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SOIL SURVEY
CAMERON COUNTY, TEXAS

BY

M. W. BECK, in Charge, and B. H. HENDRICKSON

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DESCRIPTION OF THE AREA

Cameron County is situated in the extreme southern part of Texas, about 120 miles south of Corpus Christi, 235 miles southeast of San Antonio, and 310 miles southwest of Houston. It is bordered on the east by the Gulf of Mexico and on the south by the Rio Grande, which separates it from Mexico. The county has an area of 877 square miles, or 561,280 acres.

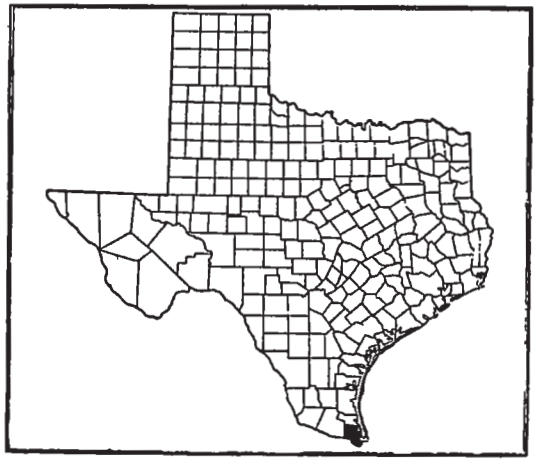


FIG. 17.—Sketch map showing location of the Cameron County area, Texas

The county lies in what is known as the Lower Rio Grande Valley. The greater part of its area is occupied by the alluvial plain or delta of the Rio Grande. This alluvial belt extends northward to the Arroyo Colorado along the Hidalgo County line and thence northwardly to a point about 3 miles south of Riohondo, where the boundary swings about due east to Los Soldados Ranch, thence northeasterly to Laguna Madre. The territory north of the delta is usually referred to as the coastal plain region.

The area of the county consists of a flat plain, with a gentle slope to the northeast. That part of it lying north of the Rio Grande delta does not differ in topographic relief or elevation from the delta itself. The latter is crossed by a number of old river channels, each having a faint ridge constituting a natural levee on each side of the channel. The broad belts between these channels, or "resacas" as they are called, consist of flat sags a few feet lower than the tops of the natural levees. The so-called coastal plain portion has a very faint undulation, but no such regularity in features as in the delta portion, with its low ridges along the resacas and its broad flat belts between. The latter contain many small lakes, mainly intermittent. A few mounds, usually described as clay dunes, are found in the county.

The Rio Grande has a well-developed channel about 350 feet in width and 15 or more feet in depth. There is a well-developed first bottom of flat surface, with numerous cut-off oxbows of the former channel, locally known as esteros. A fairly well defined outer escarpment several feet high separates the bottom from the uplands as far downstream as the flat prairie about 8 miles east of Brownsville. The lower bottom varies from a few feet in width to 2 miles or more on the Texas side.

The county has an average elevation of about 35 feet above sea level. The elevation varies from the highest point of 70 feet about 1 mile south of Santa Maria to sea level. The bank of the Rio Grande at the Hidalgo County line is 69 feet above sea level. Sebastian, which is just north of Cameron County, has an elevation of 54 feet, Harlingen about 41 feet, San Benito 37 feet, and Brownsville 35 feet.

Drainage ways are not numerous, and many large areas have no natural drainage outlets. The Rio Grande and Arroyo Colorado are the only perennial streams, and these have no important tributaries within the limits of the county. The resacas function as drainage ways to a limited extent, but owing to their elevated marginal strips little flood water enters them except upstream from the Rio Grande. The greater part of the rainfall makes its way slowly to the low flat section in the eastern part of the county. Drainage ditches in many of the low positions assist in carrying off the local precipitation. All of the first-bottom strip along the Rio Grande is overflowed during flood stage except where protected by levees. During exceptionally high floods a large acreage of low land other than the first-bottom strip is inundated. It is reported that 99,000 acres were covered by flood water in 1919, 19,000 acres in 1920, and 41,000 acres in 1922.[1] In 1920 flood water from the Rio Grande washed out 90 feet of railroad track between Harlingen and San Benito. The resacas and Arroyo Colorado are the natural outlets for flood water from the Rio Grande, but by the construction of roads, bridges, canals, and dams their natural capacities have been reduced and the excess water seeks the low flat areas between the resacas and follows their courses to the Gulf.

In the flat prairie in the eastern part of the county, where there is little slope and practically no surface drainage, and but poor underdrainage, water stands on the surface or the soil remains in a wet condition the greater part of the year. The ridges along the resacas and the more elevated coastal plain section have the best drainage. In the large flat sections, particularly those lying between the resaca ridges, the drainage is imperfect to very poor.

Cameron County was organized February 12, 1848, and was created from a part of Nueces County; in 1852 Hidalgo County was formed by taking parts of Cameron County and Starr County; the formation of Willacy County in 1912 took 200 square miles from the northern part of Cameron County, and 500 more square miles were taken in 1921 and 1922. The first courthouse was erected in Brownsville in 1886. The territory north of the Rio Grande for 100 miles was not considered suitable for settlement until toward the end of

[1] Hearings before the Committee on Foreign Affairs, House of Representatives, 68th Cong., 1st sess., on H. R. 8371, 1924, p. 25.

the eighteenth century when all this territory was allotted to wealthy Spanish cattle owners. These grants contained 250,000 to 500,000 acres, with a certain amount of river frontage. Matamoros, Mexico, was known as a congregation in 1765, and the present site of Brownsville was Matamoros Commons. A small town of Clarksville was established at the mouth of the Rio Grande on the American side in 1780, and Point Isabel and Brazos de Santiago were Mexican villages in 1788. During the Mexican trouble in 1846, Zachary Taylor was sent to this section with troops and constructed Fort Brown. A short time after General Taylor's arrival the first American built a house in Brownsville. After 1848, when the treaty was signed with Mexico, settlers began coming into this section.[2] Since the advent of the St. Louis, Brownsville & Mexico Railway in 1904 there has been a rapid influx of settlers to this country.

According to the Federal census the population of Cameron County was 14,959 in 1880, 16,095 in 1900, 27,158 in 1910, and 36,662 in 1920. The urban population comprises the inhabitants of Brownsville and San Benito. Probably only about 35 per cent of the population is actually engaged in farming. The farming population is rather evenly distributed in the various irrigated districts. Large sections in the eastern and northern parts of the county are thinly inhabited.

The settlers of Cameron County came largely from the Middle West, but there are people from most of the States. The Mexicans make up about 30 to 40 per cent of the total population; in Brownsville the proportion is said to be around 60 per cent.

Brownsville, the county seat, had a population of 11,791 in 1920. The population of San Benito was 5,070, of Harlingen 1,784, La Feria 236, Riohondo 225, Los Indios 150, and Point Isabel 200. There are a number of other small villages in the county.

Cameron County has good shipping facilities. No part of the agriculturally developed sections of the county is far from a railroad. Prior to 1904, when the St. Louis, Brownsville & Mexico Railway entered Brownsville, a daily stage route was maintained between Brownsville and Corpus Christi. All shipping to this section was by water to Point Isabel and by rail to Brownsville.

The roads of Cameron County are good, except during periods of excessive rainfall. Practically all roads in the agricultural sections are well graded and are dragged after rains. A concrete highway is under construction between Brownsville and Harlingen and thence westward. The roads of the undeveloped sections receive little attention and are very winding.

All of the well-developed farming sections are reached by rural mail delivery, but very few farms have telephones or modern lighting systems. The towns have exceptionally good school buildings and numerous churches. Country schools seem to be fairly well distributed.

CLIMATE

The table following is compiled from the records of the Weather Bureau station at Brownsville, in the southern part of the county, at an elevation of 38 feet.

[2] Historical data from "History of the Lower Rio Grande Valley," by Frank Pearce.

Normal monthly, seasonal, and annual temperature and precipitation at Brownsville

[Elevation, 38 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1886)
	° F.	° F.	° F.	Inches	Inches	Inches
December	61.5	93	15	1.49	0.32	0.69
January	59.4	90	18	1.35	.28	1.81
February	62.9	94	12	1.26	.20	2.33
Winter	61.3	94	12	4.10	.80	4.83
March	68.3	98	28	1.22	1.51	1.15
April	73.7	100	37	1.30	.43	.17
May	78.6	102	41	2.23	2.57	6.57
Spring	73.5	102	28	4.75	4.51	7.89
June	82.4	103	56	2.46	.71	7.78
July	83.8	102	57	1.89	4.52	4.88
August	83.9	104	68	2.54	.29	3.08
Summer	83.4	104	56	6.89	5.52	15.74
September	80.5	102	51	5.32	1.03	30.57
October	74.6	99	38	3.23	T.	.55
November	67.5	98	28	2.07	.29	.48
Fall	74.2	102	28	10.62	1.32	31.60
Year	73.1	104	12	26.36	12.15	60.06

The climate of Cameron County has some of the features of a semitropical climate on the one hand, and of semiarid on the other. The winters are rather short and very moderate. The mean variation in temperature is from 59.4° F. in January to 83.9° in August, or a difference of only 24.5°. The extreme temperatures are 12° in February and 104° in August, but these are not experienced very often. The absolute maximum for the winter months ranges from 90° to 94°, and the absolute minimum from 12° to 18°. The mean temperature for the winter months is 61.3°. The summers are rather long, but the extreme heat is tempered by the breezes from the Gulf. July and August have a mean temperature of 83.8° and 83.9°, respectively, an absolute maximum of 104° and an absolute minimum of 57°. The spring and fall months have a mean temperature of about 74°. The temperature throughout the year is rather uniform, owing to the fact that this section is influenced by the moisture-laden winds from the Gulf. The mean annual relative humidity is 80 per cent.

The average date of the first killing frost in the fall is December 22, and that of the last in the spring, January 28. This gives a normal growing season of 328 days, sufficient to mature two crops during a season. Frosts have been recorded as early as November 15 and as late as March 8. Occasionally a winter passes without a killing frost.

The mean annual precipitation is 26.36 inches. The total rainfall in the wettest year (1886) was 60.06 inches, and that of the driest year (1917) 12.15 inches. The fall months receive two-fifths of the

NATIVE JUNGLE ON THE RIO GRANDE SILTY CLAY LOAM, IN THE EXTREME SOUTHERN PART OF CAMERON COUNTY

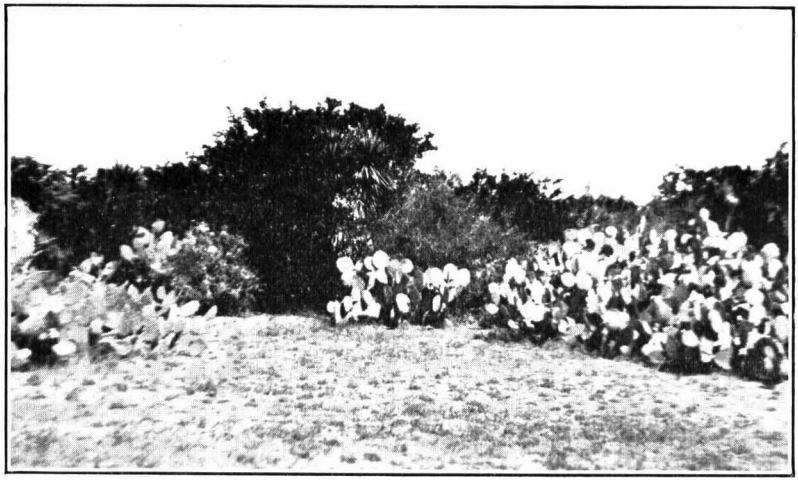


FIG. 1.—NATIVE VEGETATION ON SOILS OF THE LAREDO SERIES

Ebony, Prickly Pear, Spanish Dagger, Mesquite, and Chaparral

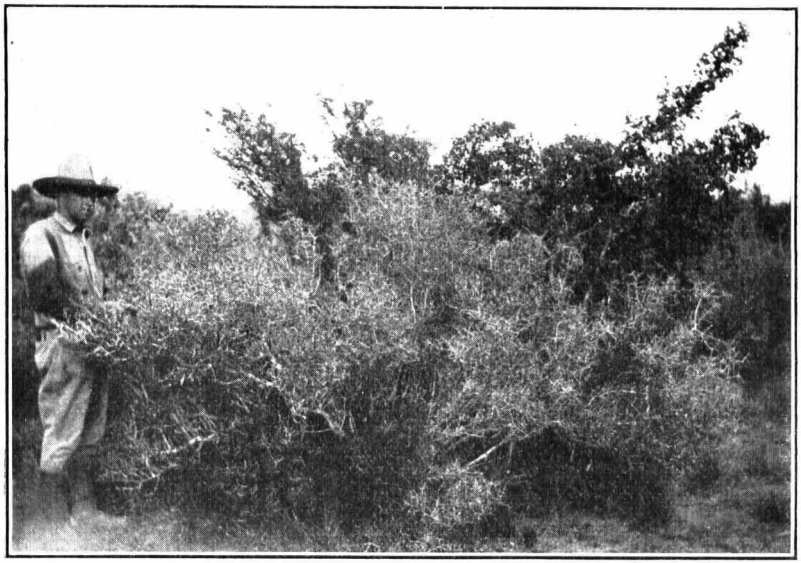


FIG. 2.—CHAPARRAL AND OTHER NATIVE PLANTS ON THE HARLINGEN CLAY

annual rainfall and the remainder is rather evenly distributed throughout the year. The annual rainfall is sufficient for certain crops, but irrigation is resorted to in order to insure production and to permit the growing of a wider variety of crops.

This region is frequented by the "northers," which cause a sudden drop in temperature. The norther in this section is usually accompanied by rain, possibly owing to the fact that the cold wind comes in contact with the warm moisture-laden Gulf winds. As a rule these northers last only a few days. Sometimes they follow each other rather closely. The prevailing winds are from the southeast, and at times attain gale velocity. Occasionally this section is visited by tropical storms; these usually occur in September and are accompanied by heavy wind and a downpour of rain. According to local information, hail is rather unusual; however, an occasional destructive hailstorm is not unknown.

