from calcareous dark upland soils. Trinity clay was mapped.

The Catalpa soils are brown or dark-gray calcareous alluvial soils several feet thick and are subject to overflow. The soil materials were washed from areas of limestone soils. These soils resemble the Trinity but are lighter in color and contain more lime carbonate. Catalpa clay was mapped.

The Miller soils are calcareous alluvial soils occurring along the Brazos River bottom lands. They are chocolate red in color and represent deposits washed from the red beds of northwest Texas. Miller fine sandy loam and Miller clay were mapped.

The soils of the Yahola series are very similar to the Miller soils in surface features but differ in having subsoils of lighter texture than the surface soils and underlain near the surface by beds of sand. The surface soils and subsoils are chocolate red and calcareous. Yahola loamy fine sand and Yahola clay were mapped.

The Ochlockonee soils are alluvial noncalcareous soils which occur in the small stream bottoms in the sandy timbered region. The surface soils are gray or brown, and the yellow and mottled subsoils in most places pass at a depth of less than 3 feet into beds of fine sand. These soils consist of soil materials washed from sandy upland soils and deposited by overflow waters in the narrow

creek bottom. Ochlockonee fine sandy loam and Ochlockonee silty clay loam were mapped.

Rough broken land is a miscellaneous classification of material which is so rough as to be largely nonagricultural.

Table 3 gives the acreage and proportionate extent of the various soils occurring in Milam County. The distribution of the soils is shown on the accompanying soil map.

TABLE 3.—*Acreage and proportionate extent of soils mapped in Milam County, Tex.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Houston black clay	28,160	11.7	Bell clay	36,480	5.6
Flat phase	6,656		Lewisville clay	13,248	2.0
Gravelly phase	41,792		Irving clay loam	20,864	3.2
Houston clay	20,928	3.2	Irving fine sandy loam	7,744	1.2
Houston clay loam	8,064	1.2	Milam fine sandy loam	22,592	3.5
Wilson clay loam	22,784	3.5	Milam gravelly fine sandy loam	3,456	.5
Wilson fine sandy loam	9,664	1.5	Leaf fine sandy loam	5,824	.9
Wilson clay	1,728	.3	Catalpa clay	65,600	10.0
Crockett fine sandy loam	12,608	1.9	Trinity clay	25,472	3.9
Crockett clay loam	6,080	.9	Ochlockonee fine sandy loam	14,592	2.2
Susquehanna fine sandy loam	35,712	5.5	Ochlockonee silty clay loam	3,904	.6
Susquehanna gravelly fine sandy loam	4,032	.6	Miller clay	5,120	.8
Luverne fine sandy loam	61,312	9.4	Miller fine sandy loam	1,152	.2
Kirvin fine sandy loam	64,576	9.9	Yahola clay	640	.1
Kirvin stony fine sandy loam	4,352	.7	Yahola loamy fine sand	1,536	.2
Tabor fine sandy loam	30,976	4.7	Rough broken land	2,240	.3
Norfolk fine sand	64,192	9.8	Total	654,080	------

HOUSTON BLACK CLAY

The surface soil of virgin Houston black clay is black, very dark-gray, or dark-brown heavy clay, in most places very calcareous and containing a very small amount of fine lime-carbonate concretions and fine limestone particles. The surface soil merges, at a depth of 10 or 15 inches, into very dark-gray or nearly black clay which is very similar to the surface soil though it is somewhat lighter in color. This layer, as a rule, shows a large content of lime carbonate by field test and carries more of the small lime-carbonate concretions. There is little difference between the upper and lower parts of the surface soil, although in many places there seems to be much less lime carbonate in the upper part of the layer than in the lower part. The subsoil consists of yellowish-gray, greenish-yellow, or greenish-brown very calcareous clay containing numerous calcium-carbonate concretions. This layer ranges from a few inches to about 1 foot in thickness and in most places occurs at a depth ranging from 2 to 4 feet. It carries considerable fine and small lime-carbonate concretions. The next layer, which is the parent material, is very crumbly and granular yellow marl, which carries a large quantity of lime carbonate. The marl is mottled slightly with gray in the upper part. This grayish color increases but becomes more bluish with depth and the yellow decreases. One or two feet below the top of the parent material the marl becomes shaly and platy.

When dry this soil hardens in uncultivated fields, but plowed land breaks down naturally into granular material. The soil cracks during very dry seasons, especially where it is uncultivated. The cracks

are several inches wide and reach down several feet to the marl in many places. In long periods of very dry weather these cracks occur also on cultivated fields. Frequent stirring with a cultivator minimizes the tendency to crack.

When wet the surface soil and subsoil are extremely sticky and tenacious, causing the soil to be called black waxy land. The soil adheres and can not be plowed until the moisture condition is just right. The dry surface of the virgin soil crumbles into a thin veneer of granular material to a depth of about one-fourth inch. In plowed fields which are occasionally cultivated this layer of fine pulverized material is from 1 to 2 inches thick and, when dry, is friable and loose. Small brownish or yellowish-brown spots a few feet across, occurring throughout this soil, give plowed fields a pronounced spotted appearance on the surface. These spots are most numerous on slopes, and few occur on the smoother or nearly flat areas.

Where the land slopes the cultivated soil erodes more easily. The seriousness of soil washing is proportionate to the degree of the slope. On slopes the black surface soil is somewhat shallower and in places is somewhat brownish, owing to the nearness of the subsoil layer to the surface. Also a more spotted appearance develops with cultivation as the brown subsoil is more exposed by cultivation and by increased erosion. It many places some rounded and subangular chert and quartzite gravel is scattered over the surface.

Houston black clay is very uniform in color and texture, but mapped areas in places include small patches of the gravelly phase of this soil and of Houston clay.

Houston black clay is not a very extensive soil in this county. Areas are widely scattered over the northern and northwestern parts. The largest area, about 15 square miles in extent, is in the northern part of the county around Burlington and Benarnold. Good-sized areas are southwest and northwest of Buckholts in the northwestern part of the county, and smaller areas occur in the western part in the vicinity of San Gabriel, Sharp, and Detmold School. This soil with its phases and with the associated areas of Houston clay and Houston clay loam, makes up a very large part of the black-land section in the northwestern part of Milam County.

The surface of this soil is undulating or gently rolling. Drainage is generally very good, there being sufficient slope to allow the water to pass readily from the surface. The slopes are susceptible to erosion during rains, but this tendency has not, as yet, resulted in a very badly washed condition. Terracing the land prevents erosion to a great extent. Owing to the heaviness and denseness of the surface soil, subsoil, and substratum internal drainage is slow, but water passes readily through the soil mass and there is no formation of a hardpan to prevent the movement of water. In uncultivated areas the surface is covered with small, shallow depressions and elevations locally known as hog wallows. These result from the cracking and shrinking of the soil in dry weather and the washing or falling of the soil into the cracks during rains, leaving the surface uneven. Wells are usually difficult to obtain on this soil, as the underlying marls afford no reservoir for free underground water. In some depressed areas, such as along draws in valleys, a few shallow wells furnish some water, but these become dry during periods of light

rainfall. Some of the well water is said to be unfit to drink on account of its large content of salt or other minerals.

Houston black clay is highly prized on account of its productiveness, and approximately 80 or 85 per cent of it is in cultivation. Small patches of pasture land have not been cultivated. This is a prairie soil, and virgin areas support a rather heavy growth of prairie grasses, a scattered growth of small mesquite trees, and a few small elm trees. Considerable chaparral and pricklypear occurs in places, and herbaceous plants or weeds are common. Buffalo grass, locally called mesquite grass, is one of the most abundant and valuable grasses. Other grasses are little barley, Colorado grass (probably the worst grass pest in cultivated fields on this soil), silky everlasting grass, low spear grass, some needle grasses, rescue grass, and a very little grama grass. A little medick was seen. Of the herbaceous plants Texas bluebonnet grows abundantly. This plant grows only on calcareous soils and is thus a good indicator of lime carbonate in the soil. (Pl. 1, B.) Other herbaceous plants growing abundantly are the Indian daisy or rose-ring Gaillardia, horsemint, wild verbena, evening primrose, wild plantain, and some others.

Nearly all the Houston black clay is devoted to the production of cotton, but some corn, oats, grain sorghums, sorgo, and millet are grown by some farmers on small acreages. Crop yields vary considerably, depending on the seasons, insect pests, soil conditions, and management, but no great difference in yields resulting from differences in productiveness of the soil is found. As a rule the smoother fields give somewhat higher yields than the very sloping areas. In good seasons cotton yields from one-half to three-fourths bale to the acre, corn from 25 to 35 bushels, and oats from 30 to 60 bushels. Under especially favorable conditions the yields are sometimes higher. The grain sorghums yield 30 or 40 bushels of grain to the acre, and sorgo gives good yields of forage. Some wheat has been grown at times, and yields ranging from 15 to 20 bushels to the acre have been obtained. Millet produces from 1 to 2 tons of hay to the acre. Yields of the grain sorghums are more certain than of corn, which does well only when climatic conditions are very favorable. Kafir, milo, and some hegari are grown, but probably an improved variety, such as Spur feterita, would be the most successful grain sorghum. Sudan grass is grown very successfully in small fields. Around some of the farm homes good gardens and small orchards produce fair yields of okra, peas, beans, cabbage, and other vegetables, and of peaches, pears, and plums, and small fruits and berries, even though the soil is not especially suited to many fruits and vegetables.

Cotton root rot, a fungous disease, was noted in places where cotton dies. Cotton affected by this disease is locally erroneously thought to be damaged by alkali in the soil.

Houston black clay is a very strong productive soil. No excessive deterioration in productiveness has been brought about by long-continued cultivation, except on some of the steeper slopes where erosion is more pronounced. Owing to the looseness and granular structure which the dry soil assumes with cultivation, the land is easy to till under optimum moisture conditions. The soil is very sticky when wet, but on drying it becomes mellow and friable and is easily stirred.

This soil is fairly drought resistant, provided there is a good supply of moisture at the beginning of the growing season. Plate 2, A, shows vigorous growth in a field of cotton on Houston black clay after 10 weeks of very hot dry weather.

Houston black clay is well suited to the crops grown on it and where good methods are used should produce good yields indefinitely. A number of crops not grown at present could be produced successfully, though under the present economic system the production of cotton will probably be continued for a long time. The soil is well suited to livestock and dairy farming, as forage crops can be grown successfully. It is well suited to the growth of alfalfa and sweet-clover, valuable both as forage crops and as soil improvers.

Houston black clay is the highest-priced land in the county, selling at this time for $100 or $125 an acre or somewhat more in the more favored locations. The price depends largely on the state of improvement, distance from shipping points, condition of roads, and other factors. As a rule the farms range from 100 to 150 acres in size, though some are as small as 50 acres and some include more than 200 acres. A few large tracts include from several hundred to more than 1,000 acres and are farmed in part by hired labor and in part by renters. Many good homes were seen on this soil, and the well-kept grounds and good improvements denote a generally prosperous condition of the farmers. Much of the land is farmed by the owners, many of whom are of German and Bohemian ancestry, and such farms generally are in much better condition than the rented farms.

Apparently no commercial fertilizers are needed on this soil, as the results of experiments in other places have shown little profit from their use. Instead, the high productiveness can be more economically maintained by crop rotation and by keeping a good supply of organic matter in the soil, especially for such crops as corn and the forage crops.

On low, very gentle slopes or near the foot of such slopes in the vicinity of Detmold School, in the western part of the county, a number of small unproductive spots of salt land have developed on this soil. These spots seem to be gradually increasing in size and are giving farmers some concern. On drying after rains an accumulation of whitish salts appears on the surface. A chemical analysis of a sample of this soil showed several salts present. Sodium chloride was the most abundant, and that salt is probably responsible for the failure of crops. The surface crust, one-fourth inch thick, contained 4,760 parts of the salt to a million parts of soil. The soil beneath this crust to a depth of 7 inches contained 6,035 parts of salt to a million parts of soil, between 7 and 36 inches 1,558 parts to a million, and between 36 and 48 inches 416 parts to a million.

The farmers have attempted to destroy this accumulation in several ways, such as adding organic matter and spreading ashes on the soil, but as yet the trouble has not been overcome. Probably a system of thorough drainage by ditching or preferably by tile drains will prevent the accumulation of these salts at the surface and will enable their removal by washing out after rains, as the salt is soluble in water.

Houston black clay, flat phase.—The surface soil of Houston black clay, flat phase, consists of black or very dark-gray clay about 36

inches thick. To a depth of 10 or 12 inches, the material is slightly darker than that below, owing to the presence of a larger quantity of organic matter. The lower part of this layer has a more grayish color, which increases with depth, and contains a few fine lime concretions in places. In most places the soil material shows no reaction for lime carbonate, though in some spots it is strongly calcareous. Below a depth of 60 or 70 inches is gray, calcareous, rather dense clay containing some small lime concretions. Between depths of 60 or 70 and about 80 or 90 inches is gray, calcareous clay, in places yellowish or mottled with yellow, which contains numerous small lime concretions. At a depth of 80 or 90 inches the subsoil grades into yellow, very calcareous clay containing numerous spots of soft lime carbonate or weathered lime-carbonate concretions, and this, at a depth between 7 and 9 feet, grades into yellow and gray shaly marl. The horizons have no definite line of separation, there being in the whole soil a gradual change from dark gray to gray, from gray to light gray, and from light gray to yellow partly weathered marl which in turn merges into the slightly weathered shaly marl. The lime carbonate also becomes more abundant with depth, and a few fine concretions are present in the lower part of the soil. These become more numerous with depth until the parent marl is reached.

Houston black clay, flat phase, is very sticky when wet, but on drying a very thin layer of granular material, probably less than one-fourth inch thick, forms on the surface. The soil dries into a hard mass from which large or small clods are broken apart with difficulty. The yellow calcareous substratum breaks into fine, small clods on drying and is rather crumbly when moist.

There is little change in the physical characteristics of this soil after it is placed in cultivation, except that the surface soil to a depth of a few inches seems to become slightly darker, probably owing to the incorporation of a larger quantity of organic matter. In places the gray subsoil is exposed at the surface in very small spots, giving a spotted appearance. The exposed subsoil is in sharp points above the flat surface, much like the exposed yellowish subsoil in places in the typical soil.

This soil is much like Wilson clay in surface features, but it has a somewhat darker-colored surface soil and is more friable than that soil. It is inextensive in this county. It occurs in close association with the typical soil and with the Wilson soils. One of the largest areas is between Yarrellton and Marak where this soil merges into Bell clay, which it closely resembles. Other small areas are in the northern part of the county a few miles north and east of Burlington.

The surface of this soil is flat, and drainage is rather slow. On drying, especially in uncultivated fields, the surface cracks deeply. In virgin areas the soil has a hog-wallow relief. As a rule, well water is not obtainable on this soil, though some wells contain a small quantity of water in seasons of normal rainfall. The lack of natural surface drainage does not prevent the growth of crops, as there is usually sufficient incline to the surface to remove most of the rain water slowly.

The native vegetation is about the same as on the typical soil. Probably more than 95 per cent of the land is in cultivation. It

is very productive and is utilized for the same crops as the typical soil. Yields are approximately the same or slightly higher. In rainy seasons the soil may remain wet so long as to make crops somewhat late. In dry seasons, crops withstand drought well, provided there is a good supply of underground moisture at the beginning of the season.

The surface soil, especially where lime carbonate is not abundant, is somewhat more inclined to bake and pack hard on drying than is the typical soil. On drying, the surface soil is easily kept rather friable and loose by cultivation. The layer of granular material is 1 or 2 inches thick.

Farms on this soil have about the same value as the best farm lands of the typical soil, the soil is suited to the same crops, and it requires about the same system of management and improvement.

Houston black clay, gravelly phase.—As a rule, the surface soil of Houston black clay, gravelly phase, is from 24 to 30 inches thick and is very dark, in places intense black in color. Most of it is considerably darker than the typical soil. In places the soil is very calcareous, but over large areas the presence of lime carbonate is not indicated by field test. Considerable chert, quartzite, and rounded and subangular quartz gravel is found on the surface and throughout the surface soil. The chert material predominates and in places is very abundant. Beneath the black surface soil the subsoil is similar to that of the typical soil.

Small areas of Houston gravelly clay, Houston clay, and Houston black clay were included with this soil in mapping. In places where this soil is bordered by sandy soils, as in the vicinity of Friendship School, the soil contains an appreciable admixture of sand, which is so abundant in places as to give the material a sandy clay texture.

Houston black clay, gravelly phase, occupies a rather large percentage of the black-land prairies in the northwestern part of the county. The largest area within the county occurs around Buckholts and northwest to the Bell County line and extends from Buckholts eastward to Cameron. A smaller area lies 4 miles southwest of Burlington. Many small tracts are around Sharp, Lilac, Union Ridge School, North Elm School, and Walker Creek Church.

The surface of this soil is generally rolling or undulating. Many of the slopes are rather steep, as the soil in many places forms the slopes of rather high ridges crested with other types of soil. Drainage is good and in many places is rather excessive. The gravelly material acts favorably in holding the soil and keeping it from washing, but in places the steeper slopes tend to become badly gullied through excessive erosion. As a rule no permanent wells of water are obtainable on this soil, though in some depressions a small and temporary supply of underground water is found.

Houston black clay, gravelly phase, is considered a prairie soil, though it supports a scattered growth of mesquite trees, with some elm and post oak in places. The elm and post oak are an encroachment from adjacent soils where such trees predominate. In places this growth of small trees is rather thick. The characteristic grass is buffalo grass, though a number of other grasses and herbaceous plants, such as are common to the typical soil, grow in abundance.

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This soil is highly prized, as it is very productive and produces good yields under long-continued cultivation. It appears to be of about the same productiveness as the typical soil and is suited to the same crops. Some farmers state that the soil is somewhat more productive than the typical soil and that crops do slightly better in periods of very dry weather. The soil does not crack quite so badly when dry as the typical soil.

