Soil Survey
of
Wheeler County, Texas

By
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Bureau of Chemistry and Soils
In cooperation with the
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SOIL SURVEY OF WHEELER COUNTY, TEXAS

By A. H. BEAN, in Charge, and T. C. REITCH, Texas Agricultural Experiment Station, and Z. C. FOSTER, United States Department of Agriculture

INTRODUCTION

Wheeler County lies in the rolling plains section of the Panhandle of Texas, in an area of light but fairly well distributed and generally adequate rainfall. The temperature is moderate, with long hot summers and cool winters accompanied by freezes of short duration. The climate is continental and uniform over the entire county.

The county consists mainly of rolling sandy plains largely covered with a coarse bunch grass (bluestem), with in places large quantities of shin oak shrubs, sand sage, and other coarse plants. The high plains on the west extend several miles into the northwestern corner, with soils of heavier texture and darker color than occur elsewhere. The soils, in general, have been developed from unconsolidated beds of sands and clays, both calcareous and noncalcareous. Since nearly all these soils are pedocalic, they are characterized by an accumulated layer of calcium carbonate in the subsoil, which is inconspicuous in many places and in some places has completely leached away. The soils were developed under grasses, and consequently large quantities of organic matter were deposited in the soil material, but, owing to the excessively loose structure and coarse texture of many of the soils, the organic matter has been largely leached out.

The rolling uplands are generally well drained with large and small drainage ways, and some areas are excessively eroded and broken. The river beds and bottom lands of North Fork Red River and Sweetwater Creek, and the bottom lands in some other valleys, have a very high water table accompanied by a salty and waterlogged condition in some of the alluvial soils.

The upland soils may be divided into three general groups: Light-colored soils, red soils, and dark-colored soils. Of these, the light-colored soils are very drought resistant, owing to their capacity for readily absorbing and retaining rain water, and, together with some of the looser and coarser textured dark-colored soils of similar moisture-holding capacity, comprise a very large proportion of the county. The red soils are characterized by their red color, fine texture, and open structure. They have inferior water-storing capacities and a tendency to erosion. The dark-colored soils are mainly of rather tight structure, fine or very fine texture, and flat surface relief. The alluvial soils are little used for cultivated crops. They are differentiated on the basis of their color and texture, which differ according to the soils from which their materials were accumulated. Several soils, covering considerable areas, are unfit for profitable cultivation, owing largely to droughtiness, unfavorable surface relief, or light loose texture. Some of these are classed as Enterprise, Vernon, Potter, Randall, and Miles soils, and some land is classed as river wash and rough broken and stony land. The distribution of the different soil groups is shown in figure 1.
The agriculture of this county is undergoing a change from cattle ranching and livestock raising to the production of cultivated crops. About 36.5 percent of the total land area is used at present for producing farm crops; but some grazing of range livestock probably always will be carried on, owing to the fact that large areas of the soils are not well suited for the production of cultivated crops.

Cotton, the principal crop both in acreage and value, is grown on many soils, but the looser dark-colored soils, owing to their moisture retentiveness and their natural fertility, seem best suited to this crop. Wheat is grown very successfully on the heavy-textured dark-colored soils. Sorghums and other forage crops do well on most of the soils farmed. Good yields of grain sorghums, Sudan grass,
and sorgo and fair yields of corn are obtained on nearly all the soils in cultivation. The lower lying moister soils and some of the alluvial soils are suitable for alfalfa and sweetclover, and many farmers are growing these crops for forage.

The trend in recent years has been toward a more balanced farm program, including rotation of crops, terracing of the soil to prevent erosion, and conservation of moisture by more thorough cultivation. Efforts to improve the fertility of the soil by the addition of organic matter and by growing leguminous crops are common. Vegetable gardens and fruit trees in small orchards are common, but vegetables and fruits are grown for local and home use only, with very few products shipped out of the county. Dairy cows, hogs, chickens, and turkeys are raised as a means of livelihood, either in connection with the balanced farm program or on a commercial scale. Cattle raising on the open range is confined mainly to about 35 large ranches, but many small herds of cattle on the livestock farms are scattered throughout the county. The general livestock-raising practice is to supplement the grazing with home-grown feeds and to sell about half of the yearly increase of animals as fat cattle and the rest as feeders. Most farmers produce sufficient dairy products for home use, and some surplus is marketed locally and shipped outside the county.

COUNTY SURVEYED

Wheeler County is in northwestern Texas on the eastern side of the panhandle (fig. 2). It adjoins Oklahoma on the east. Wheeler, the county seat, is about 100 miles northeast of Amarillo and 200 miles west of Oklahoma City. The county is approximately 30 miles square and has a total area of 915 square miles, or 585,600 acres.

Wheeler County lies in the rolling plains, a southern division of the Great Plains region. The land is a rolling and hilly, quickly drained, sandy plain which, in many places where the surface is unprotected, is subject to severe erosion by water and wind. The surface relief is featured by many short drainageways, large dune-like areas, and bodies of severely eroded soils. Several square miles of the high plains area extend into the extreme northwestern part of the county, which consists mostly of flat and uneroded areas but at the borders includes steep escarpments and rolling slopes leading to the lower plains. Many streams which cross the State have their headwaters at the borders of the high plains, both within and without the county. The south-central part of the county is characterized by strongly rolling or hilly red lands deeply cut by erosion.

About 90 percent of the land area is upland, and the rest is alluvial land comprising narrow strips along the larger streams. The streams in the southern part belong to the Red River drainage system, two flowing into Salt Fork Red River and the others into North Fork Red River. In the northern part is Gageby Creek which flows northward into Washita River. The bottoms of these rivers and streams are comparatively narrow and broken, and their tributaries are dendritic in arrangement.

The land as a whole is rolling, with some deep and many shallow valleys. Most of the slopes are uniform and smooth. The alluvial soils, consisting of narrow overflow flood plains and some narrow high terrace benches, are flat and of slight extent. The first bottoms
are subject to overflow during periods of high water but are usually submerged only a few days during the year, and the second bottoms, or terraces, lie above overflow. All the streams are intermittent, and months may pass with no water in them except in deep holes and seeped spots.

The general slope of the land is from northwest to southeast, and the elevation averages 2,500 feet above sea level. The highest elevations are on the High Plains in the northwestern corner, and the lowest in the deeper stream valleys in the southeastern part. The altitude at Shamrock is about 2,300 feet above sea level; at Texola, just across the line in Oklahoma, 2,183.9 feet; 5 miles southeast of Wheeler, 2,544 feet; and about 6 miles southeast of Zybach, 2,675.7 feet.¹

About 63.5 percent of the land is covered by the native vegetation which is used for pasture. As the county is located in the plains, only a few large trees (chiefly cottonwood, hackberry, and willow) grow along the streams. The red lands support a few scattered small mesquite trees, and the sandy soils support an abundant growth of small shin oak trees, comprising a growth locally known as “shinnery.” Small wild plum trees are abundant. On the sandy soils the grass cover consists mainly of big bluestem, little bluestem, needlegrass, some side-oats grama and black grama. The grasses on the red soils consist mostly of buffalo grass (*Buchloë dactyloides*) locally known as mesquite grass, together with side-oats grama, black grama, blue grama, and various other grasses. On the heavier and darker soils the grass cover is mainly buffalo grass, grama grasses, some wheatgrass, and little bluestem. Yucca and pricklypear occur in scattered growth, and some catclaw grows in places. Broomweed is common on the heavier dark soils, and horsemint grows thickly with sand sage and shin oak on the lightest sandy soils. The alluvial soils support a growth of saltgrass, water grass, bluestem, and reeds. On the high plains the short-grass cover is thick and consists mostly of buffalo grass, with some grama.

Good water is obtained throughout the county in wells ranging from 20 to 200 feet in depth. Some of the water contains salts which make it unpalatable, but it is used by livestock. Many small springs occur as seeps near streams. In the stream bottoms the water table

lies near the surface, and here most of the water is highly impregnated with salts and locally is known as "gyp water."