Generally there are few nights during the winter months that the temperature goes low enough to make the heating of citrus orchards necessary, and during some winters the orchards do not require artificial heating. For further data relating to the suitability of the climate to the citrus industry, see Circular No. 34, Texas Agricultural Experiment Station, pp. 1–10.[8]

AGRICULTURE

The native vegetation of Cameron County consists of trees, a large number of which are leguminous, various kinds of thorny bushes, cacti and grasses. The coastal plain and higher alluvial areas are covered with a thick growth of medium-sized to small hardwood, leguminous, thorny trees, which constitute the dominant type of vegetation on most of the soils. They are associated with a dense growth of thorny bushes and shrubs, some cacti, and a more or less continuous ground cover of native grasses, making an almost impenetrable growth. On the river-bottom land and other naturally moist situations, fairly free from alkali, as old river channels, taller trees of many species are found, as elm, hackberry, cottonwood, palms, and many others, as well as a junglelike semitropical undergrowth of bushes and climbing vines and a luxuriant growth of mesquite, crowfoot, Johnson, and Bermuda grasses (pl. 21). On the nonagricultural soils, including low, poorly drained types containing considerable alkali salts, and the salty coastal flats, the only plant growth consists of coarse salt grasses, sacahuiste grass, and alkali weeds.

The dominant native trees of the county are the mesquite, ebony, huisache, and retama. Of these, the mesquite trees are by far the most common. Other trees of lesser importance are the acacia, reynosia, brazil, hackberry, elm, cottonwood, palms, willow, anaqua, Spanish dagger, and many others (pl. 22). The dense thorn-brush vegetation consists almost entirely of chaparral bushes, 4 to 8 feet in height, although some allthorn, cat's-claw, and other thorn bushes are occasionally seen. A number of native cacti are common, but probably 95 per cent are prickly pear; these are usually 2 to 4 feet in height but may sometimes reach 8 to 10 feet.

[8] The Lower Rio Grande Valley, by A. T. Potts, chief, division of horticulture, Tex. Agr. Exp. Sta. (1924).

The principal native grasses are the common and running mesquites. Crowfoot grass, a taller variety, is found on the heavier soils. Johnson grass and Bermuda grass, originally distributed over the river-bottom soils, have spread along the irrigation canals over the upland and persist in moist situations or irrigated pastures in many parts of the county. The mesquite grasses are, however, the principal native pasture grasses of the county.

The better-drained parts of the alluvial lands support a dense growth of chaparral, and an abundance of mesquite, ebony, and prickly pear. The low flats and poorly drained areas support a more open growth of mesquite trees, low prickly pear, huisache, and retama. The coastal plain section supports a growth of large mesquite, ebony, and chaparral. At present there is an almost impenetrable growth of brush on the better drained lands. The early settlers, who were all Mexicans, used this section for cattle. In 1846, when the first Americans arrived, the Mexicans were farming only small patches on the river bottom, according to local information. They raised corn, beans, and peppers principally.

The first agricultural endeavor of any importance is said to have begun about 1890, when an American erected a small sugar factory and began raising sugar cane with irrigation. This project, however, was not followed by any considerable advancement. In 1902 permanent irrigation systems began to be installed in the lower Rio Grande Valley. In this year a rice mill was erected at Brownsville, and an extensive acreage of heavy clay was put in cultivation to rice and irrigated from the river by pumping. This project was short lived. Yields are reported to have decreased the second year, and failed almost completely the third year. Rice culture was abandoned in 1905. With the advent of the railroad in 1904, agriculture had its real beginning. New settlers came immediately into the valley. During 1908 two sugar mills were constructed, one at Brownsville and one at San Benito. Sugar cane was grown extensively for 2 or 3 years, but owing to unfavorable conditions of factory management and other causes, it is said the farmers were unable to grow cane profitably, in spite of the fact that the product had a high sugar content and large yields were obtained.

Since 1904 the larger land holdings have been broken up into small tracts, and more intensive farm methods employed. Corn and cotton are the staple crops, but vegetables and citrus fruits are important.

The Federal census reports 9,526 acres in corn in 1879, 25 acres in oats, 25 acres in cotton, and 256 acres in sugar cane. In 1909 there were 2,933 acres of corn, with an average yield of 15 bushels per acre. Cotton was grown on 3,598 acres, giving an average yield of a little less than one-fourth bale per acre. There were 1,908 acres of vegetables and 315 acres of cultivated grasses. Sugar cane was grown on 1,604 acres, yielding an average of 21 tons per acre. Animals sold and slaughtered in 1909 were valued at $197,209.

In 1919 the area in corn had increased to 21,841 acres, with an average yield of 28 bushels per acre. There were that year 20,638 acres of cotton and 2,926 acres of vegetables. The Bureau of Agricultural Economics reported in 1921, 8,150 acres of cabbage, 4,385 acres of potatoes, 4,237 acres of tomatoes, 1,190 acres of snap beans, 848 acres of lettuce, and a small acreage of carrots, beets,

peppers, spinach, and cucumbers. The 1920 census reports 1,134 acres devoted to broomcorn in 1919, with an average yield of about one-fourth ton per acre. In 1923 4,600 acres were devoted to broomcorn, according to estimates of the county agricultural agent. Coarse forage, mainly sorghum, Rhodes grass, Sudan grass, and alfalfa, was grown on 3,845 acres, with yields of a little less than 3 tons per acre. According to the census the value of dairy products in 1919, excluding home use, was $166,462, and of poultry and eggs, $150,066. The total value of all agricultural products for 1919 was $3,086,568.

The planting of citrus fruit commercially was begun in Hidalgo County in 1907 and in Cameron County about 1910, according to local information. There has been a steady increase in the number of citrus trees planted each year since 1907. In 1922 there were 5,600 acres of citrus trees, about 60 per cent grapefruit, 37 per cent oranges, and 3 per cent lemons, kumquats, and limes; a total of 560,000 trees. From the 1923–24 crop 41 carloads of citrus fruit were shipped, and from the 1924–25 crop the shipments amounted to 169 carloads.

The agriculture of Cameron County consists mainly of the production of cotton, vegetables, broomcorn, and citrus fruit as cash crops. Dairying is also a source of cash income in a small way. Strawberries are grown in small patches and give a good cash return. Hay and corn are grown for consumption on the farm. Considerable corn is sold as fresh corn. A small proportion of the corn is used for silage.

There is no general fixed scheme of rotating crops in Cameron County. Where vegetables are grown in the fall, winter, and spring they are usually followed by cotton or corn. Some farmers growing vegetables allow the land to lie fallow during the summer months. The general practice of the cotton farmers is to plant cotton on the same land for a number of years, although a few farmers alternate cotton with corn.

The same general methods are employed in the production of corn as in the other irrigated sections. The land is usually plowed in the fall or winter to a depth of about 7 inches. In the spring the land is furrowed out with a middle burster or breaker, commonly called "middle buster." The ridges are then harrowed one or more times. About 10 days before planting an irrigation is given by allowing the water to follow the furrows and soak the ground. As soon as dry enough after this watering, corn is planted in furrows, usually 3½ feet apart, spaced 12 inches in the rows, about February 1 to 15. It is harvested in June or July. A small acreage of corn is planted in September for green feed and "roasting ears." Cultivation begins when the corn is 4 to 6 inches high. The ridges are gradually worked down until the surface is nearly level, with a slight depression between the rows to convey the irrigation water. The general practice is to cultivate at least twice between irrigations. The number of irrigations depends on the rainfall. Without rainfall corn is generally irrigated every 15 or 20 days. It is allowed to ripen in the field; the fodder remains after snapping, and is plowed under or cut and burned. Corn is grown throughout both the irrigated and dry-farming sections.

The land used for cotton is usually flat-broken in the fall or winter to an average depth of about 6 inches, and is laid off in the spring in furrows about 3 to 3½ feet apart. Where cotton follows cotton, some farmers use the middle burster and furrow out between the previous rows. After the land is furrowed, the better farmers harrow the ridges one or more times. Just before planting, if rainfall is not sufficient, a heavy application of water is run down the furrows. As soon as dry, the cotton is planted in the furrow during the period of February 15 to March 15, occasionally as late as June 1. The early planting ordinarily is picked in July and August. The cotton is planted rather thick in the row, and after reaching a height of 4 to 6 inches it is thinned to a stand, with the plants spaced approximately 10 to 14 inches in the row. The general practice is to cultivate every 10 days or 2 weeks. Usually a heavy application of water is made before planting, and subsequently at intervals of about 30 days. Some farmers claim to have made good crops from a single irrigation, given before planting. In dry seasons the results of this might be doubtful. Irrigation is by the row system, as with corn. The check system may be more profitable, as demonstrated at Pecos and Balmorhea and other irrigated sections in west Texas. The most popular varieties of cotton are Mebane, Acala and Truett. Cotton is grown on all types of cultivated soils, but not with equal results.

Land used for cabbage is usually flat-broken, furrowed with the middle buster, and the ridges thus produced finally harrowed one or more times. Transplants from the seed bed are set on the side of the ridge and immediately watered. After that the plants are watered every 10 to 15 days, and are cultivated and hoed after each watering. About one-half pound of seed is required to plant an acre. The principal variety is Early Allhead. Transplanting to the field is done about the 1st of September and again about the 1st of June. Harvesting is done in December and March.

Land for lettuce is prepared the same as for cabbage, except that the ridges are flattened down more with a drag or harrow. Lettuce is planted rather thick in rows about 2½ feet apart. Some farmers plant two rows 10 inches apart, with a distance of 2½ feet between each set of two rows. Water is applied after seeding. When the lettuce has its fourth leaf it is thinned to a stand of 10 inches in the row. Lettuce as a rule is watered every 10 days, and cultivated after each watering. It is planted in October and November and harvested in January and February. The principal varieties are Big Boston, and New York, or Wonderful. The New York is considered better than Big Boston.

Land for potatoes is flat broken, laid off in ridges, furrowed 33 inches apart with a middle burster, then harrowed and dragged down to a height of 3 or 4 inches. The seed potatoes are planted on the ridge about 8 inches apart in the row, and water is applied immediately after planting. When the plants are 6 inches high they are cultivated shallow and regularly about every 10 to 15 days. The main crop is planted about the middle of January and harvested in April. A small acreage is planted in August and September for December marketing. It requires about 20 bushels of seed to plant an acre. The Triumph is the most popular variety. Potatoes are grown most extensively on the Rio Grande soils.

Tomato ground is prepared in the same way as potato land. The seeding is done by drilling in rows in the field, from which the plants are transplanted onto ridges 30 to 36 inches apart, with a spacing of 18 to 24 inches. The tomatoes are watered every 10 to 15 days and cultivated and hoed after each watering. Tomatoes are planted in December and January and harvested in May and June. A small acreage is set in September for harvest in December. The most popular variety is June Pink, an early sort.

Snap beans (string beans) are planted in the furrow about 24 to 30 inches apart, spaced about 1 inch in the row. Dry beans are planted about 3 to 4 inches apart in the row in October and harvested in December. The principal crop of snap beans is planted in February and marketed in April. Like other vegetables, beans are irrigated every 10 to 15 days and thoroughly cultivated and hoed. The leading varieties are Giant and Burpee's Stringless.

Beets and carrots are planted about 2 inches apart in rows 24 inches apart. The land is prepared the same as for lettuce.

Preparation of the seed bed for broomcorn is the same as for corn. About 4 pounds of seed is required for an acre. It is planted about 3 inches apart in rows 3 to 3½ feet apart. The best time for planting is said to be from February 15 to March 1. Harvesting takes place from June 10 to July 1.

The land for planting citrus trees should be thoroughly plowed and harrowed until a fine tilth is obtained. Successful growers advise planting trees about 18 inches deep, and frequent irrigation during the first year, with shallow cultivation between the applications of water. The waterings should be lessened in late summer or fall to permit the trees to become as dormant as possible for wintering.

A windbreak is considered essential by many growers, especially on the south and east sides of the grove. Bamboo seems to be a good windbreak, but it should not be planted too thick so as to cut off all wind. Palms and oleander are also good for wind protection. Some farmers interplant corn the first three or four years. Best results indicate that the corn should not be closer than 6 feet to the trees. Some do not plant corn in their groves, for fear it will retard the trees. A winter cover crop, such as alfalfa, vetch, or rye, to be plowed under in spring is said to be beneficial. The intercropping of an orchard with vegetables is not considered desirable.

A number of varieties of oranges succeed in the valley. Of the navel varieties, the Washington Navel is the one most planted. They ripen about November 1, are fine flavored and large. The Parson Brown is fully ripe in November. The Pineapple is very juicy and has a delightful flavor. It ripens in December and can be left on the tree until March or even April. Valencias ripen in January and may be left on the tree until summer.

Of the Mandarin group of citrus fruits, including the "kid glove oranges," the Dancy fruits early and is very prolific. The fruit deteriorates if left on the tree later than January, becoming "puffy."

Of the grapefruit varieties, the Marsh, ripening in November and December, easily leads. The Walters and Duncan are other varieties grown.

The most popular varieties of lemons are the Eureka, Lisbon, and Villa Franca. Of the limes, the Mexican, which is the West Indian or Key, is the best known. The kumquat is of little commercial value as yet, but is a very prolific bearer.

One of the most essential things for the production of first-class fruit, in order to bring the highest price in the competition of the open market, is the protection of the bearing grove from insect pests and diseases. This can be done by the use of the right spray or dust at the proper time. The most important citrus pests at the present time probably are scale insects. The Florida red scale, chaff scale, purple scale, California red scale, and soft brown scale are the most troublesome. Other insects injurious to the citrus tree are the rust mite, thrip, white fly, and red spider. Citrus trees are also subject to various diseases, the most important of which are gummosis, root rot, and mottle leaf.

The principal citrus-producing section of Cameron County lies west of Harlingen. There are also numerous groves in the vicinity of Riohondo, San Benito, Brownsville, and El Jardin School. Most orchards have been planted on the soils of the Victoria and Laredo series. The trees produce the first commercial crop when 3 years old, and come into full bearing at 7 to 10 years.[5]

Cantaloupes and watermelons are grown on rather small areas. They are planted from February 1 to February 15, and marketed from May 15 to July 1.

The principal markets for all vegetables in this section are in Texas and the Central West. Lettuce, however, is shipped to all parts of the country, and cabbage is also shipped to eastern points. The entire citrus crop at present can not supply the Texas demand. Cotton is shipped mainly to Houston and Galveston. The cattle, sheep, and goats are shipped to Fort Worth and Kansas City.

