Soil Survey

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Bee County Texas

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UNITED STATES DEPARTMENT OF AGRICULTURE
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SOIL SURVEY OF BEE COUNTY, TEXAS

By HOWARD M. SMITH, United States Department of Agriculture, in Charge, and R. M. MARSHALL, Texas Agricultural Experiment Station

COUNTY SURVEYED

Bee County, the southern part of which extends to a point within 30 miles of the Gulf coast, is in southern Texas (fig. 1). Beeville, the county seat, is 98 miles by highway southeast of San Antonio and 130 miles northeast of Laredo on the Mexican border. Corpus Christi, an excellent trade center and seaport, is about 55 miles by highway to the southeast on Corpus Christi Bay. The county is irregular in shape, with its long axis extending in a northwest-southeast direction. Its total area is 882 square miles, or 564,480 acres.

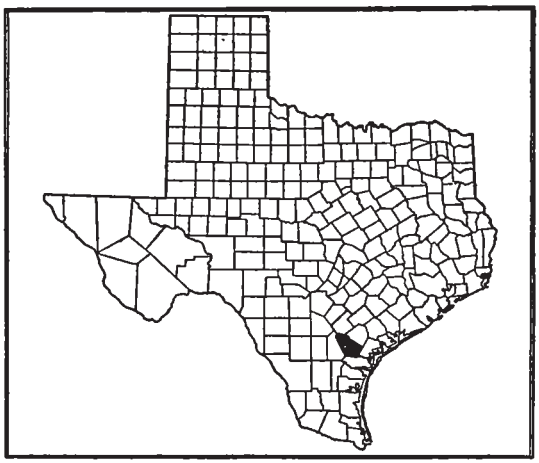

FIGURE 1.—Sketch map showing location of Bee County, Tex.

Bee County lies within the west Gulf Coastal Plain. It is at the eastern edge of the subhumid division of the Coastal Plain, wherein soils of pedocalic development occur, which extends as a smoothly undulating plain to the Rio Grande, and is locally known as the Rio Grande plain.

The regional slope of the county is gradual from the northwest to the southeast, but locally the relief ranges from smooth and nearly flat to rolling and steeply sloping. The valleys are shallow. The elevation (*2*)[1] at Pettus, in the northern part, is 299 feet above sea level; at Normanna, 273 feet; at Beeville, near the central part, 214 feet; at Skidmore, in the southwestern part, 159 feet; and at Papalote, in the southern part, 89 feet. The highest elevations are in the northwestern part on the divide between the Nueces River and Medio Creek drainage systems.

Within the county the Rio Grande plain is divided into two major divisions. The part occupying the southeastern half of the county is a low-lying smooth nearly flat or undulating terrace plain extending to the coast; and that part including the northwestern half is a high rolling plain.

[1] Italic numbers in parentheses refer to Literature Cited, p. 34.

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The outer coastal terrace plain is traversed by a few shallow drainageways, most of which originate in the higher rolling plain. to the north and have a few short and widely separated laterals. The rolling plain is much more highly dissected by dendritic tributaries than is the outer coastal terrace. None of the stream valleys are wide. Stream-laid alluvium occurs mainly in narrow valleys extending through the rolling area, and is practically lacking along stream courses in the coastal area. Drainage of the county is effected largely through two short master streams—Medio and Blanco Creeks—which rise short distances to the northwest in Karnes County. These streams flow across the northeastern side of the county, each forming a part of its boundary. A drainage divide crosses the northwestern part, the drainage waters on the northwestern side flowing through numerous creeks and gullies, chief of which is Sulphur Creek, to Nueces River. All the streams are intermittent, serving only to carry away the run-off waters during heavy or prolonged rains. Erosion in the rolling plain is active, and many slopes and hilltops are almost devoid of soil in places.

On the outer coastal plain are many long narrow depressed areas which hold water during the wet seasons of the year. Some of these depressions are isolated, but most of them are the heads of drainageways. Some of the heavier soils of the smooth coastal terrace are pitted with small shallow depressions, locally called "hog wallows", and some sandy areas of this flat section are dotted with numerous small rounded sand mounds.

The native vegetation of Bee County is extremely varied, but much of it is characteristic of a dry warm climate. In the eastern part some areas of light-colored light-textured sandy soils support a humid type of forest consisting of a scattered parklike growth of post oak. These areas are the western limits of the narrow strips of the east Texas timber country, which in places extend into the Rio Grande plain, merging there with the subhumid type of brushland, so distinctive of the western areas of low rainfall. The grasses associated with the post oak are chiefly coarse bunch grasses, largely species of *Andropogon*.

Most of the land is covered with a more or less heavy growth of grasses, of which the short grasses—curly mesquite and buffalo—predominate, especially on the heavy dark soils which occupy a very large part of the county. The dark sandy soils support a less abundant growth of short grasses and some bunch grasses. On the smooth areas of dark deep soils the short grasses are associated with small scattered mesquite trees, some huisache, and various thorny shrubs, such as lotebush, catclaw, and pricklypear. The more rolling and shallower soils, as well as some of the darker sandy soils, support scattered clumps and thickets of small live oak trees, some mesquite trees, and various shrubs, chiefly huajillo, black chaparral, agrito, lotebush, Mexican persimmon, as well as some pricklypear, yucca, guayacan, catclaw, ephedra, and in many places anaqua trees. As the moisture conditions are best on the narrow areas of deep soil in the valleys, the vegetation is most abundant. Such areas support a dense growth of mesquite trees and many shrubs, especially white bush, and in places prickly-ash, elm, sycamore, willow, cottonwood,

and hackberry line the stream banks. On the ridges where the soil is thin and on shallow or gravelly soils elsewhere huajillo and cenizo grow abundantly.

The short grasses furnish excellent grazing for livestock, and most of the small trees and shrubs are valuable browse plants for cattle, sheep, and goats. Many of the shrubs are especially good honey plants and produce a very fine quality of honey.

Bee County was organized about 1858 from a part of San Patricio County. It was named in honor of Gen. Bernard E. Bee who distinguished himself in the Texas war for independence. Land grants were first made to settlers by the Mexican Government as early as 1834 and were continued until 1836, at which time Texas gained her independence and became a republic.

This county was settled by people largely from the United States, though many of the first settlers were emigrants from Ireland and Scotland, who came as early as 1834. Many of the present inhabitants are descendants of these early settlers.

The early settlers engaged principally in cattle and sheep raising on the open range. Some cattle were marketed at Gulf ports, but the largest number were driven to railroad points in Kansas. Papalote, a village in the southern part of the county, is said to be the first settlement in Bee County. Large herds of cattle belonging to different owners were assembled here, and the drivers joined forces for the long drive to market in order to insure safety from hostile Indians and bandits, who were a menace to the early ranchers and trail drivers.

The first county seat, Beeville, was located 10 or 12 miles east of the present city of Beeville, on Medio Creek. On March 23, 1860, a tract of 150 acres in the Anna Burke League of land was donated for the present location of Beeville. Other small towns and villages are Skidmore, Normanna, Tuleta, Pettus, Tulsita, Poesta, Candlish, Mineral, Caesar, Monteola, Pawnee, Clareville, Tynan, Olmos, Waldheim, Quincey, Blanconia, and Cadiz.

The 1930 census reports a population of 15,721 for Bee County, with a density of 18.4 people a square mile. Of this number, 4,806, representing the population of Beeville, are classed as urban, and the rest, 10,915, are classed as rural, though many live in small towns and villages. The present population consists mainly of native whites, a large number of Mexicans, and a few Negroes.

Railroads and paved highways extend from the county to the principal markets and shipping points of the State. The nearest large markets are San Antonio, Houston, and Corpus Christi, though much of the cotton is exported from the State, and cattle are shipped to beef-packing centers in Texas and other States. Lines of the Southern Pacific Railroad extend through the central part of the county, one line to Corpus Christi on the coast, to the lower Rio Grande Valley, and to San Antonio in the interior; and another eastward to Houston. Several paved National and State highways pass through the county, and public roads reach all sections. These are graded and passable, except after heavy rains, when they sometimes become impassable for short periods.

Oil and gas pipe lines extend across the county, and Pettus, Beeville, and Skidmore are served with natural gas. High-power trans-

mission lines cross the county and furnish electrical energy to all the towns along their routes. Many farms and rural communities are equipped with electric power units and local lighting plants. Many city homes, farms, and ranches are supplied with water pumped by windmills from shallow wells. Many parts of the county are reached by rural free delivery of mail and star route service. All towns and many rural communities, farms, and ranches have telephones. Churches and schools are located at convenient intervals.

Ranching and farming were long the chief and almost the only occupations. In 1930 oil and gas were discovered at Pettus, and this discovery opened up an important industry. Oil, gas, and mineral rights are now considered in every land transaction, and oil and gas prospecting is active throughout the county. From time to time caliche and sand pits have been opened for commercial purposes, but all these projects have been merely temporary.

CLIMATE

Bee County is in the southern part of the United States at the eastern edge of the subhumid region, where the climate is characterized by long hot summers, though the heat is tempered by breezes from the Gulf. The winters are short and mild, and warm days predominate, but occasional cold spells with freezing temperatures, accompanied by cold winds or northers, occur periodically.

The total amount of annual rainfall is usually sufficient for most of the farm crops grown, but it is not always well distributed. In some years a deficiency of moisture in summer causes considerable reduction in crop yields. Not only is the seasonal rainfall variable, but the amount differs widely from year to year. As a rule, most of the precipitation takes place in the spring and fall, and some torrential storms occur in summer. The winter rains are slow and are attended by rather long periods of cloudy weather, but those of the other seasons are of shorter duration, more or less localized, and likely to be electrical and torrential, sometimes causing damage to crops and soils.

The mild climate is favorable, so far as temperature is concerned, to a widely diversified agriculture. Usually more than one crop may be grown on the land in 1 year, as the average frost-free period is 285 days, extending from February 20 to December 2. Frost has been recorded as late as April 5 and as early as October 27. The commercial production of vegetables in winter and early spring is one of the important agricultural enterprises in some parts of the county.

Pasture grasses grow throughout the winter. Some of the short grasses on drying retain their nutritious quality and are grazed freely. Many forage crops grow throughout most of the year.

Livestock raising has long been established here, as it is especially favored by the long grazing season, the excellent native growth of nutritious grasses, the ease with which feed and forage may be grown, and the slight need for winter shelter.

Table 1, compiled from the records of the United States Weather Bureau station at Beeville, gives the more important climatic data applicable to this county.

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

[Elevation, 225 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1903)
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*
December	55.0	89	14	2.17	(1)	1.45
January	54.9	90	13	1.34	0.46	1.41
February	57.7	96	5	1.82	.15	7.14
Winter	55.9	96	5	5.33	.61	10.00
March	64.9	100	17	2.14	.29	6.10
April	70.8	101	29	2.19	1.60	1.31
May	76.8	105	42	3.85	3.11	1.49
Spring	70.8	105	17	8.18	5.00	8.90
June	82.0	107	51	2.99	1.24	6.39
July	83.9	106	61	2.69	.88	16.42
August	84.8	108	62	2.26	1.64	1.96
Summer	83.6	108	51	7.94	3.76	24.77
September	80.8	103	44	3.58	1.37	.68
October	72.4	103	27	2.69	.17	4.64
November	63.1	95	19	2.25	1.18	.14
Fall	72.1	103	19	8.52	2.72	5.46
Year	70.6	108	5	29.97	12.09	49.13

[1] Trace.