Wheeler County was created in 1876 from Bexar and Fannin Counties, and it was organized in 1879. According to local information the first white settlers located near the present town of Old Mobeetie in 1874, at the site of old Fort Elliot, and in 1878 the town of Mobeetie was organized and the first school started.

In 1880, according to the Federal census, the population of the county was 512 and by 1910 had increased to 5,258. It increased steadily until 1930 when it reached 15,555, of which 3,780 were classed as urban. The density of the rural population is about 13 persons a square mile. Nearly all the people are white Americans, and some communities are made up largely of people of Slav, Swiss, and German descent. Shamrock, the largest town, with a population of 3,780, is in the southern part of the county. It is an important shipping and trading center located at the intersection of the Fort Worth & Denver City Railway and the Chicago, Rock Island & Gulf Railway. A cotton compress, a cottonseed-oil mill, and a casing-head gasoline plant are located in this town. Wheeler, the county seat, in the central part of the county, has a population of 931. Magic City, located about 12 miles northwest of Shamrock, is the center of the gas and oil fields. Three casing-head gasoline refineries, three carbon-black plants, and several gas pumping stations are located here. The Fort Worth & Denver City Railway extends through this town. Old Mobeetie, the first town established in the county, is a trading center. Mobeetie, Allison, and Briscoe are small towns located on the Clinton & Oklahoma Western Railway (Santa Fe lines). Ramsdell, Lela, and Benonine are small shipping points on the Chicago, Rock Island & Gulf Railway. Twitty and Kelton are two small trading centers in the central part of the county, each with a cotton gin and a schoolhouse.

Three railroad lines and three main highways, the greater parts of which are paved, extend through the county, and these, together with good lateral dirt roads extending in all directions, provide adequate transportation facilities. Schools and churches are located conveniently throughout the settled sections. Telephone lines reach all sections, and the towns are provided with electricity and gas for light and fuel. A large power plant, using natural gas as fuel, is located at Jowett and supplies this county and surrounding counties with light and power. Most of the trading centers, as well as the large towns, are supplied with natural gas from local wells. Shamrock and Wheeler have public water systems.

The oil and gas industry is very important. The area roughly outlined by Shamrock, Magic City, and Lela includes a gas field with a large number of producing wells. Several oil wells are near Magic City, but the production from these is small. Pipe lines carry the natural gas to far-distant cities. Casing-head gasoline refineries extract a large quantity of gasoline from the natural gas, and a large amount of gas is used for the manufacture of carbon black.

CLIMATE

The climate of Wheeler County is continental. It is characterized by long hot summers and cool winters. The winter weather, at times, is very cold, but many short periods of dry warm weather
occur. The general mildness of the weather is a great aid to livestock production, as few losses result from freezing and the cattle can graze on the open range throughout the winter with only the natural protection afforded in the small valleys and draws. Spring is a season of variable temperature and very high winds, usually from the north or south.

The average date of the last killing frost is April 8 and of the first is October 28, giving an average frost-free season of 203 days, which is ample for maturing all crops commonly grown. Killing frosts have occurred as late as May 7 and as early as October 6. Snows are seldom heavy, but the short freezing periods in winter and late spring often damage fruit.

The temperature and precipitation are such that some of the hardier vegetables will grow until late in the winter unless killed by a very heavy frost. It is common practice to plant a garden in the fall for winter green vegetables. Cover crops grow successfully until December or January and usually start renewed growth early in April.

The precipitation varies greatly in amount from year to year, but on the sandy soils the distribution of moisture is, in general, favorable to crop production. About 58 percent of the mean annual rainfall occurs between April 1 and August 31, or during the growing season. The spring rains are for the most part general and heavy, but the summer rains come as thunderstorms with occasional hail. Periods of drought are common in the summer, but the water-storing capacities of the soils are such that crop failures are not common for the adapted crops.

Table 1, compiled from the records of the Weather Bureau station at Canadian, about 40 miles north of Wheeler, in Hemphill County, gives normal monthly, seasonal, and annual temperature and precipitation data which are fairly representative for Wheeler County.

Table 1.—Normal monthly, seasonal, and annual temperature and precipitation at Canadian, Hemphill County, Tex.

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature Mean °F.</th>
<th>Absolute maximum °F.</th>
<th>Absolute minimum °F.</th>
<th>Precipitation Mean Inches</th>
<th>Total amount for the driest year (1917) Inches</th>
<th>Total amount for the wettest year (1922) Inches</th>
<th>Snow, average depth Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>36.4</td>
<td>81</td>
<td>-5</td>
<td>0.77</td>
<td>0.20</td>
<td>0.77</td>
<td>1.9</td>
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<tr>
<td>January</td>
<td>35.7</td>
<td>86</td>
<td>-12</td>
<td>0.41</td>
<td>0.63</td>
<td>0.00</td>
<td>1.7</td>
</tr>
<tr>
<td>February</td>
<td>40.1</td>
<td>86</td>
<td>-1</td>
<td>0.98</td>
<td>0.82</td>
<td>0.35</td>
<td>2.6</td>
</tr>
<tr>
<td>Winter</td>
<td>37.4</td>
<td>86</td>
<td>-12</td>
<td>2.16</td>
<td>1.05</td>
<td>1.12</td>
<td>6.2</td>
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<tr>
<td>March</td>
<td>47.3</td>
<td>90</td>
<td>-4</td>
<td>1.18</td>
<td>0.58</td>
<td>1.98</td>
<td>1.3</td>
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<td>April</td>
<td>50.8</td>
<td>94</td>
<td>13</td>
<td>2.29</td>
<td>2.33</td>
<td>2.91</td>
<td>4.4</td>
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<td>May</td>
<td>60.0</td>
<td>103</td>
<td>24</td>
<td>2.07</td>
<td>1.90</td>
<td>4.09</td>
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<tr>
<td>Spring</td>
<td>55.7</td>
<td>103</td>
<td>-4</td>
<td>6.44</td>
<td>4.81</td>
<td>8.98</td>
<td>1.7</td>
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<tr>
<td>June</td>
<td>78.0</td>
<td>108</td>
<td>40</td>
<td>3.49</td>
<td>0.25</td>
<td>9.23</td>
<td>0.0</td>
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<tr>
<td>July</td>
<td>86.2</td>
<td>107</td>
<td>54</td>
<td>2.14</td>
<td>1.20</td>
<td>0.32</td>
<td>0.0</td>
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<tr>
<td>August</td>
<td>79.6</td>
<td>105</td>
<td>45</td>
<td>2.44</td>
<td>3.01</td>
<td>0.98</td>
<td>0.0</td>
</tr>
<tr>
<td>Summer</td>
<td>78.8</td>
<td>108</td>
<td>40</td>
<td>8.07</td>
<td>4.46</td>
<td>10.53</td>
<td>0.0</td>
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<tr>
<td>September</td>
<td>72.2</td>
<td>102</td>
<td>34</td>
<td>2.74</td>
<td>0.20</td>
<td>8.06</td>
<td>0.0</td>
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<tr>
<td>October</td>
<td>53.3</td>
<td>95</td>
<td>13</td>
<td>2.11</td>
<td>0.10</td>
<td>9.58</td>
<td>3.0</td>
</tr>
<tr>
<td>November</td>
<td>47.2</td>
<td>89</td>
<td>-2</td>
<td>1.46</td>
<td>0.92</td>
<td>0.81</td>
<td>1.4</td>
</tr>
<tr>
<td>Fall</td>
<td>39.6</td>
<td>102</td>
<td>-2</td>
<td>6.30</td>
<td>1.22</td>
<td>18.45</td>
<td>1.9</td>
</tr>
<tr>
<td>Year</td>
<td>58.1</td>
<td>108</td>
<td>-12</td>
<td>22.97</td>
<td>11.54</td>
<td>39.08</td>
<td>6.7</td>
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</table>
AGRICULTURAL HISTORY AND STATISTICS

Prior to 1874 the country in which Wheeler County lies was a vast grassy plain entirely unoccupied by civilized man. With the increasing importance of cattle raising, the ranching industry gradually spread westward, and the area now occupied by this county was included in large cattle ranches. The abundant growth of native grasses, the moderate climate, the rolling surface relief affording protection in winter, and the streams which contained water during much of the year made this a highly desirable ranching country. With the complete use of all the land for ranches, ownership of large tracts was established and the range land was fenced. Practically no cultivated crops were grown during the early period of settlement, although small patches around the ranch headquarters were cultivated to supply corn and vegetables for home use and a small amount of rough forage for the ranch horses and occasionally for some of the cattle.