At the present time dairying and poultry raising do not supply the local demand. Considerable dairying is carried on near the principal towns, furnishing a supply of milk sufficient for local use, but some butter is imported. Eggs are also brought in from other sections. Some farmers maintain a few dairy cows and sufficient poultry for home needs. Hogs are found on only a few farms.

Practically all the farms are supplied with modern implements, such as sulky and walking plows, harrows, drags, and floats. As a rule three or four horses of medium draft type are used. A number of gasoline tractors are in use.

Ranches are being gradually replaced by small farms. However, a large proportion of the county is still used for raising cattle.

Topography and soil differences have a marked influence on the agriculture of the county. On the heavy soils of the Harlingen and Cameron series cotton and corn are the most successful, and it is recognized that these soils are not especially suited for the production of vegetables and citrus fruits, although small acreages are used for these crops. The Lomalto and Tiocano soils are used

[4] Tex. Dept. Agr. Bul. No. 75, p. 77.

[5] For further details in relation to the management of the citrus trees and conditions surrounding the industry, see Bul., Tex. Dept. of Agri., No. 79: The Citrus Industry in the Lower Rio Grande Valley of Texas (1925), and Cir., Tex. Agr. Exp. Sta., No. 34, The Lower Rio Grande Valley of Texas (1924).

almost exclusively for pasture, as grass seems to do well on these. The Rio Grande soils are used largely for potatoes, cotton, and corn. Locally they are considered the best potato soils in the valley. The Laredo and Victoria soils are used principally for cotton, corn, vegetables, and citrus fruits. The Laredo and better-drained Victoria soils seem to be better adapted to citrus fruit than the other soils. Not all farmers follow the soil adaptations to crops in practice.

The soils of Cameron County differ so widely in their agricultural value that any person unfamiliar with their characteristics should not undertake the purchase and utilization of these lands without giving full consideration to a number of soil features which are of the utmost importance in determining the value of these lands. Among the more important features are the soil alkali conditions and the behavior of moisture movement through soils of different texture and structure. Other soil features also merit careful study on the part of those who would utilize these lands. The soils vary from good to poor, and success in farming them must necessarily vary in accordance with the good or poor judgment exercised in the selection of land for cultivation.

Soil differences do not control the size of farms to any extent, but they do influence the acreage of improved land. Where the heavy and poorly drained types predominate the improved area is usually considerably smaller than on the lighter and better-drained types. The 1880 census reports 113 farms in the county, having an average size of 6,639 acres, of which 1,035.3 acres were improved. The 1920 census reports 1,507 farms, of an average size of 198.6 acres, with 55.2 acres improved.

The 1880 census reports 82.3 per cent of all farms operated by owners; the 1920 census reports 52.2 per cent operated by owners, 45.8 per cent by tenants, and 2 per cent by managers.

Farm leases vary widely. Most of the tenant farms rent on the share basis of one-third of all crops except cotton, which is grown for one-fourth rent. The landlord furnishes land and water. Cash rent ranges from $5 to $25 an acre.

The selling price of land ranges from $20 to $600 an acre for land in the brush. The selling price of raw land does not seem to be controlled to any extent by the soil or distance from town. Some land that has a young citrus orchard has sold from $1,000 to $2,000 an acre. It is possible to buy good land a short distance from market for $100 to $200 an acre, with a cost of $20 to $30 an acre for clearing. The 1920 census reports an average land value of $65.56 per acre.

The buildings on the average farm consist of a substantial frame house, garage, and small shed. A few farms have good-sized barns and silos, but these are exceptional.

Labor on the farm is more easily obtained in this section than in most other agricultural communities, owing to the fact that a large proportion of the population is Mexican. On the majority of farms additional labor is needed for harvesting only.

The use of commercial fertilizers is practically new for this county. The 1920 census reports only six farms using fertilizers. Cowpeas

are plowed under occasionally by some farmers. Manure is used only to a small extent.

The following observations are from a report on farming conditions in the region in 1914 and 1915.

> The staple crops are essential to the stability of the farm business, but the truck crops when successful are much more profitable. The second or truck crops should be diversified in character, as any one crop may be a failure, owing to market conditions or other causes. * * * Stock and staple farms are more stable, but not generally so profitable as farms producing considerable truck and properly diversified. * * * Double cropping is of prime importance to profitable farming in the lower Rio Grande irrigated district.[6]

SOILS

The soils of Cameron County are diversified in many ways and are uniform in one way. They are uniform in that all of them are sufficiently high in carbonates, mainly lime carbonate, to effervesce freely with hydrochloric acid from the surface down. In texture, although predominantly heavy, they range from loose Dunesand to extremely heavy clays. The range in color is from brown to black. There is also a wide range in content of water-soluble salts and in the changes that take place in the character of the material through the vertical soil section.

In the greater part of Cameron County the soils are but little different from the parent material. Stated in another way, these soils are still very similar to the deposits of which they are gradually being made by nature, as the changing process on which nature is engaged has not yet proceeded very far. These soils are mainly alluvial soils and are very much like the alluvial deposits that are still being laid down in some parts of the area.

Although the above statement is true, it is equally true that these soils are not all alike. The alluvium has always varied to a considerable extent in its characteristics from place to place. In addition to that original difference, a difference which may be described as an inherited one, there is another difference because of greater age and therefore to greater change from the character of the original material. In general it may be said that that part of the county lying north of the Arroyo Colorado is older and its soils are better developed as soils than those lying south of this. All those soils lying in the northern part of the county which are shown on the soil map as members of the Victoria and the Tiocano series, constitute the older soils of the region, and the country they cover constitutes the older country. The rest of the region, covered by the soils of the Harlingen, Lomalto, Cameron, Laredo, and Rio Grande soils, is younger to the extent that it constitutes a region that has been either entirely built up from a shallow margin of the Gulf into dry land or has been raised to a higher level than formerly by sediments brought down and distributed by the Rio Grande. The greater part of the county is included in the American part of the Rio Grande delta.

This delta consists roughly of a series of very low narrow ridges, with broad, intervening, slightly depressed troughs, the difference in level between ridge and trough being small, probably in no case more than 10 or 12 feet. The ridges are traversed longitudinally, but

[6] U. S. Dept. Agr. Bul. No. 65.

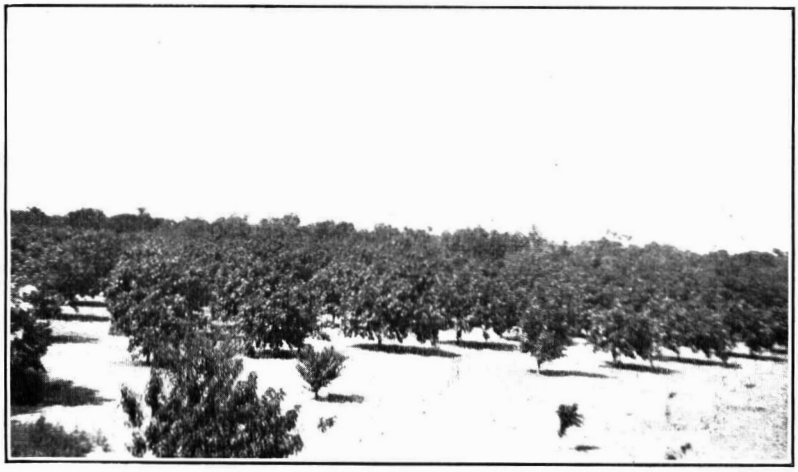


FIG. 1.—FIVE-YEAR-OLD GROVE OF MARSH GRAPEFRUIT ON VICTORIA FINE SANDY LOAM

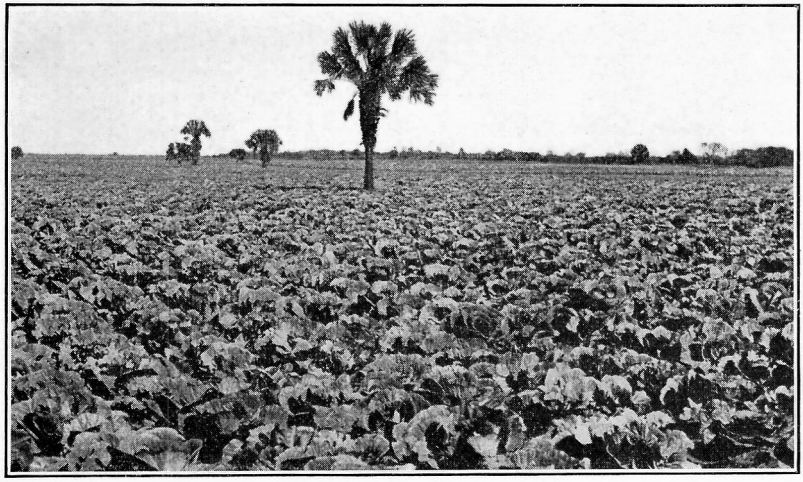


FIG. 2.—CABBAGE ON LAREDO SILTY CLAY LOAM

The picture also shows the flat topography

FIG. 1.—RHODES GRASS ON HARLINGEN CLAY

FIG. 2.—NATIVE PALMS (SABAL TEXANA) ON THE RIO GRANDE SILTY CLAY LOAM

The land among the palms is prepared for the winter-grown truck crops

through intricate windings, by flood-water channels, all of which constitute old channels of the Rio Grande. The ridges are the natural levees built during overflows when the main river occupied these channels; since then they have become flood-water channels and are the seat of deposition of the coarser material carried by the flooding waters. The finer-grained materials have been deposited in the troughs between the ridges.

The channels traversing these ridges are locally called "resacas," a Spanish word used by the native Mexican population.

The soils in the delta portion of the county have been separated into several series on the basis of drainage and the content of soluble salts. Good drainage manifests itself in the soil through more complete oxidation and therefore a browner color than where the soil is not so well drained.

The best drained soils in the delta are those lying on the resaca ridges. They are members of the Laredo soil series, of which three types, a clay, a silty clay loam, and a fine sandy loam, were mapped.

The Laredo soils are somewhat similar to the Rio Grande, but they occupy higher positions, such as natural levees, and are not subject to overflow. They are brown soils, sometimes of a chocolate-brown color at the surface, passing down into slightly lighter brown subsurface layers, and below this into pale brownish yellow to yellowish-brown, coarser-textured layers, frequently interstratified with heavier-textured layers of brown, chocolate-brown, or pinkish color. There is not much regularity in the character and arrangement of the strata from place to place. A set of horizons or layers found through the vertical section may be entirely different from a set found in the vertical section of the same soil a few hundred feet away. Some layers will be wanting, others will show a reverse of position. The soil material has been washed down from the soils of the Rio Grande drainage basin. It effervesces freely with hydrochloric acid, and the water-soluble salt content is naturally low.

Lying along the lower slopes of the natural levees or resaca ridges, between the belt of Laredo soils on the one hand and the heavier soils in the interresaca troughs on the other, is the Cameron clay. No other member of the series was mapped. It is made up of recently deposited alluvium to exactly the same extent as are the soils of the Laredo series, but the material was deposited farther from the main current, in water with a much slower current, and is fine in grain. The soil lies in a lower topographic position, consequently is less well drained, less well oxidized, and less brown in color than the Laredo soils. It has a slightly higher percentage of organic matter and is therefore darker in color.

The Cameron soils are characterized by the very dark brown to nearly black color of the surface soil, and the brownish-yellow to yellowish-brown color of the lower subsoil, which usually contains some whitish lime concretions, and by the coarser texture and brownish-yellow color of the substratum, or the material below depths of 3 to 5½ feet. In some places the coarser material comes nearer the surface. In the clay type the immediate surface on drying has a dark ashy-gray color, and breaks into fine and small clods to a depth of 2 or 3 inches, and into larger clods below this; and when wet the clay

is sticky and plastic. The material runs high in lime carbonates and moderately high in water-soluble salts. The dry subsoil is very tough, and the clods are more intractable than those of the Laredo subsoil. Plants are more often damaged by alkali than on the Laredo soils.

The Harlingen clay occupies the broad, shallow, interresaca troughs in the central and western part of the county. Since the material is very fine in grain and occupies low, imperfectly drained situations, the soil is poorly drained and poorly oxidized, as is indicated by its decidedly gray rather than brown color. This soil is somewhat better drained in the western than in central part of the county, and in the vicinity of Harlingen considerable areas have been reclaimed by drainage ditches.

The Harlingen soils are characterized by the ashy-gray color of the upper section and by the lighter ashy-gray color of the material at lower depths. Usually the surface soil has a brownish cast, but the immediate surface dries to an ashy-gray color. In case of the clay type, the material at depths of about 24 to 30 inches frequently has a brownish ashy-gray color; this passes into yellowish ashy-gray clay, and locally at depths of 4 or 5 feet into clay of slightly pinkish color. There is not much segregated lime, but the soil is rich in lime carbonates from the surface down. Some of the lower-lying and more nearly level areas of poor drainage have a lighter ashy-gray color. The soil on drying cracks deeply and breaks into rather hard small clods, with larger very tough clods below 2 or 3 inches. These clods when plowed up seem to be more intractable than those of the associated Cameron soils. It is extremely difficult to bore into the tough clay when dry. The material when wet is plastic, sticky, and impervious to percolating water. These are poorly drained soils, and they run medium to high in water-soluble salts. Some areas have a hog-wallow surface.

The Rio Grande soils occupy the most recently deposited Rio Grande flood plains. They are characterized by light-brown to brown soils, and the presence in the subsoil of layers of light brownish-yellow, lighter-textured material, interstratified with heavier-textured layers of deeper-brownish color. The heavier types, in virgin areas, crack and form small to medium clods on drying. In cultivated areas, finer aggregates develop on drying, and upturned clods tend to break down as they dry out. These are first-bottom alluvial soils, subject to overflow. The material has been washed down from the various soils of the Rio Grande drainage basin. It effervesces freely with hydrochloric acid. The water-soluble salt content is low. Underdrainage is good, so that the land has good drainage between periods of overflows.

The northern part of the county is covered by the soils of the Victoria and Tiocana series. Three types of the Victoria series and one type of the Tiocana series were mapped.