AGRICULTURAL HISTORY AND STATISTICS

The early settlers of the area including Bee County were ranchmen. Cattle and sheep were grazed on the open range, and, before railroads were built, large herds were driven to distant markets each year. At one time sheep were more numerous than cattle.

About the time of the Civil War a few small tracts were farmed to provide vegetables and food for local use. These were largely at the ranch homes or headquarters, at trail camps, and around trading centers. After the invention of barbed wire, much of the open range was fenced, and there was a trend toward better breeds of cattle and an increase in the farming area for general farm crops, largely feed crops, to augment natural range forage.

Since that time the area devoted to cultivated crops has steadily increased. Although the rainfall is irregular and in some seasons the moisture supply is inadequate for crops, dry-farming is practiced successfully, and little land is irrigated. Growing of cotton and corn was, and still is, the basis of the agricultural production of the county, but other crops have been introduced with varying success. Of these, grain sorghums, broomcorn, Sudan grass, and winter vegetables for northern markets have been the most successful. The continuous increase in the acreage and variety of crops grown indicates the transition from ranching to farming on the better soils.

Although farming has long been successfully carried on, the unstable moisture supply has necessitated variations in farm practices

from year to year. As yet a very large proportion of the land is used for grazing, and much of it is better suited for this purpose than to cultivated crops; therefore, the production of range livestock and the practice of livestock farming will doubtless remain important. Large and small herds of high-grade and some purebred Herefords comprise the chief livestock of the ranches. With fencing of the range and heavy grazing by livestock, the grass growth has been reduced. A small-tree and brushy growth has become more abundant on some of the land, and the carrying capacity of the pastures has been lowered.

According to the 1935 Federal census, 450,197 acres, or 82.2 percent of the land area of the county, was included in 1,655 farms, with an average size of 272 acres and ranging in size from less than 10 to more than 1,000, although most of the farms are between 30 and 219 acres. Of the land in farms, 107,352 acres were classed as improved land, which included cropland and plowable pasture. The total acreage of crops harvested was 92,247 acres, or not quite 17 percent of the land in the county.

Of the 1,655 farms reported by the 1935 census, 427 were operated by owners, 163 by part owners, 1,057 by tenants, and 8 by managers.

Table 2 gives the acreage of the principal crops grown in the county, as reported by the Federal censuses. These data show the general trend of agriculture.

TABLE 2.—*Acreage of the principal crops in Bee County, Tex., in stated years*

Crop	1879	1889	1899	1909	1919	1929	1934
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Corn	2,966	3,332	14,701	14,908	21,561	17,595	23,237
Cotton	44	1,422	14,409	32,288	56,239	66,934	42,338
Grain sorghums	----	----	----	584	1,879	12,613	6,749
Peanuts	----	----	1	55	226	30	195
Hay	289	338	649	2,319	435	87	929
Broomcorn	----	----	113	2,131	6,617	4,367	----

Based on acreage, corn was the chief crop until about 1899, at which time cotton was grown on a nearly equal acreage. Since then the acreage devoted to cotton has increased considerably over that of corn, and cotton is now the chief crop grown. Grain sorghums, chiefly hegari, have in recent years largely replaced corn, as the sorghums withstand droughty conditions much better than corn, are better adapted to soil and climatic conditions, and are of about equal value as feed crops. Broomcorn was first introduced in this county about 1895. It is grown on a varying acreage from year to year, depending largely on the price received for the product.

According to the 1935 census, vegetables were harvested for sale from 2,148 acres in 1934. The vegetables grown are chiefly string beans, tomatoes, cabbage, onions, watermelons, and sweet corn. They are grown in winter and early spring and shipped mainly to northern markets. Many different kinds of vegetables are grown in the farm gardens for consumption at home and for sale locally.

Small quantities of fruit are produced for home use in the small orchards on the farms. At one time the production of citrus fruit was comparatively extensive, and a number of rather large groves

were planted, but winter freezes, which occur occasionally, killed most of the trees. Satsuma oranges are grown in a few places on small acreages.

The total number of cattle in the county, according to the 1935 census, was 40,667, which includes both beef and dairy cattle. Most of them were range beef cattle, although 4,540 cows and heifers were milked. These latter included some herds of good grade Jerseys, maintained for milk production to supply local needs. Some cream is shipped to creameries. The 1930 Federal census reports that butter and whole milk sold in 1929 amounted to $175,749. The 1935 census reports 2,991 horses (largely ranch saddle horses), 4,024 mules, 4,149 swine, and 71,580 chickens on farms and ranches. Poultry raised in 1929 was valued at $113,481, and eggs sold amounted to $81,099. A large number of turkeys and chickens are shipped to outside markets.

Honey is an important commercial crop, from 5 to 10 carloads being shipped annually. The blossoms of many species of shrubs growing in the county are noted for their nectar-producing qualities and produce honey of a high grade. These shrubs are mainly huajillo, horsemint, mesquite, and white brush.

Commercial fertilizers have never been used to a great extent. The 1930 census reports 54 tons used on 47 farms in 1929, probably mainly for special truck crops (more or less experimentally), as commercial fertilizers have been considered unnecesary in this section, especially on the deeper dark soils.

Farm laborers are mostly Mexicans, and their number is generally adequate. They are paid from $1 to $1.50 a day and from $20 to $40 a month. Farm lands are leased on a share basis, but ranch lands on a cash basis. Usually the share basis is what is commonly termed the third-and-fourth plan, under which the tenant delivers one-fourth of the cotton and one-third of all other crops to the landlord for the use of the land and farm buildings, and the tenant must furnish all labor and expenses connected with growing the crop. Another, but less common, system of rental is the half-and-half plan. Under this system the landlord furnishes land, buildings, livestock, implements, and seed, and in return receives one-half of all crops, the tenant furnishing only the labor. Range lands lease for about 50 cents an acre, but the price differs slightly, according to the improvements, such as fences, water supply, and abundance of natural forage.

On farms operated by owners the improvements are fairly good. Modern implements are in general use, and many farms are equipped with tractors. The work animals consist of light- to medium-weight mules and horses.

A substation of the Texas Agricultural Experiment Station is located near Beeville, and research in developing and testing crops and in farm practices suitable for the soils and for the climatic region has produced much information of value to the agriculture of Bee County and the eastern part of the Rio Grande plain.

Livestock raising has always been the most important agricultural activity. This consists mainly of the production of beef cattle which are ranged on fenced natural-grass pastures, without artificial shelter for the animals. The dairy cattle are high-grade and some purebred Jerseys, kept in small herds.

Most of the beef cattle are high-grade Herefords, with some pure-bred cows and bulls. Most of the early range cattle were Longhorns, but with the fencing of the range 40 or 50 years ago, the first Herefords were introduced and gradually supplanted the Longhorns. Two small Shorthorn herds are reported, and, near Tuleta, Aberdeen Angus cattle are raised. Some herds, ranged largely on the flat outer coastal terrace section of the county, where flies and mosquitoes are at times serious pests to livestock are headed by Brahman bulls. Brahman cattle have thick, tough hides, and when this characteristic is imparted to a herd, the cattle are more or less immune from annoyance caused by flies, mosquitoes, and ticks.

Pasture grasses usually carry the cattle throughout the year, but in some seasons the weaker cattle must be fed. Shelters are, as a rule, unnecessary, but some heavy losses are sustained during exceptionally cold wet periods.

The range pastures vary in size from a few hundred to 9,000 or 10,000 acres. The average carrying capacity of the grazing land is about 1 beef animal to 10 acres. According to local reports the carrying capacity of the ranges has been lessened greatly since fencing because of the increase of bush and shrub growth. This bushy growth also causes the land to be less desirable as breeding ground, as it is difficult to find and treat young animals having screw-worm infection. Most of the calves are marketed when less than a year old. Most of the young cattle are shipped to the Fort Worth market as grass-fed vealers, calves, and yearlings, a few are finished on local feed lots and shipped for slaughter, others are moved to grass on the Oklahoma range and afterward sold on the Kansas market, and some are shipped as feeders to the Corn Belt of Kansas, Iowa, Indiana, and Illinois, eventually being marketed at Chicago.

Prior to 1925 the county was infested with the Texas fever tick, which caused great losses from fever and from poor animals that were discriminated against in the markets. The county is now practically tick free, due to active campaigns of eradication, although some small local outbreaks are constantly appearing and a Federal tick inspector is stationed permanently in the county. Eradication, on the whole, has been successful, and has repaid the ranchers many times for the trouble and expense incurred, in the improved quality of their cattle.

At times horses have been raised and shipped to market, but at present only enough horses are raised for use on the local ranches. Most of the mules are purchased outside of the county.

The production of swine has declined, and they are raised only for local consumption. The main breed is Duroc-Jersey.

A few sheep and goats are kept, but these are unimportant and are of use mainly in keeping down the brush growth around ranch homes and in small pastures. The goats are all of the common or Mexican breed, and the sheep are chiefly of the Southdown, Merino, and Dorset breeds.

The raising of turkeys for the holiday market is an important enterprise. Bronze, Bourbon Red, Narragansett, and White Holland are the principal breeds, the Bronze being the most popular. It is reported locally that in 1931 approximately 30 carloads of turkeys were marketed from this county. As there is no turkey-packing shed,

most of the turkeys shipped are sent to local markets by express or sold at packing sheds in nearby counties.

Ginning of cotton and processing of cottonseed is an important commercial industry. Cotton gins are located at convenient places—three each at Tynan, Beeville, and Pawnee, and one each at Skidmore, Olmos, Clareville, Normanna, Tuleta, and Pettus. Two of these, the farmers' gin at Beeville and the cooperative gin at Pawnee, are operated on a cooperative basis. The 1935 census reported 7,298 bales ginned in 1934.

A cottonseed processing plant is located at Beeville. This plant crushes an average of 4,500 tons of cottonseed annually. It is under operation generally from about August 1 to December 1 and during the operating season employs about 33 men. The products of the plant are linters, hulls, crude cottonseed oil, cottonseed cake, cracked cottonseed cake, and cottonseed meal. Linters are the short fibers obtained from reginning the seed before it is crushed. This product is shipped to all parts of the country for further processing into cellulose and cellulose products. Cottonseed hulls are consumed locally as feed for dairy cattle. They have little food value but add bulk and fiber to the ration. Crude cottonseed oil is shipped to various refineries located in the larger cities of the South. Cottonseed cake in slabs is exported to various parts of the world from nearby ports. The cracked cake is used for feeding livestock. It is placed in feeding troughs, feeding lots, or on the ground in the open pasture. Much of the cracked cake and cottonseed meal is exported, but about 25 percent is consumed locally. This mill provides the farmers a ready market for excess cottonseed and annually saves them many dollars for livestock feed by avoiding heavy transportation charges.