In places where the gravel content is very high this soil is not quite so productive as the typical soil, and it is said that it is hard to work on account of the gravel content. Cotton is the chief crop, though corn, oats, sorgo, and grain sorghums are also grown. Yields are approximately the same as on the typical soil, except on some of the steeper and eroded slopes. Some of the steeper slopes are left in native grass or are utilized in the production of sorgo hay.

This soil generally commands slightly lower prices than the typical soil and much less where the farm comprises considerable steeply sloping land. Prices range from $75 to $100 an acre, and some of the best farms in good locations are held at somewhat higher figures.

The soil of this phase should be terraced in many places to prevent erosion and washing. Where especially susceptible to washing the land should be left in pasture or put into such crops as sorgo, sweet-clover, or Sudan grass, which require little cultivation.

HOUSTON CLAY

In virgin areas the surface soil of Houston clay, to a depth ranging from 4 to 12 inches, consists of brown calcareous clay, very sticky when wet but drying out hard except in a granular, thin top layer about one-fourth inch in thickness. The granular layer extends to a depth of 1 or 2 inches when the soil is cultivated in a dry condition. On drying, deep cracks form in the soil, even in cultivated fields during long periods of hot, dry weather. The subsoil consists of yellow, yellowish-brown, or mottled yellow and gray calcareous clay, which in places has an olive or greenish tinge. This horizon, which reaches a depth of 2 or 3 feet, contains lime-carbonate concretions in places. On drying it becomes very hard but breaks into a granular mass with some pressure. It is underlain by yellow marl containing lime concretions, and at a depth of about 3 or 4 feet yellow and gray shaly marl is reached.

In places the yellow subsoil is near the surface, and in small spots on some of the steeper slopes it is exposed. In many places the exposures are in curvelike or wavy formation. Such areas are really Sumter clay and would have been mapped separately had they been sufficiently large to show on the map. On many slopes are small spots of Houston black clay which could not be shown separately. In places Houston clay shows a very spotted condition where erosion has removed much of the darker surface material. These spots are small and show brown, yellowish, and black in a checkerboard effect in some cultivated fields.

Some areas, included with Houston clay on account of their small extent, do not contain enough lime carbonate to effervesce with hydrochloric acid. The surface soil, to a depth ranging from 6 to 12 inches, is sticky when wet, crumbly when moist, and cloddy when

dry. This grades into yellowish-brown or brownish-yellow clay which in most places is noncalcareous but which locally carries a few small lime concretions. At a depth ranging from 15 to 24 inches there is mottled gray and yellow, somewhat brittle clay containing, in many places, a small quantity of lime carbonate. The parent material, at a depth ranging from 30 to 36 inches, is yellow or gray brittle clay shale. In some places this contains some small, soft, rounded particles of lime carbonate, but it is not calcareous in many places. Large round calcareous sandstone bowlders occur, in a few places, throughout the soil. This soil occurs on the rather steep slopes leading down to Pond Creek bottoms from smooth areas of Crockett fine sandy loam occupying higher positions. Drainage is excessive, and the soil often washes badly in heavy rains.

After Houston clay is placed in cultivation it becomes somewhat lighter in color, the dark brown becoming brownish and yellowish brown, owing to the increased washing and erosion on the sloping areas. This soil is not very extensive in this county, though it occurs in a number of fair-sized areas and many small ones in close association with Houston black clay throughout the northwestern and northern parts of the county. One of the largest of these areas is just northeast of Benarnold and in the neighborhood of Vogelsang Church, another lies north of Clarkson, and smaller areas are in the vicinity of Yarrellton and Benarnold. Areas comprising a few hundred acres lie in the region about Union Ridge School, and near Detmold School, Nile, and Thorndale.

Houston clay has a rolling or very rolling relief. Much of it comprises steep slopes adjacent to the larger creek valleys. Drainage is excessive as a rule and causes destructive washing of the land at times. In places gullies are formed which gradually increase in size and cause a distinct lowering of the value of the land. Well water is not obtainable on this soil, except in some shallow wells in the draws and depressions.

Probably not less than 80 per cent of this soil is in cultivation. Uncultivated areas support a heavy growth of prairie grasses and scattered small mesquite trees and chaparral bushes. A few elm, gum elastic, and post oak trees grow in places. The vegetation is much the same as that on Houston black clay.

Cotton is the principal crop on this soil, though some oats, corn, sorgo, grain sorghums, millet, and Sudan grass are grown. Crop yields average slightly less than on Houston black clay in most seasons. Cotton yields about one-half bale to the acre in good seasons, though the average for a period of years is somewhat less. Most areas of the soil occupy rather steep slopes, and the soil is more deficient in organic matter than the black clay. The soil washes in rainy seasons, and it is not so drought resistant in very dry seasons as is Houston black clay, although on the smoother areas crops endure long periods of dry weather well when a good supply of moisture has been stored in the surface soil, subsoil, and substratum. Some very fine farms with good farm homes and improvements are seen on this soil.

Houston clay is ordinarily farmed in tracts of 100 or 150 acres. The selling price of the land ranges from $75 to $100 an acre, though

some of the well-improved farms, especially the smaller ones, would sell for more.

Careful farming methods are necessary to produce the best results on this soil. Care is especially important on the more sloping areas.

Many farmers are terracing the land to prevent destructive erosion. On some of the steepest slopes the production of row crops has resulted in a rather badly washed condition, and here it would be well to grow oats, sweetclover, and sorgo for hay, as these crops require little or no tillage. The soil is well suited to sweetclover, and in addition to producing a good yield of excellent forage this crop improves the soil. At the heads of draws and gullies where erosion is severe some farmers grow sorgo for hay, leaving the smoother areas for cotton and other crops. The grain sorghums would probably produce a higher average yield of grain than does corn on this soil.

Houston clay should be farmed in such a way as to incorporate considerable organic matter in the soil. Little or no commercial fertilizer is needed for the continued profitable production of crops. The soil is well suited to livestock and dairy farming, and the growing of forage and grass on the steeper slopes holds the soil from washing.

HOUSTON CLAY LOAM

The surface soil of Houston clay loam consists of dark-gray, brownish, or nearly black rather heavy calcareous clay loam from 8 to 16 inches thick. The soil is rather sticky when wet but dries out in cultivated fields and cracks into a mass of fine granular material. In many places considerable small subangular chert gravel, together with some quartz and quartzite gravel, occurs throughout the soil. The subsoil is gray calcareous clay to a depth of 2 or 3 feet, where it merges into grayish-brown or yellowish-brown calcareous clay containing numerous lime concretions. This material is underlain at a depth of 4 or 6 feet, by yellow calcareous clay, mottled in some places with gray, which grades into shaly marl with increasing depth.

In many places, especially in plowed fields, the light-colored subsoil material, which lies near the surface, has been turned up, giving rise to grayish and brownish spots. In other places, especially where the surface is rather flat, there are many small spots of very black soil. Most of these contain no lime carbonate in the surface soil. Included with the soil as mapped are small areas of Houston clay, especially on the steeper slopes.

Houston clay loam is of slight extent in this county. It occurs in close association with the other Houston soils in the northern and western parts of the county. The larger areas, comprising a few hundred acres each, are in the northern part of the county within 2 or 3 miles of Benarnold and in the western part in the vicinity of Lilac. The remaining small areas are widely scattered.

The surface of Houston clay loam is gently rolling, though some slopes are fairly steep. As a rule the spotted appearance of the soil is more pronounced on the slopes than on the nearly flat areas. Drainage is very good, and in most places the surface is subject to

injurious washing during periods of heavy rainfall. Well water is very scarce, but small quantities are found in some low places.

This is a prairie soil which in the virgin state is occupied by practically the same growth of prairie grasses and mesquite trees as is found on the other Houston soils. Probably 90 per cent of the soil is in cultivation to the same crops that are grown on the other Houston soils. Crop yields are about the same as on Houston black clay. This soil, owing to its lighter texture and structure, is somewhat easier to cultivate than Houston black clay.

Land of this kind sells for about the same price as Houston black clay.

WILSON CLAY LOAM

The surface soil of virgin Wilson clay loam consists of dark-gray or gray rather heavy clay loam from 8 to 12 inches thick. When moist it is decidedly dark, in places almost black, but on drying it assumes a decidedly ashy or grayish shade at the immediate surface. The surface soil shows a complete absence of lime carbonate by field test. The subsoil is gray or dark-gray clay containing no lime carbonate. The line of contact between it and the surface soil is fairly distinct. On drying it becomes very tough and finally cracks into hard large clods which are broken only with difficulty. This clay subsoil merges, at a depth ranging from 30 to 36 inches, into gray clay commonly of slightly lighter color and in places containing a very small quantity of lime carbonate and some small and fine lime concretions. At a depth of about 4 or 5 feet this merges into gray clay slightly mottled with yellow. This layer is commonly moderately calcareous and carries small, fine lime concretions. This lower clay is somewhat more crumbly and more easily broken than that of the horizons above and breaks down to a small cloddy structure. At a depth of about 6 or 7 feet this layer grades into mottled yellow and gray clay which contains specks of soft white lime carbonate, and this grades below into shaly marl.

In many places small gravel, mainly chert with some quartz and quartzite, is abundant on the immediate surface. The chert is mostly subangular, and the other gravel is well rounded. The soil dries to a very hard condition, but in cultivated fields, to a depth of 1 or 2 inches, it works into a friable or loose mass. Care must be taken to cultivate the soil when at the proper moisture content, that is, when slightly moist, as otherwise the surface bakes and works up into large intractable clods. There is much less structural difference in cultivated and uncultivated fields than is observed in the heavy Houston soils. In places, especially on gentle slopes, there is a spotted condition of the soil, caused by the presence of the lighter-colored subsoil at or near the surface in areas a few feet wide. These lighter-colored spots contain considerable lime carbonate. During protracted dry spells the soil cracks to some extent where not cultivated. This has led to the formation of shallow hog wallows on the flat areas. The tendency to crack is reduced by cultivation. The areas of Wilson clay loam shown on the map include spots of Wilson clay and Wilson fine sandy loam which were too small to map separately.

Wilson clay loam, though widely scattered throughout many parts of the county, is not a very extensive soil. It occurs mainly in the northern part of the county in association with other Wilson soils and with the Houston soils. In a few small areas located in the southern or sandy part of the county the surface soil has a somewhat lighter-gray color than in the black-land regions. The largest area in the county covers several square miles just west of Baileyville, and large areas, some comprising several thousand acres, are in the vicinity of Benarold and Clarkson. A number of areas are near Davilla in the western part of the county, and smaller areas occur near Little River Church, several miles southwest of San Gabriel, and south and east of Thorndale. Small patches, the largest of which is along the International-Great Northern Railroad, occur within a few miles of Gause in the sandy region.

The surface of Wilson clay loam is typically almost flat, but a few areas are gently undulating or have a gentle incline. Surface drainage is very slow, and the water sinks downward very slowly through the dense clay subsoil and substratum. On the flat areas water stands in places for some time after rains. This lack of natural drainage is not a serious hindrance to the production of crops, although some time may be lost in working the land in rainy periods. As a rule, little water is found in wells on this soil. Rather salty well water is reported in places in the northern part of the county.

Wilson clay loam is a desirable soil, and probably 80 per cent of it is in cultivation. Originally it was a prairie soil covered with a heavy growth of prairie grass and scattered mesquite, pricklypear, and chaparral. In places a few elm, gum elastic, and post oak trees grow rather thickly. The principal grasses are grama, mesquite, and buffalo, but some needle grass is seen, and various weeds, many of which grow also on the Houston soils, are present.

Wilson clay loam is locally known as chaparral land or tight land. It dries out quickly into a rather tight, hard mass and often packs so tightly that germinating plants can not come through the surface. For this reason it is occasionally necessary to replant crops to get a good stand. After the plants come through the soil they grow rapidly, and it is said that cotton grows more quickly and matures earlier than on Houston black clay. Crops withstand dry weather well. As a rule cotton makes a smaller growth of plant than on Houston black clay, but yields are nearly if not quite as good.

The chief crops are cotton and feed crops, with some oats. Cotton is by far the most extensive crop. It yields about one-half bale to the acre in good seasons. Corn produces from 20 to 35 bushels to the acre where rainfall is favorable, but insufficient rain in late June and July sometimes causes yields to be low. Grain sorghums, sorgo, and Sudan grass produce good yields and are more successful crops than corn. Oats yield from 30 to 60 bushels to the acre in good seasons. The soil is well suited to wheat, but little or none is grown. Some vegetables, tree fruits, small fruits, and berries are grown in small orchards and home gardens for home use.

Wilson clay loam is held in farms ranging in size from 100 to several hundred acres and sells for prices ranging from about $75 to $100 an acre.

This soil requires organic matter to produce higher yields, and apparently little or no commercial fertilizer is needed. The incorporation of organic matter tends to decrease the natural tendency of the soil to dry and crust over.

WILSON FINE SANDY LOAM

The surface soil of Wilson fine sandy loam in virgin areas consists of gray, dark-gray, or grayish-brown fine sandy loam from 6 to 12 inches thick. Where very dry this soil bakes hard, but in cultivated fields a layer of loose material is maintained by shallow cultivation. This surface layer of loosened material is from 1 to 2 inches thick, and below it, even in cultivated fields, the dry soil is extremely hard throughout dry hot seasons. No lime carbonate is present. The surface soil is abruptly underlain, at a depth ranging from 6 to 12 inches, by gray, heavy, dense clay which in some places is nearly black or brown. This horizon contains no lime carbonate. When dry it is hard and breaks up with great difficulty into large, tough clods. At a depth between 24 and 30 inches this horizon grades into clay of much the same color, texture, and structure but carrying some small lime concretions and a few fine black concretions, probably of high iron content. In places this layer is somewhat mottled with yellow. At a depth of 3 or 4 feet, the partly weathered parent material of gray and yellow clay is reached. In some places this is calcareous and carries some soft white lime concretions, and in other places the soil is noncalcareous. Cultivation has produced little difference in this soil as compared with the virgin soil. Spots of Wilson clay loam have been included in mapping.

Wilson fine sandy loam is not a very extensive soil, though it occurs in numerous small and very small areas associated with the other Wilson soils throughout the county. The largest areas occur in the vicinity of Baileyville and Briary Church, other areas are 2 or 3 miles south of Davilla, and a few very small patches are near Jones Prairie, Gause, Thorndale, and Rockdale. The small spots of this soil in the southern part of the county in the sandy timbered region are somewhat lighter in color than areas on the prairies.

The surface of Wilson fine sandy loam is flat, as a rule, and surface drainage is very slow. Some gentle swells and very gentle undulating slopes are surrounded by Wilson clay loam. On some of the slopes a rather brownish or reddish subsoil occurs in very narrow areas. In the sandy timbered region the soil occupies low basins at the heads of draws and extends along them for a short distance in the form of narrow strips of lowland. The natural surface drainage is sufficient to allow the growth of crops without damage from water, though in some spots the crops may get a late start. As a rule the texture of the soil in the sandy timbered region is somewhat finer than elsewhere and in places is very fine sandy loam. As a rule well water is scarce on this soil.

Probably 70 per cent of this soil is in cultivation. It is a prairie soil and supports a native growth of mesquite trees, chaparral, and pricklypear, with some rescue, needle, buffalo, and other grasses. In positions adjacent to or within the main timbered region some

post oak, elm, haw, gum elastic, and other trees are mixed with the mesquite.

Cotton is the principal crop, but small acreages of corn, grain sorghums, sorgo, Sudan grass, and, on a few farms, oats are grown. In good seasons, cotton yields from one-third to one-half bale in the best locations. The soil is not especially suited to corn, though in good seasons yields of 20 or 30 bushels may be obtained. The grain sorghums, sorgo, and Sudan grass produce good yields when moisture conditions are favorable and fair yields under dry conditions which prevent corn from yielding.

In many small home gardens all kinds of vegetables are grown. Berries and small fruits yield well. Peaches, pears, and plums produce well in small orchards where care is used to keep the orchards in good condition. Some pecan trees, which appear to be doing well, were noted on this soil in the southern and central parts of the county.

This soil is locally called tight sandy land or black sandy land. It is considered more desirable for cotton than for other crops. It is rather hard to cultivate if it is allowed to dry out thoroughly after rains, as it packs tightly, but when worked at the optimum moisture condition a layer of loose material 1 or 2 inches thick is formed. As on Wilson clay loam, crops on this soil sometimes have to be replanted because the seeds can not break through the tightly packed crust.

Wilson fine sandy loam is currently held for about $50 or $75 an acre where it constitutes whole farms, but in most places it forms only parts of farms and is governed by the general selling price of the adjoining soils.

The soil is naturally fairly productive and of lasting quality. The incorporation of more organic matter would increase the producing capacity of the soil as well as reduce the tendency to bake hard on drying. Though cotton does not make a very large stalk, yields of lint are fairly good. Grain sorghums, sorgo, and Sudan grass are much more certain to yield grain and forage than is corn. Oats produce good winter pasturage and, if seasons are especially favorable, make fair yields of grain.

WILSON CLAY

The surface soil of virgin Wilson clay is dark-gray, heavy, tough clay, sticky when wet but hard when dry. In long periods of dry, hot weather the soil cracks deeply. It shows practically no change when cultivated and does not effervesce with hydrochloric acid. Below a depth ranging from 10 to 12 inches is gray, dense clay containing no lime carbonate. This passes, at a depth between 24 and 30 inches, into light-gray clay with no lime carbonate in the fine earth material, although small lime concretions are numerous. At a depth ranging from 48 to 60 inches this material becomes slightly mottled with yellow and passes into mottled yellow and light-gray heavy calcareous clay containing some small soft lumps of lime. Yellow and gray marl occurs at a depth of about 7 or 8 feet.