The soils of the Victoria series are very dark brown to black, being somewhat darker in the heavier types. The heavier soils pass at about 12 to 14 inches into brown or dark-brown material and at about 20 to 24 inches into yellowish brown, and this quickly into brownish-yellow rather stiff clay. At about 30 to 40 inches the material is a yellowish-brown or brownish-yellow, more friable clay, locally con-

taining a moderate amount of sand, and passing quickly into yellow or cream-colored, somewhat chalky clay containing much soft, white, limy material, some of which is of a concretionary nature. The soil on drying breaks down to a granular or fine cloddy condition to a depth of several inches, with somewhat larger clods below the surface layer. Fields are easily maintained in good condition of tilth, the sandy types usually being quite friable. The heavier soils have a flat surface but the sandy types generally have a hummocky or billowy surface. The material usually effervesces freely with hydrochloric acid. It has a relatively low content of water-soluble salts. The soil material is derived from the light-colored calcareous substratum, its dark soil color is due to the organic matter accumulated under average conditions much more moist than those of the associated Hidalgo soils (not separated from the Victoria in Cameron County owing to small extent and patchy occurrence.)

The types of the Tiocano series are dark ashy-gray to black soils which extend to depths of 3 or 4 feet without much change, although in places there are brownish splotches at depths of 2 to 3 feet. These soils are associated with the Victoria and differ from them principally in that the dark-colored material extends to greater depths. They occupy depressions and flats of poor drainage, and the content of water-soluble salts averages higher than that of the Victoria. These soils are high in lime carbonate. When dry they are extremely tough; when wet they are very sticky and plastic. The material is derived from the underlying calcareous strata.

The Lomalto clay occupies, in the eastern part of the county, a position similar to that occupied by the Harlingen clay in the western and central part. It is much like the Harlingen clay in its general characteristics differing mainly in carrying a higher percentage of soluble salts than are found in the Harlingen clay.

The Lomalto soils are ashy-brown to dark-brown soils. In the clay type the subsoil below 10 or 14 inches is a brownish ashy-gray clay, which is tough when dry and sticky and plastic when wet. This passes at about 2 feet into yellowish-brown to chocolate-brown tough clay containing some whitish aggregates, and this in turn passes at about 36 to 50 inches into pinkish, plastic clay, showing in some places faint bluish mottling. The material is high in lime carbonate as well as water-soluble salts. Crystals of gypsum are of common occurrrence below about 3 feet. In some of the depressions the soil is black and very tough, and on many of the flats and some of the shallow depressions it is light ashy gray. The surface dries to a decidedly ashy-gray color and tends to crack into small clods. The lighter-textured soils are more yellowish in the subsoil, and the surface dries to a light-gray color and cracks less. These are typically prairie soils. They occupy low flat positions near the coast and are partly covered by salt water at times of high water forced in by protracted winds from the Gulf. The Lomalto soils in Cameron County do not have as much of the semimarsh character as the Harris soils of southeastern Texas, and they run higher in carbonates and water-soluble salts; but otherwise the two series represent essentially the same soil condition, i. e., they are very recent marine deposits.

The Point Isabel soils have an ashy-brown to brownish ashy gray color when dry. There are some thin seams through the vertical section of lighter ashy-gray sandy clay and of yellowish-brown very fine sandy loam, but otherwise there is not much change from the surface down to depths of 10 feet or more. The exposed surface cracks into hard clods which are very difficult to break down. The subsoil is specked with white salty material. These soils are high in lime carbonate and water-soluble salts. They occur as dunelike ridges on the windward sides of "valles saladas" (pl. 25). They have been formed by the blowing up of aggregate material from the bottoms of the dry depressions.

The "valles saladas," or "salty valleys," shown on the soil map by intermittent-lake symbols in the eastern part of the county, are usually covered with water during the winter and dry out during the summer. The material consists of yellowish-brown clay containing some sand, being often very sandy near the outer edges, with some bluish-gray or ashy-gray clay layers, and a chocolate-red clay substratum showing some rusty-brown and black concretions. When moist this material is extremely sticky. Crystals of sodium chloride give the surface a snow-white appearance.

Dunesand consists of pale-yellowish loose fine sand occurring on the coastal islands and in places near the beach on the mainland. The surface is hillocky and more or less fixed in places by the binding effect of salt-loving grasses. There are intervening salty flats (valles saladas), which dry out hard, and a shell-strewn beach of plastic clay immediately along the Gulf front.

All the soils within the delta part of Cameron County have a surface feature that is found to be universally present in soils that carry a considerable percentage of soluble salts. The soil map at the end of this report shows the percentage of soluble salts in a number of places in all of the important soil types. Yet if these determinations had not been made, the upper part of the soil section would have shown that a certain amount of salts is present.

The feature referred to consists of a thin surface crust on all the soils, ranging up to half an inch in thickness, underlain by a thin layer of loose granular material usually called the mulch. This feature is faintly developed on the Laredo clay but rarely on the fine sandy loam. On the Harlingen and Lomalto soils it is generally present and is practically universal on the Cameron clay. It is not usually present on the Victoria soils.

A mile northeast of Loma Alta Lake the crust and mulch together forms a layer about an inch in thickness. This is underlain by a heavy, dark-colored clay, with rather abundant salt spots or segregations, extending to a depth of 5 inches. Below this the material becomes brown and at about 30 inches somewhat sandy.

Four miles northwest of Point Isabel, on the Lomalto clay, the crust and mulch are about as well developed as at Loma Alta Lake, but the segregations of salts are noticeable to a depth of nearly 4 feet, becoming more abundant in the lower part. Below 4 feet the material becomes sandy and carries less salt.

A few miles northwest of the last locality the profile is practically identical with that just described, the salt segregations or spots, white in color, being abundant at 3 feet.

On a resaca 4 miles east of Los Fresnos, the crust and mulch and the salt segregations are not present. At a depth of about 20 inches the material becomes pinkish in color and somewhat more calcareous than higher up.

West and north of Harlingen, on the Victoria soils, the surface crust is not present and the profile is normal for a soil in the southern part of the zone in which lime carbonate increases in the soil. The surface soil is dark brown to very dark brown to 12 inches. Below this is a layer which becomes browner downward to a zone of carbonate accumulation at about 36 inches. In none of the area occupied by these more mature soils in Cameron County is there an indurated lime-accumulation zone. This is present a few miles north of Cameron County, but the deposits of even the older part of the county are not yet old enough to have developed this indurated horizon.

The relations between native vegetation and soils of the county is especially noticeable with respect to drainage conditions and alkali content. These characters are closely linked together. Textural and structural differences alone do not seem to alter appreciably the type of native vegetation.

For example, a sturdy dominant growth of medium to large mesquite and ebony trees, large chaparral, medium to large prickly pear, and an almost continuous cover of mesquite grass and other native pasture grasses, occurs on the soils of the Victoria series, which are well drained and consistently low in alkali content. Soils having poorly established drainage and medium alkali content maintain a growth of small mesquite trees, small to medium chaparral, prickly pear, and the moisture-loving huisache and retama trees. The mesquite grass cover is usually excellent on such soils. In soils having a high alkali content the only trees found are scattered small mesquites, or Spanish dagger if the drainage is fairly good. Under conditions of excessive alkali and very poor drainage only salt grasses, sacahuiste grass and alkali weeds are found.

The following observations relative to the vegetation on the soils of Cameron County were made by B. H. Hendrickson, of the Bureau of Soils, incidental to his work in connection with the soil survey of the county.

Victoria soils.—Trees dominant, consisting mainly of large mesquite and ebony (15 to 20 feet tall) with 15 to 20 per cent of large chaparral (5 to 8 feet tall). Some scattered prickly pear of medium height (2 to 4 feet). Continuous grass cover of mesquite grass and the taller wild pasture grasses. No open space. Land adapted to citrus fruit, vegetables, and farm crops, and to ranching.

Laredo soils.—Trees dominant, medium-sized mesquite and ebony mainly (8 to 15 feet high), with 20 to 30 per cent medium to large-sized green chaparral, including some white chaparral. Considerable medium to large prickly pear (2 to 8 feet tall). Mesquite grass mainly, covering about 50 to 75 per cent of ground space. Open space about 25 per cent. Adapted to citrus fruit and all usual truck and farm crops, and to ranching.

Cameron soils.—Trees dominant, medium-sized (8 to 12 feet tall), mainly mesquite, ebony and huisache, with 25 to 40 per cent medium-sized mixed chaparral growth (4 to 8 feet), green types predominating. Considerable medium-sized prickly pear (2 to 4 feet). Practically continuous mesquite grass cover. Little or no open space. Adapted to heavy truck, cotton, corn, and sorghums, and to ranching.

Harlingen soils.—Two distinct types of vegetation are found on this soil group, a small tree dominant, and a brush dominant type: (1) Continuous

small to medium mesquite trees (6 to 10 feet), with a thick undergrowth of small to medium-sized prickly pear (2 to 4 feet high), and continuous mesquite grass cover (good ranch pasture); and (2) a dense growth of small to medium-mixed chaparral (4 to 6 feet) and a thin mesquite grass cover. No open space. Adapted to shallow-rooted vegetables, cotton, and sorghum, under winter irrigation, or limited amount of summer irrigation.

Tiocano and Lomalto soils.—Two main types of vegetation are found on soils of this group, depending upon whether the alkali content is medium, or high to excessive: (1) Thickets of small trees (6 to 8 feet high) consisting of mesquite, retama, huisache, and willow, without shrubs or cacti, but usually a solid cover of mesquite or marsh grasses; and (2) 100 per cent salt and sacahuiste grasses, or alkali weeds, depending upon variations in the alkali content and drainage condition. Adapted to pasture only.

Point Isabel soils.—Scattered small tree growth (6 to 10 feet high) of mesquite trees and Spanish dagger, with some small to medium mixed chaparral (4 to 6 feet) and some small to medium prickly pears (2 to 4 feet). Also a scattering growth of mesquite and salt grasses. From 25 per cent to 75 per cent open space, depending upon alkali content and drainage conditions. Is second or third-class pasture or browsing land.

Dunesand.—Nearly devoid of vegetation. Scattering growth of drought-resistant salt grasses, sand grasses, and alkali weeds.

Rio Grande soils.—Large trees dominant, mesquite, palms, acacia, and many others. Some large green chaparral and prickly pear. Rank grass growth of mesquite and other taller pasture grasses. No open space. There is a great variety of trees, brush, and grasses on soils of this group. Adapted to winter and spring truck crops, potatoes, corn, and sorghum, and makes excellent pasture.

In subsequent pages of this report the soil types of Cameron County are described in detail and their relation to agriculture is brought out. Their distribution is shown on the accompanying soil map, and their extent is given in the table below.

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Lomalto clay	97,216	22.0	Tiocano clay	15,872	2.8
Light-colored phase	26,176		Point Isabel clay	14,080	2.5
Victoria clay loam	111,936	19.9	Rio Grande silty clay loam	12,544	2.2
Harlingen clay	65,472	17.9	Victoria sandy clay loam	11,648	2.2
Light-colored phase	24,512		Dunesand	10,752	1.9
Depression phase	6,144		Rio Grande very fine sandy loam	4,864	.9
Eroded phase	4,032		Rio Grande clay	4,672	.8
Laredo silty clay loam	66,112	11.8	Laredo fine sandy loam	3,200	.6
Victoria fine sandy loam	32,128	5.7			
Cameron clay	28,416	5.1	Total	561,280	
Laredo clay	8,768	3.7			
Deep phase	12,736				

VICTORIA FINE SANDY LOAM

The soil of the Victoria fine sandy loam consists of a dark grayish-brown to dark-brown fine sand or fine sandy loam to a depth of 10 to 15 inches. The subsoil is a yellowish-brown fine sandy clay extending to a depth of 36 inches or more. The lower subsoil is slightly lighter in color than the upper portion, which may be partly due to an abundance of lime accumulations. Soft lime concretions are abundant throughout the subsoil and increase with depth. When wet the soil frequently has an almost black appearance. Immediately beneath the plow depth the soil is rather compact in some places. The soil is loose and friable; the subsoil is slightly sticky when wet but crumbly when dry.

The Victoria fine sandy loam includes some small areas in which the fine sandy loam extends to a depth of 3 feet or more and is subject to slight drifting. There are also areas where lime accumulation is not noticed above 40 inches but increases with depth, and at 6 feet the subsoil is whitish from lime.

This soil is confined principally to the territory north of the Arroyo Colorado, with some unimportant areas between Jarratada Ranch and Laguna Atascoso. Large areas occur in the vicinity of El Pie Ranch and Tiocano. The surface typically is very gently undulating and occupies a slightly higher position than adjacent soils. The drainage is good.

Probably 5 per cent of the type is under cultivation. The remainder is covered with a rather dense growth of large mesquite trees, ebony, several kinds of chaparral, and prickly pear. Various native grasses are fairly abundant, the large and small crowfoot grasses being predominant. The white and pink Mexican poppies are also rather abundant.

The Victoria fine sandy loam is considered locally as the best citrus-fruit soil in the county (pl. 23, fig. 1). Cotton and citrus fruits are the important crops, although corn, vegetables, and melons are grown to some extent. This soil is probably the best producer among the regional soils in dry weather. The corn grown is usually fed on the farm; the other crops are sold.

VICTORIA SANDY CLAY LOAM

The surface soil of the Victoria sandy clay loam consists of a dark-brown sandy clay loam to a depth of about 10 to 15 inches, having an ashy grayish-brown appearance when dry but very dark brown to black when wet. The subsoil to a depth of 36 inches or more is a yellowish-brown or cream-colored, highly calcareous clay loam to clay. Soft whitish lime material, apparently of a concretionary nature, is encountered at about 10 to 24 inches and increases in quantity with depth. The lower subsoil is usually whitish from streaks of soft chalky lime material. The dry soil has a granular to small cloddy structure. In plowing the soil turns up in moderately large clods, but these break down easily with slight pressure or with exposure. The subsoil is moderately friable and is easily penetrated by plant roots. When wet the soil and subsoil are rather sticky. Included in this type are small areas that are typical Hidalgo sandy clay loam, but owing to their small extent they were not separated.

The Victoria sandy clay loam is confined almost entirely to that part of the county north of the Arroyo Colorado and occurs in rather small areas. The largest areas are at Combes, northwest of Santa Rosa, and south and southeast of La Feria.

The type has a flat to very gently undulating surface and usually occupies a position slightly higher than the clay loam. It is intermediate in position between the clay loam and fine sandy loam. The surface and internal drainage are fair to good.