Some of the broomcorn is used by two small broom factories within the county. A number of local residents are employed each year during the vegetable shipping season at the local packing sheds. A harness shop supplies the local needs for saddles, harness, chaps, and other leather goods.

SOIL-SURVEY METHODS AND DEFINITIONS

In soil-survey procedure, soils are classified according to those characteristics, both physical and chemical, which can be determined by observation, examination, and simple tests in the field.

Excavations or borings are made at frequent intervals and the nature of the soil carefully observed. It will be noted that each hole dug exposes a series of layers or "horizons", and the entire section from the surface down is known as the "soil profile." The classification is based largely on the character of the soil material in the several horizons of the soil profile, together with such external characteristics as relief, drainage, and stoniness of the land. The vegetation—either native vegetation or crops—is observed, and its correlation with the soils is studied. In this way the natural productivity of the soil and its adaptation to various crops can be determined or estimated with a fair degree of accuracy. In classifying virgin lands that may be brought under cultivation, the observation of like soils now cultivated is important.

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Three units are commonly used in the field mapping of soils: the series, type, and phase. Most important of these is the series, which includes those soils having certain features in common, such as color, structure, thickness, and chemical composition of the horizons of the soil profile, essentially the same natural drainage conditions, and in most instances similar relief and nature of the parent material. The series are given geographic names taken from locations near which they are first identified. Victoria, Monteola, Clareville, and Goliad are names of soil series in Bee County. The soil texture or size of soil particles may vary within a series. A series may include one or more soil types, defined according to the texture of the surface soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Clareville clay loam and Clareville fine sandy loam are types within the Clareville series. Except for texture of the surface soil, these soils have approximately the same general characteristics. A phase of a soil type is a soil that varies from the type in some minor soil characteristic that may have especial practical significance. Differences in relief, depth of soil material, and content of gravel and stone are frequently the bases for phase separations. These differences may not materially influence soil character but may be of great importance in land use.

SOILS AND CROPS

In the soil survey of Bee County, 13 soil types and 3 phases, in addition to a miscellaneous land type, riverwash, were identified and mapped. The soils range in texture from fine sand to clay. The most important agricultural soils are clays, clay loams, and fine sandy loams.

The soils of this county may be considered as belonging to two broad use groups—agricultural lands and grazing lands. The agricultural lands have smooth or gently undulating relief and are deep well-drained productive soils, whereas the lands suitable only for grazing are either flat and poorly drained, or rolling, and have thin or gravelly soils.

For the purpose of a systematic study and discussion of the relation of soils and crops within the county, the soils adapted to agriculture are grouped in three groups: (1) Dark-colored heavy soils, (2) dark-colored medium-textured soils, and (3) light-colored sandy soils. The grazing lands are discussed under the heading of "Soils not suited to farming."

The lands valuable for farming are distributed throughout all parts of the county, but the largest bodies are in the eastern, southern, and southwestern parts, and in the northwestern corner, or the Pawnee district. The largest areas of shallow soils occupy a wide band through the north-central part of the county, and the poorly drained soils are chiefly in the southern part.

The soils suited to farm crops are characterized by deep surface soils over deep subsoils, which for the most part are readily penetrated by air, water, and plant roots. These soils differ in productiveness and in suitability for different kinds of crops. All the crops

are produced by dry-farming methods, and the irregularity of rainfall and occasional scarcity of soil moisture result in wide differences in crop yields. The deep, smooth-lying soils absorb and retain large quantities of water and are the most certain to produce crops, provided the character of the relief allows moderate drainage. This important advantage is reflected especially in the production of winter and early spring vegetables which are shipped to northern markets.

About 19 percent of the total area of the county is devoted to farm crops, and the rest is still used to pasture livestock. Although the cropland in use consists, for the most part, of the more productive soils, much more land suitable for farm crops remains in use as pasture land; and, on the other hand, some small areas of the land used for crops are so low in productivity that they would better have been left in pasture grasses. The marginal farming land occurs chiefly in the rolling sections where the farms include some good deep soils and some poor thin soils. The land in cultivation has been chosen largely with reference to ease of clearing and cultivation and its accessibility to shipping and trading points.

The principal crops grown are cotton, corn, grain sorghums, broomcorn, Sudan grass, sorgo (the last two are used largely for hay), and an increasing and diverse vegetable crop. The three leading crops—cotton, corn, and sorghums—occupy most of the cultivated acreage.

Cotton occupies approximately 65 percent of the cultivated land, corn 16 percent, grain sorghums 12 percent, and the rest is used for miscellaneous crops, chief of which are broomcorn and various truck crops.

Vegetables are grown for market on both large and small acreages, largely in connection with general farming, and they are produced on many different soils. Onions, tomatoes, beans, cucumbers, cabbage, and sweet corn are the chief vegetables, and a small acreage is devoted to squash, watermelons, cantaloups, cowpeas, carrots, beets, okra, and several other vegetables for home consumption. A very small acreage of the cultivated land is devoted to fruits and berries, and at present none of these may be considered commercial crops.

The general farm crops and some vegetable crops are produced on practically all of the tillable soils. The staple crops are grown to a greater extent on the dark heavier textured soils, and the dark medium-textured soils are better suited to vegetables. The dark soils of heavy texture are considered more droughty than are the medium-textured soils, although they are inherently much more productive under favorable moisture conditions. The dark heavy soils do not absorb rain water so rapidly as do the more friable soils, the wilting coefficient (percentage of water in the soil when plants wilt from lack of moisture) of the soil is higher, but the reserve of soil moisture available for plants is often less. The general farm crops are, as a rule, more drought resistant than are vegetable crops, and this partly explains the more general use of the dark heavy soils for the general farm crops. The light-colored sandy soils drain more readily than do the heavier dark soils, are warmer during the winter and spring, and are better adapted for growing vegetables for the winter and early spring markets.

The gravelly shallow soils with rolling relief and the poorly drained low-lying soils with impervious claypan subsoils are used almost entirely for grazing. The grass cover and brush browse on these soils provide valuable range pasture, and they are important in cattle raising. The alluvial soils are of minor extent and are used mainly for pasture and general crops. They are similar in crop adaptation to the dark-colored heavy soils.

The most important crop, cotton, has a wide range of adaptability and is grown on most of the cultivated soils. Yields differ widely and range in proportion to the natural productivity of the soil and the prevailing moisture conditions. The varieties giving the best results, according to tests made at the Texas Agricultural Experiment Station substation no. 1, near Beeville, are New Boykin, Sunshine, Harper, Lankart, Kasch, Mebane, and Lone Star. The staple is about 1 inch in length and is of good quality.[2]

In seasons of much rainfall, cotton suffers to some extent from insect infestation and diseases. The boll weevil, bollworm, leaf worm, and most insects which prey on the crop are especially injurious under moist conditions. Root rot, a fungous disease affecting the roots of the cotton plant, at times causes a considerable loss of the crop. This disease is most severe on the dark heavy soils, as a rule, but it also occurs on the dark medium-textured soils. Root rot seems to be more generally prevalent on sandy soils in the subhumid regions than on soils of the same texture in humid regions. The greater alkalinity of the subhumid sandy soils may account for the greater destructiveness of the disease on these western soils of sandy texture (*8*).

Cotton is grown year after year on Monteola clay, Victoria clay, and the smooth-lying heavier soils generally. These soils have a narrower crop adaptation but produce a higher average yield when moisture is adequate than do the other soils. Cotton is grown also on Clareville fine sandy loam and Clareville clay loam to a considerable extent, but, owing to the wider crop adaptation of these soils, some vegetable crops and broomcorn are grown. Yields of cotton on all these soils are about the same in the same year, but they differ greatly from year to year according to moisture conditions and damage from insects and diseases. The average acre yield in 1934 was slightly less than one-fourth bale, but the yearly average ranges from one-fourth to one-third bale over a number of years. The average yield on the lighter textured soils is lower than on the heavy dark-colored soils, but because of greater drought resistance the annual acre yield is not subject to such wide fluctuations.

Corn is grown on many different soils in widely scattered sections, and the average acre yield of 7.7 bushels in 1934 indicates that climatic and soil conditions are not always highly favorable for this crop. It does best on the mellower or sandier dark soils. Clareville fine sandy loam and Clareville clay loam are probably the best suited extensive soils of the county to corn.

Variety tests at the local experiment substation show that early-maturing varieties are most successful. In a 10-year period the varieties producing the highest average yields were Surcropper,

[2] TEXAS AGRICULTURAL EXPERIMENT STATION unpublished records.

Thomas, and Reese Drought Resister, which produced an average of a little more than 20 bushels an acre (*5*).

Grain sorghums are increasing in popularity each year, and data from the last several census reports show that sorghums are gradually replacing corn as a grain crop. Sorghums are used for feeding work animals and to some extent as a supplement to range grasses for cattle in winter and for finishing steers. The grain sorghums are grown generally over the county and do well on soils which range widely in fertility and drought resistance. On the whole they yield better than corn under droughty conditions. The grain sorghums grown are largely hegari, Texas Blackhull kafir, Red kafir, milo, schrock, and feterita. They produce good yields of both grain and forage. The 1935 census reports an average acre yield of about 11 bushels of grain in 1934. Most of the crop is harvested and fed without separating the grain from the head. The average acre yield of dry forage is approximately 2 tons. Feeding experiments show that grain sorghums have about the same feeding value as corn (*3*). Hegari is the most widely grown variety, as it is the most drought-resistant and it stands late planting better than other varieties.

Red Top sorgo and Sudan grass are grown on fairly large acreages and used largely for hay, although some is grazed. Sorgo and Sudan grass do comparatively well on all the cultivated soils and withstand adverse moisture conditions fully as well as grain sorghums.

Alfalfa has been grown but without much success because of insufficient moisture during some seasons. The smooth-lying deep heavy dark soils seem well suited to alfalfa, and probably it would grow well on them if adequate moisture were provided. Root rot would probably affect it adversely.

Broomcorn has been an important cash crop in the county for a number of years, but recently the low price has not given profitable returns and the acreage has decreased materially. It is grown mostly on the friable medium- or heavy-textured dark soils. The acre yield ranges from 200 to 300 pounds. This is a crop that does well in a dry climate and yields moderately well even in dry seasons. Rain sometimes darkens the straw, which makes it less desirable on the market.

Vegetables and truck crops are grown on all the tillable soils, but the sandier soils are better suited to their growth than are the clay soils. Onions and cabbage do well on Victoria clay and Monteola clay, but, in general, they are not grown commercially on these soils. They are grown extensively on Victoria clay loam and Clareville clay loam, the latter soil probably being best suited to these crops. Silverskin Bermuda is the principal variety. Moderately dark and friable soils, including Goliad fine sandy loam and Clareville fine sandy loam, are best suited for the production of onions, cucumbers, squash, radishes, beans, peas, beets, turnips, cabbage, and green corn.

The lighter colored sandy soils, including Medio loamy fine sand, DeWitt fine sandy loam, and DeWitt fine sand, are best suited to tomatoes, cucumbers, beans, squash, peanuts, cantaloups, and watermelons.

In the following pages, the soils of Bee County are described in detail, and their agricultural relationships are discussed; their dis-

tribution and location are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 3.