Wilson clay closely resembles Houston black clay, flat phase, but is somewhat lighter in color, as a rule, and does not contain lime car-

bonate in the upper horizons. The surface soil hardens or crusts over more than does the surface soil of Houston black clay, flat phase.

Wilson clay is of very small extent in Milam County. It is found in a few small areas associated in most places with Wilson clay loam and soils of the Houston series. One small area lies just east of Watts and several smaller ones are near by. A small area is 2½ miles southwest of San Gabriel, and another is 2 miles northeast of Thorndale. Some of the larger areas occur in the vicinity of Clarkson in the northern part of the county.

Wilson clay is very flat. Although drainage is poor it is in most places sufficient to allow the production of crops. Hog wallows are found on the virgin soil.

This is a prairie soil and supports the same native vegetation as Wilson clay loam, which it closely resembles except in its greater density and difficulty to work. It is utilized for the same crops as that soil, and the yields are about the same. The virgin soil cracks deeply in long periods of hot dry weather, but in cultivated areas the tendency to crack is less marked.

CROCKETT FINE SANDY LOAM

The surface soil of Crockett fine sandy loam consists of rather heavy dark-gray, brown, or nearly black fine sandy loam from 6 to 10 inches thick. It has about the same appearance in cultivated and uncultivated areas. No lime carbonate is shown by field test. The subsoil is tough, heavy, brown or reddish-brown clay, in some places mottled with gray, and contains no lime carbonate. At a depth ranging from 20 to 30 inches it grades into reddish-brown or mottled red and gray tough clay, which in places shows a very slight reaction for lime. At a depth of 4 to 5 feet this clay grades into mottled yellow and gray, brittle clay, in some places containing some lime, which passes below into yellow and gray sandy clay or clay shale.

In the larger areas of this soil there are included patches of Crockett clay loam, Wilson clay loam, and Wilson fine sandy loam. In places near Baileyville and Jones Prairie considerable small chert, quartz, and quartzite gravel is scattered over the surface in some areas.

Crockett fine sandy loam occurs chiefly in the marginal areas between the black prairie lands and the sandy timbered soils, although many small widely separated areas of semiprairie appearance occur throughout the sandy timberlands in various parts of southern and central Milam County. The larger areas occurring as marginal strips are in the vicinity of Jones Prairie School, Jones Prairie, Little River Church, Baileyville, Sneed Chapel, and elsewhere in the northeastern part of Milam County. Many small prairie areas occur in timberlands in the vicinity of Minerva, Rockdale, Davilla, Forest Grove Church, Nile, Pleasant Retreat Church, and Gay Hill, and in widely scattered positions throughout the southwestern part of the county.

The surface of Crockett fine sandy loam is undulating or gently rolling. In the small flats within mapped areas of the soil are

found inclusions of the Wilson soils. Drainage is good, and in most places the surface is not susceptible to exhaustive erosion except during very heavy rain. Well water is usually scarce or can not be obtained.

Crockett fine sandy loam is a prairie soil, though in virgin areas there is a considerable growth of small mesquite trees. In addition there are some shrubs, such as chaparral, some pricklypear, and a few wild grapevines. The grasses consist largely of needle, buffalo, grama, and others. Near timbered lands some post oak and a few elm trees grow, as well as a few small haw trees. Probably 70 per cent of this soil is in cultivation.

Crockett fine sandy loam is considered a rather strong and productive soil and is utilized mainly for the production of cotton. Smaller acreages are devoted to corn, sorgo, and in places to grain sorghums. Sudan grass and smaller acreages of other crops, such as oats, millet, and fruit and vegetables for home use are grown. In favorable seasons cotton yields about one-half bale to the acre, corn from 15 to 30 bushels, oats from 20 to 40 bushels, and grain sorghums from 20 to 30 bushels. Peaches, pears, plums, small fruits, berries, grapes, and vegetables do well in the small home gardens.

This soil is fairly easy to cultivate and may be worked with less difficulty than Wilson fine sandy loam, owing to a much slighter tendency to pack into a hard mass on drying. The soil becomes very hard in long, hot, dry spells, but a shallow surface layer of loose material is easily maintained by cultivation.

Much of the land has been farmed for a long time with little effort to maintain productiveness. Such land is rather poor in organic matter, but the growing of such crops as peas or sweetclover and the turning under of the vines or stalks will improve the producing power of the soil.

Most of the Crockett fine sandy loam occurs in such small areas that few farms are made up entirely of this soil. It currently sells for about the same price as the associated soils, commanding from about $40 to $75 an acre. In the sandy regions of the county the small areas of this soil are locally referred to as mesquite land.

CROCKETT CLAY LOAM

The surface soil of Crockett clay loam, to a depth ranging from 8 to 12 inches, consists of dark-brown or black clay loam, somewhat sticky when wet but breaking into fine clods on drying. The subsoil is dark brownish-red or reddish-brown clay, nearly black in some places, which grades at a depth of about 24 inches into mottled yellow and brown or red and gray clay. This, in turn, grades at a depth of about 36 inches into mottled yellow and gray clay containing a few lime concretions in some places. The surface soil and subsoil material show no content of lime carbonate by field test. At a depth of about 4 feet the subsoil grades into the parent material, consisting of mottled yellow and gray clay shale in which the gray color increases with depth. In a few places this material contains a little lime carbonate in the form of small concretions or in layers about one-fourth inch thick.

The soil is about the same when cultivated as in the virgin condition. In some places there are, on the surface and through the soil, round calcareous sandstone or sandy limestone bowlders, possibly of a concretionary character. These range from a few inches to several feet in diameter. In some places numerous reddish-yellow ironstone fragments occur in the surface soil and upper part of the subsoil, which contain some shell impressions in the rock but give no reaction for lime carbonate. In such places the subsoil between depths of about 12 and 60 inches consists of reddish-yellow clay. Locally there are many brown outcrops, a few feet across, of the subsoil material.

The surface soil, though rather heavy, is cultivated easily and breaks down into a granular or fine cloddy structure. The soil hardens and cracks in virgin areas during very dry weather but does not crust and bake so tightly in cultivated fields as does Wilson clay loam.

Crockett clay loam is not a very extensive soil in the county, though it occurs in many widely separated small areas scattered throughout the southern part. Most of it is in the sandy timbered area and occurs as isolated semiprairies on which some of the surrounding timber growth has encroached. Small areas occur a few miles south of Thorndale and Rockdale, near Stalty, Elevation, and Gay Hill, in the vicinity of Conoley and Watson Branch School, and in many other places in the southern part of the county. Small spots are in the northern and central parts near Harlan Chapel and Little River Church. One of the larger areas constitutes Gee Prairie about 8 miles southeast of Rockdale.

The surface of this soil is generally undulating or gently rolling, though a few slopes are rather steep. Surface drainage is very good, and in places the soil is subject to damaging erosion in heavy rains. The soil holds moisture well, but there is no impervious material in the subsoil that would cause poor internal drainage. Well water is scarce or entirely lacking.

Crockett clay loam is a prairie or semiprairie land, though numerous small mesquite trees, some chaparral shrubs, and pricklypear grow on it, and in many places the post oak and elm trees have spread to it from the adjacent timbers. The grass growth is much the same as that on the Houston soils, buffalo, grama, and other grasses being abundant. Probably 70 per cent of the soil is in cultivation.

Crockett clay loam is considered a very productive and strong soil. It is utilized chiefly in the production of cotton, which yields about one-half bale to the acre in good seasons. Small fields of corn, sorgo, and grain sorghums are grown. In good seasons corn yields from 20 to 30 bushels, sorgo 2 or 3 tons of forage, and grain sorghums 25 or 30 bushels. Oats yield from 25 to 50 bushels to the acre but are not grown generally.

This soil is held at about the same or a slightly higher price than the adjoining soils. In many places it makes up only a small part of the land area of a farm. Probably in the better locations it commands between $40 and $75 an acre.

The soil is well suited to cotton, grain sorghums, sorgo, and small grains. With care, it does not lose productiveness rapidly, but maximum yields are best insured by terracing and keeping a good supply of humus in the soil, practices which prevent erosion. Probably

sweetclover would grow well on this soil and prove a valuable crop. Peaches, pears, berries, and fruits yield very well, and vegetables are grown successfully in small home gardens. This soil is locally called mesquite land.

SUSQUEHANNA FINE SANDY LOAM

The surface soil of virgin Susquehanna fine sandy loam consists of gray or brownish-gray fine sand or loamy fine sand, from 2 to 4 inches thick, grading into pale-yellow or grayish-yellow fine sand which continues downward to a depth ranging from about 12 to 24 inches. In places the lower part of this layer is slightly loamy and in some places is faintly mottled with gray and yellow. In cultivated fields the surface layer in places consists of grayish or grayish-brown fine sand to a depth of 6 or 8 inches. The subsoil consists of red, heavy, dense clay mottled with gray, which merges at a depth of 2 or 3 feet into slightly more crumbly and brittle clay or sandy clay, mottled gray and red with some yellowish color in many places. Below a depth ranging from 3 to 6 feet is hard gray sand or gray sandy clay, with red, yellow, and brownish spots. This grades below into gray clay shale, with reddish-yellow, brown, or black spots and streaks along the cleavage lines. Plate 2, B, shows a cut where Susquehanna fine sandy loam is exposed to a depth of about 5 feet.

Although Susquehanna fine sandy loam is not a very extensive soil in this county, it occurs in numerous small areas in the northeastern, central, and southern parts. The largest areas are a few miles northwest of Branchville and in the vicinity of Jones Prairie and Cross Roads in the northeastern part of the county. Small areas in the form of long narrow strips are in widely separated positions in the central and southwestern parts within a few miles of Rockdale, and some are near Milano, Bailie, Fairview School, and in many other places in this general region. The soil is found in the sandy timberland section of the county in close association with the other sandy soils, mainly with the Luverne, Kirvin, and Tabor fine sandy loams.

Susquehanna fine sandy loam has a gently undulating or gently rolling relief in the larger areas. Surface drainage is fairly good, and there may be some erosion on the steeper slopes. A very large acreage of this soil in the southern part of the county occupies the gently sloping inclines and flats adjacent to small draws and branches, and in many places occupies small shallow basins at the heads of these draws and extends down the draws for some distance. Surface drainage in such places is slow, although the excess water usually flows away through the draws and branches shortly after rains. The heavy subsoil retains water for some time, and internal drainage is poor. In rainy seasons the soil remains saturated for a long time and somewhat delays the growth of crops, though the natural drainage is sufficient to allow the raising of crops every year. Well water can be obtained at various depths. As this soil collects and holds much water, crops grow fairly well through very dry seasons, provided there is a good store of water in the subsoil at the beginning of the season. In some of the lowest positions immediately adjacent to and around stream heads there are many very

small flat, poorly drained spots of gray fine sandy loam or very fine sandy loam over heavy dark-gray clay. Had these spots been large enough they would have been shown as Lufkin fine sandy loam or Lufkin very fine sandy loam.

Susquehanna fine sandy loam is covered with a growth of native oak and other trees where not in cultivation, though probably about 30 per cent of the soil is either cultivated or in cleared pasture land. The main tree growth is post oak, with some blackjack oak, hickory, various shrubs, and a few grasses. A wild bean is abundant in low places.

The principal crop is cotton, which yields about one-fourth bale to the acre or slightly more in good seasons. Corn is grown in small fields and when climatic conditions are favorable it yields from 15 to 25 bushels to the acre. Sorgo and Sudan grass yield a very good tonnage of forage or hay. Some vegetables, fruits, and berries are grown in the small home gardens and orchards, and yields are very good. Bermuda grass furnishes excellent pasturage in some of the small meadows and in pastures. Some vegetables, melons, and sweet-potatoes are grown for the market on this soil in places.

This is a fairly productive soil when it is properly managed. It is somewhat deficient in humus, and much organic matter should be plowed under. Such legumes as cowpeas, beans, and black-eyed peas are beneficial to the soil, especially when the vines are plowed under. The soil is well suited to vegetables, melons, berries, peaches, plums, pears, peanuts, and many other crops. It appears to be somewhat deficient in nitrogen and phosphoric acid, and the application of commercial fertilizers containing these constituents would doubtless increase yields in favorable seasons.

This land currently commands between $25 and $50 an acre, depending on location and acreage of associated soils in the individual farms.

SUSQUEHANNA GRAVELLY FINE SANDY LOAM

The surface soil of Susquehanna gravelly fine sandy loam, to a depth varying from 2 to 4 inches, consists of gray fine sand containing a large quantity of rounded gravel. This grades into yellow or pale-yellow fine sand containing a large amount of gravel and resting, at a depth varying from 1 to 3 feet, on very heavy gravelly clay mottled red and gray. This rests, at a depth ranging from 3 to 6 feet, on mottled gray and red, tough clay containing no gravel, which grades below into gray shaly clay. The gravel in the surface soil comprises from 50 to 90 per cent of the soil mass, but in the clay subsoil the percentage is smaller. The gravel consists mainly of subangular chert, along with some well-rounded quartz and quartzite gravel. The gravel ranges from very small to 3 inches in diameter. No lime carbonate is present in either the surface soil or subsoil.

Susquehanna gravelly fine sandy loam is inextensive in this county. It occurs in several good-sized areas and a few small scattered areas in the northeastern part of the county, in the vicinity of Wildcat Bridge, String Prairie Church, Harlan Chapel, and Little River Church. It occupies ridges and swells of land, and slopes are fairly steep in places. Drainage is good.

Practically none of this soil is in cultivation, as it is so gravelly and contains such a small amount of fine earth that there is little plant food present. Even were there more fine earth present the gravel would make cultivation difficult. In some places the soil to a depth of several inches contains only a little gravel. This soil is wooded with fairly good-sized post oak and blackjack oak trees, with some hickory and a sparse undergrowth of shrubs. Some wild grapevines grow well.

This soil is used mostly for the scant pasturage of coarse grasses it affords and for woodland. It supplies firewood, fence posts, and some rough timber for building operations. Considerable of the gravel is used for road building. It is not desirable for surfacing, making a rather rough road, as the chert wears down very slowly and insufficient clay or sand is present for binding. Probably the soil is best suited for woodland and for pasture. It seems likely that grapes would do well on it.

LUVERNE FINE SANDY LOAM

The surface soil of virgin Luverne fine sandy loam to a depth of 2 or 3 inches consists of gray or grayish-brown fine sand grading into yellow, pale-yellow, or grayish-yellow fine sand which extends downward to a depth between 12 and 24 inches. In many places a few small, black, smooth ironstone fragments occur on the surface and throughout the soil. This soil is loose when dry and only very slightly coherent when wet. When excessively dry, as during long periods of hot, rainless weather, the soil bakes to a depth of 2 or 3 inches, even in cultivated fields. The surface soil rests on heavy red clay which in places is slightly sandy and shows faint-yellowish mottling. This clay grades, at a depth ranging from 24 to 30 inches, into light-red, yellowish-red, or reddish-yellow clay or sandy clay which in some places shows slight grayish mottling. The subsoil consists of rather heavy clay. On drying in exposures, it becomes very hard and cracks irregularly, especially vertically. With slight pressure this cracked clay breaks apart into fine clods. The lower subsoil layer is even more brittle and less dense than the upper layer. Below a depth of 3 or 4 feet is clayey sand and below this is reddish-yellow or yellow sand, containing some grayish mottles and spots of red and a few iron concretions in the lower part. In places the surface soil and subsoil both contain thin horizontal layers of iron sandstone.

This soil is generally rather uniform, but small areas of Kirvin fine sandy loam have been included, as well as some patches of Bowie, Orangeburg, and Ruston fine sandy loams. The included Bowie fine sandy loam has a brownish surface soil and a mottled red and gray, rather friable sandy clay subsoil; the included Ruston fine sandy loam has a similar surface soil, and a friable, reddish-yellow sandy clay subsoil; and the included Orangeburg fine sandy loam has a brown or light-brown surface soil and a friable sandy clay subsoil.

Luverne fine sandy loam is an extensive soil in this county. It occurs in a number of fairly large areas and many small ones throughout the sandy timberland region of eastern and southern Milam County. Good-sized areas occur around Jones Prairie, Gause, Rock-

dale, and Milano, and many small areas are through the sections of the county just south of Gause and Rockdale, in the vicinity of Fairview, Pleasant Hill, Oakdale, Oak Hill, and Sipe Springs Schools, Eagle Church, and Stalty. The soil is almost everywhere closely associated with Kirvin fine sandy loam. It occupies the tops of hills and ridges whose slopes consist of the Kirvin soils.

Luverne fine sandy loam has a gently rolling or undulating surface. In many places it occupies smooth ridges or crests of ridges and slight elevations. The surface drainage is fairly good as a rule, and water passes readily, though slowly, downward through the heavy subsoil. In periods of considerable rainfall much of this soil stays in a saturated condition for a considerable time and subsequently dries out slowly, owing to the fact that the deep sandy surface soil collects rain water and the clay subsoil causes slow internal drainage. This saturated condition causes crops to be backward in wet spring seasons. On the other hand the loose sandy surface soil prevents rapid evaporation of moisture, and when a good supply of water is in the surface soil, subsoil, and substratum at the beginning of the season the crops withstand droughty conditions to a considerable degree, especially on farms where the management of the soil has been such as to maintain a fairly productive condition. Although some unprotected slopes are eroded during heavy rainfall, this soil is not so susceptible to severe washing as the associated Kirvin fine sandy loam. Wells of good water are obtained at a depth of 90 or 100 feet.