This type is forested with a rather dense growth of chaparral, ebony, mesquite, and prickly pear, along with some cat's-claw. Various grasses of the coarser kinds grow on this soil.

The type is not of great agricultural importance, only a small part being under irrigation. About 5 per cent of the type is under cultivation; the remainder is used for pasture. This soil is utilized for cotton, corn, citrus fruit, and a small acreage of vegetables. The yields of citrus fruit are slightly lower than on the fine sandy loam, but the cotton and corn yields are somewhat larger. The soil is considered ideal for irrigation, as the water is absorbed readily and retained well.

VICTORIA CLAY LOAM

The surface layer of the Victoria clay loam consists of a very dark brown clay loam or heavy clay loam with an ashy-gray cast, especially on the dry surface; it is crumbly to about 3 inches and below this is a stiffer heavy clay loam. This passes at 5 or 6 inches into dark-colored clay and at about 12 inches into ashy-gray or dark ashy-gray stiff clay, which at about 40 inches passes into dark yellowish-brown stiff clay and at about 50 inches into yellowish-brown clay containing some sand and enough soft white lime material to impart a noticeable degree of friability. When wet the soil is almost black.

Some areas are dark grayish-brown to very dark brown clay loam, with a grayish cast on the dry surface, passing at about 8 to 12 inches into dark-brown clay with a grayish cast, and this at about 24 to 38 inches into yellowish-brown or light-brown clay, which passes at about 34 to 38 inches into yellowish cream-colored clay of a friable or chalky nature due to soft white lime material present.

In some areas, particularly in the vicinity of Riohondo, the soil is a dark-brown to black clay loam to a depth of 10 inches, and the subsoil is a light yellowish-gray or cream-colored clay, streaked with white limy material, which increases with depth.

The Victoria clay loam has a granular structure and pulverizes readily when dry. When wet it is sticky and slightly plastic. It plows up in rather large clods but breaks down into a fine seed bed.

This is an extensive soil. It is confined principally to the section north of the Arroyo Colorado, with a rather large development in the vicinity of Jarratada Ranch. Several smaller bodies lie between San Benito and Harlingen. The largest areas occur around La Feria and in the northwestern part of the county.

The surface typically is flat, and the surface drainage is rather poor. The underdrainage is good in most places. This type is retentive of moisture.

Owing to its large extent and productiveness, this is one of the most important agricultural soils of the region. About 15 per cent of it has been cleared of its native timber and is now under irrigation. Small areas are also farmed under dry-farming methods. The native vegetation consists of ebony, mesquite, chaparral, some scattered cat's-claw, and prickly pear. There is also a fair growth of rather coarse grasses, and some mesquite grass. The trees on this soil attain greater height and circumference than on the other soils of the upland section.

Cotton, corn, citrus fruits, potatoes, and cabbage are the principal crops grown. The land not under irrigation is utilized for ranching and will support 1 cow to about 15 acres. No general rotation is

followed, as corn and cotton are grown in the summer months and vegetable crops are grown in the winter months on a limited area.

Yields on this type could possibly be increased by the use of acid phosphate. The plowing under of leguminous crops and the addition of manure may be expected to improve yields. Some areas, particularly in the vicinity of Anaquitas Ranch, have become so high in soluble salt content that artificial drainage is necessary for their proper reclamation.

TIOCANO CLAY

The Tiocano clay consists of a dark ashy-gray to black clay, which extends to a depth of 3 to 4 feet without much change, although in places there are brownish splotches of sandy material at depths of 2 to 3 feet. When dry the soil is extremely tough, and when wet it is very sticky and plastic. In the more depressed positions the black or dark ashy-gray clay extends to a depth of 20 to 24 inches, where it is underlain by blue, sticky, dense clay.

The greater part of this type is mapped in small areas throughout the region occupied by the Victoria soils. There are, however, several rather large bodies northeast of Harlingen, southwest of Santa Rosa, and in the vicinity of Yescas Ranch and Anaquitas Ranch. The type occupies depressed positions in the areas of Victoria soils. The surface is flat and the drainage very poor.

All of the type is still covered with its native vegetation of mesquite, chaparral, prickly pear, salt grass, and other coarse grasses. It is valued only for pasture and will support one steer to about 8 acres.

Until an efficient drainage system is installed, this soil will be most suitable for pasture. Owing to its low-lying position it is doubtful if reclamation would be profitable.

LAREDO FINE SANDY LOAM

The typical Laredo fine sandy loam is a brown to dark-brown fine sandy loam, grading at about 14 to 16 inches into lighter-brown fine sandy loam. At about 24 to 28 inches yellowish-brown light fine sandy loam is encountered, which passes quickly into yellowish-brown fine sand or loamy fine sand, in places ranging close to loam. The soil is friable and the subsoil is loose and porous. The soil has considerable organic matter and is retentive of moisture. In places the surface soil consists of loose, fine sand and is subject to slight drifting by the wind. A few patches of very fine sandy loam have been included.

The type as mapped includes some small areas of Laredo loam. This consists of brown loam underlain at about 12 to 14 inches by brown silty clay loam, which extends to depths of about 18 to 20 inches. Below this a yellow very fine sandy loam is encountered. The soil is very friable, and the subsoil is porous and rather loose.

The Laredo fine sandy loam is inextensive, occurring in small areas in various locations south of the Arroyo Colorado. The largest bodies are at Heywood, 3 miles northeast of Brownsville, and north of Anaguas Ranch.

The type occupies positions slightly higher than adjacent soils. Its topography is very gently undulating to billowy. The natural drainage is good.

About 25 per cent of the type is under cultivation. Cotton, corn, and citrus fruit are the principal crops, with a small acreage devoted to vegetables. Vegetation is sparse, as on other Laredo soils. There is less grass and this is coarser. Cotton yields one-third to 1 bale per acre, corn 20 to 45 bushels, cabbage 3 to 6 tons, lettuce 150 to 300 hampers. Cowpeas attain good growth. The young citrus trees seem to be doing very well.

This soil is very much subject to "subbing" (accumulation of an excess of irrigation water in the subsoil because of inadequate drainage outlets), and several acres have been ruined by excessive salt accumulation. Owing to the open texture and structure of this soil, artificial draining should be comparatively easy and work efficiently. The plowing under of green manures and application of acid phosphate would possibly give increased returns.

LAREDO SILTY CLAY LOAM

The Laredo silty clay loam consists typically of a brown heavy silty clay loam passing at about 8 to 10 inches into slightly lighter brown silty clay, which grades at about 12 to 15 inches into grayish-yellow or pale brownish-yellow, friable or rather chalky silty clay loam. Below about 24 to 28 inches it is a pale brownish-yellow very fine sand, passing at about 40 inches into brownish-yellow silty clay loam, which is underlain at about 48 inches by dark-brown clay, specked with white, soft material apparently consisting of segregated lime. In the virgin state this type has a surface crust about one-fourth inch in thickness. Beneath this the soil is crumbly and granular to depths of 12 to 18 inches. The soil is very friable and only slightly sticky when wet; it plows up granular and forms a good seed bed.

This is one of the most important types in the county from the standpoint of potential value. There are several large areas in the vicinity of Barreda and Olmito adjacent to Resaca del Rancho Viejo and Resaca de los Cuates. There are also large bodies at Rangerville, Santa Maria, southeast of Brownsville and northeast of Los Fresnos.

The Laredo silty clay loam occupies a natural levee position and is higher than the adjacent soils. The surface is smooth with a gentle slope away from the resacas. The drainage is good, but owing to the open nature of the subsoil it is subject to "subbing" and consequent injury by accumulation of alkali salts.

The native growth consists of dense mesquite, ebony, chaparral, brazil, guayacan, allthorn, and prickly pear, with a sparse covering of grasses, mainly mesquite and nut grass. In places there is an impenetrable growth of chaparral and prickly pear, with a scattered tree growth.

Probably 15 to 20 per cent of this soil is under cultivation to all the crops grown in the region. The principal crops are cotton, cabbage (pl. 23, fig. 2), lettuce, and citrus fruit, with a small acreage devoted to all the other crops. The area remaining in timber is used for pasture and supports one head to 20 acres. Cotton yields

from one-fourth bale to 1½ bales per acre, according to reports, corn 20 to 60 bushels, potatoes 40 to 125 bushels, cabbage 4 to 7 tons, citrus fruit about 150 boxes on 7-year-old trees and 150 to 250 on older trees. Lettuce sometimes yields 400 to 500 hampers, beans 100 to 200 hampers, broomcorn one-fourth to three-fourths ton, and spinach 150 to 300 bushels.

The principal problem with this soil seems to be the prevention of "subbing." There are many acres which have been ruined for agricultural cultivation for the present or until an efficient drainage system has been installed to prevent the "subbing." This soil appears to be one of the best in the valley where the drainage conditions are favorable. Applications of acid phosphate might give increased yields of some crops, since there appears to be an excessive leafage growth. This is especially true of cotton.

LAREDO CLAY

The Laredo clay consists of a brown clay, which, when dry, has a small-cloddy structure; at about 8 inches, where there is more moisture, the clods are larger. At about 12 to 14 inches the material is light-brown friable clay, which passes at about 18 to 22 inches into yellowish-brown stiff clay containing white lime material. At depths of 28 or 30 inches yellowish-brown friable silty clay loam and at 36 inches yellowish-brown friable very fine sand are commonly encountered. This coarser material is underlain at a depth of about 4 feet by pinkish heavy clay, with an abundance of white lime concretions. The soil is sticky and plastic when wet but tends to assume a fine granular condition on drying. On plowing rather large clods turn up, but these soon break down on exposure to either air or rain water. This type does not crack so badly as the Cameron and Harlingen clays.

The Laredo clay is unimportant and occupies only a few areas. The largest area lies southeast of San Benito. Other large areas lie near Los Fresnos, Los Indios, and Las Rucias. Generally the type has a very gently undulating to flat surface. Both the surface drainage and underdrainage are fair to good, where not retarded by seepage water. Excessive "subbing" sometimes takes place, if adequate drainage outlets are not provided.

The virgin vegetation consists of a dense growth of chaparral, mesquite, ebony, Spanish dagger, and prickly pear. In the open spaces between the tree and brush vegetation a carpet of mesquite grass and several other coarser grasses is commonly present.

Not over 5 per cent of the type is under cultivation. Cotton, corn, and cabbage are the crops grown, with reported yields of one-fourth to three-fourths bale of cotton, 25 to 35 bushels of corn, and 4 to 6 tons of cabbage per acre.

The virgin soil does not contain an excessive amount of alkali except where influenced by irrigation. Under present methods of irrigation a rather large acreage has become impregnated with water-soluble salts. These salts probably can be eliminated by thoroughly draining and flooding. The addition of manure and acid phosphate might increase the yields.

Laredo clay, deep phase.—The deep phase of the Laredo clay consists of chocolate-brown, more or less friable clay loam, underlain

at 2 inches by chocolate-brown clay, which passes at about 40 inches into light-brown, yellowish-brown, or yellowish chocolate brown silty clay loam, and this at about 50 inches into light yellowish brown very fine sandy loam. In places, particularly between San Benito and Nopalton, the surface soil has a decidedly chocolate-red color, but the subsoil conforms to the prevailing condition.

This phase is rather extensive. The largest body is adjacent to the Fresnos Resaca, extending from San Benito to 6 miles southeast of La Feria and north of Rangerville. Several other well-defined areas are in close proximity to the Fresnos Resaca.

Probably 25 per cent of the phase is under cultivation. The remainder is used for pasture and supports a dense growth of chaparral, ebony, mesquite, Spanish dagger, and prickly pear. The phase occupies the same general topographic position as the typical soil. The underdrainage is not so good.

Cotton, cabbage, lettuce, corn, and citrus fruit do very well, although citrus fruit does not do so well as on a lighter type. Cotton yields one-fourth to 1 bale per acre, corn 25 to 50 bushels, lettuce 250 to 400 hampers, and cabbage 4 to 9 tons. The principal problem with this soil seems to be keeping the water table below 6 feet. This can be done by stopping the seepage water at its source.

CAMERON CLAY

The Cameron clay consists of a nearly black clay to a depth of 14 to 18 inches. On drying this assumes an ashy-gray color on the immediate surface, breaks into small and fine clods in cultivated fields, and cracks into medium clods in uncultivated areas. The subsoil is a dark-brown clay, grading at about 20 inches into yellowish-brown silty clay loam or silty clay and at about 24 to 28 inches into brownish-yellow or light yellowish-brown clay, which is sticky and plastic when wet and contains some whitish lime concretions. In places the type consists of brown clay grading at about 4½ feet into lighter-brown or grayish-brown clay. As a rule the substratum below depths of 5 or 6 feet is a brownish-yellow fine sandy clay. The soil dries out to a depth of about 2 feet and cracks into large clods, which break under blows into medium to small clods.

Some areas consist of brown clay to a depth of 24 inches, grading into lighter-brown clay and at 30 to 36 inches into light-brown, yellowish-brown or dark yellowish-brown clay containing some whitish lime concretions, this passing at about 5½ feet into brownish-yellow fine sandy clay loam. East of Blalack the soil consists of dark-brown to very dark brown clay, underlain at 14 to 16 inches by brown clay, grading at about 20 inches into yellowish-brown silty clay loam, and this at 24 to 26 inches into yellowish-brown heavy very fine sandy loam, with brown heavy plastic clay at 3½ feet.

This type occurs in rather large areas south of the Arroyo Colorado. The principal areas are at Olmito, south and west of Tandy and southeast of Brownsville.

The type is generally flat, with only a gentle slope. It occupies positions intermediate between the Laredo soils and the light-colored phase of the Harlingen clay. The drainage is poor.

A very small proportion of this soil is under cultivation. It is covered rather densely with mesquite, retama, huisache, chaparral,

and prickly pear, and a good covering of mesquite grass and in places salt grass and other coarse grasses. Cotton and corn are the only crops grown. Corn yields from 10 to 30 bushels per acre, and cotton averages about one-fourth bale per acre.

Apparently this is a good soil under favorable conditions, but owing to accumulation of alkali salts and poor drainage a large acreage has been abandoned. By installing an efficient drainage system and flooding it is probable that this soil could be made very productive.