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

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Victoria clay	14,016	2.5	DeWitt fine sand	14,400	2.6
Victoria clay loam	14,400	2.6	Goliad fine sandy loam, shallow phase	78,400	13.9
Monteola clay	15,488	2.7	Goliad gravelly fine sandy loam	4,352	.8
Monteola clay loam	13,056	2.3	Orelia fine sandy loam, depression phase	7,040	1.2
Clareville clay loam	13,632	2.4	Monteola clay, shallow phase	1,024	.2
Leona clay loam	23,552	4.2	Riverwash	2,560	.5
Clareville fine sandy loam	92,032	16.3			
Goliad fine sandy loam	69,632	12.3	Total	564,480	-----
Orelia fine sandy loam	110,144	19.5			
Medio loamy fine sand	23,872	4.2			
DeWitt fine sandy loam	66,880	11.8			

DARK-COLORED HEAVY SOILS SUITED TO FARMING

The dark-colored heavy farming soils are Victoria clay, Victoria clay loam, Monteola clay, Monteola clay loam, Clareville clay loam, and Leona clay loam. These are some of the more extensive soils of the general region in which Bee County lies. The soils of the group cover 147.1 square miles, or 16.7 percent of the land in the county. They are calcareous in all soil layers, occupy smooth almost flat to undulating or gently rolling relief, and are of comparatively high productivity. The largest areas are in the southwestern and northwestern parts of the county, and smaller areas are in the southern part. The areas in the southern and southwestern parts are smooth or undulating and lack a well-developed drainage system; but those in the northwestern part range from undulating to rolling, a well-developed system of drainage is established, and erosion is active.

These soils are largely suited to general crops and general systems of farming, and a number of them, especially the clay loams, are well suited to the production of Bermuda onions, cabbage, and other truck crops.

In surface appearance these soils are similar, but marked differences of texture, structure, and consistence give them widely different capacities for crop production. The Victoria soils are characterized by heavy calcareous surface soils of crumbly structure over heavy subsoils which are fairly permeable. The Clareville and Monteola soils have topsoils of heavy calcareous materials of crumbly structure, which overlie moderately heavy subsoils. These soils have good moisture-holding capacity, and crops do not suffer quickly in dry seasons. Leona clay loam occurs in narrow creek bottoms.

Victoria clay.—Victoria clay occupies a total area of 21.9 square miles and is one of the most productive soils in this section of the State. The crops for which it is best suited are cotton, corn, grain sorghums, sorgo, Sudan grass, Bermuda onions, and cabbage.

The smooth almost flat relief has favored the development of thick soil layers that merge gradually with the underlying parent material. The soil material in the virgin state contains much organic

matter. The surface soil is very dark gray or black calcareous clay, 8 or 10 inches thick. The material becomes lighter colored with increase in depth, and below a depth of about 16 inches it is light brownish-gray or gray clay containing many soft lumps of calcium carbonate ranging in size from an inch in diameter to minute specks. Infiltrations of the darker surface soil material through old root channels occur in the subsoil. Below a depth of about 5 feet the material is solid white, light-gray, or yellowish-gray chalky calcareous clay. The white spots and lumps of calcium carbonate in the upper part of the subsoil represent the zone of accumulation.

This soil is calcareous from the surface downward. The topsoil is readily maintained in a friable condition under cultivation. When the soil is very dry, wide cracks open on the surface and extend to considerable depth in virgin areas. In the virgin state the surface is pitted with small depressions, locally known as hog wallows.

This soil is fairly absorptive and retains moisture well; but absorption is slow, much water is lost by run-off or evaporation, and sometimes not enough moisture is accumulated during wet periods, when the soil may become very dry, although crops on this soil seem to have more drought resistance than on some of the other dark soils of the coastal terrace. The soil doubtless has a high wilting coefficient, and a large part of the soil moisture is unavailable to plants. High crop yields are obtained on this soil in seasons of favorable moisture conditions, though crop failures sometimes occur in very wet years or very dry years. Low yields are due largely to insect and disease infestations in wet years and to drought in dry years.

The soil occurs in large bodies favorable to cultivation by machinery. Because of its heavy character it needs more power for tillage than many lighter soils. It is considered a good cotton soil. No commercial fertilizers or green-manure crops are used, nor do they seem necessary. No definite system of cropping is in use. Many of the farms are very large and are operated by tenants.

Crop yields probably average as high as on any soil in the county. The average yield of cotton is between one-third and one-fourth bale an acre. Corn yields from 30 to 40 bushels, grain sorghums from 20 to 30 bushels, sorgo and Sudan-grass hay from 1 to 2 tons, and cabbage and onions, the principal truck crops, from 4 to 6 tons and from 75 to 100 bushels, respectively.

Victoria clay loam.—Victoria clay loam is similar to Victoria clay except that the surface soil, a clay loam, is lighter in texture. It occurs adjacent to Victoria clay and is a transitional soil, lying between areas of clay soils and areas of sandy soils. It is slightly more drought resistant and possibly a little more constant in crop production, and much of the land is in cultivation. Crops and yields are about the same as on Victoria clay, but this soil is lighter textured and easier to cultivate. Both soils are considered excellent for pasture, as the virgin areas support a thick growth of nutritious short grasses, largely curly mesquite grass, buffalo grass, and some grama grass.

Victoria clay loam has a surface soil of black clay loam about 6 inches thick over black calcareous clay which, at a depth of 20 inches, grades into light-gray or yellowish-gray calcareous clay.

Monteola clay.—Monteola clay is the principal dark-colored soil in the northwestern part of the county. It occupies a smooth rolling terrain which is dissected thoroughly by drainageways of Sulphur and Salt Creeks. It is entirely isolated from the other bodies of dark-colored soils. This is a deep dark soil of high productivity. The rolling relief is smooth and moderate, but both sheet and gully erosion are very active.

This is an excellent pasture soil, but fully 50 percent of it is in cultivation (pl. 1). The principal crop is cotton, though corn, grain sorghums, sorgo, and Sudan grass are grown. No vegetables are produced commercially. With adequate and well-distributed moisture high yields are obtained, but usually the uneven distribution of rainfall and the tendency of crops to suffer from lack of moisture lower yields considerably.

The surface soil of Monteola clay is grayish-black calcareous clay about 10 inches thick. This grades below into calcareous clay which, like the surface soil, separates to fine particles on drying. Below a depth of about 24 inches this material grades into yellowish-brown or gray chalky clay containing concretions of calcium carbonate and a few gypsum crystals, which is continuous to a depth of several feet and in places is underlain by gray marl. The soil material from the surface downward is highly calcareous, and it works readily into a friable seedbed.

Monteola clay loam.—Monteola clay loam occupies positions similar to those occupied by Monteola clay and occurs in close association with that soil. In many places it occupies a gradational position between Monteola clay and the sandier soils. It is slightly more drought-resistant than Monteola clay, but in other respects it is similar to that soil. It is cleared and farmed in conjunction with the clay.

The surface soil of Monteola clay loam is black calcareous clay loam about 10 inches thick, which in places contains numerous small shells. The surface soil passes through a transitional layer into lighter gray calcareous clay with some small hard calcium carbonate concretions, and below a depth of 40 inches the material contains a large quantity of calcareous lumps and concretions. Below a depth of 60 inches the material is gray marl splotched with pink and yellow.

Erosion is severe in places where the soil is not protected by a covering of vegetation. Both this soil and Monteola clay should be terraced if they are to be cultivated on slopes sufficiently steep to favor rapid erosion.

This soil supports a native growth of small trees and shrubs, mainly mesquite, Spanish-dagger, and agrito, and a thick cover of short grasses, principally curly mesquite grass and buffalo grass.

Clareville clay loam.—Clareville clay loam is one of the best agricultural soils in the county and occurs in broad low smoothly undulating areas. It is developed mainly in moderately large bodies in a northeast-southwest belt across the central part of the county, from the vicinity of the Texas & New Orleans Railroad bridge across Blanco Creek on the eastern boundary to the vicinity of Clareville in the western part of the county. Numerous small bodies are scattered throughout the rolling area, in association with Clareville

A, Cotton and corn on Monteola clay in the western part of the county, *B*, thick caliche layer beneath Goliad fine sandy loam, shallow phase, exposed in a pit along the Southern Pacific Railroad The caliche has been excavated for railroad ballast and for use in highway construction

fine sandy loam and the Goliad soils. A considerable part of the Texas Agricultural Experiment Station substation farm at Poesta is located on this soil.

This soil is not so extensive as some of the other dark-colored soils, but in inherent fertility and moisture-absorbing and -holding capacity, it is the equal of any in the county and is well suited to the production of all the general farm crops. The principal crops are cotton, corn, grain sorghums, sorgo, Sudan grass, broomcorn, onions, cabbage, and some tomatoes. This is a valuable soil for pasture, as it supports a thick growth of nutritious grasses, and various browse shrubs common to this section. The friable drought-resistant character of this soil, together with its inherent fertility, gives it first place as a summer-pasture soil. Much of it remains in pasture, although its productiveness and suitability to cultivation indicate that the area now in pasture eventually will be devoted to farm crops.

Clareville clay loam consists of a 15-inch layer of dark-brown or black crumbly clay loam which merges below with dark-brown crumbly clay. Below a depth of 30 inches the soil material grades into brown or yellowish-brown calcareous friable sandy clay containing many soft white chalky accumulations. This continues downward to various depths and rests on a bed of soft calcareous sandy clay. In some places beds of light-gray or white caliche underlie the soil at a depth ranging from 30 inches to 6 feet.

Leona clay loam.—Leona clay loam is an alluvial soil which occurs in narrow strips along some of the smaller drains of the rolling plain section of the county. None of the bodies is large. Much of the land occurring in association with the Clareville and Goliad soils is cultivated. As mapped, this soil includes a few areas of fine sandy loam texture, which are too small to map separately.

Leona clay loam is well suited to the production of the staple crops grown in the county, and high yields are obtained in years when moisture conditions are good. It is not considered so desirable a soil as Clareville clay loam. In some places it includes small areas, known as "slick spots", where soluble salts have accumulated. It is generally more droughty and consequently less productive than the more friable and better drained Clareville clay loam. It supports a dense heavy growth of small trees and shrubs, mainly mesquite and huisache, together with the small thorny brush native to this section. Where the soil has not been placed in cultivation, the grass cover is rank and affords excellent forage.

Leona clay loam is black clay loam or sandy clay loam to a depth of about 10 inches. This material grades below into black or very dark gray clay or sandy clay, which is lighter colored—gray or light gray—in the lower part of the subsoil.

DARK-COLORED MEDIUM-TEXTURED SOILS SUITED TO FARMING

The dark-colored medium-textured soils are second in importance to the dark-colored heavy soils. The four soils in this group are Clareville fine sandy loam, Goliad fine sandy loam, Orelia fine sandy loam, and Medio loamy fine sand. Orelia fine sandy loam is the most extensive, but Clareville fine sandy loam and Goliad fine sandy loam

are the most valuable for cultivation. Rather large areas of the Clareville and Goliad soils occur in the northwestern rolling plain section of the county, and Orelia fine sandy loam and Medio loamy fine sand are largely in the flat southeastern coastal terrace section, though the Medio soil occupies some lower areas in the more rolling central part. Goliad fine sandy loam and Clareville fine sandy loam comprise the greater part of the tillable soils in the rolling plain section. They occur in some fairly extensive bodies in low places and on ridges, but more generally in comparatively narrow bands in close association with Goliad fine sandy loam, shallow phase.