With the introduction of cotton about 1900, farming as an independent enterprise began to develop to considerable extent, and the farming population increased rapidly. Since that time many of the ranches have been cut up into small farms, and, although some cattle ranching is still carried on, a very large acreage of the better soils is now used for the production of cultivated crops, and on most of the ranches some forage is grown to supplement the grazing of the native grasses. According to the 1930 census, about 36.5 percent of the total land of the county was used for producing farm crops in 1929.

The principal farm crops grown are cotton, grain sorghums, corn, and wheat. In addition to these, some broomcorn, peanuts, forage crops, and small grains are sometimes grown on a small acreage, and on nearly every farm fruits, vegetables, and melons are grown for home and local use. Many farmers have several cows which are milked, and the surplus milk, above home requirements, is sold to local markets and to cream routes for transportation to outside dairy manufacturing plants.

According to the 1930 census, the total value of farm, garden, and orchard crops produced in Wheeler County in 1929 was $3,768,621, of which the value of cotton represented the greater part. The value of cereals amounted to $653,671. Cotton, the chief crop, occupied about 50 percent of the total crop land harvested in 1929. Grain sorghum and corn comprise the next most important crops in acreage, but the combined acreage of these two crops is somewhat less than that of cotton alone. Table 2 shows the acreage devoted to the principal crops grown in the county in 1889, 1899, 1909, 1919, and 1929.

Table 2.—Acreage of the leading crops in Wheeler County, Tex., in stated years

<table>
<thead>
<tr>
<th>Year</th>
<th>Cotton</th>
<th>Corn</th>
<th>Grain sorghum</th>
<th>Wheat</th>
<th>Oats</th>
<th>Hay</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Acres</td>
<td>Acres</td>
<td>Acres</td>
<td>Acres</td>
<td>Acres</td>
</tr>
<tr>
<td>1889</td>
<td></td>
<td></td>
<td>409</td>
<td></td>
<td>140</td>
<td>2,634</td>
</tr>
<tr>
<td>1899</td>
<td>10</td>
<td>678</td>
<td></td>
<td></td>
<td>384</td>
<td>6,298</td>
</tr>
<tr>
<td>1899</td>
<td>3,990</td>
<td>43,198</td>
<td>4,777</td>
<td>1,631</td>
<td>384</td>
<td>5,101</td>
</tr>
<tr>
<td>1909</td>
<td>12,418</td>
<td>50,863</td>
<td>47,006</td>
<td>11,659</td>
<td>3,361</td>
<td>3,568</td>
</tr>
<tr>
<td>1929</td>
<td>93,186</td>
<td>50,550</td>
<td>33,060</td>
<td>7,936</td>
<td>128</td>
<td>2,403</td>
</tr>
</tbody>
</table>
The value of all domestic animals on farms in Wheeler County in 1930 was $1,699,631, of which $1,137,304 represented the value of cattle; $94,656 the value of swine; and $44,355 the value of chickens. There were 5,200 cows and heifers milked in 1929. Dairy products, including butter, cream, and whole milk, of which cream was the principal product, were sold to the amount of $162,924. The value of chickens and chicken eggs sold amounted to more than $132,000. The cattle on farms numbered 27,462 animals, largely beef cattle on the ranches.

Table 3 shows the number of domestic animals on farms in 1920, 1925, and 1930.

<table>
<thead>
<tr>
<th>Animal</th>
<th>1920</th>
<th>1925</th>
<th>1930</th>
<th>Animal</th>
<th>1920</th>
<th>1925</th>
<th>1930</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Number</td>
<td>Number</td>
<td></td>
<td>Number</td>
<td>Number</td>
<td>Number</td>
</tr>
<tr>
<td>Horses</td>
<td>4,849</td>
<td>4,568</td>
<td>4,660</td>
<td>Sheep</td>
<td>209</td>
<td>75</td>
<td>1,190</td>
</tr>
<tr>
<td>Mules</td>
<td>2,869</td>
<td>4,061</td>
<td>4,328</td>
<td>Swine</td>
<td>13,310</td>
<td>5,819</td>
<td>8,079</td>
</tr>
<tr>
<td>Cattle</td>
<td>53,459</td>
<td>19,839</td>
<td>27,462</td>
<td>Chickens</td>
<td>69,727</td>
<td>77,502</td>
<td>89,362</td>
</tr>
</tbody>
</table>

Most of the farm laborers are white, and the supply is usually adequate and is readily obtained at wages ranging from $30 to $45 a month, or from $1 to $2 a day.

According to the Federal census, 41.5 percent of the farms are operated by owners, 57.9 percent by tenants, and 0.6 percent by managers. Grazing lands are usually leased for about 50 cents an acre a year. Most of the tenants pay a share of the crop grown as rental for the land. The common rental paid to the owner is one-fourth of the cotton and one-third of the grain, although a small number of tenants, who are furnished not only the land but the livestock and equipment for working the land, pay the owner one-half of all crops. A few tenants pay cash rent for farm land.

According to the 1930 census, of the 1,626 farms in the county, more than one-half were between 100 and 500 acres in size, and 35 farms were between 1,000 and 5,000 acres. These latter farms are doubtless used mainly for ranching and livestock farming. The census lists 82.4 percent of the total land area as farm land, with an average of 290.2 acres a farm, but the actual crop land totals only about 36 percent of the farm area, or an average of 129 acres a farm.

Farm improvements are fairly good. The work animals consist of medium-weight mules and horses. Machinery is modern. Tractors are in use on the larger farms, and windmills are universally employed. Most of the dairy cows are grade Jerseys, and the beef cattle are mainly high-grade Herefords. The quality of the animals is being maintained by the use of purebred bulls.

Little if any commercial fertilizer is bought. Small quantities are used on gardens and lawns, but practically none is used on the land in general farm crops.

**SOILS AND CROPS**

An excavation in a soil reveals a series of layers, or horizons, called collectively the soil profile. The character of the profile, together with such general features as drainage, relief, and stoniness
determine how the soil is classified. The characteristics and properties of the soil are those that can be determined by simple tests in the field.

The three units used in field mapping of soils are series, type, and phase. Most important of these is the series which includes soils having essentially the same color, structure, thickness of the several horizons, relief, drainage, and approximately the same parent material. The series is given a geographical name taken from the location in which the included soils were first recognized. The types within a soil series are named according to the texture of the surface soil, as sand, silt loam, or clay. The textural class name added to the series name gives the complete name of the type. A phase is a subdivision of a type, having characteristics worthy of recognition, yet not sufficiently different from the typical soil to justify the establishment of a new type. For example, in this county, Abilene is the name of a series; Abilene loamy fine sand, the name of a type; and Abilene loamy fine sand, deep phase, the name of a phase, or slight variation from the type.

Based on the soil characteristics described, 18 different soil types, 3 phases, and 2 miscellaneous land types are differentiated and mapped in this county. All the soils have developed from deep beds of unconsolidated sands or from clay beds. The greater part of the county comprises a rolling sandy plain, and the soils have developed from loose sandy deposits, probably of Tertiary or Quaternary age, which are low in calcium carbonate. In the southeastern part these materials have been entirely eroded from the general surface in places, thereby exposing the “Red Beds” of Triassic or Permian age, and from these have developed red soils of less sandy character. In places the soil material has been entirely eroded, leaving the bare formation with little or no surface soil development. The parent material of the “Red Beds” consists of very sandy unconsolidated calcareous materials with some layers of gypsum which are exposed in places.