HARLINGEN CLAY

The Harlingen clay consists of ashy-gray to dark ashy-gray clay, which, when moderately dry, is crumbly to a depth of 3 or 4 inches, where the moist ashy-gray to dark ashy-gray plastic clay is reached. This contains some white lime concretions at about 2 feet and at about 32 to 36 inches passes into lighter ashy-gray, plastic, sticky clay. At 4 or 4½ feet the color of the plastic, sticky clay changes to yellowish gray or ashy gray. Some lime concretions are present throughout the subsoil and substratum. The soil has a slight brownish cast when moist, but the immediate surface dries out to the color of wood ashes. The subsoil is very tough above the wet sticky clay.

In places the soil has a brown to slightly dark brown color, with an ashy cast, and in cultivated areas has a crumbly structure while in the moderately moist condition. With increase in moisture content the clay becomes plastic and finally sticky. The moist subsoil at depths of 14 to 16 inches consists of light-brown plastic clay, and this grades at about 24 to 30 inches into chocolate-brown clay, which extends to depths of 4 to 6 feet without any important change. The immediate surface soil of this brownish variation dries out to the dark ashy-gray color of the Laredo soils, but the coarser substratum of the Laredo is not present. In some areas south of Harlingen the dry soil is a brown crumbly clay with an ashy cast. This passes at about 12 to 15 inches into brownish ashy-gray clay, which when moist is plastic at about 2 feet. At depths of about 36 to 40 inches yellowish ashy-gray, moist, plastic clay containing a few lime concretions is reached, and this extends to 6 feet or more.

The Harlingen clay is one of the most extensive soils in the county. It occurs in both large and small areas. The largest bodies are found at Harlingen, from Santa Maria to San Benito, and northeast and west of Olmito.

The topography is characteristically flat to nearly level, and the drainage is imperfect to very poor. In some places the water table is reached at 2 feet below the surface.

Possibly 20 per cent of the Harlingen clay is under cultivation; the remainder is covered with mesquite, prickly pear, ebony (in places), and a dense growth of white chaparral ("ceniga" or "chaparro blanco"). Cotton and corn are the principal crops grown. Citrus fruit has been tried but has not given satisfaction. Cotton is said to yield from one-fourth bale to 1 bale, and corn from 25 to 40 bushels, with reported yields of 75 bushels. Some Rhodes grass is grown (pl. 24, fig. 1). Small patches are devoted to cabbage, lettuce, beets, and carrots in winter months, with good yields.

This type could be greatly improved by draining. At present the alkali salts have become so concentrated in some areas that economic crop production is impossible. Applications of acid phosphate to areas comparatively free of alkali might give good returns.

Harlingen clay, light-colored phase.—The light-colored phase has a surface layer of ashy-gray clay, with a small-cloddy structure when dry. Below the dry surface, that is, in the moist clay, reached ordinarily at 2 or 3 inches, the clay is broken into larger clods and the color is brownish ashy gray. At about 12 to 14 inches wet, plastic, sticky, ashy-gray clay is encountered. Below about 2 feet a brownish tinge comes in, giving the clay a brownish ashy-gray color. This grades at about 40 to 50 inches into pink or salmon-colored clay containing some specks of whitish material, with a decidedly salty taste, and a little gray mottling. When dry, some areas crack deeply. These usually consist of ashy-gray clay slightly darker below the dry surface layer of hard clods, continuing downward as a very tough clay containing a few whitish concretions to depths of about 30 inches, where lighter ashy-gray clay comes in. At about 36 inches the color is a slightly yellowish ashy gray, and at about 48 inches slightly pinkish, although still showing a grayish cast.

This phase is rather extensive in Cameron County, occurring in several large areas, such as that 3 miles east of San Benito. The surface is flat and level, with practically no natural drainage. This soil occupies the lowest positions between the resacas. Most of it is covered with mesquite, retama, huisache, and prickly pear, all of rather stunted growth. A good growth of mesquite grass comes in on cleared land.

A small acreage only has been put into cultivation. The results have been poor, with some complete failures. Sorghum seems to give the best results of the crops tried. A 5-year-old citrus orchard was observed to be declining rapidly. Cotton and corn are usually poor, often failing completely.

Probably this land can be utilized most economically for pasturage, with possibly a small acreage devoted to sorghum.

Harlingen clay, depression phase.—The depression phase consists of ashy-gray clay passing at about 30 or more inches into lighter ashy-gray clay. The soil when dry cracks deeply into large clods. The dry soil is hard and difficult to bore into. In the more poorly drained places the soil is a dark ashy-gray to black, stiff, plastic clay to 20 or 30 inches, where it is underlain by dark-bluish, sticky, plastic clay.

This phase occurs only in small areas throughout the territory south of Arroyo Colorado. It occupies depressions along the resacas. The drainage is imperfect to very poor. The vegetation is mainly huisache and retama, with some tule and coarse grasses. This soil has no agricultural value except as pasture land. Owing to its low-lying position it is doubtful whether it could be profitably reclaimed.

Harlingen clay, eroded phase.—The eroded phase has the same profile characteristics as the typical Harlingen clay, differing only in the dissected condition resulting from the abundance of small streamlets that cut across it to enter the Arroyo Colorado. The gullies are mostly deep, with steep sides.

Such eroded land occurs only along the Arroyo Colorado, extending from the western county line to south of Riohondo. The strip varies in width from a few yards to a mile or more. The soil has the same growth as the typical soil, with possibly more ebony. It has no agricultural value because of the unevenness of its surface.

RIO GRANDE VERY FINE SANDY LOAM

The Rio Grande very fine sandy loam consists of about 15 inches of yellowish-brown to grayish-yellow very fine sandy loam, underlain by pale-yellow or yellowish-gray very fine sandy loam, which extends to depths of 36 inches or more. In places both the soil and subsoil consist of grayish-yellow very fine sand 3 feet or more deep; in other places the subsoil is interstratified with very fine sand and silty clay or silty clay loam of light-brown color.

This soil is very small in extent. The largest areas are those lying south of Alcala and west of San Pedros Ranch. The surface is hummocky in most cases. Some areas have a billowy appearance. The drainage is good. The vegetation is the same as on other Rio Grande soils.

The type is used for production of potatoes, cotton, corn, and vegetables for home use. The yields are practically the same as on the silty clay loam type.

RIO GRANDE SILTY CLAY LOAM

The Rio Grande silty clay loam consists of light-brown silty clay loam, passing at about 8 to 16 inches into light-brown to grayish-yellow very fine sand or very fine sandy loam. Some areas consist of a light-brown, rather heavy silty clay loam, underlain at 14 to 16 inches by brown silty clay loam extending to depths of 3 feet or more before entering the lighter-textured material. The dry soil plows up in medium-sized clods, but these crumble down to a fine granular condition on exposure to air or rain. The subsoil is very friable. The surface dries out to a brownish-gray color. In places the soil is a light-brown silty clay loam, hard when dry, with a thin sublayer of light-brown silty clay, and underlain at about 8 inches by light brownish-yellow very fine sandy loam, which extends to depths of 3 feet or more.

This soil is the predominant type in the first bottoms of the Rio Grande. It occurs in rather large areas from the westerly county line to the salt prairie east of Brownsville.

The surface is typically flat and nearly level. Locally it is billowy or slightly hummocky. The drainage is good, especially the underdrainage. The water table usually stands at about the average level of water in the river. The land is subject to overflows except where protected by levees.

The predominant vegetation is hackberry, willow, sabal palm (pl. 24, fig. 2), wild cane, reynosia, and acacia, with some ash and elm and numerous vines.

The greater part of this soil is under cultivation, mainly to cotton, corn, potatoes, and vegetables. It is recognized locally as being the best potato soil in the county. Corn yields 40 to 75 bushels, according to reports, cotton one-half bale to 2 bales per acre, and potatoes 75 to 200 bushels. Other crops yield well. The soil is very productive, receiving annual enrichment by deposits from overflow water.

RIO GRANDE CLAY

The Rio Grande clay consists of a brown silty clay, which shows little change to depths of 36 inches or more, before reaching the substratum of sandy material. In places the soil is a brown silty clay or silty clay loam showing little change down to about 24 inches, where a thin layer of brownish-yellow very fine sand is encountered; below this the brown silty clay extends to about 36 inches, where another layer of very fine sand comes in. When this soil is dry it becomes rather hard at the surface, and below about 6 inches spades up into fine to small clods.

This soil is not extensive. It occurs in first bottoms of the Rio Grande. The largest areas are at Bluetown, Carmen Ranch and near Brownsville. The surface is flat to slightly depressed below the level of the Rio Grande silty clay loam. Drainage is good.

The vegetation is the same on this soil as on the Rio Grande silty clay loam. The greater part of the type is under cultivation to cotton and corn. Cotton yields one-fourth bale to 1¾ bales, and corn 30 to 60 bushels per acre.

LOMALTO CLAY

The Lomalto clay typically consists of dark-brown clay, grading at about 10 to 14 inches into brownish ashy-gray, tough clay, which is plastic when moist. At about 2 feet this passes into yellowish-brown, tough, plastic clay, containing some whitish concretions. Gypsum crystals are found as a rule below the 3-foot depth. Below about 4 to 4½ feet the material is a pinkish, plastic, heavy clay with faint bluish mottlings and containing gypsum crystals. The immediate surface dries to an ashy-gray color, and the soil cracks to 2 feet or more when dry. The dry cracked soil consists of small clods up to about 2½ inches diameter, with larger clods beneath.

Included with the type are some areas of yellowish-brown fine sandy clay loam, underlain at 1 to 2 inches by salmon-colored clay, plastic when moist, and containing some yellowish mottling. This passes at about 2 feet into light-pinkish plastic clay with a little bluish mottling, and at 3 feet some fine sand is present in the clay, also some whitish salty material. This variation occupies a slightly elevated position, with incipient clay dunes near by along the edge of broad basins. There are also slight depressions in which the soil consists of black clay passing at about 2 feet into dark ashy-gray clay and at about 30 inches into wet, plastic, ashy-gray clay. This black color is probably due to a heavy growth of vegetation under abnormally moist conditions.

The Lomalto clay is very extensively developed, occupying practically all of the coastal prairie section in the eastern part of the county as immense flats. The surface is flat and level. There is practically no drainage, and the soil remains wet through the greater part of the year.

The type is covered with a dense growth of sacahuiste grass and a few very small mesquite bushes and alkali weeds. It is utilized for pasture only, supporting about one head of cattle to 30 or 40 acres.

There are some included areas of Lomalto fine sandy loam, which consists of yellowish-brown fine sandy loam grading at about 14 to

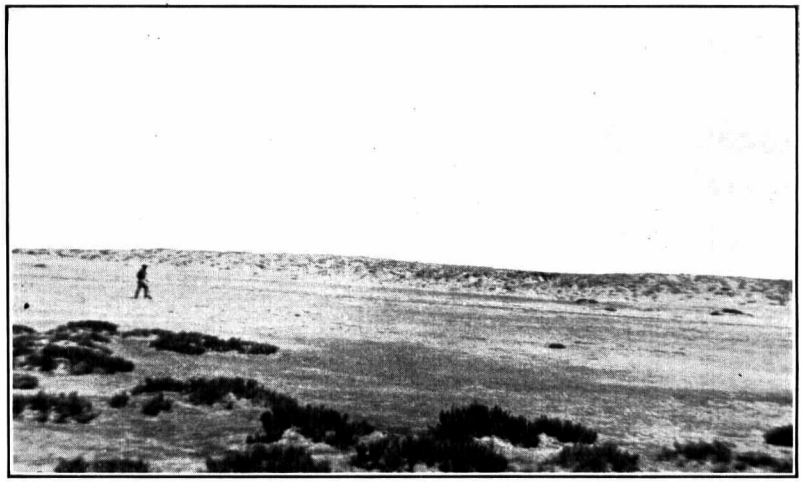


FIG. 1.—DRY SALT LAKE BED (VALLE SALADA); CLAY DUNE OF POINT ISABEL CLAY IN BACKGROUND

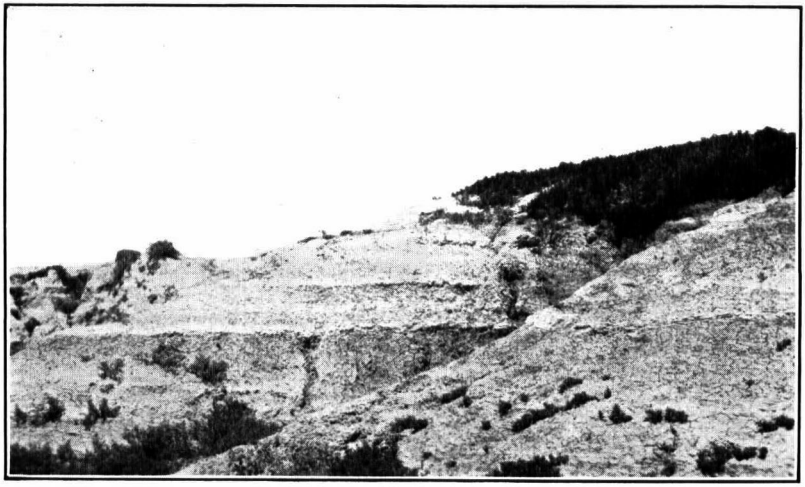


FIG. 2.—CLAY DUNE (POINT ISABEL CLAY)

Showing stratification of clay with very fine sand and very fine sandy loam

16 inches into yellowish-gray fine sandy clay, very sticky when wet. At about 28 inches it passes into pale yellowish-gray, heavy fine sandy loam to fine sandy clay loam, containing lime concretions and some faint mottlings of yellowish gray. The surface dries out to light gray. This soil occurs in a few small areas north and northwest of Loma Alta Lake. The surface is flat to slightly billowy, and the drainage is poor. This soil is covered with salt-loving vegetation and is utilized for pasture.

Lomalto clay, light-colored phase.—The light-colored phase of the Lomalto clay consists of a surface layer of ashy-brown clay, which cracks into small clods when dry. This passes at about 8 inches into ashy-gray clay, which is usually moist and plastic and contains whitish salty material irregularly distributed through it; at about 40 inches gypsum crystals and small black concretionary material occur; and at about 4½ to 5 feet plastic clay, mottled pink, ashy gray, and yellowish brown, is encountered. In places the soil consists of yellowish-brown, friable clay, which dries off to an ashy cast, passing at about 8 to 10 inches into ashy-gray clay containing some small specks consisting of yellowish and whitish salt. At about 30 inches plastic clay, mottled yellowish brown, gray and pinkish, is reached. Crab holes and chimneys are numerous.