These soils have permeable medium-textured or sandy surface soils, and they collect and retain rain water to good advantage. They are lower in inherent fertility than the dark-colored heavy soils previously described, and in years of abundant rainfall crop yields are somewhat lower. On the other hand, they are more drought-resistant, have wider crop adaptations, and lend themselves more readily to soil-improvement programs. They are better suited to the production of truck crops, fruits, and berries than are the dark-colored heavy soils. They are more productive than the light-colored sandy soils.

Clareville fine sandy loam.—Clareville fine sandy loam is developed in comparatively large areas in low places between higher ridges of Goliad soils and on some of the broad ridges in the black Monteola soil section in the northwestern part of the county. It also occurs as narrow bands of colluvial soil in narrow valleys along small drainageways in the rolling plain section.

It is the most productive medium-textured dark soil, as it contains a larger quantity of organic matter. Most of the common crops are grown with excellent success on this soil. Cotton is the leading crop and yields from one-fourth to one-third bale an acre. Corn, grain sorghums, sorgo, broomcorn, Sudan grass, tomatoes, and cabbage return good yields. The native vegetation consists largely of mesquite, pricklypear, and the small brushy growth common to the general region.

The surface soil is brownish-black, very dark brown, or brown heavy fine sandy loam, loam, or light clay loam, about 14 inches thick, containing, as a rule, many small snail shells. This grades below into dark-brown crumbly and permeable fine sandy clay loam. At a depth of about 20 or 24 inches this material grades into slightly pinkish brown or brown friable fine sandy clay containing some hard small carbonate concretions and many soft accumulations. In places, at a depth of 2½ or 3 feet, this material, in turn, rests on a layer of hardened calcium carbonate (caliche) or very calcareous sandy clay.

Goliad fine sandy loam.—Goliad fine sandy loam is the normally developed dark soil of the rolling plain section of the county. Because of its higher and more sloping position, this soil is thinner, lighter colored, and less productive than Clareville sandy loam.

The land is cultivated in conjunction with the Clareville soils and is adapted to the same crops, but yields are slightly lower. In places much rain water is lost in the run-off, erosion is active, and terracing probably would be beneficial.

Many farms have small orchards, in which peaches, nectarines, plums, pears, berries, grapes, and some citrus trees grow and do

well. The native vegetation consists of shrubs and grasses similar to those on Clareville fine sandy loam.

Goliad fine sandy loam is a well-developed soil. The surface soil, to a depth of about 10 inches, is heavy fine sandy loam, loam, or light clay loam, which is dark brown or black and contains many small snail shells. It is underlain by a transitional layer of brown or reddish-brown sandy clay loam or sandy clay, ranging from 6 to 10 inches in thickness, which gradually merges with heavy reddish-brown or brownish-red friable sandy clay, and this, at a depth of about 30 inches, passes below into light-gray or white highly calcareous chalky calcium carbonate. The accumulation of calcium carbonate beneath this soil ranges in thickness from a few inches to several feet.

Orelia fine sandy loam.—Orelia fine sandy loam is the most extensive dark-colored soil in the county. It is not an important farming soil, as much of it remains in pasture for livestock. This is a soil with a definite claypan character, and it has a thin sandy or loamy surface soil resting on tough dense clay. Surface drainage is slow because of the flat relief, and underdrainage is slow owing to the dense subsoil. On drying thoroughly the surface soil bakes to a hard crust which is difficult to break with tillage implements. Many long narrow very shallow pondlike incipient drainageways wind through the areas of this soil.

The surface soil is dark grayish-brown fine sandy loam or loam about 10 inches thick. This thin soil layer contacts abruptly with the subsoil which consists of dark-gray or almost black tight heavy plastic clay or sandy clay, that is very hard when dry. Below a depth of about 18 inches the claypan grades into gray clay or sandy clay, which in places contains yellowish splotches. The surface soil and subsoil, to a depth of about 15 inches, range from neutral to acid in reaction, but below this depth the reaction is alkaline. The subsoil is dull-gray heavy sandy clay which is somewhat calcareous below a depth of 2 or 2½ feet and contains soft and hard white concretions. These increase in quantity with depth, and at a depth ranging from 8 to 10 feet the material is white or brownish-white soft chalky sandy clay.

The principal crops grown on the small acreage of this soil in cultivation are sorghums, broomcorn, and other drought-resistant crops. On many of the ranches some of this soil is cleared and planted to feed crops, mainly grain sorghums and sorgo, with fair success. The native vegetation consists of curly mesquite grass, buffalo grass, mesquite trees, and, in places, lotebush and huisache. The grasses are very good for pasturing range livestock. Live oak trees grow in some of the valleys occupied by this soil.

Medio loamy fine sand.—Medio loamy fine sand is not very extensive. It may be considered a transitional soil between the medium-textured dark soils and the sandy light-colored soils. Most of it occurs in slightly raised and undulating bodies on the coastal terrace in the southern part of the county, and a few scattered bodies lie within the rolling area, in association with the Goliad and Clareville soils.

Medio loamy fine sand consists of dark grayish-brown loamy fine sand to a depth ranging from 14 to 30 inches. This is under-

lain by dark-gray clay containing red and brown splotches. This material, in turn, passes, at a depth of 2 or 2½ feet, into dense light-gray clay which, with increase in depth, is calcareous and contains white lumps and concretions of calcium carbonate. At a depth of about 6 feet the material is soft white caliche mixed with fine earth. In some places there is a substratum of brownish-red dense sandy clay.

Some of this soil is cultivated in the vicinities of Skidmore and Quincey and is largely used for the production of early vegetables, such as tomatoes, cabbage, cucumbers, squash, peppers, beans, cowpeas, cantaloups, watermelons, sweet corn, peanuts, and sweet-potatoes. Some fruits and berries do well. The soil is not so well suited to the production of general farm crops, although some staple crops, especially feeds, are grown with moderate yields. With more suitable soils available for farm crops, however, it seems that this soil might be more profitably used for the production of winter and early spring vegetables.

The subsoil is rather tight and impervious, but the overlaying layer of sandy soil is generally of sufficient depth to offset any tendency toward drought. It responds well to applications of commercial fertilizer and green-manure crops when moisture is adequate. At present only small quantities of commercial fertilizer are used for the production of early tomatoes and beans.

LIGHT-COLORED SANDY SOILS SUITED TO FARMING

The light-colored sandy farm soils include DeWitt fine sandy loam and DeWitt fine sand. These soils occupy large areas on the smooth coastal terrace in the eastern and southern parts of the county and extend in narrow bands along the larger creeks into the rolling plains section. The relief is smooth or slightly undulating. These soils have developed mostly from noncalcareous parent materials comprising sandy clays, and there is no accumulation of calcium carbonate in most places, although there are white lime concretions in the subsoil in some places.

The native vegetation consists mainly of an open parklike growth of post oak with live oak trees in groves on the prairies in places. The grasses differ from those on the heavier and darker soils in that they consist of the coarser species of bunch grass. These soils are considered excellent for grazing land, especially during dry summer months when they produce a good growth of succulent grasses and weeds.

Most of the land is in pasture, although DeWitt fine sandy loam is used to some extent for truck crops. The soils are of low inherent productivity and are suited only to truck crops in some of the more favorable situations. They do not seem to produce good yields of the general farm crops.

DeWitt fine sandy loam.—DeWitt fine sandy loam has an 8- or 10-inch surface soil consisting of gray fine sand, loamy fine sand, or fine sandy loam, which is slightly colored by dark organic matter in the topmost ½-inch layer and is slightly lighter gray in the lower part. The surface soil rests on stiff heavy plastic sandy clay which breaks naturally into angular aggregates about the size of a hickory

nut. The material in this layer is dark brownish-gray dense clay mottled or splotched with rust brown. Below a depth of 1½ or 2 feet, the material is very dark grayish-brown compact plastic sandy clay which gradually becomes lighter in color with increase in depth, and, at a depth ranging from 30 to 35 inches, it is light gray and contains soft white concretions of calcium carbonate in places. Above a depth of 30 inches the soil is acid in reaction, but below this depth it is alkaline.

Most of this soil is in range pasture. Small areas are cultivated, mainly to truck crops.

DeWitt fine sand.—DeWitt fine sand occurs in a number of areas along some of the larger creeks in the southeastern part of the county, in association with DeWitt fine sandy loam. It consists mainly of fine sand, blown from the areas of sandy loam or from dry creek beds, which has formed undulating mounds or low ridges of deep fine sand or loamy fine sand having the same color and vegetative cover as DeWitt fine sandy loam.

This soil, in the virgin condition, consists of gray fine sand to a depth ranging from 30 to 90 inches, where it is underlain by gray tough fine sandy clay containing rust-brown splotches. The soil material in places is alkaline below a depth of 60 inches.

This soil supports an open growth of post oak and some live oak trees, and a grass cover consisting mainly of coarse bunch grass. None of the land is in cultivation, although it may be fairly well suited to truck crops, especially vine crops, such as watermelons, cantaloups, and sweetpotatoes. It is too sandy to hold much moisture but absorbs rainfall readily and, if it were moistened frequently, might be fairly satisfactory for growing these crops. The rather dense cover of coarse grasses prevents the soil from blowing, but if cleared for cultivation the surface soil would blow and drift considerably.

SOILS NOT SUITED TO FARMING

This group includes those soils which are not sufficiently productive to warrant cultivation under present economic conditions. They could be rendered more productive by soil-conservation and soil-improvement practices, such as terracing, drainage, fertilization, and the growing of cover crops, but the present cost of these methods of improvement is generally in excess of the returns which reasonably may be expected. They are best devoted to use as range for livestock. The group includes the shallow or gravelly soils—Goliad fine sandy loam, shallow phase; Goliad gravelly fine sandy loam; Monteola clay, shallow phase; the poorly drained Orelia fine sandy loam, depression phase; and riverwash which is composed of unstable sandy material subject to occasional flooding and erosion.

Goliad fine sandy loam, shallow phase.—Goliad fine sandy loam, shallow phase, is an extensive soil. It occupies large areas throughout the rolling plain section of the county, covering a total area of 122.5 square miles on rolling surfaces, ridge tops, and eroded hillsides. As mapped, it includes areas in which the soil is less than 15 inches thick over beds of caliche. Where the soil is 12 or 15 inches deep, some of it is cultivated, but most of it is too shallow for successful cultivation, as the thin surface layer not only contains a small supply of

plant nutrients but does not retain sufficient moisture for crops when the rainfall is light.

This soil fits into the prevailing scheme of agriculture for this section, however, as it supports a fair grass cover, together with certain shrubs, such as mesquite, huajillo, and others, which furnish browse for cattle during seasons when little or no grass is available. Some of the shrubs are valuable for the production of honey, and many colonies of bees are kept where such shrubs are abundant. The land supports a fairly heavy growth of buffalo, curly mesquite, and other grasses, and a scattered growth of trees and shrubs consisting mostly of live oak, mesquite, huajillo, black chaparral, agrito, Mexican persimmon, lotebush, and others.