In the extreme northwestern corner the flat high plains project into the county, and here the soils have developed from calcareous clays of Cenozoic age. These soils are dark and moderately heavy in texture. At the eastern border of this high-plains division the lower sandy rolling plains are reached by a moderately or steeply sloping and rolling escarpment area which is several miles wide and considerably eroded. In places the topsoil is largely washed away, although some of the slopes are sufficiently smooth to allow cultivation. In the northwestern part of the county at the base of the general escarpment and extending out from it for several miles onto the rolling plains, are smooth comparatively large bodies of dark fairly heavy soils that are somewhat similar to the high-plains soils.

For the purpose of discussion of the various types and their agricultural uses and values, the soils are arbitrarily divided into arable soils and nonarable soils.

In the following pages, the different soils of Wheeler County are described in detail, and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 4.
Table 4.—Acreage and proportionate extent of soils mapped in Wheeler County, Tex.

<table>
<thead>
<tr>
<th>Type of soil</th>
<th>Acres</th>
<th>Percent</th>
<th>Type of soil</th>
<th>Acres</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles fine sandy loam</td>
<td>117,312</td>
<td>29.0</td>
<td>Yahola very fine sandy loam</td>
<td>2,112</td>
<td>0.4</td>
</tr>
<tr>
<td>Miles loamy fine sand</td>
<td>18,948</td>
<td>4.7</td>
<td>Spur fine sandy loam</td>
<td>1,920</td>
<td>0.3</td>
</tr>
<tr>
<td>Abilene loamy fine sand</td>
<td>91,392</td>
<td>23.3</td>
<td>Sweetwater silty clay loam</td>
<td>2,624</td>
<td>0.4</td>
</tr>
<tr>
<td>Abilene loamy fine sand, deep</td>
<td>39,424</td>
<td>10.1</td>
<td>Miles fine sand</td>
<td>100,588</td>
<td>27.1</td>
</tr>
<tr>
<td>phase</td>
<td>24,704</td>
<td>6.2</td>
<td>Enterprise fine sand, dune phase,</td>
<td>27,320</td>
<td>7.2</td>
</tr>
<tr>
<td>Vernon very fine sandy loam</td>
<td>38,064</td>
<td>9.3</td>
<td>Vernon very fine sandy loam, eroded phase</td>
<td>28,544</td>
<td>7.4</td>
</tr>
<tr>
<td>Wichita very fine sandy loam</td>
<td>1,024</td>
<td>0.2</td>
<td>Rough broken and stony land</td>
<td>4,952</td>
<td>1.1</td>
</tr>
<tr>
<td>Abilene very fine sandy loam</td>
<td>30,592</td>
<td>7.7</td>
<td>River wash</td>
<td>6,236</td>
<td>1.1</td>
</tr>
<tr>
<td>Abilene fine sandy loam</td>
<td>18,178</td>
<td>4.5</td>
<td>Potter very fine sandy loam</td>
<td>13,032</td>
<td>3.3</td>
</tr>
<tr>
<td>Abilene clay loam</td>
<td>512</td>
<td>0.1</td>
<td>Randall clay loam</td>
<td>512</td>
<td>0.1</td>
</tr>
<tr>
<td>Zita silty clay loam</td>
<td>6,848</td>
<td>1.7</td>
<td>Total</td>
<td>585,600</td>
<td></td>
</tr>
<tr>
<td>Richfield silty clay loam</td>
<td>384</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lincoln loamy fine sand</td>
<td>14,848</td>
<td>3.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ARABLE SOILS

The arable soils may be and are cultivated to some extent, although they differ widely in productive capacity and in their suitability for different crops. These soils occur throughout all parts of the county and are used largely for all the crops grown in this general area. Cotton, corn, grain sorghums, and forage crops are grown generally on all the soils, and wheat and small grains are grown more largely on the dark heavy soils. Owing to the deep surface soils and subsoils, which contain sufficient clay to enable the storage and retention of a large amount of soil moisture, most of the smooth soils are fairly drought resistant, and the loose coarse texture and open structure are such that a very large proportion of the rain water is caught and absorbed in the soil mass.

For convenience the arable soils are divided into five groups on the basis of their most outstanding characteristics. These groups are as follows: (1) Light-colored loose sandy soils, (2) dark-colored loose sandy soils, (3) red tight soils, (4) dark-colored tight soils, and (5) alluvial soils.

LIGHT-COLORED LOOSE SANDY SOILS

This group includes light-colored loose sandy soils of fine texture, having sandy clay subsoils. These soils occupy many large areas throughout the county and occur extensively over many parts of the rolling plains of northwestern Texas and western Oklahoma. They are farmed to a considerable extent and, although crops on them are drought resistant, the soils are subject to drifting in heavy winds, causing some difficulty in getting stands of young crops early in the spring. The soils in this group include Miles fine sandy loam and Miles loamy fine sand. Although they occur in large areas, a number of other soils are intermixed with them in many places.

In places the red sandy and sandy clay materials of the "Red Beds" occur within 3 feet of the surface, but they seem to have little effect on crop adaptation or production.

The light-colored loose sandy soils are moderately productive and well suited to vegetables and fruits; although they are only moderately suited to, but are used largely for, the production of cotton,
corn, grain sorghums, and other forage crops. They are also well suited to broomcorn, Sudan grass, millet, and many other crops, and are especially suited to melons and vine crops of all kinds. Grapes, plums, apples, peaches, cherries, small fruits, and berries also do well.

The native vegetation is mainly coarse bluestem grasses with a considerable amount of shin oak shrubs, and sand sage is a typical growth on virgin areas. The heavy growth of shinnery, or shin oak shrubs, adds very little to the soil and actually detracts from the value of the land for pasture. Stockmen report that it is unsafe to allow livestock to graze on shinnery vegetation during the period extending approximately from May 1 to May 15, the presumption being that the tender succulent leaves of the shin oak at this stage of growth kill, by poisoning, many cattle.

*Miles fine sandy loam.*—The 6- to 8-inch topsoil of Miles fine sandy loam consists of gray or brownish-gray loamy fine sand which grades into light-red or reddish-yellow slightly loamy fine sand. This material grades, at a depth ranging from 12 to 18 inches, through a short transitional zone, into dull-red friable fine sandy clay. With increase in depth the clay subsoil becomes lighter in color, and, below a depth ranging from 24 to 30 inches, the material is yellowish-red or reddish-yellow crumbly fine sandy clay which in many places, at a depth ranging from 4 to 6 feet, is calcareous, owing to an accumulation of calcium carbonate. This material passes, at a depth of several feet, into sandy noncalcareous clay—the parent material.

The surface relief ranges from undulating to gently rolling. The topsoil is highly absorptive, allowing water to pass downward quickly, and therefore little rain water runs off the surface. The subsoil contains sufficient sand to enable the free movement of soil moisture and allows good circulation of air and easy penetration of plant roots, but the clay content of the subsoil is sufficient to retain and store a large amount of soil moisture for the use of growing plants. Therefore crops on this soil are fairly resistant to drought and continue to grow through very dry seasons, provided a good supply of moisture has been accumulated and stored in the subsoil prior to the growing season. This favorable moisture condition is also owing largely to the facility with which the soil moisture may be taken up by plant roots, as the textural quality of the soil material is such that the available moisture is not held so tightly in the mass as in soils composed more largely of fine clayey particles. The loose topsoil is unfavorable for the rapid evaporation of soil moisture.

The virgin soil is covered by a very heavy growth of coarse grasses, largely bluestems, with a small amount of side-oats grama and other grasses. In many places a very characteristic and dominant growth comprises many low small shin oak trees, most of which are not more than 2 feet high, accompanied by considerable sand sage.

*Miles fine sandy loam* is one of the most extensive soils in the county. It occurs in large and small bodies, generally associated with Miles loamy fine sand, Miles fine sand, and with the dark-colored loose sandy soils. It is one of the most widely cultivated
soils, probably 50 percent of it being used for cultivated crops. The principal crops grown are cotton and feed crops. This soil is especially favored for the production of grain sorghums, corn, and forage crops, and perhaps 50 percent of the crop land is in these crops, with a nearly equal amount in cotton. Small orchards and home gardens, planted around nearly every farm home, produce vegetables, fruits, and berries for home use. The soil is especially suited to melons, tubers, and vine crops, such fruits as apples, cherries, peaches, plums, and grapes, and various small fruits and berries. Melons, sweetpotatoes, peanuts, and other vine crops are grown in small patches and yield well.