Luverne fine sandy loam is a wooded soil and where uncultivated supports a rather heavy growth of post oak with some blackjack oak and a few hickory trees. Shrubs growing on this soil consist mainly of yaupon (a species of holly) and Spanish mulberry or American beautyberry. Texas plume, a weed having very beautiful flowers, is also common on this soil, as are bull nettle and poison ivy or poison oak. Mustang grapevines grow luxuriantly, and horsemint grows in many places. Some grasses grow on this soil, such as broom sedge and purple love grass. Probably about 40 per cent of the soil is cleared, and most of it is in cultivation. Small areas of the cleared land and all of the uncleared land are used for pasture.

Luverne fine sandy loam is utilized in the production of the crops generally grown on the soils of the county, namely cotton, corn, sorgo, and small acreages of grain sorghums and Sudan grass. Cotton is the principal crop, and probably 80 per cent of the land on most farms is devoted to it. The soil is fairly productive, especially where it is managed carefully and organic matter is added yearly. Crop yields vary with climatic conditions and the care given to keeping the soil in a productive condition. In favorable seasons cotton yields from one-fourth to one-third bale to the acre and on some farms more, corn from 15 to 20 bushels, and forage crops, such as sorgo and Sudan grass, do well. Grain sorghums yield well in many seaons. Peanuts make good yields and are a very successful crop. Cowpeas and black-eyed peas make a fine growth and produce good yields of seed. Many farmers practice growing peas in alternate rows with corn to improve the soil. Melons grow well and give profitable yields. Vegetables of all kinds and peaches, grapes, pears, plums, and berries are produced very successfully in the small home gardens and some of these products, mainly toma-

toes, melons, sweetpotatoes, peppers, and other vegetables, are grown by many farmers for local markets and some are shipped. Bermuda grass is utilized for pasturage.

Luverne fine sandy loam is a loose soil, is rather drought resistant, and is easily cultivated. It is especially suited to fruits, grapes, berries, vegetables, melons, sweetpotatoes, and peanuts. It is less suited to the general farm crops and is not suited to small grains, though small acreages of small grains could be grown for winter pasturage.

This soil ranges in price at the present time from about $25 to $60 an acre, depending on location, size of farm, improvements, and condition of the soil. Some farms are as small as 50 acres, but most of them range from 100 to 150 acres in extent and many are larger. Most farms on this soil include areas of other soils. Although there are some good farm homes and good improvements on this soil, many farmers have very modest homes and only the simplest improvements.

As a rule there is no great or systematic effort made to maintain or increase the productiveness of this soil. The practice of some farmers of growing legumes, such as black-eyed peas, in rotation, together with plowing under pea vines and other organic matter to keep a good supply of humus in the soil, has proved very beneficial. On the whole the soil is rather deficient in organic matter. Some farmers have used commercial fertilizers with good results under favorable moisture conditions. In very dry or very wet seasons, however, on many farms the returns have not proved profitable, and for that reason the use of fertilizers is not general. For truck crops and for melons or other special products the use of commercial fertilizers has proved more profitable than for the general farm crops. Analyses of soils similar to Luverne fine sandy loam have been made by the Texas Agricultural Experiment Station, and results have shown that the soil needs first of all a legume rotation and the incorporation of organic matter. In Circular No. 31[4] of the Texas Agricultural Experiment Station a number of fertilizer formulas are recommended for soils of this character for different crops. The soil responds especially well to applications of barnyard manure and composts of vegetable matter.

KIRVIN FINE SANDY LOAM

In the virgin condition the surface soil of Kirvin fine sandy loam is brown, reddish-brown, or brownish-red fine sandy loam, generally from 4 to 10 inches thick. A few small ironstone fragments occur in the surface soil in many places. The soil in cultivated fields is practically the same as in the virgin state. It rests abruptly on the subsoil of deep-red or dark-red, heavy, stiff clay which is sticky when wet but very hard when dry. When dry it cracks in exposures, along irregular lines. With only slight pressure the cracked masses break down into fine, small clods, with some coarse fragments. At a depth ranging from 20 to 26 inches, this layer grades into yellowish-red or reddish-yellow heavy clay or sandy clay, which in some places is mottled red, yellow, and gray. Below a depth of 30 or 40 inches is the

[4] FRAPS, G. S. Op. cit.

parent material, which consists of yellow and gray shale, shaly clay, or sandy clay. Some layers are composed of compact fine sand, some of silt, and some of clay. Locally thin iron seams occur along lines of stratification. Occasional seams of dark, bituminous, shaly clay occur in the subsoil, in most places at a depth of several feet. Between depths of 6 to 10 or more feet compact fine sand is seen in many places. No lime carbonate is present from the surface down.

In places the top of the clay subsoil layer rises and falls in a regular wavelike formation. (Pl. 2, C.) As a rule the surface soil is rather shallow. In spots it is only about 2 inches thick, but in some rather smooth or nearly level places it is 12 or 14 inches thick. In very small areas on some slopes the subsoil is exposed on the surface. A few small areas mapped with Kirvin fine sandy loam had a reddish surface soil 15 or 18 inches thick underlain by red sandy clay. This soil resembles Greenville fine sandy loam, but owing to its small extent it was not mapped as a separate type.

Kirvin fine sandy loam occurs in close association with the Luverne, Tabor, Susquehanna, and Crockett fine sandy loams, and mapped areas of Kirvin fine sandy loam include small areas of those soils. Kirvin fine sandy loam is one of the most extensive soils in the county. It occupies large and small areas throughout the sandy timberland in the eastern and southern parts of the county. Large areas occur in the region between Milano and Cameron, around Rockdale, and in the vicinity of Minerva. Probably a smaller percentage lies in the southeastern part of the county than elsewhere in the timbered region. Large areas occur around Eagle Church, Hickory Grove School, Gay Hill, Stalty, and Conoley.

The surface of Kirvin fine sandy loam ranges from gently rolling to very rolling and somewhat hilly. Many of the slopes are rather steep. Surface drainage is very good in all places, and severe erosion is common. On most of the slopes, surface wash has been so severe as to remove considerable of the surface soil and in many places the land is marked by numerous gullies. The rather shallow soil cover does not hold a large supply of water, and the dense subsoil allows only a slow absorption. Hence, in heavy rains the run-off is excessive. Good water is obtained in wells from 90 to 100 feet deep or shallower in some low places.

Kirvin fine sandy loam is a wooded soil, though perhaps 40 per cent of it is in cultivation. The main tree growth is post oak, with a few blackjack oak and some hickory trees. A scattered growth of small mesquite trees seen in some places probably spread from adjacent areas of Crockett fine sandy loam. The grass is chiefly broom sedge, though some buffalo grass and needle grass are also found in association with the mesquite trees in areas where the soil is very shallow. Various shrubs, including some haw, yaupon, and wild grapevines, are common.

Cotton farming is the principal industry on this soil. Cotton yields from one-fourth to one-third bale to the acre in favorable seasons on the better farms; corn, which is grown on small acreages, yields from 15 to 25 bushels to the acre under good moisture conditions; and sorgo and Sudan grass, generally grown in small fields, yield a fairly good tonnage of forage under the best conditions of soil and weather. Small acreages of grain sorghums yield well. Some oats

are grown for pasturage. Peanuts, sweetpotatoes, and melons are grown to some extent and yield well except where the soil is very shallow. Small orchards of peaches, pears, plums, and berries grow well and produce fairly good yields. All kinds of vegetables are grown successfully in the small home gardens. Tree fruits, berries, vegetables, peanuts, melons, and grapes do best where the soil is deepest. On the shallow spots such crops as sorgo, Sudan grass, oats, and grain sorghums are more satisfactory than corn or cotton and prevent erosion to some extent. Black-eyed peas and cowpeas grow well, improve the soil, and make fair yields of seed and vines.

This soil is rather productive where the surface soil is not too shallow and where the soil is kept well supplied with humus. On eroded and washed slopes crop yields are very small. It is said by farmers that this soil produces fairly well when moisture conditions are favorable, but in dry seasons crops suffer more quickly than on the deeper fine sandy loams. On the other hand, in rather wet seasons this soil is not so soggy and does not remain saturated so long as the other fine sandy loams. It is a droughty soil in many places, and crops do best with light but rather frequent showers.

Farms on this soil sell at the present time at prices between $25 and $60 an acre, depending on the size of the farm, location, and improvements.

Kirvin fine sandy loam is naturally a rather strong soil and with good management proves very satisfactory for general farm crops and for vegetables and fruits. First of all the soil needs protection to prevent further erosion, and many farmers are finding that terracing the land is of great value in overcoming or in minimizing surface wash and gullying. The soil needs organic matter and responds well to the incorporation of vegetable matter and barnyard manure or any composted organic matter. It responds well to legume rotation and by growing such legumes as peas, beans, and peanuts the soil is improved, especially if the vines are plowed under. By sowing crops such as peas, oats, or forage crops on the steeper slopes erosion is retarded to a considerable extent. As the soil is deficient in nitrogen and phosphoric acid, the commercial fertilizers recommended for Milam fine sandy loam would prove beneficial.

KIRVIN STONY FINE SANDY LOAM

The surface soil of Kirvin stony fine sandy loam consists of red or reddish-brown loamy fine sand from 6 to 10 inches thick, containing a large quantity of small and large ironstone fragments, in many places so abundant and large as to almost preclude cultivation. The subsoil is red, heavy clay which contains some ironstone layers or thin ironstone seams. At a depth between 20 and 24 inches the clay merges into reddish-yellow clay, which in places is mottled with gray and which contains some iron streaks. At a depth of 3 or 4 feet this grades into reddish-yellow sandy clay, passing beneath into the parent material of stratified gray and yellow sand and clay. Some small areas of rough broken land are included in mapping.

Kirvin stony fine sandy loam is a very inextensive soil in the county. It occurs in a number of small, widely separated patches in the sandy timberland of southern and eastern Milam County.

Several of these areas are between Sneed Chapel and Jones Prairie, one area is near Little Rocky School several miles east of Cameron, a few patches are in the vicinity of Milano, and a number of small tracts are around Gause and in the vicinity of Oklahoma School.

This soil occupies small ridges or hill crests and some rather steep slopes. Drainage is good, and in cleared areas erosion is severe and denudes the land of considerable of the soil cover. This soil is in most places surrounded by Luverne fine sandy loam and Kirvin fine sandy loam. It covers the higher knolls, ridges, and slopes within the larger areas of these soils.

Probably less than 10 per cent of this soil is in cultivation and where cultivated it occupies very small parts of fields. The native growth is characteristically blackjack oak, with a few hickory and post oak trees. Various shrubs and vines and some wild grapevines form the undergrowth.

Where the stones are not very abundant small yields of cotton and forage crops are obtained. The soil appears to be best suited to the production of fruits, berries, and vegetables and probably would be excellent for grapes. Cultivation would be very difficult or almost impossible over areas where there is considerable stony material.

TABOR FINE SANDY LOAM

The surface soil of virgin Tabor fine sandy loam consists of gray fine sand from 2 to 4 inches thick, grading into pale-yellow, yellow, or grayish-yellow fine sand showing some gray mottling in places. At a depth ranging from 12 to 24 inches this layer rests on yellow rather heavy sandy or very slightly sandy clay, containing faint-grayish mottles which increase in number with depth. In places a few small iron concretions and small amounts of friable reddish material, probably of incipient concretionary nature, occur in the subsoil. At a depth of 3 or 4 feet the subsoil grades into mottled gray, yellow, and red sandy clay which is underlain, at a depth of 10 or 13 feet, by hard, stratified layers of fine sand, with some red and yellow along exposures or lines of cleavage. When fully dry the surface soil and subsoil become very hard and difficult to break down. The subsoil cracks along vertical lines of cleavage in places but on the whole breaks up with difficulty into large, very hard clods of irregular shape.

As mapped, this soil includes some patches of Norfolk, Susquehanna, and Lufkin fine sandy loams. The included Norfolk fine sandy loam has a light-brownish fine sandy loam surface soil underlain by a yellow, friable sandy clay subsoil.

Tabor fine sandy loam is scattered widely through the sandy timberlands of southern and eastern Milam County in numerous small areas and a number of good-sized tracts. It is associated with all the other sandy soils of the upland timber country. The largest areas are in the vicinity of Gause and several miles east and south of that place. Some good-sized areas occur around Caddo School and Cross Roads in the northeastern part of the county, and smaller areas are widely scattered throughout all the southern part of the county between Rockdale, Milano, Cameron, and Hanover, and in many small

spots in the territory south of the International-Great Northern Railroad.

Large areas of Tabor fine sandy loam are undulating and fairly well drained, but most areas occur as rather low gentle slopes along small draws or along the lower positions in shallow valleys. The soil occupies the slightly basinlike areas at the heads of many draws, although the flat low parts of these basins or swales in most places comprise small spots of Susquehanna fine sandy loam. As a rule, surface drainage is rather slow, as the slopes are very gentle, though the drawheads which enter most areas remove the water readily. The subsoil, though rather permeable, is sufficiently heavy to cause the downward movement of soil water to be very slow. On the whole, much of the soil is saturated for considerable periods during wet seasons. Good water is usually obtained in wells from 30 to 100 feet deep.

This is a wooded soil on which the native growth includes post oak with some blackjack oak, hickory, and a few other trees. Pin oaks, or water oaks, grow on this soil in places. Probably 20 per cent of the soil is in cultivation to the crops common in the county. It is fairly productive and where it has not been cropped too exhaustively, fair yields are obtained in favorable seasons. Cotton, the chief crop, yields from one-fourth to one-third bale to the acre in good seasons, and corn, grown to some extent, produces from 15 to 20 bushels to the acre when climatic conditions are favorable. Sorgo is grown for forage and produces good yields. Small acreages of Sudan grass and grain sorghums are grown successfully. Fruits and vegetables are produced in small orchards and gardens for home use. Cowpeas, black-eyed peas, peanuts, and melons give good yields. Wild grapes grow well.

This soil sells at this time for between $30 and $50 an acre in connection with associated soils.

Tabor fine sandy loam is well suited to the crops grown, though probably it is better suited to grain sorghums than to corn. The soil is too light to produce oats for grain, but this crop furnishes fairly good winter pasturage. Some fields support a heavy growth of Bermuda grass, which affords excellent pasturage. The soil seems especially suited to the production of vegetables, peaches, plums, grapes, melons, field peas, peanuts, and similar crops.

This soil responds well to applications of barnyard manure and to the growth of legumes, such as peas. The soil is deficient in humus in most places and probably contains insufficient quantities of nitrogen and phosphoric acid. Some commercial fertilizers have been used with good results when moisture conditions were favorable. Some areas might be improved by ditching to facilitate drainage, and other places, especially where gullies are forming or are likely to form, would be improved by terracing. In some places gullies extend into areas of this soil and as they grow larger slowly but gradually they remove the soil and reduce the cultivable area.

NORFOLK FINE SAND

The surface soil of virgin Norfolk fine sand is gray or brownish-gray, loose fine sand from 2 to 4 inches thick. This is commonly lighter colored in fields which have been in cultivation for a long

time. The surface soil grades into pale-yellow or grayish-yellow, loose fine sand which becomes a little more yellow with increase in depth and is distinctly yellow at a depth of 2 or 3 feet. This yellow fine sand extends to a depth of 8 or 10 feet over large areas. This lower material commonly contains some reddish iron concretions. At the greater depths orange, yellow, or reddish sand is underlain by gray, compact sand.

In many places the fine sand is underlain, at a depth ranging from 3 to 5 feet, by red, yellow, gray, and orange sandy clay, beneath which is shaly clay interstratified with compact gray or gray and yellow sand. These areas of deep sand are distinguished by surface conditions and vegetation, but no attempt was made to separate them as a phase as the soils intermingle to a great extent and a separation on the map was deemed impractical.

Both the surface soil and subsoil of Norfolk fine sand are very loose and even when wet are only faintly coherent. When moist the soil is somewhat darker than when dry. The cultivated dry soil is subject to blowing and drifting in heavy winds. On some slopes and ridges in the areas of deep sand there are a few long narrow outcrops of sandstone.

Norfolk fine sand is an extensive soil and occupies some large areas and numerous small ones throughout southern Milam County. The largest areas, some of which are several miles across, occur in the region north and south of the International-Great Northern Railroad between Gause and Milano. Large areas occur from Milano south to the county line and southwestward from Rockdale to the southwestern corner of the county. A number of small areas are in the territory from Rockdale, Milano, and Gause northward to Little River Valley, and a few are in the northeastern part of the county in the vicinity of Cross Roads and Caddo School. As a rule, in the small areas the underlying clay is within a few feet of the surface and the large areas are occupied by the very deep sand.

Norfolk fine sand occupies the high knolls and broad ridges which comprise divides between creek drainage systems. The surface is undulating, as a rule, with some fairly steep though smooth slopes. In the large areas of the very deep sand the surface has a somewhat billowy configuration, owing probably to wind action. Surface drainage is fairly good, and underdrainage is rapid, the looseness of the soil enabling rapid absorption and downward movement of soil water. The surface soil and subsoil are both porous and leachy. Small areas of reddish-brown deep sand occur in the county, but these were so inextensive that they were mapped with Norfolk fine sand. Several areas of Norfolk sand extending from 3 to 10 miles northeast of Rockdale were also included with Norfolk fine sand. This sand is slightly coarser but otherwise has the same characteristics as the fine sand.

Norfolk fine sand is a wooded soil, with a rather open growth on the deepest sand. It supports a number of shrubs and weeds, but the grass growth is scant and consists principally of broom sedge. The tree growth consists principally of post oak, with some blackjack oak, a few hickory trees, and in the larger areas of deep sand numerous bluejack and sandjack oaks. The sandjack oak does not grow on any other type of soil in this county. A peculiarity of the tree growth on Norfolk fine sand is that in the large areas of the

soil where the sand is deepest the tree growth is almost entirely absent or is very scattered. This condition, according to old residents, results entirely from natural causes, though the exact reason is not known. Poison ivy is extremely abundant, occurring very thickly over thousands of acres. Bull nettle is very abundant, and horsemint grows extensively in many places. The wild grapevine (mustang) attains great size and is abundant. Yaupon is an abundant evergreen shrub which is valuable for cattle grazing. Among other shrubs growing on the soil are *Batodendron arboreum* (Marsh) Nutt., a kind of tree huckleberry, *Stillingia sylvatical*, *Elea microcarpa* Small, prickly ash (*Zanthoxylum americanum* Mill.), and American beautyberry (*Callicarpa americana* L.). A very abundant weed is croton weed. Probably less than 5 per cent of the Norfolk fine sand is in cultivation. The remainder is utilized for pasture.