The surface soil of Goliad fine sandy loam, shallow phase, is dark-colored, or brownish-black, fine sandy loam or loam, 8 or 10 inches thick. It grades into red or reddish-brown friable sandy clay which, at a depth of 12 or 15 inches, rests on caliche, and this extends to a great depth. In some places the reddish-brown subsoil is lacking, and the dark surface soil rests directly on the caliche; in other places there are small spots of the typical deeper soil; and in places the dark surface layer is lacking and the reddish-brown subsoil is exposed. In places where the soil is very shallow, it is generally calcareous throughout, although the more deeply developed soil layers are not calcareous.

Goliad gravelly fine sandy loam.—Goliad gravelly fine sandy loam occurs locally on some high ridge tops north of Clareville in the Mulos Hills. This soil consists of brown or red gravelly fine sandy loam, ranging from a few inches to 2 feet in thickness and resting on beds of caliche. The gravel, which constitutes from 30 to 90 percent of the soil mass, is well rounded and consists of quartz, quartzite, chert, and other rocks, ranging from one-half inch to 3 inches in diameter. In places a reddish-brown or red sandy clay underlies the surface soil, and beneath this, at a depth ranging from 10 to 13 inches, is hard platy caliche which extends to a great depth.

The native vegetation, which is similar to that on Goliad fine sandy loam, shallow phase, consists of grazing, browse, and honey-making plants and shrubs. Huajillo is the most abundant and valuable as a browse plant.

If this soil were more extensive, it might have been correlated with the Webb or Duval soils, but, owing to its small extent and to the fact that neither of these soils is developed in the county, it is correlated with the Goliad soils.

Orelia fine sandy loam, depression phase.—Orelia fine sandy loam, depression phase, occurs as long and narrow shallow depressions in the coastal terrace section of the county, in close association with Orelia fine sandy loam and the DeWitt soils. In places the areas are isolated, and in other places they occur as chains of narrow connected depressions which form the heads of the sluggish drainageways. In wet seasons these depressions are filled with water to form ponds, and in summer they dry and the soil bakes to a hard compact mass. The areas are practically devoid of brush but are rimmed with a thick growth of huisache trees and large live oak trees in places. In general, soil in the depressions supports a sparse growth of coarse grasses and some water-loving plants.

The surface soil consists of a 5-inch layer of tightly compact light-gray acid fine sandy loam which becomes dark gray when wet. This material overlies tight sandy clay which is light gray when dry and dark gray when wet, contains a few iron stains, and has an acid reaction. At a depth of 2 feet, the soil material gradually becomes lighter gray and calcareous, and, at a depth ranging from 2 to 3 feet, numbers of small white carbonate of lime nodules and blotches occur.

At present this soil cannot be tilled without drainage, as it is covered with water during rainy periods.

Monteola clay, shallow phase.—Monteola clay, shallow phase, is of very small extent. It occurs in a few small areas on slopes and ridges in the northwestern part of the county, in association with Monteola clay and Monteola clay loam.

This is a thin dark-colored soil which consists of a few inches of dark grayish-brown calcareous clay resting on white chalky caliche or lime hardpan. In many places the caliche is broken into hard fragments and scattered over the surface and throughout the soil. In excessively eroded and shallow spots the white caliche outcrops in places.

This soil inherently is not very productive, and it occupies such sloping relief that rain water runs off rapidly and little moisture is absorbed. The land supports a scant cover of vegetation consisting of a few short grasses and a number of shrubs, such as mesquite, lotebush, guayacan, catclaw, ephedra, yucca, and others. The soil is not suited for farm crops and has but slight value for grazing and browse.

Riverwash.—Riverwash comprises small areas of loose fine sand lying close to creek channels and in the dry beds of streams. The material ranges in places from sand to clay and is unsuitable for cultivation, although it affords some pasture in places where there is a scant growth of grasses. In many places it supports a dense growth of trees, such as elm, sycamore, and cottonwood, which are native to the more humid regions.

AGRICULTURAL METHODS AND MANAGEMENT[8]

The agriculture of the section in which Bee County is located comprises two distinct branches—the long-established cattle ranching on the range and the more recently developed general farming, or crop growing, which has in some sections largely taken the place of ranching. Owing to low rainfall and the comparative uncertainty of producing some of the important crops, farming has not become so well established as in some older sections of the State. Cattle raising in this section has been, for the most part, separate from general farming or crop growing, although some feed crops have been grown on the ranches. At present the trend seems to be toward a combination of livestock production and general farming, with the use of smaller improved permanent pastures and the production of crops that fit into a satisfactory system of combined livestock feed production and commercial crop production. Many

[8] Information supplied in part by R. A. Hall, superintendent of substation no. 1, Texas Agricultural Experiment Station.

farmers keep a few head of livestock, but most of the cattle are raised on the natural range pastures and are sold young as grass-fed animals. On tenant farms, as a rule, no livestock is raised, and some farms are operated entirely by use of machinery.

At present cotton, corn, and the sorghums are the chief crops. These and a few other crops are grown on most farms with no definite rotation or system. No special care is taken of the soils, cover crops and green-manure crops are not grown, and only a very small proportion of the land is terraced. Commercial fertilizers and manure are not generally used.

The discussion, in the section on Soils and Crops, regarding the comparative productivity of the soils of this county, is based on natural unamended soil characteristics. Production on some of the soils possibly may be profitably increased by various treatments and amendments. It seems probable that the rolling sandy soils, including Goliad fine sandy loam, Clareville fine sandy loam, Medio loamy fine sand, and the DeWitt soils, might be made more productive by terracing, by the practice of crop rotation, and, possibly, by the addition of manures and commercial fertilizers, under favorable conditions. On Orelia fine sandy loam a system of irrigation from wells with some method of adequate drainage, such as tile or ditches, would possibly increase the productiveness of this droughty claypan soil.

Terracing of the rolling lands is of immediate concern, not only to prevent erosion of the soil by run-off water but to hold the water and cause it to sink into the soil to be held in reserve for growing crops. Natural fertility, as well as moisture, which is so necessary to maximum crop production on the Monteola soils, would be conserved by terracing.

As yet, the economic need of all these practices, especially irrigation, has not arisen, but with further demands for more land for cultivation and larger production, they may become desirable or necessary.

The Texas Agricultural Experiment Station, substation no. 1, is located 3 miles northeast of Beeville. It comprises about 150 acres of land, of which 125 acres are in cultivation. Most of the soils on it are deep, dark colored, and of medium to heavy texture. They represent, for the most part, the principal agricultural soils of the county, though there is a small area of shallow soil, typical of the shallow rolling grazing lands. Many lines of research in agricultural production are carried on at this station, and results are periodically published in bulletins which are free to the public.

This substation was established in 1894 for the purpose of studying the possibilities of fruit and truck growing on a commercial scale in southern Texas. The first work undertaken was the testing of varieties and kinds of fruits. Varieties of peaches, plums, apricots, pears, apples, persimmons, figs, pineapples, grapes, chestnuts, pecans, oranges, lemons, grapefruit, and other fruits have been tested.

Results show that most fruits are not well suited to this section. Some varieties of peaches do well for a few years, but the trees are short lived. Only honey peaches and such varieties as Pallas and others, are of economic importance. Some of the small sour plums

do well but are of use only for cooking. Abundance, Burbank, and a few others have given fair yields, but, like peaches, all the trees have been short lived. Apples have failed to grow satisfactorily, and pears have given almost equally negative results because of the blight. Nuts of various kinds have proved of little value on the soils included in the substation farm. Cotton root rot has proved injurious to grapes, but the Carman variety now promises to give fair results. The use of Dog Ridge rootstock would greatly reduce the loss from cotton root rot, with the result that more varieties of grapes could be grown. The Magnolia fig has given promising results, but occasionally it is damaged by cold weather and by cotton root rot. The olive makes a beautiful ornamental tree but is of slow growth, is often injured by cold, and seldom produces fruit. Pineapples, quinces, and prunes have given poor results. Chinese jujubes are well adapted to the soils and climate, are always thrifty, and have never failed to produce abundantly, but they are of little value at present because of the lack of a market for the fruit.

The most profitable fruits for this section are the citrus fruits. A total of 1,077 citrus trees have been planted on the substation farm, including 840 orange, 89 grapefruit, 71 lemon, 68 kumquat, 4 lime, and 5 tangerine. Most of the common varieties of each kind are included in these plantings, and much valuable data have been recorded.

The orange variety test has shown that the Satsuma is the outstanding orange for this section. Its importance lies in the facts that it is more cold resistant, blooms late in the spring, and ripens early in the fall. The fruit has a fine flavor and quality and sells well wherever it is known. For the 10-year period, 1915–24, the annual average value of fruit from all Satsuma orange trees in the orchards was approximately $200 an acre. The Jaffa orange is hardy and produces an abundance of excellent fruit; the Dugat is very prolific, but is rather small and seedy; the Washington Navel has very excellent quality and flavor, but is a poor fruiter; and the Valencia is not suited to this section because of its late maturity.

Grapefruit trees produce very excellent fruit, but they are rather tender and are often injured by cold. Kumquats are sure bearers, but the market is too limited at this time for them to be of much economic value. Limes are too susceptible to cold to be grown to advantage, and all common varieties of lemons likewise have proved too tender for this section, although the Meyers lemon is a promising variety. The trees are almost as cold resistant as Satsuma orange trees, and the fruit is of good flavor and quality.

Frost protection through the use of orchard heaters has been fairly successful (*7*). The great need in the production of citrus fruit in this section is further tests with orchard heating. No citrus fruits are grown commercially in the county, owing to losses by cold weather.

In 1896 research work on vegetables was started at the Beeville substation with variety tests of onions, cabbage, and cauliflower and a fertilizer test for potatoes. This work was enlarged and increased until it soon covered the entire field in variety and fertilizer

work, also in methods of culture and irrigation for most of the vegetables grown in this section. Bulletins have been issued from time to time dealing with the results of these experiments.

In 1901 a bulletin on growing onions was issued (*6*). Of 23 varieties of onions tested only 2 were recommended for southern and southwestern Texas. Since that time one of these, the Bermuda, has made some sections of southwestern Texas famous for onions.

In the earlier investigations at this station it was demonstrated that some system of irrigation (*1*) was necessary for the success of vegetable production in this section, and the present system of irrigating from wells was established on the station farm. Further work was done to determine the proper amount and method for the irrigation of different crops. These results have been published and otherwise distributed to the public, and the information has doubtless been used as a foundation for the well and canal irrigation projects that have developed to such large proportions in southern and southwestern Texas. The reservoir constructed on substation no. 1 in 1897 is still in good condition, though very little upkeep or repair work has been done on it.

Since the section farther south has developed as a fruit and truck growing section of considerable magnitude, the section surrounding Beeville has been displaced for truck growing because the season is about 2 weeks later, which is a serious handicap. As a result the Beeville section has taken up a diversified field-crop system of farming. Much of the investigational work, therefore, now includes field crops.