In good seasons, where moisture conditions are favorable, acre yields of cotton range from one-third to one-half bale, and on especially favored fields under the best conditions yields as high as 1 bale have been produced. Under favorable conditions, yields of corn range from 25 to 35 bushels an acre and of grain sorghums from 25 to 40 bushels of threshed grain. Broomcorn does well but, owing to low prices, has not been grown to a great extent within several years. A very small acreage is sometimes devoted to oats, although this soil does not seem to be especially suited to small grains. Some farmers report that in good seasons when moisture conditions are favorable, yields ranging from 25 to 40 bushels of oats have been obtained.

Miles fine sandy loam is moderately productive, although it does not contain a large amount of available plant nutrients and is low in organic matter. According to local reports, the soil responds well to applications of barnyard manure and to the incorporation of organic matter, as well as to the growing of such legumes as peas. It is not known, as yet, the exact response from the use of commercial fertilizers, but it seems that with favorable moisture conditions increased yields might possibly be obtained by the use of a complete fertilizer, especially one high in nitrogen and phosphoric acid.

Miles loamy fine sand.—Miles loamy fine sand is essentially the same soil as Miles fine sandy loam, with the exception that the sandy layers are thicker and the clay subsoil lies at a greater depth beneath the surface and has a slightly higher content of fine sand. The 8-inch topsoil is rather loose and incoherent grayish-brown loamy fine sand. It grades into brownish-red, reddish-brown, or dull-red loamy fine sand which, at a depth ranging from 2 to 3 feet, grades into red or yellowish-red fine sandy clay or, in places, fine sandy loam or fine sandy clay loam. A thinly developed layer of soft chalky accumulated calcium carbonate occurs in places at a depth ranging from 4 to 6 feet. The soil is very loose and has free internal drainage.

This soil is developed on the high rolling areas, in many places occupying the higher ridges. In places small areas of deep fine sand of dunelike relief are associated with it. The native vegetation is practically the same as that on Miles fine sandy loam, although more shin oak and sand sage grow on the loamy fine sand. This is a rather extensive soil and occurs in some good-sized areas, mostly in association with Miles fine sandy loam and Miles fine sand.

About the same crops are grown on this soil as on Miles fine sandy loam, but on the whole crop yields are slightly lower and the soil is slightly more subject to drifting by wind where unprotected. The
moisture-holding capacities of the two soils are nearly the same, but, owing to the deeper and looser character of the loamy fine sand, it is not so generally selected for cultivation as the shallower fine sandy loam. Only about 20 percent of the land is in cultivation, in most places in conjunction with areas of Miles fine sandy loam.

**DARK-COLORED LOOSE SANDY SOILS**

This group includes those soils of dark-gray or brown color, which occur in many small and some large areas on the smoother sandy plains, in association with Miles fine sandy loam and Miles loamy fine sand. These dark-colored soils are moderately loose and friable and in many places are incoherent, but they contain more very fine soil particles than do the Miles sandy soils and, therefore, are slightly heavier. These soils are underlain by brown or yellowish-brown sandy clay subsoils which, below a depth ranging from 2 to 3 feet, have a layer of accumulated calcium carbonate ranging from 2 to 3 feet in thickness. This layer is underlain by less calcareous clay parent material. Most of these soils occupy areas with smooth and flat or undulating surface relief, although in some places small areas of eroded shallow soil material occur on the slopes.

The native vegetation is somewhat similar to that on the light-colored loose sandy soils, but the grama and bluestem grasses are more abundant than on those soils, and shin oak is much less abundant. These soils are suited to the general farm crops—mainly cotton, corn, grain sorghums, and other forage crops—and are equally or slightly more productive than the light-colored soils, except where eroded severely.

Though these dark-colored loose sandy soils are naturally slightly more fertile than the lighter colored sandy soils, the natural productivity is not high and constant cropping reduces crop yields. No results have been reported as to the use of commercial fertilizers. The soils of this group include Abilene loamy fine sand; Abilene loamy fine sand, deep phase; and Potter fine sandy loam.

**Abilene loamy fine sand**—The topsoil of Abilene loamy fine sand consists of a 6- or 8-inch layer of brown or yellowish-brown loamy fine sand that is moderately loose, although it does not shift greatly in high winds. The topsoil grades below into dark reddish-brown or brown fine sandy loam which is friable and crumbly. This material changes gradually, at a depth of about 20 inches, into reddish-brown fine sandy clay which clods on drying but readily breaks down to single grains and granules and in vertical cuts cracks into wedge-shaped or angular blocks. The clay continues downward to a depth ranging from 5 to 6 feet, where it grades into a brown or grayish-brown calcareous layer several inches thick, and this, in turn, is directly underlain by reddish-brown or reddish-yellow fine sandy clay or fine sandy loam which is only slightly calcareous.

This is considered the best general-purpose agricultural soil in the county and is used to some extent for the production of every crop grown. It occurs in large areas, and its smooth surface relief, friable topsoil, and rather open permeable subsoil favor the collection and retention of a very large proportion of the rain water.

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*Herefore correlated as Abilene fine sandy loam.*
About 50 or 60 percent of the land is in cultivation. The dark color is caused by organic matter which has been added to the soil by the heavy grass vegetation and which aids in holding soil moisture. The texture is not so heavy as to interfere with the free circulation of water and air through the soil mass, and soil moisture is probably nearly as available to plants as in Miles fine sandy loam. This soil is slightly higher in inherent productivity than the Miles soil.

Cotton occupies about 60 percent of the crop land, grain sorghums about 20 percent, corn 5 percent, barley, oats, millet, and Sudan grass 10 percent, and fruits and vegetables 5 percent. Acre yields of cotton are reported by farmers to range from one-half to 1 bale in very favorable seasons, corn from 30 to 40 bushels, and grain sorghums from 40 to 45 bushels of threshed grain. Good yields of small grains and hay are obtained, depending on the season, but they average about the same or better than on Miles fine sandy loam. Vegetables and fruits do well.

This soil is especially suited to cotton, and the yields are usually fairly good. The moisture-holding capacity of the soil is such that cotton does not ordinarily suffer quickly from lack of moisture. The land is easily tilled, and a good stand is nearly always obtained early in the season.

Included with this soil as mapped are some small shallow depressions which, though largely surrounded by the more sandy light-colored soils, have collected enough organic matter, through slow drainage and a resultant heavier grass growth, that the profile is very nearly the same as that of Abilene loamy fine sand.

**Abilene loamy fine sand, deep phase.**—The surface soil of Abilene loamy fine sand, deep phase, consists of brown loose loamy fine sand from 9 to 12 inches thick, underlain by dark grayish-brown loamy fine sand that is slightly loamy and coherent. At a depth of about 3 feet, this material grades into loose slightly calcareous reddish-yellow fine sand or sand. This soil is developed over large areas having smoothly rolling or undulating surface relief, and it occurs largely in association with Abilene loamy fine sand.

The native vegetation is principally scattered small shin oak trees and sand sage, accompanied by a heavy grass growth of bluestem, needlegrass, and a small proportion of grama. The grass growth affords good grazing for cattle, and about 95 percent of the land is used for this purpose. This soil has the property, common to the loose-textured soils, of collecting a large quantity of the rain water, but, owing to the very light textured subsoil, it does not retain a large reserve of soil moisture and is only moderate in natural fertility. Some of it is used for cultivated farm crops, but ordinarily only in fields where it is associated with the heavier Abilene loamy fine sand.

Closely associated with Abilene loamy fine sand, deep phase, at the foot of slopes, are included narrow areas of a darker soil which is moister because it is subirrigated by seepage from the higher slopes. As this soil occurs only in very narrow strips and broken spots it cannot be used separately for the major crops, but it is valued highly for vegetables and fruits. Cotton, corn, grain sorghums, and other crops make very good yields, but much of the included soil is used as pasture land, and it is prized because of its
more luxuriant growth of grasses, for the shade provided by cottonwood and willow trees, and for its proximity to water for the livestock.