This soil is utilized extensively for the grazing of cattle and to some extent for grazing hogs. Ordinarily there is sufficient grass to support a number of cattle, and this is supplemented by the evergreen shrubbery such as yaupon. The acorns from the oak trees supply considerable feed for hogs. Where cultivated the soil is utilized for cotton, corn, sorghum, field peas, peanuts, and vegetables. The soil is rather light for all crops, though in seasons when rainfall is ample fair yields are produced. In some very dry seasons some of the lower-lying areas which receive seepage water from higher areas produce fair yields of crops. Good water is obtained in wells from 40 to 100 feet deep. Areas in which the sand is not more than 6 feet deep appear somewhat more productive than areas where it is much deeper, and it is largely the shallower sand which is in cultivation. In favorable seasons cotton may yield from one-fifth to one-fourth bale to the acre in the better locations. Vegetables, melons, and peanuts do well, and sorghum does better than corn, which ordinarily yields very little. The soil seems best suited to vegetables, field peas, melons, peanuts, sweetpotatoes, grapes, plums, and berries, and is fairly well suited to peaches and pears.

Norfolk fine sand is very deficient in organic matter, and crop yields are increased by adding this material as well as by growing such legumes as black-eyed peas or cowpeas. The soil responds well to applications of barnyard manure and composted vegetable matter. Any cropping should be under a rotation system, including a leguminous crop such as cowpeas. The soil is deficient in nitrogen and phosphoric acid and in seasons when rainfall is neither too heavy nor too light good results are obtained by using commercial fertilizers. However, the soil should have a good supply of organic matter for best results. The Texas Agricultural Experiment Station recommends complete fertilizers containing nitrogen, phosphoric acid, and potash for vegetables, sweetpotatoes, and melons.[5]

Norfolk fine sand is not a very productive soil, but with good management and fertilization some crops do very well and produce profitable yields. The land is currently held at prices ranging from $10 to $25 an acre in large areas, but higher prices prevail where the soil occupies only small parts of farms. Some pastures sodded in Ber-

[5] FRAPS, G. S. Op. cit.

muda grass show excellent growth. Many small springs and seeps of water flow at the base of cuts and in the draws, and here Bermuda grass affords excellent pasturage during the driest seasons.

BELL CLAY

The surface soil of Bell clay in virgin areas consists of gray or black calcareous clay from 8 to 12 inches thick. This passes with but little change into very similar calcareous clay of slightly lighter color, which extends to a depth of 30 or 36 inches. The upper layer is a little darker because of its slightly larger content of organic matter. Both the surface layer and subsurface layer are strongly calcareous and carry a few fine snail-shell fragments and a few small lime concretions in many places. Below a depth of 30 or 36 inches is the subsoil proper, which is reached through a gradual change. This layer consists of gray or light-gray very calcareous clay which contains many lime concretions. At a depth of 4 or 5 feet this grades into gray, calcareous clay, slightly mottled with yellow and containing only a few small lime concretions. At a depth of about 6 feet this material grades into yellow calcareous clay or marl, in some places mottled slightly with gray, which contains some soft lime-carbonate lumps. When exposed the subsoil clay breaks into large, small, and fine clods on drying and finally pulverizes to form a coating of granular material. As the parent material dries it becomes granular. The surface soil, subsoil, and parent material show a columnar structure where exposed in cuts. The soil material cracks vertically in large and small cracks and horizontally in fine, irregular seams. At a depth between 5 and 20 feet below the surface there are beds of sand and rounded small gravel of chert, quartzite, and quartz, and in places some rounded limestone gravel and shells in association with the other gravel. A view of Bell clay, with underlying gravel beds, is shown in Plate 3, A. Apparently the surface soil is altered very little, if at all, when placed in cultivation. In virgin areas it becomes very hard on drying, though a loose layer about one-fourth inch thick forms on the surface. The virgin soil cracks deeply in long periods of hot dry weather, and many hog wallows have developed. Under cultivation the hog-wallow condition gradually disappears by a process of smoothing down the surface, and the soil works readily into a friable loamy mass 1 or 2 inches thick. The soil is very sticky when wet but is easily cultivated under the optimum moisture conditions. If plowed when too wet large clods are formed, but these break down naturally into fine clods and granular material on drying.

In a few areas included with this soil in mapping the surface soil is clay loam. This included soil rather closely resembles the flat phase of Houston black clay, but it seems to contain a larger quantity of lime carbonate in the upper layers than does the Houston soil and is underlain by beds of gravel, indicating a different origin. Locally this soil is known as elm land or red elm flats. A few high areas, some rather large, showing practically no soil difference from typical, occupy very high old stream terraces farther back from the stream bottoms, as a rule, than typical. These are from 40 to 75 or more feet above the areas of typical Bell clay. The gravel beds lie somewhat deeper than in the typical soil, being found generally

at a depth of 25 or 30 feet. One such area is at Marak and another is just north of San Gabriel. Smaller patches occur around San Andres School, Thorndale, and Detmold School.

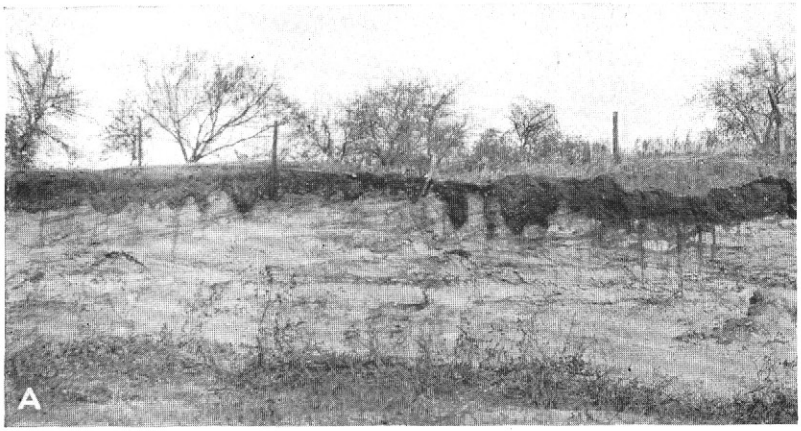
Bell clay is a rather extensive soil, occurring in good-sized areas in broad strips or bands bordering the larger stream valleys within the black-land sections of northern and western Milam County. The largest areas border the Little River bottoms in the vicinity of Maysfield, Cameron, Norman Valley Bridge, Cummins Bridge, and Valverde School. Other rather large areas occur along Pond, Elm, and Walker Creeks and some other black-land creek bottoms in the northern part, and along the bottoms of San Gabriel River, and Alligator, Brushy, and Turkey Creeks in the southwestern part of the county. A few small areas are near the Brazos River bottoms, one at Port Sullivan, and three near Baileyville in the northeastern part of the county.

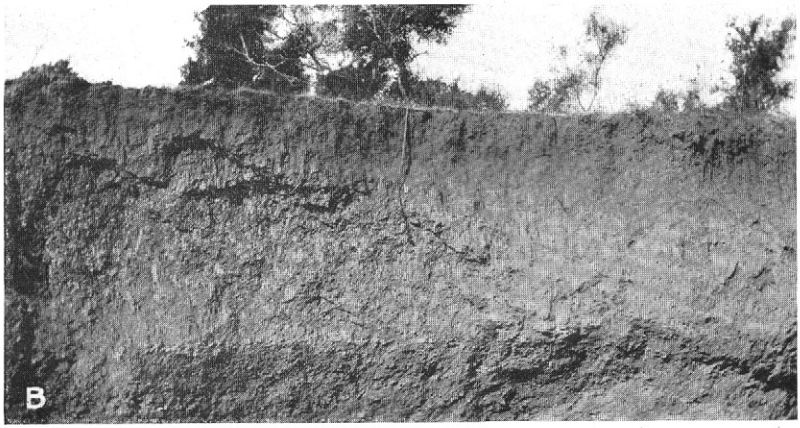
Bell clay has a nearly flat surface, though there are many gentle inclines. In places the surface is gently undulating, and some slightly depressed areas occur. As a rule surface drainage is rather slow, and water stands in depressions for some time after heavy rains. The surface soil, subsoil, and substratum are rather heavy and dense but are not impervious, and water passes readily, though slowly, through the soil mass. As a rule natural drainage is adequate for all agricultural operations and for the successful growth of all crops. In most places on this soil excellent water is obtained in wells from 15 to 25 feet deep.

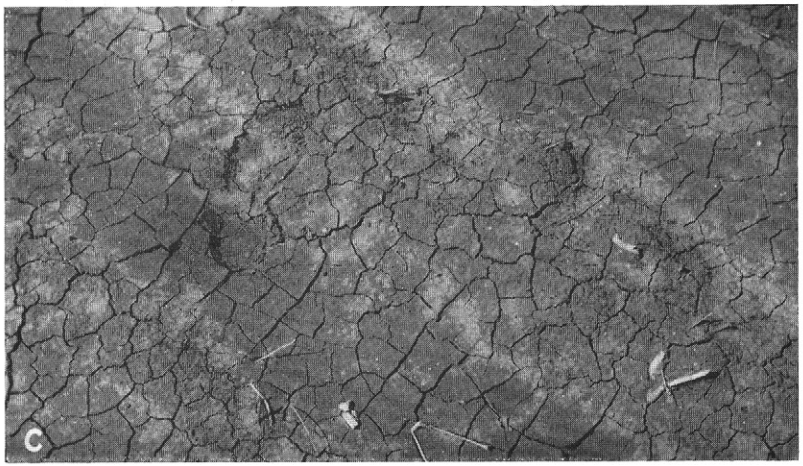
Bell clay occupies flat terrace lands adjacent to the larger stream-bottom lands. It is bordered by rather steep slopes reaching down to the bottoms and by well-defined gentle slopes reaching down from the higher-lying uplands. These terraces lie from 10 to 30 or more feet above the bottoms. In places, as along Elm Creek near Marak, there are three or four successive steplike benches, one a few feet above the other, which increase in height as they recede from the bottoms.

The native vegetation on this soil is much like that on Houston black clay, though the tree growth, largely elm and mesquite, is somewhat thicker. There are also a few live oak, hackberry, and gum elastic trees in places. Chaparral and pricklypear are very widely distributed. In places the stand of elm trees is very thick. Buffalo grass is one of the most important and valuable grasses.

Probably 80 per cent of this soil is in cultivation. The main crop grown is cotton, and in good seasons yields range from one-half to three-fourths bale to the acre. Corn yields from 25 to 40 bushels to the acre when climatic conditions are favorable. The grain sorghums, principally kafir, milo, or feterita, grown yield about 25 or 30 bushels of grain to the acre. Sorgo produces high yields and is generally grown in fields of sufficient size to provide forage for the farm animals. Some Sudan grass is grown and produces good yields. Oats are grown in some years, and yields range from 40 to 60 bushels to the acre in favorable seasons. Though this is a rather heavy soil for fruit and vegetables, there are many small home gardens and orchards. Peaches, pears, and plums yield well. Millet is grown at times by a few farmers and produces good







A, Soil profile of Bell clay, showing bed of gravel from 6 to 10 feet below the surface; B, soil profile of Milam fine sandy loam; C, cracks on surface of flat-cultivated field of Catalpa clay drying out after rain

yields of hay. Bell clay is highly prized by farmers, who consider it one of the most productive and surest soils in the county.

When wet this soil is very sticky, but if worked when nearly dry it becomes very friable and granular. Crops withstand drought very well, especially if there is a good supply of underground water at the beginning of the growing season.

This soil is well suited to the production of all crops commonly grown, and to alfalfa, sweetclover, broomcorn, wheat, and various other crops. The soil is one on which dairy and livestock farming would prove successful. Farmers state that cotton root rot is not so prevalent on this as on some of the rolling calcareous soils.

Bell clay is held in farms ranging in extent from 100 to 200 acres, though some are smaller than 100 acres and a few comprise several hundred acres. The land sells, at this time, at prices between $75 and $125 an acre, depending on location and improvements.

This is one of the best soils in Milam County. Owing to its flat surface there is little run-off of rain water, most of which is stored in the surface soil, subsoil, and substratum for the use of growing crops. There is little damage from erosion or washing. The soil is fairly rich in organic matter, though for best results a system of farming that would include the regular addition of organic matter to the soil would tend to maintain and increase production. A systematic crop rotation would also prove beneficial in keeping the soil highly productive and in lessening the tendency of fungous plant diseases, such as cotton root rot, to grow or spread.

LEWISVILLE CLAY

The dry surface soil of Lewisville clay consists of rich-brown or dark-brown crumbly calcareous clay from 8 to 12 inches thick. The subsoil of yellowish-brown or light-brown calcareous and crumbly clay grades at a depth ranging from 12 to 24 inches into yellow, granular, chalky clay which continues downward and rests on beds of rounded limestone, chert, and quartz gravel at a depth between 5 and 20 feet below the surface. A few small lime-carbonate concretions occur in the surface soil and subsoil, and many are in the parent material, together with many lumps of soft lime carbonate. In surface appearance this soil resembles Houston clay, but it has a different origin and position. The parent material consists of recent water-laid material resting on gravel beds.

A few widely scattered areas of Lewisville fine sandy loam are included in mapped areas of Lewisville clay. One such area is 1½ miles south of Maysfield, some are 2 or 3 miles southeast and east of Cameron, and some are in the vicinity of Norman Valley Bridge, Cummins Bridge, and Valverde School, along the edge of the Little River bottom lands.

Lewisville clay is of small extent in the county. It occurs in close association with Bell clay and really constitutes the more highly oxidized and leached areas of that soil resulting from the more sloping position and better drainage. Lewisville clay occurs mostly as long narrow areas on gentle slopes between areas of Bell clay. Only a few small areas are in the southwestern part of the county in the vicinity of Thorndale, Detmold School, Duncan School, Valverde

School, and Tracy. Small broken areas occur along the edge of the upland adjoining the Little River bottoms for several miles south of Cameron.

The surface of this soil is gently or rather steeply sloping, and drainage is good. In most places the surface has been eroded to such an extent as to change the soil considerably. Wells of good water are obtained at a depth ranging from 12 to 25 feet.

At least 80 per cent of this soil is in cultivation. The virgin areas support a thin native growth of mesquite trees and chaparral, with a few elm or post oak trees. The grass growth is about the same in character and species as that found on Bell clay.

Lewisville clay, although a rather heavy soil, works into a friable condition, and a surface layer of granular material is easily maintained in the dry soil. The soil is very productive, though it is slightly less productive than Bell clay. Owing to its generally sloping position the run-off of rain water is considerable, and crops do not withstand droughty conditions so well as on Bell clay. Apparently the soil is poor in organic matter.

Cotton, almost the only crop grown on this soil, yields from one-third to one-half bale to the acre in fairly good seasons. Small acreages of corn yield from 15 to 25 bushels to the acre. Some sorgo, grain sorghums, oats, millet, and Sudan grass are grown by a few farmers, and fairly good yields are obtained. A few small orchards and gardens around the farm homes give fair yields of several fruits and many kinds of vegetables. Lewisville clay is well suited to the crops grown, although corn is rather uncertain, owing to unfavorable climatic conditions at the critical period of growth. The soil is suited to alfalfa, sweetclover, and other legumes.

Lewisville clay occupies only a small part of many of the farms on which it occurs, and its value is governed to a considerable extent by the price of the adjacent soils.

This land should be terraced in many places to prevent serious washing and erosion. Organic matter should be added to increase the productiveness of the soil and its water-holding capacity. The growth of such legumes as sweetclover would be beneficial. Growing sowed crops instead of row crops would reduce the tendency to wash during heavy rains.

Some badly eroded areas of Lewisville clay were combined with the typical soil in mapping. The soil in these areas is brown or grayish-brown calcareous crumbly clay or clay loam from 2 to 6 inches thick. The subsoil is grayish-brown or yellowish-brown crumbly calcareous clay, in some places mottled with yellow or gray. This merges at a depth ranging from 12 to 18 inches into the parent material of yellow calcareous clay containing some lime-carbonate concretions and many soft chalky lumps of lime carbonate. The surface soil and subsoil both contain some of the small lime-carbonate concretions. In places some rounded chert and quartz gravel occur on the surface and throughout the surface soil and subsoil. The parent material rests at a depth ranging from 5 to 20 feet on beds of round chert, quartz, quartzite, and limestone gravel with which some small waterworn hard shells are admixed. Many of the chert and limestone gravel have a highly polished surface. In exposed places layers of this gravel from 1 to 2 feet thick have been cemented into a

hard concrete, but most of the gravel beds are not consolidated but consist of well-rounded gravel and calcareous sand or sandy clay. In many places the surface soil has been washed away, and here the yellowish-brown subsoil or yellow granular parent clay is exposed at the surface, producing a spotted yellow, brown, and grayish checkered effect.

The eroded areas occur in numerous narrow winding strips occupying slopes of high terraces which lead down to the bottom lands of Little and San Gabriel Rivers and to some of the larger creek bottoms. These areas lie around San Gabriel, in the vicinity of Cameron, and not far from Liveoak School, Cummins Bridge, Bryant Station Bridge, and Corinth School.