This soil occurs in rather large areas in the coastal prairie section, occupying the beds of lakes, some of which are known as "valle saladas." The largest area is that occupying the bed of Tule Lake. During seasons of heavy rainfall the soil is covered with water. The surface is level and there is no chance for drainage.

Some of the areas are separated by low, faint ridges covered by brown fine sandy loam, with an ashy-gray sticky clay subsoil. These have the appearance of former beach lines.

This soil supports some flesh-colored salt weeds and a shrublike weed with sharp-pointed leaves. The alkali content runs up to 2½ per cent or more. The land is without value except for very meager grazing.

POINT ISABEL CLAY

The Point Isabel clay is an ashy-gray clay with a decidedly brownish cast immediately below the surface and inside of the clods formed when the soil dries. Beneath the immediate surface the color is slightly lighter, but no great change takes place from the surface down. The clay cracks on drying to small and medium-sized clods. Snail shells are abundant on the surface and also are present throughout the soil profile. Stratification is rather uncommon in the type. However, in an area 5 miles west of Point Isabel the soil is an ashy-brown fine sandy clay, with an abundance of white salty material irregularly distributed over the dry surface, underlain at about 10 inches by slightly darker ashy-gray clay containing white salty material, this extending to about 24 inches, where a layer of about 1 inch of yellowish-brown very fine sandy loam overlies brown clay, which dries out to an ashy-gray color and passes at about 40 inches into lighter ashy-brown fine sandy clay loam and at 46 to 48 inches into brown to ashy-gray clay containing some sand. The clay layers dry to an ashy-gray color and break into hard, fine and small clods, and contain segregated salt material.

The strata vary in thickness and slope gently down from the lake margins along which the type occurs.

The Point Isabel clay is restricted to the coastal prairie country in the eastern part of the county. The most prominent areas are along Loma Alta Lake and 5 miles west of Point Isabel.

This type really represents clay dunes, whose formation is due in part to wind action. Predominantly the clay-dune country is flat, with a gradual upward gradient inland, but there are many very shallow depressions through it. The most conspicuous depressions are the valles saladas or salty valleys. These are characterized by flat bottoms which are covered by water during the wet seasons, drying up in the dry seasons (pl. 25, fig. 1). The material is very salty, and, in drying, assumes a fluffy or highly granular structure, so that particles of aggregated material are picked up readily by the wind, rolled along, and swept up usually along the northerly sides of the depressions to form dunes, which in many places stand 25 feet above the bottom of the valles saladas. They are decidedly steep on the windward side and slope off gradually on the lee or northerly side (pl. 25, fig. 2).

This soil is nearly free of vegetation except for a scrubby growth of screw bean, mesquite, Spanish dagger, prickly pear, jaguar, and chaparral. The topography is ridgelike. The surface drainage is excessive but underdrainage is slow. None of the soil is under cultivation. Its only present value is for pasture.

DUNESAND

Dunesand consists of pale-yellowish, loose fine sand of dune topography, that is, hillocky, with intervening flats. Water stands at times over the flats; at times they dry out and harden. They are quite salty and represent a type of valle saladas. A species of sacahuiste known as "aspgia" grows on many of the dunes. Dunesand is rather extensive. It occupies the whole of Padre and Brazos Islands and a considerable area north of the Rio Grande. It has no agricultural value aside from the scant grazing afforded

IRRIGATION

Irrigation was first practiced in the county about 1890, when Louis Burley installed a small pumping plant on the banks of the Rio Grande on his plantation south of Brownsville, and successfully produced cotton and sugar cane under irrigation. The first irrigation system of any magnitude was constructed about 1902 by an irrigation company near Brownsville. Irrigation development in the county has been continuous since 1904.

Following the advent of the St. Louis, Brownsville & Mexico Railway in 1904, there was an influx of promoters and speculators. Many of the "porciones" and larger land grants were purchased at nominal sums, and irrigation systems were constructed to give them agricultural value. All the new projects were built on the same general plan. Pumping plants were installed on the river banks and the water raised into canals running back into the county. To reach the second or higher bench lands additional pumping plants were in-

stalled at "relift stations." No comprehensive plan of development was undertaken, and there was no cooperation between the promoters. Each promoter constructed an independent system, the object nearly always being to get the water on the land at the lowest possible first cost, and dispose of the land as quickly as possible. Most of the original owners of these enterprises met with financial disaster, and it has been necessary for the settlers to organize irrigation districts and take over and operate the systems. The average operation and maintenance cost in 1920 is said to have been $12.50 per acre of land irrigated.

According to the United States census there were 29,439 acres irrigated on 314 farms in 1909, and 60,008 acres irrigated on 871 farms in 1919. In 1920 there were 17 independent irrigation enterprises in the county, comprising 23 pumping plants, 140 miles of main canals, and 456 miles of laterals. The total horsepower of the pumping plants was reported as 5,847 in 1920, with a total pumping capacity of 887,212 gallons per minute. The average lift is 15 feet. Capital invested in irrigation enterprises was given as $3,108,489 in 1920.

According to canal company records, there are six irrigation districts comprising 164,404 acres, about 60 per cent of this area being actually irrigated at the present time (1923). In addition one other cooperative irrigation system supplies about 4,000 acres, and several small pumping plants supply water to river-bottom land estimated as additional 2,100 acres.

The average flat rate for Cameron County's irrigation districts at present (1923) is $2 to $3 per acre per year, for all the land in the district capable of producing crops, whether irrigated or not; sinking-fund cost, $1 to $1.75 per acre per year; watering, $1 to $1.50 per acre.

The entire water supply for irrigation in Cameron County comes directly from the Rio Grande. The discharge of the upper river is regulated by the Elephant Butte Reservoir, and practically its entire flow above that point is used for irrigation in Colorado, New Mexico, and the El Paso Valley of Texas. The principal tributaries below Elephant Butte Reservoir are the Pecos and Devils Rivers from the American side, and the Conchos, Salado, and San Juan Rivers from the Mexican side. Mexico contains about 63 per cent of this watershed area. Up to the present time there has been an ample supply of water in the river to supply all needs, although occasionally, at low-water periods of the river, it has been difficult to keep the pumps supplied.

During the 13 years of record of discharges the two tributaries from the United States contributed about 16.5 per cent of the total run-off and the three Mexican streams furnished 52.7 per cent, the other 30.8 per cent coming from the remainder of the catchment basin. The Pecos and Devils Rivers run-off is made up of a small fairly uniform discharge from springs along their courses and floods that may come, usually in the summer. The Rio San Juan and Rio Salado supply large quantities of water to the Rio Grande. Their contributions are principally in the form of short violent floods. For the 13 years of record, it appears that the flood flow from these streams was 92 per cent and 87 per cent, respectively, of their total run-off.

The Rio Grande is an international stream, the center of its deepest channel being the boundary line between the United States and Mexico. Under terms of existing treaties neither country can construct any work that may impede or interrupt its navigation without the consent of the other, so that no storage or diversion dams can be built across its channel except by mutual agreement between the two Republics. At the present time the area irrigated on the Mexican side is negligible. An agreement between the two nations for joint development of storage water and its equitable distribution would stabilize irrigation development on both sides of the river and reduce the danger of recurrent floods to a minimum.

The water of the Rio Grande does not contain enough soluble alkali salts to injure plant growth. In 1920 a number of samples of river water were collected by the United States Reclamation Service and analyzed by G. S. Fraps, State chemist of Texas. These samples were taken during drought periods. The following table, compiled from tables G and H, in the manuscript of the "Report on the Lower Rio Grande project, Texas," made by the United States Reclamation Service in 1921, gives results of analyses made by Doctor Fraps of the samples taken in 1920 and of six samples collected by him in earlier years.

Chemical analyses of irrigation water

[Parts per million]

Sample	Date	$CaCO_3$	$CaSO_4$	$CaCl_2$	$MgCO_3$	$MgSO_4$	$MgCl_2$	Na_2SO_4	NaCl	Total
Drain ditch south of San Benito	1920	165	160	0	0	185	0	41	446	997
Arroyo Colorado, 1 mile southeast of Harlingen, low water	1920	188	916	0	0	359	254	0	2,459	4,176
Arroyo Colorado at Rio-hondo, low water	1920	182	962	0	0	624	312	0	3,615	5,695
Fresnos Resaca, 2 miles north of San Benito, above dam	1920	140	202	0	0	200	0	30	479	1,051
Resaca del Rancho Viejo, 3 miles south of San Benito, above dam	1920	145	153	0	0	174	11	0	393	876
Drain ditch, ¼ mile west of San Benito	1920	238	187	0	0	253	0	124	325	1,127
San Benito Gravity Canal	1920	130	172	0	0	158	48	0	376	884
Drainage, Fresnos Resaca, 7 miles east of San Benito	1920	85	668	0	0	123	312	0	1,371	2,559
Tile drain from water-logged farm, 2 miles north of San Benito	1920	317	1,132	0	0	1,216	0	50	4,818	7,533
Drain ditch from Tule Lake district, 15 miles southeast of San Benito	1920	87	1,251	0	0	408	926	0	5,445	8,117
Well at Point Isabel	1920	312	0	0	129	195	37	0	553	1,226
Seep well, northeast of Brownsville on edge of resaca	1920	360	452	0	0	281	330	0	394	1,817
River 15 feet below bank	1908 Mar. 1 to Apr. 23	110	190	0	0	140	0	117	401	958
River 7½ feet below bank	do	225	9	107	0	0	131	0	0	472
River bank full	do	404	261	4	0	0	62	0	56	787
Lowest stage of river	1908 Dec. 18	91	216	0	0	95	74	0	229	705
River 17 feet below bank	1909 May 2	160	78	0	0	275	0	0	407	920
Lowest stage of river in 3½ years	1910 Mar. 14	135	88	0	0	240	0	60	370	893

Professor Gow found from June, 1893, to June, 1894, that the Rio Grande averaged 22,606 pounds of silt per acre-foot of water, which contained 31.4 pounds P_2O_5, 325.5 pounds K_2O and 24.4 pounds N.

For irrigation water, 5,000 parts per million of soluble alkali salts have generally been taken as the extreme limit of endurance for plants, while 2,500 to 3,000 parts per million mark the danger point at which results from the use of water are very uncertain.

The pumping plants of the first bench are at the river bank, the pumps being located in concrete pits about 10 feet below the general surface of the ground. Suction pipes extend into the river or the dredged channels that have been rendered necessary by a change in the course of the river. The discharge pipes lead to a discharge basin, usually concrete, that empties into the supply canal or settling basin, from which the canal carries the water to the land or to the foot of the next bench, where the same procedure is repeated. Distribution is made through gravity canals and laterals, the bottoms of which are near the general level of the ground, the banks being built up from narrow pits on both sides of the channel.

On the farms the furrow system of irrigation is used almost exclusively, the slopes being gentle enough, as a rule, to permit running the water down furrows in the direction of greatest slope. Citrus orchards are frequently irrigated by the basin system, that is, water is carried by small-field laterals between alternate rows of trees and introduced into basins around each tree, small border ridges having been thrown up to retain the water. In some orchards underground pipes, usually of concrete, are used to distribute water.

Up to the present time no record has been kept of the quantities of water delivered to the farmers. Consequently more than enough for a satisfactory watering is commonly used, and little attention is paid to economy in the use of water, or prevention of waste water, which finds its way along roadsides and accumulates in low places, to the detriment of lower-lying lands. As no measurements of quantities of water used to produce crops are available, the water duty for different crops and different soils is unknown. It is estimated that from 2 to 3 acre-feet is used for most crops. Less is required to produce cotton.

Irrigation development in Cameron County has included only a part of the irrigable lands. Many large tracts suitable for irrigation remain as cattle, sheep, and goat ranches, on which some corn, sorghum, and occasionally cotton are grown under dry-farming conditions.

On the lower areas of river-bottom land, which are flooded by high water, no irrigation is required. On the higher areas, levees are constructed for protection against floods, and small pumping plants installed at the river bank to supply the near-by fields. It is stated that the bottom land of the Rio Grande series requires more water to raise a crop than is necessary on the upland soils.

There is an organized movement in favor of gravity irrigation for the entire valley, the irrigation of the whole project to be considered as a unit. The United States Reclamation Service has made preliminary investigations and a report, but in view of the large amount of capital invested in pumping plants and the present canal systems, it is problematical whether or not a gravity system will be constructed.

DRAINAGE

Drainage is notably poor in the county as a whole. As the slope of the delta is away from the river, no tributaries enter it in Cameron County. The coastal plain likewise slopes gradually in a northeast

direction, away from the river, consequently none of its drainage waters find their way into the river. Both delta and coastal plain reach a low elevation near the coast line, and meet the low coastal flats which slope very slightly toward the Laguna Madre.

There are no well-defined natural drainage ways in the county aside from the Arroyo Colorado, which is a deeply cut flood channel heading near Mercedes, in Hidalgo County, and extending through Cameron County to the Laguna Madre. The bottom of this channel has been cut below sea level, and salt water stands in it as far upstream as Harlingen. As its banks are 10 to 40 feet high, many short deep gulches have been cut by erosion along its course, forming a narrow belt of dissected land, a mile across in places.

The slope of the river-bottom lands being away from the river, the run-off waters pond back, generally near the higher bank, but soon disappear by evaporation and by downward percolation through the sandy subsoil and substratum.

The run-off from rainfall in the delta proper finds its way by sheet flow into the low basins and flats between the higher natural levee ridges built up by old river or distributary channels, locally termed resacas. Prior to the construction of drainage ditches, numerous shallow lakes formed in these basins and retained water during the greater part of the year, but at present the system of drainage ditches removes much of the ponded water. On the coastal plain the run-off collects in rather numerous shallow depressions and low areas, the excess moving in poorly defined channels over the flattish country in a general northeast direction toward the lowlands bordering the coast. In the low coastal country there are many shallow lakes, which receive drainage water and retain it until evaporation dries them up. Nearly all the run-off water of the county, except for considerable quantities retained in ponds and depressions, flows into the numerous shallow estuaries of the Laguna Madre, which extend well back into the low coastal flats, forming a highly indented coast line.