The first agronomic work was carried on at this station in 1898. It included variety and spacing tests of cotton and variety, spacing, and cultural tests of corn. It was demonstrated that corn from native-grown seed outyielded that grown from seed brought from the East. Today 90 percent of the corn acreage in the Beeville territory is planted to Texas-bred varieties. A date-of-seeding test of corn closed a 10-year period in 1927. Of the three dates of planting used in this test the medium date, March 15, proved to be the best. The general practice in this section has been to plant corn in February, but more and more farmers are changing to the later date of planting.

A spacing test of corn, concluded in 1927, shows the best yields to be obtained from 24- to 30-inch spacings in 3-foot rows. A close spacing in 6-foot rows outyields, by a small margin, a 3-foot row with twice the distance between hills. This information is used by many farmers in this section in their soil-building program. Corn is planted in 6-foot rows and a row of cowpeas is planted between. Ear-to-row selections of Thomas corn have assisted materially in standardizing that corn and have increased the yield by 4½ bushels an acre.

The principal work with cotton has been in variety tests, spacing tests, and time-of-thinning tests. The variety tests have demonstrated that the most profitable cotton for this section is the one with a 1- to 1⅛-inch staple, medium-sized boll, and 34 to 38 percent of lint, as represented by the Mebane types. Cotton spaced from 18 to 21 inches in 3-foot rows has given the best yields, although the yields

do not differ greatly within the spacings between 9 and 24 inches. Cotton apparently has the power to adjust itself to the prevailing climatic conditions. The tests have demonstrated that deferred thinning, which was practiced by many farmers at one time is detrimental rather than a benefit.

Cultural tests of cotton and corn have demonstrated that the primary object of cultivation in this section is to control grass and weeds, and crops generally should be cultivated only sufficiently to accomplish this result.

The cowpea has always been the only available summer legume for southern and southwestern Texas. A variety test carried on at the Beeville station for many years has demonstrated that Chinese Red cowpeas are outstanding for seed and hay. This variety fits well in the cropping system and has yielded such good returns that it has become very popular in this section. Methods of preparation for seedbed tests, including deep and shallow plowing, subsoiling, middle-busting, disking, and dynamiting, have proved that plowing about 5 inches deep is best.

Grain sorghums have been tested and found to be of great value as feed crops. Blackhull kafir and hegari are the outstanding varieties. Several thousand pounds of pure-line seed of these varieties are distributed each year with the result that the acreage of grain sorghums has greatly increased in the last few years. Experiments have been made to determine the best time for planting sorghums. In a 5-year period with six different varieties it was found that early planting gave the best results in most instances. Hegari responded to late planting better than the other varieties (*4*), and for this reason it is more largely grown than the other grain sorghums, as it can follow early truck crops or can be planted after other crops have failed due to early spring droughts.

Experiments at the station have demonstrated that crop rotation is an excellent practice. On fields continuously cropped for the last 12 years, cotton yields have been reduced 70 pounds of lint an acre, corn 0.63 bushel of grain, grain sorghums 3 bushels of grain, broomcorn 208 pounds of straw, and Sudan grass 1,595 pounds of hay. Sorgo, sown broadcast, has lost 5,306 pounds of forage an acre.

As a more intensive system of farming and livestock production is being developed, the need for feed crops is greater, and grain sorghums seem to fill this requirement. None of the available small grains seems successfully to withstand the stem and leaf rust, and rust-resistant varieties of small grains, that can be used through the winter as a grazing crop and can then be depended on for an early spring crop, are needed.

One of the greatest needs of the entire Beeville section is a suitable legume that will fit into the cropping system and supply both hay and pasture for cattle. Tame grasses for permanent pastures also are desired. More information regarding the proper cropping system to insure the greatest livestock-carrying capacity of these lands is needed.

Soil fertility is a problem that is beginning to claim the attention of the farmers, and demands for information on fertilizers are rapidly increasing.

MORPHOLOGY AND GENESIS OF SOILS

Bee County lies in the transitional zone between humid and subhumid regions where the Pedalfers grade into the Pedocals. Most of the soils are Pedocals, but there are some Pedalfers. Most of the soils are dark and highly calcareous, and they may be considered as southern Chernozems or as Rendzinas. They have a thick layer of soft calcium carbonate in the subsoil, in some places as much as 40 feet thick. There are also large areas of light-colored sandy pedalferic soils which, for the most part, have developed under a tree cover.

The parent materials of the soils of this county are beds of unconsolidated sands, sandy clays, clays, and marls, most of which are calcareous. These beds dip gently toward the southeast, and the soils have developed from the exposed parts which occupy parallel strips of different widths and parallel the coast line in a general way.

The relief of this general region is that of a plain sloping gently toward the coast, and within this county the plain consists of two general types of relief—a smooth flat coastal terrace, which is only slightly dissected, and a more mature interior plain, which is higher, is more extensively dissected, and has undulating to rolling relief.

The climate is characterized by high temperatures and moderately low rainfall. The records of the United States Weather Bureau station at Beeville, which is centrally located, records the mean annual temperature as 70.6° F., and the mean precipitation as 29.97 inches. In the period during which records have been kept, the highest annual rainfall amounted to 49.13 inches and the lowest was 12.09 inches.

The vegetation over most of the area consists of a brush and short-grass growth. An exception to this occurs on the lighter colored sandy soils in the southeastern part of the county where the land supports a scattered forest growth of post oak and live oak trees, together with some coarse grasses. This is a vegetal association common to the humid region on the light-colored soils which have characteristics placing them as Pedalfers. Here the oak-tree belt seems to be the southwestern extension of the east Texas timber country. The brush and short grasses are uniformly associated with the dark and moderately dark soils, which are characteristic of the subhumid Rio Grande plain, the most easterly limit of which is in this county or just east of it.

The high temperatures of this section are favorable to bacterial action in the soil, although the dry condition of the soil during much of the time is unfavorable; but, during those seasons and in those soils where moisture conditions are favorable, bacterial action is a large factor in converting organic matter to available plant nutrients.

The above conditions, occurring in various combinations with different parent materials, have developed the soils as they exist at present in this section. The heavy, slowly permeable calcareous sandy clay and marl parent materials have developed into the dark soils. The parent materials, consisting of lighter sandy clays and sands, have weathered rapidly and have developed into more mature soils, in which soil profiles are well developed. The dark soils of the

outer coastal-terrace section are probably developed from the youngest geologic formation, Beaumont clay; but the dark soils of the rolling plains are developed from older geologic materials.

Owing to the differences in relief, and the kind and age of the parent materials in this county, there are two broad groups of soils, each represented by a well-defined normal profile. These two broad groups are the Pedocals of subhumid development and the Pedalfers developed under the influence of a humid region. As the county is situated in the zone of transition between these two great soil regions, some soils have characteristics of both regions. All the soils are pedocalic in development, except the DeWitt soils, which are light-colored soils developed under a tree cover and which have in most places no accumulated layer of calcium carbonate in the profile. All the other upland soils have a more or less well-defined layer of calcium carbonate, which is characteristic of pedocalic soils.

The normal, well-developed soils occur in comparatively small areas associated with larger areas of less mature soils. There are three fairly distinct stages of development in the dark-colored pedocalic upland soils: (1) Soils with slight development—Leona clay loam, Monteola clay, shallow phase, Goliad fine sandy loam, shallow phase, Goliad gravelly fine sandy loam, and Orelia fine sandy loam, depression phase; (2) moderately heavy and heavy soils which have no well-defined texture profile, in which the surface soils and subsoils are not greatly different in texture—Victoria clay, Victoria clay loam, Monteola clay loam, and Clareville clay loam, which are probably best considered as Rendzinas; and (3) medium-textured or sandy soils which have a fairly thoroughly eluviated surface soil producing well-defined different textured layers. These are Orelia fine sandy loam, Clareville fine sandy loam, Goliad fine sandy loam, and Medio loamy fine sand.

Soils developed under the influence of a humid region, the pedalferic soils, are represented by DeWitt fine sandy loam and DeWitt fine sand, which are light-colored acid sandy forested soils underlain by heavy clay of slow permeability. They have developed under a thin forest cover with some grass. The topsoils are thoroughly leached and eluviated, and the concentration of clay below has produced a claypan horizon. Following is a description of a typical profile of DeWitt fine sandy loam, as observed about 20 miles southeast of Beeville:

A 1. 0 to 10 inches, gray loamy fine sand which is slightly acid and very loose.

A 2. 10 to 11 inches, white or very light gray fine sand which is acid in reaction.

B 1. 11 to 18 inches, dark-gray dense waxy very heavy acid clay containing rusty-brown splotches. On drying, the material separates into blocks and some irregular clods, 1 or 2 inches in diameter, which are coated with dark gray.

B 2. 18 to 30 inches, gray dense clay which is noncalcareous and contains brown splotches. The sand content increases with increase in depth.

C. 30 inches +, gray or light-gray dense clay, in places containing a few concretions of calcium carbonate at a depth of several feet, though, as a rule, the fine earth of the parent material is not calcareous.

The relief is nearly flat, though there are some gentle slopes. In the sloping areas, the subsoil is more rusty brown than on the flats, owing to the greater oxidation in these better drained areas. The

native vegetation comprises an open growth of post oak trees and some coarse bunch grasses.

DeWitt fine sand is very similar to DeWitt fine sandy loam, but the upper horizons of loose fine sand extend to a depth of 2½ feet or more.

Medio loamy fine sand is a soil with characteristics transitional between those of the DeWitt soils and those of the darker soils of pedocalic development. It is much darker in the topsoil and more oxidized in the subsoil. It also has a layer of accumulated calcium carbonate. Following is a description of a profile of Medio loamy fine sand, as observed about 8 miles southeast of Beeville:

A. 0 to 14 inches, dark grayish-brown loamy fine sand or fine sandy loam, which is not calcareous. In places this horizon is as much as 30 inches thick.

B_1. 14 to 24 inches, dark-gray clay with red and reddish-yellow splotches. The material is not calcareous. On drying, it separates into small angular slick dark-coated clods 1 or 2 inches in diameter.

B_2. 24 to 30 inches, light-gray dense clay which is noncalcareous, rather sandy, and contains, rust-brown splotches. The material separates into irregular sharp angular clods.

C_c. 30 to 50 inches, gray calcareous fine sandy clay containing white lumps and concretions of calcium carbonate. This is the zone of carbonate accumulation.

C. 50 to 60 inches +, red and gray mottled fine sandy clay which is not calcareous but contains a few fine concretions of calcium carbonate.

This soil occupies gentle slopes and low ridges and has good drainage. The native vegetation is largely coarse grasses and shrubs, but the land also supports a scattered growth of live oak trees and small mesquite trees.

Orelia fine sandy loam is a dark-colored pedocalic soil with a maturely developed profile. It not only contains a layer of accumulated calcium carbonate but has a dense claypan subsoil indicating advanced eluviation. Following is a description of a profile of Orelia fine sandy loam, as observed about 5 miles southeast of Beeville:

A. 0 to 10 inches, dark grayish-brown noncalcareous fine sandy loam which, where undisturbed, is friable when moist but packs and crusts tightly on drying.