As a rule the eroded strips of Lewisville clay are not more than one-fourth mile wide. The soil is excessively drained, and the surface is washed and gullied badly in many places. This has resulted in the complete removal of the surface soil in many spots and has seriously impaired the agricultural value of the land. A considerable part of these areas is in cultivation, and the remainder is covered with a scattered growth of mesquite trees, chaparral, some pricklypear, and in places some elm, live oak, hackberry, and post oak trees. Grasses forming a rather thin growth consist mainly of buffalo grass, needle grasses, and others. The needle grasses predominate on the fine sandy loam spots, and here also pricklypear is abundant, especially on the small spots containing considerable gravel.

Cotton, corn, sorgo, grain sorghums, and Sudan grass are the most important crops. The yields do not average very high.

IRVING CLAY LOAM

The surface soil of Irving clay loam is rather heavy dark-gray clay loam which in places is slightly sandy. This layer merges, at a depth ranging from 8 to 12 inches, into gray or dark-gray very heavy dense clay which grades, at a depth between 23 and 36 inches, into gray or light-gray clay containing small lime-carbonate concretions. At a depth of 4 or 5 feet the subsoil merges into yellow or mottled yellow and gray calcareous clay containing some small lime-carbonate concretions and soft white lumps of the same material. This clay continues downward several feet and rests at a depth ranging from 6 to 20 feet on beds of rounded chert, quartz, and quartzite gravel embedded in calcareous clay which makes up but a very small percentage of the gravel bed. The surface soil and subsoil are not calcareous according to field tests, but below the subsoil the material is in most places very slightly or strongly calcareous. The parent material is very calcareous.

When wet the surface soil is very sticky, and on drying it bakes into a hard crust in both virgin and cultivated areas. If cultivated when moisture conditions are right, the soil works into a mass of fine granular material, but if allowed to dry before cultivation it breaks into hard, intractable clods and leaves the seed bed in a very refractory condition. In places some gravel occurs over the surface and in the surface soil and subsoil. In a few places the gray calcareous subsoil comes to the surface in small spots.

Included in mapped areas of Irving clay loam are small unmappable areas of Irving fine sandy loam and Irving clay, as well as patches of gravelly soils. Where Irving clay loam merges into or adjoins the Milam soils small spots have a reddish or brownish subsoil, or a subsoil mottled with red and gray. This soil resembles Wilson clay loam in characteristics of color, texture, and structure and reacts much like that soil under cultivation. It has a distinctly recent origin, however, as is shown by the presence of the underlying gravel beds.

Irving clay loam is widely distributed in a number of rather large areas and many small ones throughout the central, western, and southwestern parts of the county. It occurs on the flat terrace lands bordering the larger stream valleys, where it is closely associated with Bell clay, and on some very high ancient terraces or terrace remnants in the western part of the county which apparently have no relation to any of the present local streams. Some of the largest areas of the soil occur on the high terraces along San Gabriel River, Brushy Creek, and Turkey Creek, in the vicinity of Ellison Ridge School, Detmold School, Thorndale, Liberty Hill School, Tracy, and Sharp. Other areas occur on the high terraces of Little River in the vicinity of Port Sullivan, Branchville, Belmena School, Walker Creek Church, Cameron, and Corinth School. Small areas lie on a very high ridge, or ancient terrace, between Buckholts and Cameron.

The surface of Irving clay loam is flat. In places slightly depressed areas head small gullies or draws which drain off surplus surface water. Drainage is slow, and in places water stands for some time after rains. Percolation downward through the dense clay subsoil is slow. However, in a region of no greater rainfall than occurs here natural drainage is sufficient to allow successful crop production, though in rainy spring seasons planting and cultivation may be delayed somewhat. Small basins which have no drainage are transformed into lakes during rainy seasons. Good water is generally obtained in wells from 20 to 30 feet deep. The terraces on which much of this soil occurs are from a few feet to 75 feet higher than the lowlands, but on the high terrace around Hall School and Pettibone the soil occupies positions about 150 feet higher than the Little River bottom lands which lie several miles to the south. As a rule this soil does not crack so badly in dry seasons as the heavier soils, and the hog-wallow condition of the surface is not so pronounced as on Houston black clay, Bell clay, and other heavy dark soils.

Probably about 80 per cent of this soil is in cultivation, and most of the remainder is covered by a rather dense growth of mesquite trees, chaparral, pricklypear, and about the same grasses as grow on the Houston and Bell soils. In addition some elm, post oak, and gum elastic trees grow in many places. Considerable buffalo grass is found. Some medick was seen growing on this soil, as well as some tall grasses, such as little barley, slender fescue, and, in wet places, rushes.

Irving clay loam is a rather strong and fairly productive soil and is generally esteemed by farmers as a good cotton soil. It becomes refractory on drying and some trouble is experienced in getting a

stand of crops at times, as the soil crusts over on drying after rains and prevents young plants from coming up. The soil works easily when in a slightly moist condition. It is said that sometimes it is too wet to cultivate in the morning and too hard to work in the afternoon, and that the only really good time to work it is at the noon hour. Hence it is called dinner-bell land.

Crops on this soil do rather poorly in dry seasons when they grow fairly well on looser soils, but as a rule cotton appears to thrive in dry seasons. The principal crop is cotton, which produces from one-fourth to one-half bale to the acre in good seasons. When the rainfall comes at the proper times corn yields from 20 to 30 bushels to the acre. Grain sorghums are grown on a small acreage by some farmers and produce good yields of forage and grain, except in very rainy seasons, when the condition known as "blasting" of the plant occurs. Sorgo grows well and produces good yields of forage. Sudan grass is a successful crop but is grown only in very small patches as a rule. Millet produces fair yields of hay. Oats do well, in many seasons yielding from 20 to 50 bushels to the acre. This crop is not generally grown by all farmers. Small acreages of wheat have been grown successfully, but wheat is generally considered an unprofitable crop as compared with cotton. Small home orchards of peaches, pears, and plums show that these fruits may be produced successfully on this soil, though it is not especially suited to fruits or vegetables. Gardens around the farm homes produce fair yields of many vegetables and berries. The soil seems especially suited to cotton, grain sorghums, and such forage crops as Sudan grass and sorgo. Although not especially suited to clovers, a good growth of sweetclover was noted in one small field. The soil is suited to the production of broomcorn. Spur feterita, an improved grain sorghum, would do well and probably prove more successful than many of the other grain sorghums.

Irving clay loam is held, at the present time, at prices ranging from about $60 to $100 or more an acre, depending on the size of the farm, improvements, and location.

On many areas of this soil artificial drainage by ditching would prove beneficial. The soil is very productive, and if it is kept well supplied with organic matter the productiveness will increase, especially for such crops as corn. A large supply of organic matter would reduce to some extent the tendency of this soil to bake or crust.

IRVING FINE SANDY LOAM

The surface soil of Irving fine sandy loam in virgin areas consists of dark-gray, grayish-black, or grayish-brown rather heavy fine sandy loam from 8 to 12 inches thick, which in many places contains small amounts of gravel. No indications of the presence of lime carbonate are shown by field tests. The subsoil is tough, dense clay, typically gray in color but mottled with reddish, yellowish, or brownish in many areas adjacent to sandy soils of other series. Lime carbonate is not common in the upper part of the subsoil. At a depth ranging from 18 to 30 inches this clay grades, with little change, into heavy gray clay, locally somewhat calcareous and containing many small lime-carbonate concretions. At a depth of 4 or

5 feet yellowish mottles are present, and the material grades into calcareous yellow clay, mottled with gray and containing soft lumps of lime carbonate. This rests, at a depth between 5 and 30 feet, on beds of chert, quartzite, and quartz gravel.

Irving fine sandy loam is closely associated with Irving clay loam and with soils of the Bell, Leaf, and Milam series. It has practically the same color, texture, and structure as Wilson fine sandy loam but is derived from recent water-laid material. In small areas it partakes considerably of the color characteristics of adjoining soils. In many places the surface soil and subsoil contain considerable gravel, and here the gravel beds lie near to or crop out at the surface.

The surface soil, like that of Irving clay loam, has a tendency to bake hard and crust after rains, though if cultivated when moist a friable layer 2 or 3 inches thick is obtained. In dry seasons the soil becomes hard, even in cultivated fields, just below the 1 or 2 inch layer of loose material. The subsoil dries very hard and is broken with difficulty into large, heavy, tight clods.

Irving fine sandy loam is an inextensive soil. It is widely distributed in small areas in the central, western, and southwestern parts of the county on the high old stream terraces bordering the San Gabriel River and Little River bottom lands, and a few areas are in the vicinity of Pettibone and in the general territory between Buckholts and Cameron on a very high old terrace. Small areas occur in and around Cameron, and some are in the vicinity of Port Sullivan, Branchville, Maysfield, and near Belmena School and Walker Creek Church. Other areas are in the vicinity of Sharp and Corinth School.

The surface of Irving fine sandy loam is flat or undulating in most places. A few areas occupy gentle swells or ridgelike elevations with gentle slopes. Drainage is fairly good over much of the soil, though in some places water stands for some time after heavy rains. The dense subsoil holds water well, and moisture passes downward very slowly. Good water is obtained in wells from 15 to 30 feet deep.

About 80 per cent of this soil is in cultivation, and the remainder is covered with a native vegetation similar to that found on Irving clay loam. The same crops are grown as on Irving clay loam, and the yields are about the same, though, on the whole, this soil is somewhat less suited to the small grains and better suited to fruits, berries, and vegetables than the clay loam. The farming land currently sells at about the same price as Irving clay loam.

Although it is fairly productive, this soil needs organic matter for best results. It is said that it requires more rain than Houston clay and Bell clay and other calcareous soils. Some fairly good peanuts were seen growing in small fields.

MILAM FINE SANDY LOAM

The surface soil of Milam fine sandy loam in virgin areas consists of a 2 or 3 inch layer of grayish-brown or reddish-brown fine sand or loamy fine sand, merging into reddish, reddish-yellow, brown, or yellowish fine sand or loamy fine sand which continues to a depth ranging from about 12 to 18 inches. In cultivated fields the surface layer is 6 or 8 inches thick and ranges in color from grayish

brown to reddish brown. In many places the surface soil contains numerous fine and small rounded gravel of chert and quartz. The subsoil consists of red clay, moderately friable and in places somewhat sandy. On drying it easily breaks into small and fine clods. This layer merges, at a depth ranging from 18 to 28 inches, into reddish-yellow or yellowish-red clay. As a rule this clay is somewhat more crumbly and less massive than the upper part of the subsoil and contains some fine white chert particles and in places some gravel. At a depth ranging from about 3 to 5 or more feet this material rests on beds of smooth rounded gravel. The gravel ranges from fine to small, but some is as large as 2 or 3 inches in diameter. The gravel consists mainly of chert, quartz, and quartzite, along with small quantities of limestone and small waterworn shells. Some of the gravel, especially the chert, has a decidedly polished surface. There is considerable lime carbonate in the gravel beds in the form of very fine material and white floury streaks and lumps. Some layers of the gravel 2 or 3 feet thick are cemented into a concrete or conglomerate. In places the red clay subsoil extends down, in the form of narrow pockets, several feet into the gravel bed. On some slopes the gravel beds lie near the surface and crop out in spots. The peculiar wavy character of the contact line between the subsoil and gravel bed is shown in Plate 3, B. A similar wavy contact line occurs between the surface soil and subsoil.

In Milam fine sandy loam are included some small areas where the red clay subsoil does not occur above a depth of 30 or 36 inches. Small spots of Milam gravelly sandy loam are also included. In many places the lower part of the subsoil contains gray mottles. Where this gray mottling occurs in the upper part of the subsoil as well as in the lower part the areas, if not too small, were mapped as Leaf fine sandy loam.

Milam fine sandy loam is a widely distributed soil, occurring in many small areas throughout the northern, central, and western parts of the county. Some fair-sized areas occur on the old high stream terraces bordering the Little River Valley in the vicinity of Branchville, Maysfield, Cameron, Sharp, Lilac, and Davilla. Numerous small areas are in the region about Oakville, Corinth, Salem, Valverde, and Friendship Schools. In the northern part of the county near Branchville and Maysfield, the soil is mixed with Susquehanna, Leaf, and some other soils in such a way that in places boundaries could not be shown as definitely as where Milam fine sandy loam occurs in close relationship with the dark-colored soils of the Irving series. The town of Cameron is located partly on this soil.

Areas of Milam fine sandy loam are undulating or very gently rolling. Surface drainage is good in most places, and water passes readily through the surface soil and subsoil, though the soil is not very porous or leachy except in spots where gravel beds come to or nearly to the surface. The greater part of this soil occupies the higher parts of old high stream terraces. Along with Milam gravelly fine sandy loam and Leaf fine sandy loam it occupies the larger part of such benches. Good water is obtained in wells from 20 to 30 feet deep.

At least 70 per cent of the Milam fine sandy loam is in cultivation. The native growth consists of post oak, with some blackjack oak and hickory, and a few live oak trees. Wild grapevines grow profusely and luxuriantly in the forests and along fences. Some gum elastic trees grow in places. The grasses are mainly needle grasses and broom sedge.

The same crops are grown on this soil as on the other soils of the county. Cotton yields from one-fourth to one-half bale to the acre in good seasons, corn from 20 to 25 bushels, grain sorghums from 20 to 30 bushels, and sorgo several tons of forage. Some Sudan grass is grown successfully. Good yields of vegetables, melons, sweet-potatoes, peas, and peanuts are obtained in the small home gardens, and some of these products are marketed locally. Peaches, pears, and plums, various small fruits, grapes, and berries are grown successfully for home use, and the surplus is sold locally.

This soil is fairly productive, especially where it is well managed to insure the retention of a good supply of organic matter. Natural drainage is sufficient to insure a warm, dry soil early in the season, and only where the gravel beds come too near the surface is the soil inclined to be droughty.

Milam fine sandy loam is especially suited to the production of fruits, grapes, berries, and vegetables of all kinds, melons, peanuts, and other vine crops. It is less well suited to cotton, grain sorghums, and forage crops, but these can be and are grown very successfully. It is not suited to the production of small grains, though such crops as oats give satisfactory winter pasturage.

Milam fine sandy loam is a rather loose soil, but on drying the lower part becomes rather hard in long, hot, dry seasons. It is rather easily cultivated at all times. For the best results humus must be plentiful, and plowing under vegetable matter is very beneficial. The soil responds well to barnyard manure. The growing of such legumes as peas and beans improves the soil, especially where the vines are plowed under. This is an excellent soil for the development of truck farming, and some areas are utilized successfully for the commercial production of vegetables and fruits. The soil appears to be low in nitrogen and active phosphoric acid and would probably respond to commercial fertilizers containing these constituents.

A few areas included with Milam fine sandy loam in mapping occupy low, flat terraces only a few feet above the river bottom lands, on the edge of the Little River bottoms in the vicinity of, or within 2 or 3 miles of, Maysfield, Branchville, Cameron, Bryant Station Bridge, and about 2 miles south of Salem School. Two small areas border the Brazos River bottom about 2 miles northeast of Caddo School. In a few places these areas occur as small islands surrounded by the first-bottom lands. The surface is nearly flat, but both surface and internal drainage are good. Occasional very high overflows cause small areas to be covered with water for a short time, but most of the soil is free from such inundation. Good water is obtained on these low terraces at a depth of 10 or 20 feet.

This included soil supports the same native growth as the typical soil, the same crops are grown, about the same yields are obtained, and the adaptations to crops and fertilizer requirements are similar.

MILAM GRAVELLY FINE SANDY LOAM

The surface soil of Milam gravelly fine sandy loam, to a depth ranging from 4 to 6 inches, consists of brown, reddish-brown, or grayish-brown fine sand, of which in places small and large rounded gravel of chert, quartz, and quartzite constitutes as much as 60 or 80 per cent. The surface soil merges below into somewhat lighter-colored gravelly sand, which at a depth ranging from 12 to 24 inches, rests on red gravelly clay. The line of contact between these layers is irregular and wavy. The red gravelly clay grades into yellowish-red clay or gravelly clay, which at a depth between 3 and 6 or more feet, rests on beds of chert, quartz, and quartzite gravel with some limestone and shell gravel in a mixture of calcareous sand or sandy clay containing white lumps and seams of soft lime carbonate. In places the underlying bed of gravel comes near the surface, and here the clay subsoil is very thin or lacking. The red clay extends down in many long, narrow pockets for several feet into the gravel bed.

This soil is inextensive in the county. It occurs in a number of rather small areas in the vicinities of Branchville, Cameron, and Maysfield. Near Friendship School it occupies a long narrow ridge. Some very small isolated patches are surrounded by Milam fine sandy loam and Leaf fine sandy loam.

Milam gravelly fine sandy loam occupies gently undulating ridges and swells of land with gentle slopes. Surface drainage is good, and internal drainage is rapid owing to the large percentage of gravelly material present. The soil occupies the highest positions on old high stream terraces or small remnants of terraces that have been almost entirely eroded.

Probably not more than 10 per cent of this soil is in cultivation. Most cultivated areas occur as small parts of fields composed mostly of other sandy soils. Uncultivated areas support a forest growth of post oak, blackjack oak, hickory, and some elm, and numerous shrubs, such as yaupon. A thin growth of needle grasses, broom sedge, and other coarse grasses and weeds is present.

As a rule crops do not do very well on this soil as it is too thin, loose, and porous. It is said that the most satisfactory crop is sorgo, which makes fair yields in good seasons. Cotton, corn, grain sorghums, and other crops give very small yields. Wild grapevines grow well. Vegetables, berries, and fruits do fairly well on the better areas where the gravel is not too abundant. Considerable barnyard manure or well-rotted composted vegetable matter is beneficial. Where the gravel beds are near the surface they provide a large quantity of gravel for building and road construction.