**Potter fine sandy loam.**—Potter fine sandy loam consists of about a 10-inch layer of grayish-brown or dark-gray loamy fine sand underlain by white or yellowish-white chalky sandy loam or sandy clay, which is very calcareous and contains chalky lumps and concretions of calcium carbonate, locally called “caliche.” Some of this soil as mapped, especially near areas of Abilene loamy fine sand, contains a layer of calcareous brown sandy clay between the sandy topsoil and the lower zone of calcium carbonate concentration. Where this layer of clay is present, the soil is fairly drought resistant and produces moderate yields of cultivated crops.

This soil consists of very thinly developed soil layers, because of excessive erosion. It occurs mostly on ridges and steep slopes where the surface soil and subsoil layers have been largely washed away, leaving the calcium carbonate accumulation very close to the surface. The depth to the caliche layer is variable, but in very few places is it more than 2 feet from the surface. In only one body, near Kelton, has this soil developed on smooth flat land. Small areas are so shallow as to expose the caliche, which gives the land a bare spotted appearance. The plowed soil has a brown and white color, owing to the presence of many lumps and particles of hardened calcium carbonate on the surface. Only where the sandy clay subsoil layer is present is the soil suitable for farm crop production, as the caliche layer does not favor the retention of water. Crop yields are much lower than on the other deeper soils, and a very large part of the land is marginal or submarginal for farm crops. Most of the land is used for pasture, except where small areas occur within large cultivated fields of deeper soils.

The native vegetation is about the same as on Abilene loamy fine sand but is more scant. Hegari and other feed crops are said to do better than most other crops, but in very dry seasons crop failure of these also is common. Some cotton is grown, but the yields are very small. Forage crops only are commonly planted on such shallow soil.

The horizon of accumulated calcium carbonate ranges in thickness from a foot to many feet, just over the parent material. Because this caliche hardens on exposure to air, and because of its wearing qualities, it is a popular road material for local use. It is placed on the road as dug from the beds and packed to a hard white smooth surface. Water does not easily penetrate the packed mass, and therefore little wear occurs, except during long-continued heavy rains and under very heavy traffic. This soil occurs in small and large bodies throughout the northern and north-central parts of the county and is associated with most of the loose sandy soils.

**Red Tight Soils**

The red tight soils do not occupy a very large area. They occur in scattered bodies throughout the southeastern and south-central parts of the county. They have developed from “Red Beds” materials, are calcareous, and have very fine sandy textures. On drying after rains the soils become rather hard and do not allow such
rapid penetration of rain water as do the lighter, looser soils. These soils, especially where they occupy sloping areas, are susceptible to rather severe erosion, as the unabsorbed water runs off rapidly, causing both sheet erosion and gullying. They are productive soils when moisture conditions are favorable and are used for about the same crops, with approximately the same yields, as the light-colored soils. These soils require more rainfall than the looser soils because of their less favorable water absorption and storage. They are more rolling, have much more rapid surface drainage, and have much slower internal drainage than the looser soils. They support a short-grass type of vegetation which consists largely of grama and buffalo grasses, together with a little bluestem in the sandier spots. Yuca and pricklypear make a scattered growth, with a few catclaw shrubs and small mesquite trees in places.

Large areas of these soils have been rendered nonarable and changed by excessive erosion to eroded and broken lands unsuited to farm crops.

The red till soils group includes only two members—Vernon very fine sandy loam and Wichita very fine sandy loam.

**Vernon very fine sandy loam.**—The topsoil of Vernon very fine sandy loam consists of a 10-inch layer of reddish-brown or chocolate-brown calcareous very fine sandy loam. This layer grades into bright-red calcareous granular very fine sandy clay loam which in most places is heavier in texture than the topsoil layer and bakes very hard in dry weather. In vertical cuts the material in the second layer cracks vertically into prisms which are broken with difficulty into small granules that are irregular in size and shape but are hard and have sharp edges, giving the outer parts of the prisms a rough appearance. This material extends to a depth of about 20 inches, where it grades into a layer of red clay loam which, though calcareous, is not granular, and which, at a depth ranging from 3 to 5 feet, grades into the parent material of bright-red calcareous very fine sandy loam or very fine sandy clay containing a large number of soft and hard white concretions and some gypsum fragments.

This soil is not so drought resistant as the looser soils, because the topsoil is more compact and forms a hard thin crust in dry weather, which effectively sheds a heavy rainfall, although long gentle rains penetrate slowly. Hence the rain from thundershowers in the summer very seldom penetrates to the second layer but runs off quickly and allows little water storage. The granular character of the first and second layers aids in air and root penetration. If a good supply of soil moisture is stored in the surface soil and subsoil, crops withstand dry droughty periods for a long time.

As Vernon very fine sandy loam has not the drought-resistant properties of the loose sandy soils, it is not so well suited to cotton and forage crops under the prevailing climatic conditions. About 40 percent of the cultivated land is devoted to cotton, 20 percent to corn, 20 percent to grain sorghums, and 20 percent to wheat and other small grains. In seasons of favorable moisture conditions two-thirds of a bale, or more, of cotton an acre is produced in some places, but the average is probably about one-third of a bale. Corn produces about 20 bushels and grain sorghums about 25 bushels of
grain an acre. Small grains are said to be fairly well suited to this soil, and from 20 to 30 bushels of wheat are reported in favorable seasons. Only about 25 percent of the land is cultivated, and the rest is used for grazing, largely in conjunction with large areas of Vernon very fine sandy loam, eroded phase. The short-grass cover of grama and buffalo grasses is very nutritious and grows quickly after each rain, and these grasses retain their nutritious elements on the range during the winter after they have cured on the stalk. Small streams, gullies, and canyons, common in areas of this soil, provide shelter for winter-pastured range cattle.

Vernon very fine sandy loam occurs in association with areas of Vernon very fine sandy loam, eroded phase, and to some extent with rough broken and stony land. Most of the bodies are small and irregular. Small included bodies of a colluvial soil comprise deeper chocolate-brown soil lying at the foot of slopes and along draws. This deeper soil is the result of sheet washing and deposition of the surface material from higher lying areas of Vernon very fine sandy loam. These small areas are not greatly different in texture, color, or crop adaptation from the typical soil, but crops do a little better, owing to the better moisture conditions provided by the deeper soil.

Wichita very fine sandy loam.—Wichita very fine sandy loam is a second-bottom soil occupying small narrow coves and benches along North Fork Red River. About 1 percent of this land is in cultivation and is used mostly for grain sorghums and corn, acre yields of which range from 25 to 30 bushels of grain. This soil is associated with the Vernon soils, and nearly all of its parent material was originally washed from the “Red Beds” soils.

The surface soil of Wichita very fine sandy loam consists of a 6-inch layer of brown calcareous very fine sandy loam grading quickly into dark-red friable calcareous clay loam. This material grades, at a depth of 14 inches, into mottled brown and yellow very fine sandy loam which occurs in irregular bands, with various mixtures of clay, sand, and sandy loam. The material in this layer is very calcareous, with some concretions and with the crumblike particles of the mass thickly powdered with white carbonate of lime. This material grades downward, becoming progressively coarser with increase in depth until, at a depth of about 6 feet, yellowish-brown medium sand (river sand) which is very calcareous and is wet the year round is reached.

This soil is more drought resistant than Vernon very fine sandy loam, but its occurrence in small irregular areas in isolated positions precludes extensive use for crop production. The underlying wet sand and the more porous character of the soil tend toward subirrigation, and alfalfa would probably be an excellent crop on this soil. The native vegetation consists mainly of coarse bluestems and weeds, together with some sand sage and a few hackberry and cottonwood trees.

DARK-COLORED TIGHT SOILS

In the northern part of the county, both on the rolling plains and on the high plains, are many areas of dark-colored tight soils. These dark-colored soils are of comparatively heavy texture and compact structure, ranging from fine sandy loam to silty clay loam.
Although they are friable, they tend to pack tightly on drying, especially the heavier textured soils, but under cultivation they are readily maintained in a pulverulent condition.