B_1. 10 to 18 inches, very dark gray dense and heavy noncalcareous clay constituting a claypan. On drying, the material separates into irregular angular small clods 2 or 3 inches in diameter.

B_2. 18 to 24 inches, gray dense noncalcareous clay containing slight rust-brown splotches. Cracks form horizontally in the dry material in places, and smaller vertical cracks cause a separation of the material into cubical clods with slick surfaces, ranging from ¼ inch to 2 inches in diameter.

C_c. 24 to 60 inches, gray heavy crumbly and permeable sandy calcareous clay containing many white concretions of calcium carbonate.

C. 60 inches +, gray calcareous clay containing a great many soft and hard lumps of calcium carbonate.

The relief of this land is smooth, and drainage is slow. The native vegetation consists of short grasses—buffalo and curly mesquite—and coarse bunch grasses, together with shrubs and small mesquite and huisache trees.

Victoria clay is representative of the immature heavy dark soils of pedocalic development. These soils have no well-developed texture profile and are so youthful that the calcium carbonate is not leached

from the upper horizons. The processes of eluviation and illuviation have not been very active, and the zone of calcium carbonate accumulation is not everywhere distinct. It seems probable that this soil should be considered a Rendzina. The heavy calcareous soil material as yet has not been leached to a marked extent. Victoria clay is developed on the smooth coastal terrace from calcareous clay. Following is a description of a profile of this soil, as observed 6 miles southeast of Clareville:

A_1. 0 to 10 inches, black granular calcareous clay which is very sticky when wet and cracks deeply in uncultivated areas when thoroughly dry. The surface is pitted with shallow regular depressions a few feet wide, wherein the black clay soil ranges from 3 to 4 feet in depth. The miniature mounds between the depressions range from 6 to 18 inches in height and have a thin topsoil of black clay over brownish-gray clay in places.

B_1. 10 to 50 inches, gray calcareous clay which is hard and firm when dry but is not a claypan. On drying, deep cracks extend through the surface soil and subsoil separating the material into huge irregular clods.

C_c and C. 50 inches +, chalky yellowish-gray calcareous clay containing soft lumps of calcium carbonate. This is the zone of calcium carbonate accumulation, but the material is only slightly more calcareous than the parent material beneath, indicating the immature stage of development.

The Goliad soils show an advanced stage of maturity of the dark pedocalic soils in that the surface soil and upper subsoil horizon, though very dark, indicating a large organic residue from the grass cover, are rather thoroughly leached of calcium carbonate, and the accumulated layer of this material below is almost pure soft chalky calcium carbonate, in many places several feet thick. Following is a description of a profile of Goliad fine sandy loam, as observed 5 miles west of Beeville:

A_1. 0 to 8 inches, black noncalcareous fine sandy loam.

B_1. 8 to 14 inches, very dark reddish-brown noncalcareous heavy clay. On drying, the material separates to small irregular clods, ranging from one-half inch to 2 inches in thickness, with clean smooth surfaces coated with brown.

B_2. 14 to 30 inches, dark brownish-red or reddish-brown crumbly noncalcareous clay.

C_c and C. 30 inches +, a chalky bed of calcium carbonate several feet thick. In places the upper part of the bed is a thin layer of hardened calcium carbonate.

This soil is developed on undulating or gently rolling uplands on which the chief grasses are curly mesquite and grama. There is a scattered growth of small live oak, mesquite, and anaqua trees, and lotebush, agrito, huajillo, black chaparral, Mexican persimmon, and other shrubs and herbaceous plants of subhumid types.

In places large areas of a shallow phase of Goliad fine sandy loam are representative of the group of soils of youthful development, which occupy comparatively steep or rolling land where runoff has been rapid, erosion active, leaching slight, and vegetation comparatively sparse. This soil resembles the typical soil in color of the surface soil, although this layer in most places is thin and less dark. The brownish-red clay subsoil horizon also is very thin, and in many places it is lacking. The beds of caliche (calcium carbonate) are in places many feet thick. Large areas occur in which

the dark thin layer of surface soil rests directly on the bed of calcium carbonate.

A local condition found in places on the soils of Bee County is of much interest to farmers. This is the presence of spots, ranging from a few feet in diameter to several acres in size, in which chlorosis is developed in certain plants, such as corn, broomcorn, and grain sorghum. Most of these areas are slightly higher than the surrounding land, the soil is lighter in color, and snail shells are abundant in the surface soil. These areas are not of sufficient size to be deterrent to cultivation of the land. The surface soil in such spots seems to be more highly calcareous than the surrounding soil, and it is very probable that the concentration of carbonates at the surface is the cause of inhibited chlorophyll development in plants which are not tolerant of this condition.

Table 4 gives the results of pH determinations of several of the important soils of Bee County. These determinations were made in the Bureau of Chemistry and Soils by the hydrogen-electrode method.

TABLE 4.—*pH determinations of several soils from Bee County, Tex.*

Soil type and sample no.	Depth	pH	Soil type and sample no.	Depth	pH
Medio loamy fine sand:	*Inches*		Victoria clay loam:	*Inches*	
448404	0–16	7.8	448425	0– 5	7.6
448405	16–34	7.6	448426	5–20	7.9
448406	34–40	8.2	448427	20–50+	9.0
448407	40–72	7.4	Clareville fine sandy loam:		
Orelia fine sandy loam:			448428	0–24	8.3
448408	0– 7	6.7	448429	24–48	8.6
448409	7–16	7.6	Goliad fine sandy loam:		
448410	16–26	8.2	448430	0–10	7.8
448411	26–40	8.1	448431	10–20	8.1
448412	40–70+	8.2	448432	20–26	8.3
DeWitt fine sandy loam:			448433	26–40	8.4
448413	0–10	7.1	448434	40–60+	8.7
448414	10–23	5.6			
448415	23–30	6.8			
448416	30–63+	8.6			

SUMMARY

Bee County is in southern Texas about 98 miles by highway southeast of San Antonio and 30 miles northwest of the coastal bays of the Gulf of Mexico. It is situated in the west Gulf Coastal Plain at the eastern edge of the Rio Grande plain, a smooth, brushy grassland with warm climate and a low average annual rainfall. In this county moisture is frequently insufficient for the best production of farm crops, yet a fairly large area of land is in small farms where successful production is possible by the selection of crops suited to the section and by practices that tend to conserve and utilize the available soil moisture.

The southern part of the county includes the northern edge of a flat coastal terrace extending to the Gulf coast, but most of the county is rolling or undulating. Elevations above sea level range from about 80 to 300 feet.

All the land formerly was used for the production of range livestock, chiefly cattle, and, according to the census of 1935, less than 20 percent of the land is used for the production of farm

crops. The rest is used for pasture, much of which is in small and some in fairly large ranches.

Most of the farms are small, so far as land in cultivation is concerned. Cotton is the chief crop, and other crops grown for sale include small quantities of broomcorn and truck crops, some of which are marketed locally and the rest shipped to outside markets. Feed crops, chiefly grain sorghums, corn, sorgo, and Sudan grass, are grown on every farm. In recent years corn has been supplanted to some extent by grain sorghums because the sorghums give better yields under dry conditions that frequently occur in the summer.

Most of the land is used for the production of beef cattle which are grazed on the range and, for the most part, shipped as young animals to other sections or States for feeding, though some are fed locally. Small quantities of dairy products are sold locally, and some poultry products are sold from the farms.

The soils of this county are mostly deep dark soils, more or less calcareous, underlain by highly calcareous subsoils and parent materials. In general they occupy smooth lands, and most of them are highly productive when moisture conditions are favorable. Some areas of light-colored forested soils in the eastern part are not highly productive. The county includes rather large areas of rolling land, on which the soils are so shallow that they are suited only for pasture.

The dark soils are Pedocals, and the light-colored sandy soils are pedalferic, though they are not typically developed Pedalfers.

The dark-colored heavy soils are deep, highly productive, and well suited to the general farm crops and, to a limited extent, to truck crops. These are Victoria clay, Victoria clay loam, Monteola clay, Monteola clay loam, Clareville clay loam, and Leona clay loam. The virgin soils support a heavy cover of short grasses which provide excellent pasture for livestock. The rather large areas under cultivation are used mainly for the production of cotton and sorghums.

The dark-colored medium-textured soils are similar to the dark-colored heavy soils, but they have light-textured surface soils. They are more easily cultivated and dry out less quickly than the heavy soils, so that crops grown on them are less affected by drought. They are suited to all the general farm crops and are very well suited to truck crops and certain fruits. These are Orelia fine sandy loam, Clareville fine sandy loam, and Goliad fine sandy loam.

The light-colored sandy soils have very sandy surface soils and fairly dense clay subsoils. They support a thin stand of post oak trees and are not used to a great extent for farming. These are Medio loamy fine sand, DeWitt fine sandy loam, and DeWitt fine sand.

Soils that are shallow and not suited to cultivation occupy rather large areas. These are best suited to grazing and are used mostly for that purpose. They are Goliad fine sandy loam, shallow phase; Goliad gravelly fine sandy loam; and Monteola clay, shallow phase. Orelia fine sandy loam, depression phase, is a poorly drained soil, not suited to cultivation; and riverwash is unfit for cultivation because it is subject to overflow and erosion by streams and because of the droughty character of the soil material.

LITERATURE CITED

(1) CONNELL, J. H., and MCHENRY, S. A.
1898. THE BEEVILLE EXPERIMENT STATION. Tex. Agr. Expt. Sta. Bull. 48, pp. [927]–958, illus.
(2) GANNETT, H.
1906. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. U. S. Geol. Survey Bull. 274, ed. 4, 1072 pp.
(3) JONES, J. M., BREWER, R. A., and DICKSON, R. E.
1922. GRAIN SORGHUMS VERSUS CORN FOR FATTENING BABY BEEVES. Tex. Agr. Expt. Sta. Bull. 296, 25 pp.
(4) KARPER, R. E., QUINBY, J. R., JONES, D. L., and DICKSON, R. E.
1931. GRAIN SORGHUMS DATE-OF-PLANTING AND SPACING EXPERIMENTS. Tex. Agr. Expt. Sta. Bull. 424, 71 pp., illus.
(5) MANGELSDORF, P. C.
1929. CORN VARIETIES IN TEXAS; THEIR REGIONAL AND SEASONAL ADAPTATION. Tex. Agr. Expt. Sta. Bull. 397, 74 pp., illus.
(6) PITTUCK, B. C., and MCHENRY, S. A.
1901. TWO METHODS OF GROWING ONIONS. Tex. Agr. Expt. Sta. Bull. 60, pp. [99]–111, illus.
(7) POTTS, A. T.
1912. REPORT ON EXPERIMENTS WITH CITRUS FRUITS AT THE BEEVILLE SUBSTATION. Tex. Agr. Expt. Sta. Bull. 148, 22 pp., illus.
(8) TAUBENHAUS, J. J., EZEKIEL, W. N., and KILLOUGH, D. T.
1928. RELATION OF COTTON ROOT ROT AND FUSARIUM WILT TO THE ACIDITY AND ALKALINITY OF THE SOIL. Tex. Agr. Expt. Sta. Bull. 389, 19 pp., illus.

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