LEAF FINE SANDY LOAM

The surface soil of Leaf fine sandy loam, to a depth ranging from 2 to 6 inches, consists of gray or grayish-brown fine sand or loamy fine sand merging into pale-yellow or grayish-yellow fine sand, which at a depth between 12 and 18 inches rests on heavy clay, mottled red and gray. This clay continues downward, the gray color increasing and the red decreasing, until at a depth between 24 and 30 inches the subsoil is dense tough bluish-gray clay mottled with red. This

material extends downward several feet and rests on gravel beds similar to those found beneath Milam fine sandy loam. In places a small quantity of small chert and quartz gravel is found in the surface soil and subsoil.

Leaf fine sandy loam is not a very extensive soil. It occurs on the high old stream terraces in close association with Milam fine sandy loam. Small areas are near and within Cameron, and others are on still higher old terrace remnants around Pettibone. Larger areas occur in the vicinity of Maysfield, and small scattered areas are near Friendship School in the southwestern part of the county.

Leaf fine sandy loam has a gently undulating or nearly flat surface. Drainage is good in most places, though a few small depressions hold water for a long time after rains. Good water is obtained in wells from 20 to 30 feet deep.

The native vegetation on this soil is about the same as on Milam fine sandy loam. Wild grapevines grow luxuriantly in many places. Probably 70 per cent of the soil is in cultivation to the same crops as are grown on Milam fine sandy loam. Yields are about the same on the two soils in good seasons. In rainy seasons this soil does not drain so quickly as some other sandy soils, and crops are somewhat slower in getting started. Cotton, the principal crop, yields about one-fourth bale to the acre in fairly good seasons. The small acreages of corn grown yield from 15 to 25 bushels to the acre in good seasons. Sorgo, grain sorghums, Sudan grass, and other forage crops do well. The soil is well suited to vegetables, fruits, berries, melons, sweetpotatoes, and peanuts, which are grown for home use. Some of these products are sold locally from a few small truck farms near Cameron.

This soil is easily cultivated, and crops on it withstand dry weather very well. It is well suited to all the crops grown but is especially adapted to fruits, grapes, berries, vegetables, melons, sweetpotatoes, and peanuts.

This soil is deficient in humus and responds well to the addition of manure and organic matter and to the growth of such legumes as black-eyed peas and cowpeas. The method of soil improvement and fertilization recommended for Milam fine sandy loam apply also to this soil.

CATALPA CLAY

The dry surface soil of Catalpa clay is dark-gray crumbly calcareous clay or silty clay several feet thick. The surface 10-inch layer is slightly darker than the material beneath, but otherwise there is little difference. As a rule the soil gradually becomes lighter in color with increasing depth. One characteristic of the surface soil and subsoil is the presence of a few fragments of snail shells over some areas.

In a narrow band along the stream fronts the soil is somewhat lighter in color and texture than farther back from the stream. These areas consist of silty clay loam or silty clay, but owing to their small size and irregular occurrence they were not separately mapped. Very small patches along the river bank are slightly sandy in a few places. All of the material near the river seems more calcareous than the soil elsewhere, though all of the soil contains a large per-

centage of lime carbonate. In some places along creeks some of the surface soil has a rather brownish-gray or grayish-brown color. The subsoil is yellowish or brownish near the creek but is black in low areas near the upland.

The surface soil and subsoil of Catalpa clay are very sticky when wet and on drying become hard, though exposed surfaces break down into a grain structure. The surface soil and subsoil crack and bake into a hard mass (pl. 3, C) but are easily broken into large clods which crumble into fine clods and grains. The soil works easily into a very loose granular bed. Exposed clods weather quickly into a loose mass of fine and coarse grains.

Catalpa clay is a very extensive soil in Milam County. It occurs as long bottom-land strips along the rivers and creeks. The largest area comprises the first bottom of Little River, which extends through the central part of the county from west to east, a distance of many miles. This bottom is from 1 to 3 miles wide. Areas in the southwestern part of the county occur along San Gabriel River and Brushy and Turkey Creeks in strips from one-half to 1 mile wide. The soil is very uniform, as there are no other soils in these bottoms, except in a few places adjacent to the uplands.

Areas of Catalpa clay are nearly flat. The higher part is along the stream banks, and the lower part is adjacent to the upland. The depressed strip of bottom land along the uplands receives most of the local drainage, and some fairly well-defined sloughs or drainage ways lead downstream close to the upland for long distances before flowing into the main streams. A number of small, depressed, very shallow basins, occurring especially in the eastern part of the county, are almost swampy except in very dry seasons. In places a number of sloughs winding through the soil are either tributary channels of streams reaching from the uplands or are old river channels. The surface of the soil lies from 15 to 30 feet above the beds of the rivers and from 10 to 20 feet above creek beds. The drainage is very slow, especially in the depressed areas where water may stand for a long time. The soil is overflowed occasionally, and some severe crop losses have been sustained. Usually, however, natural drainage is sufficient to enable successful crop production. Good water is obtained in wells from 20 to 30 feet deep. Damage from overflows along Little River is more common in the western part of the county than in the eastern, as the bottoms are narrower and the river channel is choked in many places by a deep accumulation of logs and rotting vegetation.

Probably 70 per cent of the Catalpa clay is in cultivation, and only a few areas remain uncleared. The native vegetation consists of a heavy growth of trees composed mainly of elm, ash, hackberry, pecan, and some gum elastic, white oak, bur oak, and wild chinaberry. Pecan trees appear to grow especially well and are very numerous on this soil. These trees seem to do especially well in the San Gabriel River bottoms, and many native orchards of pecan trees produce good yields of nuts. Many large and beautiful pecan trees left in the cultivated fields on this soil in all parts of the county afford much shade and an excellent revenue from nuts. (Pl. 1, A.) It is noted that crops can be grown successfully closer to pecan trees than to many other kinds of trees.

Catalpa clay is utilized mainly for cotton, which yields from one-half to three-fourths bale to the acre and, in especially good seasons, 1 bale to the acre. Corn yields from 20 to 40 bushels to the acre and in places has yielded 60 bushels when seasonal conditions were advantageous. Sorgo gives high yields of forage. Some grain sorghums are grown by a few farmers, and yields of 30 or 40 bushels of grain to the acre, besides a large tonnage of forage, are obtained. Alfalfa, which is grown in a few small fields, yields five cuttings a year in favorable seasons, averaging about 1 ton at a cutting. The soil produces excellent yields of vegetables and fruits, especially on the higher and better-drained areas, but scarcely any of these products are raised, as no farm homes are located on this soil and such products are grown only in small orchards and gardens around the homes. Small fields are irrigated from Little River and other streams during dry seasons, and excellent crop yields are made. The greater part of the Catalpa clay is held in large tracts by planters who rent the land to tenants who live on the uplands near the bottoms. Some of the large farms are operated partly by hired labor.

Cotton root rot damages some cotton on this soil, but not so much as on some of the upland soils. Only very small acreages of small grains are grown, as the stalk is inclined to make too rank a growth. Johnson grass, a great pest in cultivated fields, is sometimes allowed to take certain fields and is cut for hay, yielding about 1 ton to the acre of valuable forage.

Catalpa clay is prized by farmers not only for its productiveness but for the ease with which it can be cultivated. It works readily into a deep seed bed of excellent tilth and is cultivated without difficulty under proper moisture conditions. In the virgin state the soil bakes and cracks and becomes covered with numerous small inequalities, locally called hog wallows. These disappear with cultivation. The cultivated land cracks to some extent in very long dry hot periods, but cracking is prevented to a great extent by frequent cultivation. When a good supply of underground water is in the surface soil and subsoil the crops withstand long, hot, dry periods remarkably well. In very wet seasons the lack of drainage causes a backward condition of crops, but as a rule this does not prevent their growth and maturity.

Land of this type is currently held at prices ranging from $40 to $100 an acre, depending largely on location. Where the land lies in such a position that currents from overflows sweep rapidly and wash out the soil the value is somewhat less than in places where the inundations come as quiet backwater and do no damage from washing but improve the soil by leaving rich sediment. Danger from overflows tends to lower the value of the soil, and the absence of buildings or other improvements naturally results in a lower comparative valuation than for the best upland farms.

Catalpa clay is a very strong productive soil and apparently does not require fertilizers. The main problem is drainage. Some large areas have been protected by levees, but these were washed out considerably during the last great overflow several years ago and have not been rebuilt.

TRINITY CLAY

The surface soil of Trinity clay consists of black, very dark-gray, or grayish-black clay. The surface soil grades downward, at a depth of about 10 inches, into dark-gray clay which differs from the surface soil mainly in being slightly lighter in color. The change from the surface soil downward is in most places not only very slight but very gradual. The subsoil extends to a depth of several feet with but little change, though in a few places it is brown or yellow calcareous clay.

This soil is very heavy, is highly calcareous, and when wet is extremely sticky, but on drying it cracks deeply and breaks apart into large clods. On drying the surface soil breaks up naturally into a granular layer from one-fourth to one-half inch thick in virgin areas and from 2 to 3 inches thick in plowed fields. The soil should be plowed or cultivated when it contains only a little moisture, owing to its adhesiveness when more moist, but cultivation always results in a very friable condition. The soil does not bake and crust after rains, and it dries out into a mass of small particles. Hence, no difficulty is experienced in getting a good stand of crops. The subsoil has much the same structure as the surface soil and contains a large amount of lime carbonate.

Some small areas of Catalpa clay, very similar to Trinity clay except in their brown color, are included with this soil in mapping. Such areas occur chiefly along Pond Creek. One small area around Liveoak School, on the edge of the Little River bottom in the northwestern part of the county, occupies a bench a few feet above the level of the river bottom, is rather brown in color, and rests on beds of sand and gravel a few feet below the surface.

Trinity clay is a rather extensive soil in the county. It occurs chiefly in the northern part of the county in long narrow strips of bottom land, from one-fourth mile to as much as 1 mile in width. The largest areas are along Elm and South Elm Creeks, and large areas are along Walker, Pond, and Little Pond Creeks, and along Alligator Creek in the southwestern part of the county. The soil also occurs in a number of narrow creek and branch bottoms in the black-land region of the county. It constitutes some fair-sized areas on the edge of the Little River bottoms adjacent to the uplands where sediment from local black-land areas has been deposited, but very little of it is in the Little River bottoms east of Cameron.

Trinity clay has a flat surface. Areas adjacent to the upland are as a rule slightly lower than those near the stream, giving a slightly depressed or basinlike configuration in most places where the soil adjoins the upland slopes. This slight depression follows the upland downstream and receives much of the local drainage. In places a shallow trench or poorly defined stream bed follows this depressed area for miles and eventually empties into the main stream where that stream approaches the upland. Natural drainage is slow, and in rainy seasons the soil remains saturated and water stands on the surface in places. Occasional overflows cover the land, and rarely crops are lost by such inundations. In virgin areas the surface of this soil is hog wallowed; that is, it is covered with numerous small depressions and elevations. Good water is obtained in wells from 10 to 30 feet deep.

Trinity clay is highly prized on account of its productiveness, and probably 70 per cent of it is in cultivation. Uncultivated areas support a heavy native growth of trees consisting mainly of elm, with some ash, hackberry, pecan, mesquite, and a few white oak, red haw, gum elastic, wild chinaberry, and various shrubs. Buffalo grass, the principal native grass, grows luxuriantly where the large tree growth is not thick.

Trinity clay is utilized mainly in the production of cotton. Corn, sorgo, some grain sorghums, and oats are grown to some extent. In normal seasons cotton yields from one-half to three-fourths bale to the acre and corn from 20 to 40 bushels, but under especially favorable conditions cotton yields 1 bale to the acre and corn as high as 60 bushels. Sorgo and grain sorghums make very good yields, the latter probably yielding as much as 40 bushels to the acre. Small grains, such as oats and wheat, make too rank a growth of stalk to produce high yields. Johnson grass grows luxuriantly and becomes a serious pest in cultivated fields. It makes heavy yields of good hay.

This soil, though heavy, is not difficult to cultivate. It works into a good tilth. If a good underground supply of moisture is present at the beginning of the season, crops withstand droughty conditions very well. In wet seasons planting may be retarded and the growth slow, as natural drainage is poor.

This soil is especially suited to corn, cotton, grain sorghums, sorgo, Sudan grass, alfalfa, and sweetclover. It is suited to livestock and dairy farming, as it produces high yields of forage and other feeds. Vegetables and fruits can be grown on the better-drained areas. No residences or other buildings are on this soil, owing to poor drainage conditions and overflows.

This soil is very strong and productive and needs no special treatment at present to maintain fertility. The chief problem is to establish good drainage. In places it is feasible and practical to build levees to protect the land from overflows and to extend a system of ditches to carry off surplus water, but such improvements depend on the economic gain and this must be decided by local conditions. Cotton root rot does some damage in places on this soil.

OCHLOCKONEE FINE SANDY LOAM

The surface soil of Ochlockonee fine sandy loam consists of dark-gray, brown, or brownish-gray loamy fine sand or fine sandy loam from 6 to 10 inches thick, grading below into pale-yellow fine sand or loamy fine sand several feet thick. The soil is not uniform, and in much of it strata of clay loam or clay occur at varying depths in the subsoil. These strata are of different thicknesses, and the colors range from brown and rust brown to gray with mottles of blue along with some yellow and in places a little red. In places the surface soil is grayish-brown loamy fine sand or fine sandy loam and is underlain, at a depth ranging from 6 to 10 inches, by brown or mottled gray and yellow clay loam which is underlain, at a depth ranging from 12 to 18 inches, by gray fine sand or fine sandy loam which in turn grades, at a depth of 2 or 3 feet, into gray, yellow, and red splotched clay underlain at a still greater depth by fine sand. The soil is extremely variable in texture and color in the subsoil, but as a rule the underlying formation, 2 or 3 feet deep, is the lightest material pres-

ent. Much of the soil is so light in texture that it would have been classified as fine sand had it been more extensive. The soil gives no reaction for free lime carbonate.

Ochlockonee fine sandy loam occurs in very narrow strips many miles long, as creek bottoms throughout the sandy wooded area in the southern part of the county. Although none of this soil occurs in large areas in any one locality, the aggregate acreage is considerable. The soil is so widespread in occurrence that it occurs on many farms. Along nearly every creek and branch in the sandy region there are narrow bottom-land strips of this soil, some so narrow that they could not be shown on a map of the scale used. The wider areas occur along Cedar, Pinoak, Sandy, Yegua, Sixmile, Threemile, Davidsons, and Cannonsnap Creeks. Just east of Sneed Chapel on the edge of the Brazos River bottom and 1 mile northeast of Hanover on the edge of the Little River bottom there are small areas of sandy soil washed in from local slopes which were mapped as Ochlockonee fine sandy loam. Here the soil differs somewhat from the soil found along the small creeks. However, in the areas in the Little River bottoms the sandy material has been washed over Frio clay and therefore at a depth of several feet, or even above the 3-foot depth, some lime carbonate occurs in places. Some areas occur along Harl and Maysfield Creeks in the northern part of the county.

The surface of Ochlockonee fine sandy loam is flat, but owing to the light texture and loose structure of the subsoil the underdrainage is fairly good, though in periods of considerable rainfall the water table is high and the soil may remain saturated for a long time. The creeks provide good drainage. Overflows are of rather frequent occurrence in some years, but crops are grown nearly every year. The period of inundation is usually only a few hours.

Probably 30 per cent of the Ochlockonee fine sandy loam is cleared and either cultivated or used for native grass or Bermuda grass pasture. Uncultivated areas support a rather heavy forest growth, consisting of several kinds of trees of which a water oak, locally called pin oak, is by far the most abundant. Some white oak, hackberry, and pecan trees are also present. A few good native pecan orchards on this soil appear thrifty. Some haw, yaupon, gum elastic, and other small trees and shrubs grow, and greenbrier is abundant. Spanish mulberry and coffee bean, especially the latter, grow in many places, and a few ash and elm trees were noted. A number of grasses are seen, but these grow thinly, in the wooded areas.

Ochlockonee fine sandy loam is a fairly productive soil. It is utilized in the production of cotton, corn, and forage crops. Results are best in rather dry seasons when there are occasional light rains. Under favorable conditions cotton yields about one-half bale to the acre and corn from 25 to 30 bushels. Sorgo does well, and small acreages of grain sorghums give good yields. Bermuda grass makes a fine growth and produces much valuable grazing for cattle, horses, and hogs. Some sugarcane has been grown, and high yields of good-quality sirup were obtained. In dry seasons watermelons give high yields of superior-quality melons. The soil is well suited to vegetables, but few are grown on account of danger from overflows. This

soil is well suited to cotton, corn, forage crops, sugarcane, melons, sweetpotatoes, vegetables, and berries.

OCHLOCKONEE SILTY CLAY LOAM

Ochlockonee silty clay loam consists of brown or grayish-brown silty clay loam to a depth ranging from 6 to 12 inches. In especially poorly drained areas there is slight gray mottling. The subsoil consists of pale-yellow fine sand, in many places interstratified with layers of clay or clay loam of varying thickness. The texture of the subsoil is very variable. The lower part of the subsoil is characteristically lighter in texture than the surface soil. The layers of heavy material in the subsoil range in color from gray to brown and yellow and in many places there is a mottling of these colors. Along Big Briary and Hog Creeks the soil included in Ochlockonee silty clay loam is somewhat darker than typical, owing to an admixture of black-land soil material washed from local areas. Typically, Ochlockonee silty clay loam contains no free carbonate of lime, although some of the included areas containing wash from limy soils may be locally calcareous.

Ochlockonee silty clay loam is inextensive in this county. It occurs in narrow strips as bottom land along the creeks in the sandy wooded region of the county. The largest areas are along Yegua Creek in the southern part of the county and along parts of Sandy Creek in the central part. Small areas occur along some of the small streams in this same general region, and some areas are in the northeastern part of the county along Briary, Hog, and Pond Creeks and in a few other places on the edge of the Brazos River and Little River bottoms.