The poor drainage conditions of the county are emphasized by periodic floods of the Rio Grande. Whenever the river reaches a flood-gage height of 15 feet in the Brownsville district, or 20 feet in the Mission section, Hidalgo County, the water begins to overflow at low points along its banks into the resacas or old river beds and distributary channels. Many of these old channels have become closed or restricted at numerous points, either from natural causes or the construction of canal banks, roads, or dikes, so that if the flood stage is long maintained or increases they in turn overflow and inundate the lower lands in the interstream areas, causing considerable damage to crops and property. The three most notable overflows in recent times occurred in August, 1909, September, 1919, and June, 1922.

The cause of floods of the Rio Grande is explained in a report of the Weather Bureau [7] as follows:

> It so happens that tropical storms which strike the Gulf coast in the vicinity of the mouth of the Rio Grande generally dissipate in torrential rains over northern Mexico. Owing to the highly diversified topography and the sparseness of vegetal cover on most of this region the run-off is very great and prac-

[7] Weather Bureau, Climatological Data, Texas Section, November, 1919.

tically all of it comes from the right bank. There are two flood seasons on the Rio Grande, viz, the late spring and early autumn. The first comes generally in May when the run-off from melting snow reaches its maximum. Heavy rainfall over the watershed in southern Colorado and New Mexico is quite apt to cause floods in the river in those States notwithstanding the fact that considerable flow is diverted for irrigation. A serious flood in the lower river is rarely caused by an upstream flood unless heavy rain should fall in the lower watershed concurrently with rains in west Texas and New Mexico. The autumn flood is confined almost wholly to the lower river and may be considered as the major flood of the year. It is an aftermath of the tropical storms or West Indian hurricanes which occasionally strike the coast in the vicinity of the mouth of the Rio Grande as above stated.

About 1902 the first irrigation scheme of any size was installed near Brownsville, to irrigate a tract of land believed to be suitable for the production of rice. Good yields are said to have been obtained for the first two years, but thereafter decreased to such an extent that the project was abandoned about 1906. Lack of drainage and accumulation of alkali salts near the surface appear to have been the cause of the failure. Later a similar large tract of unsuitable land was planted to sugar cane, with like results, for the same reasons. These experiences established the urgent need of artificial drainage.

At the present time three drainage districts have been organized in Cameron County and about 100 miles of large open drainage ditches constructed. At the present writing (1923) a fourth drainage district is in process of organization. A number of farm tile and open drainage ditch systems empty into these outlets, thereby providing the means of maintaining a low water table in the irrigated lands and preventing alkali accumulation.

As in practically all irrigated sections, this phase of the drainage problem is particularly important from the standpoint of continuous agricultural development of Cameron County. However, the construction of drainage ditches has not kept pace with the increasing use of irrigation water. Strips and small areas of land showing harmful effects of alkali concentration caused by seepage from canals were noted on both the coastal plain and delta soils, but particularly the latter. Considerable areas of land under irrigation but with insufficient drainage have become so impregnated with alkali salts as to be useful only for the production of the more resistant crops, or pasture grasses. Some land has become barren. However, with the further extension of drainage ditches, the reduction of the flood hazard by providing flood channels and levees, improvement in canal systems, and more efficient handling of irrigation water, it is reasonable to predict that the alkali salts will be gradually leached out of the soils and greater crop production obtained.

ALKALI

The term " alkali " refers to a number of more or less water-soluble neutral and alkaline salts which normally form and exist in soils of semiarid and arid regions. These salts are detrimental to plant growth if present in excessive quantities. Alkali salts differ in their toxicity to plants, and there is also a wide variation among agricultural plants in their resistance to different kinds and amounts of salts present in the soil. The alkali situation may, therefore, have a controlling influence on agriculture.

Alkali is most commonly formed in the soil by the effects of weathering on the mineral particles. When there is insufficient rainfall to thoroughly leach out the salts as rapidly as they form, they tend to accumulate. Drainage water then carries out dissolved alkali salts to lower-lying lands, as those occupying lower slopes, flats, and basins, causing them to be more highly impregnated than the soils in well-drained positions. Stream alluvium which is laid down over salty coastal flats or in salt marshes, bordering ocean or gulf, as in a delta formation, becomes impregnated from the underlying beds, and if it remains in a poorly drained condition, most of the acquired alkali is retained.

Both of these causes of alkali accumulation in the soil are found in Cameron County, giving rise to a wide distribution of alkali salts, but varying greatly in amount present, from a negligible to low percentage in the better-drained soils, to high or excessive quantities in the low, poorly drained basins and coastal flats. The soils of the county which normally contain high to excessive quantities of alkali are principally on the lower parts of the delta and coastal prairie in poorly drained positions near the salty coastal flats. The river-bottom soils of the Rio Grande series, from a point about 15 miles upstream from its mouth, contain but little alkali. The same is true of the Victoria soils, which occupy the greater part of the coastal plain in the northwestern part of the county. The Laredo soils of the delta are normally low in alkali, but are easily influenced by seepage from canals because of the open sandy subsoil and proximity to bodies of land carrying high amounts of alkali salts; thus their content of alkali is variable. The remaining soils of the county contain low or medium to high amounts of alkali salts, the percentage formed locally depending frequently upon conditions brought about by seepage from higher situated land, rise of water table, and proximity to highly impregnated soils.

A general idea of the approximate distribution of alkali salts present in representative soils of the county, under undisturbed conditions, may be gained from the table below, which is a summary of results of a large number of electrolytic-bridge tests made during the course of the survey. The figures indicate totals of average alkali content to a 6-foot depth. Under virgin conditions, the percentage of total salts is lowest in the surface foot, and increases quite uniformly with depth as a rule. The figures in the table are only approximations at best, as there is sometimes wider variation in alkali content of a single soil type than between different soil types.

Approximate total alkali salts in virgin soils of Cameron County

Soils	Approximate total alkali	Approximate average
	Per cent	*Per cent*
Rio Grande series	0.03 to 0.16	0.10
Victoria series	.06 to .18	.11
Laredo series	.07 to .25	.20
Laredo clay, deep phase	.27 to .33	.30
Harlingen clay	.37 to .65	.38
Cameron clay	.40 to .80	.45
Harlingen clay, light-colored phase	.83 to 1.20	1.00
Point Isabe clay		1.35
Lomalto series		+2.65
Lomalto clay, light-colored phase		+3.00

In composition, the alkali salts found in the soils of the county are of the white alkali group, and consist almost entirely of chlorides and sulphates of sodium, potassium, calcium, and magnesium.

A number of samples of soil, taken at wide intervals throughout the area, have been analyzed to determine their content of alkali salts. The location of each sample is shown on the soil map by a red dot, and the percentage of alkali salts is shown by figures in red. These samples were not taken in sufficient numbers to indicate the distribution of alkali. In other words, the absence of an analysis figure does not mean the absence of alkali salts in that locality. On the contrary, these analyses may be considered representative of the alkali conditions that prevail in the soil type in which the sample was taken. More detailed information concerning the distribution of alkali is contained in the chapter on soils and the description of the soil types.

The importance of natural drainage in connection with normal distribution of soil alkali has already been pointed out. When the adjustments in the soil are disturbed by the application of large quantities of irrigation water, difficulties arise if much alkali is present, owing to sluggish drainage conditions, seepage, the rise of the water table and the rise of alkali. The delta is, on the whole, very flat, as is also most of the coastal plain. Furthermore, most of the soils have a fine or clayey texture. These conditions favor slow run-off and slow water movement through the soil. Under irrigation, waste surface waters and water lost by deep percolation through the soil, and seepage from reservoirs, canals, and laterals, tend to materially increase the volume of surplus water which must be drained away if a rise of the water table is to be avoided. A high water table causes an unhealthy, water-logged condition of the soil, and brings up alkali from the substratum to a point within reach of plant roots. Evaporation then tends to raise a part of the alkali-charged ground water by capillarity to the surface, when the salts accumulate in dangerous quantities if the conditions are favorable. In this manner a soil sufficiently well drained under virgin conditions may soon become unproductive on account of rise of alkali if adequate drainage ways are not provided for the removal of the excess water of irrigation.

To overcome seepage, it is advisable to prevent the subsurface movement of water from canals and reservoirs to lower-lying land by means of impervious linings. Concrete is often utilized for this purpose. Seepage from earthen canals can be partially interrupted and drained away by keeping open borrow pits or drains along the side of the canals. To prevent rise of water table and rise of alkali, however, the fundamental remedy lies in the proper construction and maintenance of tile or open drainage systems capable of carrying away the surplus water, and keeping the water table down to 5 or 6 feet below the surface, if deep-rooted crops, as orchard trees, are to be grown successfully.

Fortunately a considerable number of shallow-rooted crops can be grown on soils carrying medium quantities of alkali. Cotton, grain sorghum, broomcorn, sorgo (sweet sorghum), Sudan grass, Rhodes

grass, and Bermuda grass are crops fairly resistant to alkali, and are grown successfully on all soils of the county except those having high to excessive amounts of alkali, or the better soils which locally have a high water table or have been affected by seepage. A large variety of shallow-rooted winter vegetable crops are grown on soils containing considerable alkali. It is customary, however, to irrigate and cultivate frequently, and this practice, together with low rate of evaporation during the winter months, results in keeping the salts down in the subsoil and substratum during the summer months. The careful use of water to avoid waste, and good cultivation to avoid undue evaporation, is good practice on alkali land. Permanent reclamation of alkali soils, however, can be effected only by adequate drainage and sufficient flooding with irrigation water to dissolve and drain out the excess salts.

SUMMARY

Cameron County lies in the extreme southern part of Texas, bordering on the Rio Grande and Gulf of Mexico. It has an area of 877 square miles, or 561,280 acres.

The topography is generally flat. In the coastal country there are sand dunes and clay dunes or hills standing about 25 to 30 feet above surrounding territory. The drainage is to the north and east, but regional drainage is not well developed, and the greater part of the county would be benefited by artificial draining. Only very narrow strips of country along the Rio Grande and Arroyo Colorado are drained by these courses.

The population of Cameron County increased from 14,959 in 1880 to 36,662 in 1920, with 54 per cent classed as rural. A large proportion of the population is Mexican. Brownsville, the county seat and largest town, had a population of 11,791 in 1920.

The county is well supplied with transportation facilities. The roads are well maintained. A concrete road extends from Brownsville to the west county line, passing through San Benito, Harlingen, and La Feria.

The climate of Cameron County is considered semitropical and semiarid. The winters are short and very mild. The summers are long and moderately hot, but are modified by a good Gulf breeze. The monthly mean temperatures range from 59.4° F. in January to 83.9° in August. Rainfall is deficient for most economic crops and consequently irrigation is practiced. The average rainfall is 26.36 inches, one-fifth of which usually comes in September.

The greater part of the county is suited to agriculture. Cotton, citrus fruit, and truck crops are the principal farm products. Cotton and corn are produced on the greatest acreage. However, citrus-fruit growing is increasing rapidly. The section of the county not under irrigation is used for raising cattle.

According to the 1920 census reports, 52.2 per cent of the farms are operated by owners. The average farm has about 30 acres under irrigation. The farm buildings as a rule are very good.

Fourteen soil types and five phases, representing eight soil series, and dunesand, were mapped in Cameron County. The soils range in texture from sand to heavy clay. The clay and clay loam types predominate.

In general the soils of Cameron County are very productive, but owing to poor drainage conditions and accumulation of excessive quantities of alkali salts, some of the soils are of no value for economic crops. Efficient drainage systems would greatly increase the agricultural value of the soils.

PUBLIC RESOLUTION—No. 9

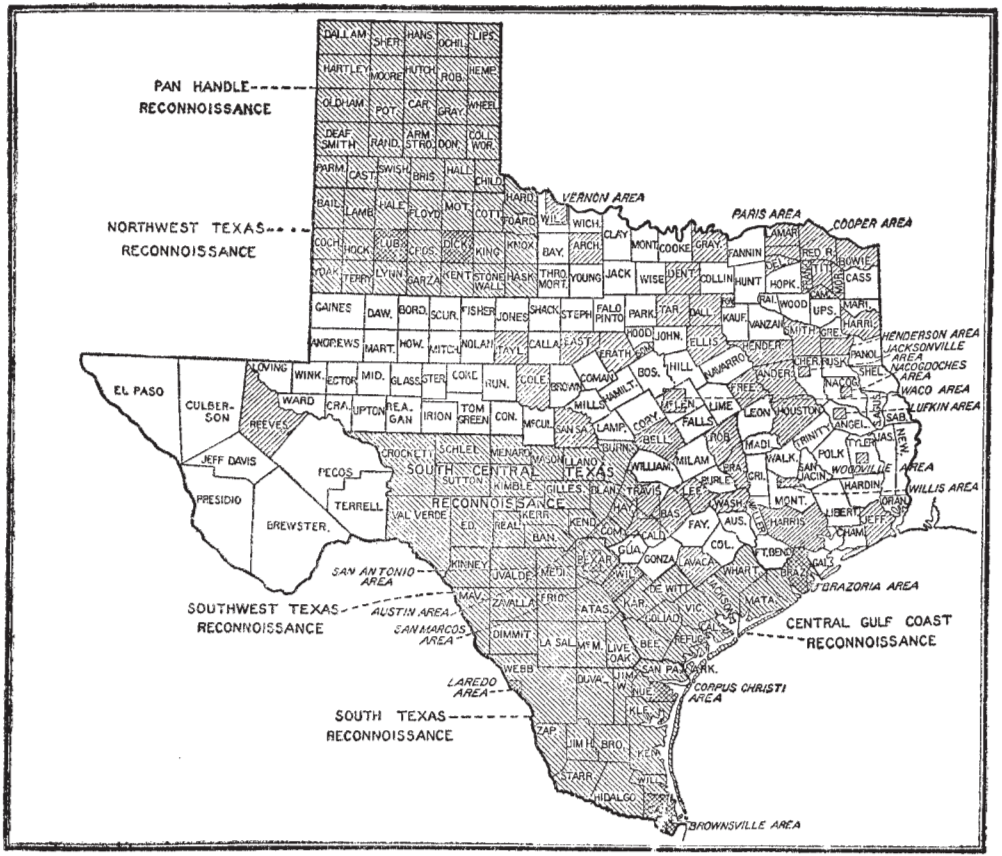
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved March 14, 1904.

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



Areas surveyed in Texas, shown by shading

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