These soils have developed on smooth flat or undulating divides in rather broad areas, and many of the smaller bodies are developed at the heads of drainageways in small irregular flats. They have developed under a short-grass cover consisting largely of buffalo grass, with some of several species of grama (side-oats, black, and blue), wheatgrasses, and others. Clumps of little bluestem grow in places, in association with some scattered yucca plants and a few pricklypears. The grass cover has added a comparatively large quantity of organic matter to the soil and has given it a dark color. Surface and internal drainage are slow, and no excessive leaching or erosion has taken place. These are the most nearly normally developed soils in the county. They are characterized by dark granular surface soils overlying dull dark clay subsoils which are underlain by a thick accumulation of calcium carbonate.

These soils pack fairly tight in dry hot seasons unless cultivated, and, for this reason, rainfall is not absorbed readily if it is of the sudden dashing type, especially on areas which have sloping surface relief. Erosion on unprotected slopes is in places severe, but this can be avoided to a great extent. As compared with the loose sandy soils, the soil moisture is in many places less favorable in these dark tight soils because of slowness of absorption of rain water, but with adequate stores of reserve moisture laid down in seasons of rainfall these dark soils produce crops well into and through rather severe droughts. Inherently these soils are highly productive when moisture conditions are favorable, and they return much higher yields than the light sandy soils. They are especially suited to wheat and other small grains, although cotton, corn, and grain sorghums also produce good yields in favorable seasons. Vegetables and fruits do well on some of the soils but not so well as on the looser sandy soils which, as a rule, have better moisture conditions for these crops.

The dark-colored tight soils include Abilene fine sandy loam, Abilene very fine sandy loam, Abilene clay loam, Zita silty clay loam, and Richfield silty clay loam.

**Abilene very fine sandy loam.**—The 6- to 10-inch surface layer of Abilene very fine sandy loam consists of brown or dark-brown heavy friable very fine sandy loam. It grades through a thin transitional layer into black or very dark brown clay or very fine sandy clay which is noncalcareous, highly granular, and breaks when dry into prisms by vertical cracking, the prisms separating naturally into irregular clods which break down into small rough granules of irregular size and shape. The appearance of the outsides of the broken clods is rough, and the rounded lumps are slightly shiny. At a depth of about 18 inches this material grades into brown cloddy clay which breaks into angular particles that are not granular. At a depth of 30 inches, the clay grades into reddish-brown fine sandy clay which is calcareous, friable, and contains films of calcium carbonate. Below a depth of 5 feet is somewhat red highly calcareous clay which constitutes the zone of calcium carbonate accumulation.

Although this is a rather tight soil when dry, especially when compared with the loose sandy soils, the granular structure of the
subsoil, together with its moderately open permeable character, allows the storage and retention of a good reserve of soil moisture, and the deep subsoil holds a large quantity of water for the use of growing crops. The soil has a fairly good supply of organic matter and plant nutrients, and, when adequate moisture is available, crop yields are very good. This is a highly prized soil and sells for about as much as any farm land in the county.

About 25 percent of this soil is cultivated. In most years, about one-half of the crop land is devoted to wheat which, in favorable seasons, yields from 25 to 35 bushels an acre; and the rest is about equally divided between cotton, corn, grain sorghums, oats, and other small grains. Cotton yields range from one-half to three-fourths an acre in good seasons but much less in very dry seasons. Grain sorghums and corn yield as high as 40 bushels an acre, grain sorghums yielding more than corn in very dry seasons. Yields of all crops are very high in the best years when a good supply of moisture is stored in the surface soil and subsoil in the winter and spring. This soil is well suited to wheat and other small grains.

**Abilene fine sandy loam.**—Abilene fine sandy loam is similar to Abilene very fine sandy loam in color and general characteristics, but it has a coarser textured topsoil which consists of a 10- to 14-inch layer of dark-brown or grayish-brown fine sandy loam. This material grades into brown or dark-brown fine sandy clay loam or sandy clay, of nearly the same character as the subsoil of Abilene very fine sandy loam, but it is slightly coarser in texture. In places the material in this layer has a red tinge. When it dries, it separates into coarse grains. At a depth of about 30 inches the subsoil grades into brown calcareous clay loam, forming the zone of calcium carbonate accumulation, which, below a depth of about 4 feet, contains a very large quantity of soft chalky calcium carbonate. This material grades into less calcareous sandy clay—the parent material.

Abilene fine sandy loam occurs in some fairly large areas, mainly in the northwestern part of the county. A few bodies of this soil are sufficiently large for cultivation separate and apart from the more extensive associated soils. The general farm crops—cotton, grain sorghums, and corn, together with hay and various other forage crops—occupy the small areas cultivated. Yields are about the same as on the heavier Abilene soils.

The surface relief is a little less smooth than that of Abilene very fine sandy loam, except in a few spots, notably near Mobeetie where this soil occupies a few rather large nearly flat areas. A few small areas, which are included in mapping, differ slightly in texture but are the same in general characteristics and productivity.

**Abilene clay loam.**—The 8-inch surface soil of Abilene clay loam consists of brown or dark-brown clay loam. It grades into very dark brown clay which, like the topsoil, is noncalcareous. At a depth of about 18 inches the subsoil grades into reddish-brown clay which is also noncalcareous, and this material grades below a depth of about 30 inches into red or brown clay which, at a depth ranging from 4 to 5 feet, has some accumulation of calcium carbonate in the form of soft chalky material. On drying, the topsoil separates into rough well-developed dark grains. The subsoil layer, between depths of 8 and 18 inches, consists of well-developed dark-coated rough granules which, on crushing, are reddish brown in color. The material be-
between depths of 18 and 30 inches is much less granular than that in the layer above, but it is moderately open and permeable.

The surface relief of Abilene clay loam is smoothly undulating or nearly flat. Although the soil material packs rather hard on drying, it does not offer much difficulty to the penetration of water, and consequently, where the surface slope is moderate, a large proportion of the rainfall is absorbed and retained in the deep clay subsoil. The soil pulverizes readily with cultivation.

A rather large proportion of this land is in cultivation. The native vegetation, composed largely of short grasses, affords very valuable pasture for livestock. This soil is very productive. About half of the crop land is devoted to wheat, and the farmers report acre yields ranging from 25 to 30 bushels in favorable seasons. Cotton is reported to have produced more than a bale an acre under exceptionally favorable conditions, but ordinarily yields average about one-half bale. Under normal conditions, grain sorghums produce from 30 to 40 bushels of grain an acre and a large tonnage of forage.

**Zita silty clay loam.**—Zita silty clay loam is a dark soil occurring in broad smoothly undulating areas in the northwestern part of the county, at the margin of and very slightly below the main level of the high plains. It is associated with the Richfield, Potter, and Abilene soils.

The topsoil consists of a 4- to 6-inch layer of very dark brown or black friable silty clay loam which grades into very dark brown or black granular and noncalcareous clay. This material, at a depth ranging from 14 to 18 inches, grades into brown cloddy clay which breaks down into irregular-shaped lumps with smooth surfaces. This material is noncalcareous and is less granular than that in the layer above. At a depth of about 30 inches this layer is underlain by brown calcareous clay which comprises the upper part of the zone of carbonate accumulation, extending to a depth ranging from 4 to 5 feet. Soil moisture is held very tightly in the clay subsurface layers, and in dry weather crops on this soil suffer more quickly than those on the looser sandy soils.

The native vegetation of short grasses is very valuable for grazing. Probably 75 percent of the land has been placed in cultivation, as it is highly esteemed as a small-grain and grain-sorghum soil. About one-half of the cultivated land is used for wheat, about one-third for cotton, and most of the rest for grain sorghums. In years when moisture conditions are favorable, acre yields of wheat range from 25 to 35 bushels; cotton, one-third to two-thirds bale; and grain sorghums, 30 to 40 bushels.

The soil has fairly high natural productivity, and when moisture conditions are favorable excellent yields are obtained. If the store of moisture in the subsoil layers is large, crops go through long rainless periods without much damage and make some yield, but, unless a reserve of moisture is held, drouth conditions, if long continued, cause severe reductions or absolute failure of crops.