Ochlockonee silty clay loam occupies low, flat, bottom-land areas. Natural drainage is rather poor, and the soil is subject to overflow. Overflows and poor drainage conditions do not, however, cause a loss of crops very often. The areas along Pond Creek are rather high and are not subject to frequent overflow.

The trees and other native growth on this soil are practically the same as on Ochlockonee fine sandy loam. Probably 40 per cent of the soil is cultivated. The same crops are grown as on Ochlockonee fine sandy loam, but yields are slightly higher, as the soil is somewhat stronger and more productive. The areas along Pond, Briary, and Hog Creeks produce three-fourths bale of cotton and 50 bushels of corn to the acre under the most favorable conditions. This soil is less suited to melons, sugarcane, berries, and vegetables than is Ochlockonee fine sandy loam, but is better suited to corn, cotton, forage crops, and grasses.

MILLER CLAY

Miller clay is dark chocolate-red or reddish-brown calcareous silty clay passing, at a depth of 10 or 12 inches, into calcareous clay of about the same color and texture. The surface soil, to a depth of a few inches, is very slightly darker than the subsoil. The clay is at least 10 or 15 feet deep, as is shown in cuts. The surface soil and subsoil are both very sticky when wet but dry out to a hard mass which on exposed surfaces breaks down naturally into grains, fine

fragments, and small clods. This granular layer is less than one-half inch thick on the virgin soil, but in fields which have been plowed the granular layer is 2 or 3 inches thick. The soil cracks deeply in long periods of dry, hot weather, and even in cultivated fields cracks occur between the rows of cultivated crops. Frequent tillage tends to prevent the formation of cracks. In virgin areas the soil contains numerous inequalities in the form of miniature circular basins a few inches deep and a few feet wide bordered by humps. These are termed "hog wallows" and occur on practically all the heavy clay soils in the county. After rains the soil bakes into a hard crust and prevents young plants from coming up.

Miller clay is not an extensive soil in the county. It occurs in only a few areas in the Brazos River bottoms on the eastern edge of the county. The largest area, just east of Sneed Chapel, is more than 1 mile wide in places and is several miles long; another area is 2 miles northeast of Branchville; two areas are near Port Sullivan; and several very small areas occur farther down the river in isolated positions.

The surface of Miller clay is very flat, though a few small areas adjacent to the uplands are slightly depressed. All of the soil is poorly drained, and the low areas remain wet for long periods of time. The underdrainage is slow, owing to the heavy texture of the subsoil. However, natural drainage is sufficient to allow crop production every year under the prevailing climatic conditions. The surface of the soil lies from 25 to 40 feet above the river bed, but occasional overflows of Brazos River greatly damage and even destroy crops. Good water is obtained in wells from 25 to 30 feet deep.

Probably 80 per cent of this soil is in cultivation, practically all of the timber having been cut and cleared away. The original tree growth consisted of hackberry, elm, ash, pecan, gum elastic, and probably pin oak and some other trees. A few of the pecan trees still remain, even in fields, and produce good yields of nuts.

Miller clay is a strong and very productive soil. It is utilized almost exclusively for cotton production, much of the land being in large plantations operated by owners who work it largely on the tenant and share-cropping system. In good seasons cotton produces from one-half to three-fourths bale to the acre and in some years 1 bale or more. Some corn is grown, and yields ordinarily range from 25 to 40 bushels to the acre though as much as 60 bushels have been obtained. Small fields of grain sorghums, sorgo, and other forage crops produce high yields of grain and seed.

Miller clay is highly prized for cotton. If plowed and cultivated when slightly moist it works into a deep, well-pulverized seed bed, and frequent shallow cultivations keep a shallow layer of granular material on the surface. It is noted, however, that during long very hot dry periods the ground in places becomes baked very hard almost to the surface and cracks open between the rows of cultivated crops. If the soil is well supplied with water at the beginning of the growing season the crops stand dry, hot weather very well. The soil is well suited to cotton, corn, forage crops, and grain sorghums and is excellent for alfalfa, sweetclover, and grass.

The present selling prices range from about $50 to $100 an acre. The danger of damaging overflows reduces the price of the land somewhat. No buildings or permanent improvements are located on this land, and this causes its value to be lower than it would otherwise be.

MILLER FINE SANDY LOAM

The surface soil of Miller fine sandy loam is chocolate-brown or reddish-brown, calcareous fine sandy loam about 10 or 12 inches thick. The subsoil to a depth of 4 or more feet is chocolate-red calcareous silty clay. Fine or very fine sandy material occurs at a depth of several feet below this clay, and in places layers of this lighter material occur within 3 feet of the surface. If such areas had been sufficiently large they would have been mapped as Yahola fine sandy loam.

Miller fine sandy loam is of very small extent. It occurs in a number of very small, widely separated areas in various parts of the Brazos River bottoms on the east side of the county in association with Miller clay and with members of the Yahola series.

The surface of Miller fine sandy loam is flat or very gently undulating, and drainage is fairly good. The soil occurs on the high benches of the bottoms but is sometimes overflowed.

Miller fine sandy loam was originally wooded, but about 75 per cent of it is now in cultivation. The timber has been cut from most of it, though some cottonwood, pecan, hackberry, and other trees still remain.

Cotton, the principal crop on this soil, yields about one-half bale to the acre in good seasons. Corn is grown in some small fields and yields from 20 to 30 bushels to the acre when seasonal conditions are favorable and sometimes more in very favorable seasons. Sorgo yields well, and grain sorghums are successful. One small field of alfalfa noticed during the survey was doing well. The soil is easily cultivated and is very productive. It seems well suited to the crops grown and is also an excellent soil for grapes, small fruits, berries, sweetpotatoes, field peas, peanuts, and vegetables of all kinds. Good native pecan trees produce excellent yields of nuts.

YAHOLA CLAY

The surface soil of Yahola clay consists of a dark chocolate-red or reddish-brown, calcareous silty clay varying from about 6 to 12 inches in depth. The subsoil to a depth of 3 feet varies considerably in different locations. In general it comprises two or more layers of materials ranging from loam or silty clay loam to silty clay interbedded with fine sand, very fine sand, or very fine sandy loam. In places the subsoil consists of chocolate-red silty clay to a depth of 24 inches, and there grades into light chocolate-red very fine sandy loam. This grades downward through strata of varying textures, showing little regularity from place to place. All of the subsoil material, whatever the texture, is chocolate red in color and is calcareous, the heavy material, however, being darker red than the sandy material.

In some small low spots the surface soil is only a few inches deep and rests on fine or very fine sand. Small spots of Yahola silty clay loam and Yahola loamy fine sand were included with mapped areas of this soil, because of their small extent. Some other included areas, which really consist of Pledger clay, have a dark surface soil over chocolate-red clay.

Yahola clay is a very inextensive soil. It occurs in a few very small areas in the Brazos River bottoms on the east side of the county. These areas are widely separated and aggregate only a few hundred acres. The largest lies about 2 miles north of Port Sullivan. The soil is surrounded by other Yahola and some Miller soils.

Yahola clay occurs principally on the lower flood-plain bench of the river bottom, though a little of it is on the higher Miller clay terrace. On the lower positions the soil generally occupies depressed swales surrounded by some small dunes on the bank of higher lands. This low position results in very poor drainage, though the porous subsoil and substratum allow good underground drainage except in very wet seasons when the water table is high.

Most of the soil on the low flats is covered with a growth of cottonwood, willow, and some hackberry trees. Probably not more than 10 per cent of it is cultivated. Where the heavy material in the subsoil is rather thick, the soil is fairly productive, but where the sandy subsoil material predominates and comes near the surface crop yields are very light, especially in dry seasons. On the better areas of the soil cotton yields about one-half bale and corn from 20 to 25 bushels to the acre in good seasons.

This soil is suited for cotton, corn, sorgo, grain sorghums, alfalfa, sweetclover, and Bermuda grass. The danger from overflow damage is greater than on the Miller soils. Probably the best use of this soil is for Bermuda-grass pasture, as grass makes a fine growth. Sweetclover would probably yield very well, and sorgo would probably succeed more often than corn or cotton.

YAHOLA LOAMY FINE SAND

The surface soil of Yahola loamy fine sand is chocolate-brown, light chocolate-brown, or reddish-brown calcareous loamy fine sand from 4 to 12 inches thick. In places the surface soil is very fine sandy loam and in other places it is fine sand. The subsoil is gray or grayish-brown fine sand several feet thick. The subsoil material as well as the surface soil is everywhere strongly calcareous.

Yahola loamy fine sand is an inextensive soil in this county. It occupies a number of short, narrow strips in the Brazos River bottom on the east side of the county, in association with the Yabola and Miller soils. As mapped it includes very small unmappable areas of some of the other Yahola soils.

This soil occupies the low bottom lands near the stream channel, occurring on a bench from 15 to 25 feet above the stream bed. It has a bumpy uneven surface in places, owing to its placement by swift currents and probably to some change by wind. The slight dunelike configuration in some places indicates some drifting by wind before the soil had become covered with vegetation. Drainage is very good, as the looseness of the subsoil allows rapid percolation

of water downward. In wet seasons the water table becomes high and induces a soggy condition near or at the surface in some low places. The soil is subjected to occasional overflows from the river.

The soil supports a scant and scattered growth of cottonwood, willow, and pecan trees. In most places it is covered with a heavy growth of Bermuda grass.

Yahola loamy fine sand is not cultivated, as it is a very thin soil and would produce only a very light growth of crops. Melons, plums, and some vegetables would yield fairly well, and sweetclover would probably produce fair yields. If the soil were cultivated it would probably blow and drift considerably in heavy winds.

The present utilization of the soil for pecans and for Bermuda-grass pastures seems about the best use to which it can be put.

ROUGH BROKEN LAND

Rough broken land includes areas of rough and hilly land which has been cut into by erosion and gullied so badly that the land has no agricultural value. This cutting usually occurs on slopes and broken areas adjacent to large stream valleys. Rough broken land is sandy timberland, and the soil is very shallow. In many places red and gray clay is exposed at the surface.

One area of this broken land is just west of Wildcat Bridge on Brazos River, and another is a long strip of steeply sloping land just north of Gay Hill in the southwestern part of the county, bordering the Brushy Creek bottom lands.

Some areas included with rough broken land in mapping are not only broken but are also very stony. These areas have a little value for grazing.

IRRIGATION

Although Milam County lies within the humid region where rainfall is usually ample for the successful production of crops, there are some seasons, especially in very dry summers, when the use of small amounts of irrigation water would be profitable for some crops. The crops which would be most benefited, as a rule, are corn, vegetables, fruits, and berries.

Small acreages of land are irrigated in some dry seasons by pumping water from Little and San Gabriel Rivers. The crops thus irrigated have been corn, forage crops, cotton, and vegetables. The results have been very satisfactory of late years, since the introduction of small portable pumping plants operated by tractors. Several years ago some small pumping plants were established for irrigation along the streams mentioned, but they were destroyed by overflows.

The use of the small portable plants seems feasible, and results have been satisfactory. Some land along Little River near Cameron was irrigated during the very dry season of 1925 by such a portable pumping plant. The crops produced consisted of cotton, sorgo, and some vegetables, and production was very satisfactory.

On the uplands water could be used very advantageously for small areas of vegetables, fruits, and berries in many seasons, by pumping from wells with small pumping plants or windmills.

SUMMARY

Milam County is in east-central Texas. Its land area is 1,022 square miles, or 654,080 acres.

The relief is predominantly rolling or gently rolling, though small areas of rough land and some good-sized areas of flat land occur. The county has a large acreage of flat bottom lands, in strips from one-fourth to 3 miles wide. Most of the county lies from 300 to 500 feet above sea level. All the land is drained by Brazos River and its tributaries, the largest of which is Little River. Drainage is good in all sections, though it is slow on some flat areas which, under conditions of higher rainfall, would be termed poorly drained. Considerable farm land is subject to injurious erosion, which can be remedied.

In 1920 the population of Milam County was 38,104. Cameron, the county seat and largest town, had a population of 4,298. Several lines of railroads provide good transportation facilities to all the large markets of the country. More than 400 miles of improved graveled roads have been built.

The climate is mild and healthful. The average frost-free season is 248 days.

The agriculture of Milam County consists mainly of general farming, the principal crops being cotton, corn, and forage crops. Small acreages of vegetables and melons are grown for shipment and marketed out of the county. Livestock farming and dairying are generally carried on only as side lines. Fruit is raised successfully for home and local needs.

About 78 per cent of all the land in the county is in farms, and 68 per cent of the land in farms is improved.

Systematic crop rotations are not followed, but many farmers change the crops from time to time. Farm labor is abundant and is not unduly expensive. A very large proportion of the land is farmed by tenants. Improved farm land commands between $25 and $200 an acre, and some unimproved land sells for as low as $10 an acre.

About two-fifths of the county lies within the black-prairie region and three-fifths within the east Texas timber country. Broad and narrow flat bottom lands extend along the streams, and high flat old terraces composed of sediments laid down by ancient streams border these bottoms. The heavy forest growth of the bottom lands has been nearly all cleared off.

The Houston soils are the most productive and important soils on the black prairies. They are suited to the production of cotton, corn, forage crops, small grains, alfalfa, and sweetclover. The Wilson soils are somewhat droughty and are better suited to cotton and forage crops than to corn, vegetables, or fruits. The Crockett soils are somewhat less productive than the Houston soils but are more tractable than the Wilson.

The Susquehanna soils are wooded soils of moderate productiveness and are best suited to vegetables, forage crops, and cotton. Luverne fine sandy loam is moderately productive. It is best suited to fruits, melons, berries, vegetables, and forage crops, and with good management will produce cotton and corn. Kirvin fine sandy loam has about the same crop adaptations as Luverne fine sandy loam

but requires more careful treatment to prevent erosion. Norfolk fine sand is a thin wooded soil that is only slightly improved. It will produce vegetables, fruits, berries, and grapes but is generally not suited to other crops, except where managed carefully and fertilized.

Tabor fine sandy loam is of about the same productiveness and has approximately the same crop adaptations as Susquehanna fine sandy loam. Bell clay is an important dark calcareous soil, is very productive, and is suited to cotton, corn, alfalfa, forage crops, and small grains. The Irving soils are intractable noncalcareous soils like the Wilson and have the same crop adaptations. Lewisville clay produces only moderate yields. Milam fine sandy loam is suited to many crops but more especially to vegetables, fruits, berries, and grapes, and to a less degree to cotton, corn, and forage crops. Leaf fine sandy loam is associated closely with Milam fine sandy loam and differs from that soil chiefly in being slightly less well drained.

Trinity clay is a very productive soil and is suited to cotton, corn, alfalfa, forage crops, and many other crops. It is subject to overflow. Catalpa clay is also very productive and has the same crop adaptations as Trinity clay. It also is overflowed at times. The Miller soils are strongly calcareous and productive. Occasional overflows cover them. The crop adaptations are the same as of Trinity clay.

The Yahola soils are less productive than the Miller and are rather unimportant in this county. The Ochlockonee soils are especially suited to cotton, corn, and sugarcane. They are subject to rather frequent overflow in some years.

Only a very small percentage of the land in the county is entirely unsuited to farming. Such areas were mapped as rough broken land.

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[PUBLIC RESOLUTION—No. 9]

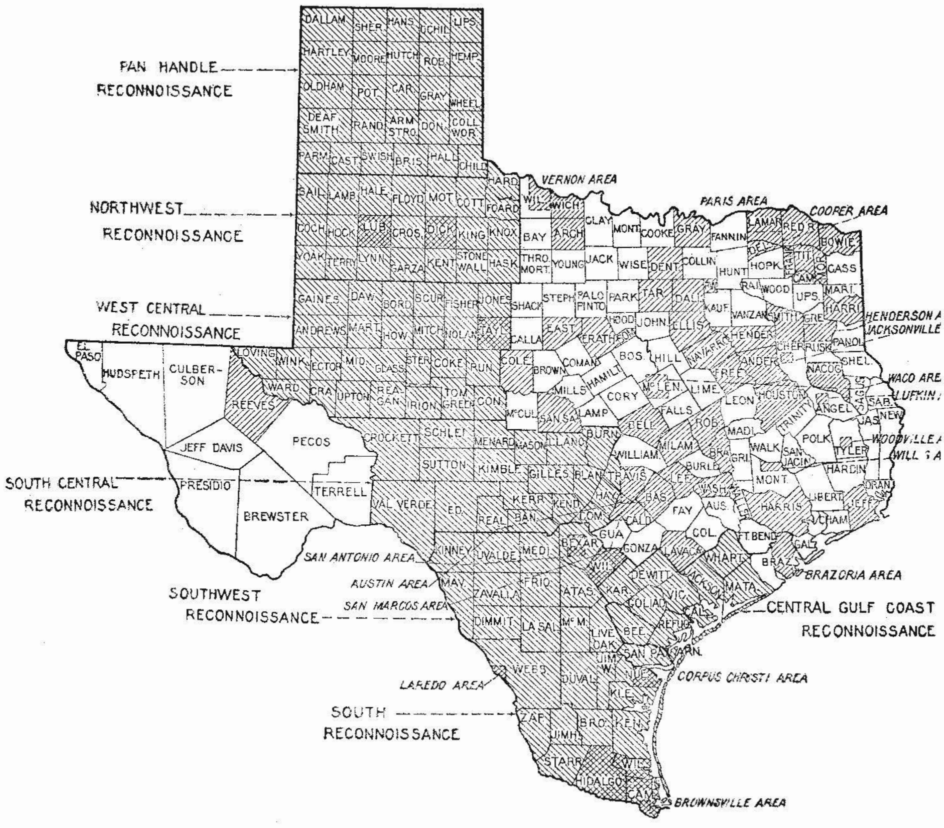
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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 as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Texas, shown by shading

U. S. GOVERNMENT PRINTING OFFICE: 19

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