**Richfield silty clay loam.**—Richfield silty clay loam is a smooth dark soil occurring on the flattest areas of the high plains. It is of slight extent in this county, but it occurs in some large areas to the north and west.
The 6-inch surface layer is very dark brown or black silty clay loam which grades, through a thin transitional zone, into very dark brown or black moderately granular but not very friable crumbly clay. At a depth ranging from 8 to 12 inches this material grades into dark-brown cloddy clay, the clods being irregular and slick on the surface. At a depth ranging from 16 to 20 inches, this layer, in turn, grades into brown cloddy clay which, as in all the layers above, is not calcareous and grades, below a depth of about 30 inches, into brown calcareous clay that becomes grayish brown and very calcareous at a depth ranging from 4 to 5 feet. This soil differs chiefly from Pullman silty clay loam of the high plains in that it is darker, the upper layers are slightly granular, and the subsoil has no reddish-brown color.

About 50 percent of this soil is in cultivation, and practically all of it is devoted to wheat, a crop to which it is well suited. Acre yields ranging from 20 to 30 or more bushels are obtained in years of favorable moisture. The native grass cover is predominantly buffalo grass, and there is some grama. This is a strong and highly productive soil. Penetration of the soil by water, air, and plant roots is slow, but the natural productivity makes it an excellent soil for wheat and other small grains. Some cotton is grown and produces excellent yields when moisture is adequate, but because of the high altitude and the short growing season, only a small acreage is devoted to this crop.

**ALLUVIAL SOILS**

The arable alluvial soils comprise 3.6 percent of the land area of the county. Owing to their small extent, wet condition, and generally low inherent productiveness, their use for farm crops is slight, although many farmers cultivate some areas of them. Crop yields are generally high on some of the better soils, and some hay is cut from a large part of the smoother low-lying land which is naturally irrigated by seepage from adjacent slopes.

Most of these soils are rather loose and very sandy, although a few areas of tight soils occur in places. These alluvial, or first-bottom soils, take their color from the kinds of soil from which they have been washed. They are all calcareous from the surface down, and, in some places, where drainage is poor or subirrigation is natural, they are salty and not suitable for crops. The land is sometimes overflowed for short periods, but in most places internal drainage is sufficiently free to allow the soil to dry out enough for cultivation within a very few days. The water table is generally high, and crops on these soils do not suffer appreciably from drought. Alfalfa and sweetclover yield 5 or 6 cuttings yearly on the better soils. In the virgin state, most of these soils have a grass cover of bluestems and other grasses, accompanied by a scattered growth of cottonwood, willow, and hackberry trees.

The alluvial soils are differentiated, on the basis of their color and texture, into Lincoln loamy fine sand, Yahola very fine sandy loam, Spur fine sandy loam, and Sweetwater silty clay loam.

**Lincoln loamy fine sand.**—Lincoln loamy fine sand is the most extensive alluvial soil in the county. It occupies a fairly broad bottom along Sweetwater Creek and narrower strips along its tribu-
taries, the first bottoms along North Fork Red River, and small strips along Salt Creek, Long Dry Creek, and other creeks in various parts of the county.

This soil consists of a 12-inch layer of brown slightly loamy fine sand or fine sandy loam, grading slowly below into a layer of very dark gray or gray loamy fine sand which extends to a depth of several feet. The second layer contains a large quantity of silt intermixed with the coarser sand. Most of the better agricultural areas have a deeper topsoil consisting of a 10-inch layer of calcareous brown fine sandy loam overlying brownish-gray loamy fine sand which, at a depth of about 22 inches, is underlain by brownish-gray or grayish-white loamy fine sand that is very wet and inclined to be quicksand. In few places is the water table more than 3 feet below the surface, and consequently the soil always contains sufficient water for the production of crops. Where seeps, excessive subirrigation, or slow drainage occur, there are a few “salt” spots which are not cultivated. The salts may be removed by thorough drainage, but the areas affected are too small to warrant great expense or labor in reclaiming them. The surface relief is smooth and flat with, in places, a few small mounds or dunes of wind-blown sand. This soil has developed from material washed from the looser sandy upland soils of the county.

The native vegetation is mainly saltgrass, bluestems, and scattered hackberry, willow, and cottonwood trees. Probably 10 percent of this land is cultivated. The high water table and the subirrigation make it suitable for the production of vegetables, and much of the smaller areas in cultivation is used for this purpose. Alfalfa is said to produce good yields each year for about 3 years after seeding, but after that the plants begin to die out, probably owing to excessively high water around the roots. Corn, cotton, grain sorghums, and forage crops are the principal crops, and some vegetables and fruits are grown. Probably about 30 percent of the land is in corn which yields about 40 bushels an acre. Cotton yields range from one-third to 1 bale, and grain sorghums yield from 40 to 50 bushels of threshed grain. Forage crops and vegetables produce good yields. Fruits, as a rule, do not thrive so well on this soil as they do on the gentle slopes leading down to the bottoms.

**Yahola very fine sandy loam.**—Yahola very fine sandy loam occurs in the first bottoms of North Fork Red River and along its tributaries. It is of slight extent and has developed from soil materials washed from the “Red Beds” soils.

The topsoil consists of a 12-inch layer of chocolate-brown or reddish-brown calcareous very fine sandy loam which grades into darker colored very fine sandy loam, also calcareous, and, at a depth of about 24 inches, the material changes to light grayish-brown loamy fine sand. This, in turn, grades into yellow or brownish-white fine sand or medium fine sand. Drainage is free, owing to the open structure of the soil which is easily penetrated by air and plant roots. The water table is not so near the surface as it is under Lincoln loamy fine sand. It lies at a depth ranging from 4 to 5 feet.

Probably about 5 percent of this soil is cultivated. Of the crops grown, cotton yields about three-fourths bale and corn about 35 bushels an acre. Grain sorghums and forage crops, including alfalfa,
Sudan grass, and sorgo, do well, and vegetables and fruits are successfully grown in home gardens. Much of the uncultivated soil is covered with a heavy growth of saltgrasses and sedges, which provide good grazing and good hay.

The surface relief is flat and smooth, with very few sand mounds or dunes. Fewer trees grow on this land than on Lincoln loamy fine sand.

**Spur fine sandy loam.**—Spur fine sandy loam occurs along streams draining the High Plains. It is composed of materials washed from the Zita, Richfield, and Potter soils. The largest areas occupy the bottom along Gageby Creek in the northwestern part of the county.

This soil consists of brown friable calcareous fine sandy loam to a depth of 12 inches and grades into brownish-gray fine sandy loam, and this material, at a depth of 24 inches, grades into yellow very fine sand containing some soft chalky lumps. This soil is seldom overflowed, internal drainage is good, and the land is not wet or marshy. It is cultivated extensively, largely in connection with areas of Zita silty clay loam, and crop yields are good. It is not subirrigated or droughty, as its water-holding capacity is somewhat greater than that of either the Lincoln or Yahola soil.

**Sweetwater silty clay loam.**—Sweetwater silty clay loam is a very wet heavy alluvial soil. It has developed from materials washed from local upland soils and because of obstructed drainage and excessive seepage has collected more of the finer textured soil materials and somewhat larger quantities of organic matter than the other alluvial soils. Its high content of organic matter has given it a very dark color.

This soil consists of a 6-inch layer of dark bluish-gray or black heavy silty clay loam underlain by bluish-gray or gray heavy fine sandy loam or silt loam, and this, in turn, at a depth of about 14 inches, passes directly into dark-gray very wet calcareous loamy fine sand. The topsoil when moist is friable, but it becomes very hard in dry hot weather.

This soil occupies the deep valleys in the sand hills, and the surface relief in most places slopes both toward the stream and downstream. The outer edges of the soil areas are less water-logged and of coarser texture than the land nearest the stream. The water table is high—about 18 inches below the surface. In some places the soil probably contains a high amount of salts that render it unfavorable to plant growth. Drainage of this land would be, perhaps, too expensive to warrant the growing of ordinary farm crops, but a strongly productive soil would be the result of such treatment. A few of the better drained spots, where the water table is lower, have been cultivated for gardens, and some forage crops that return large yields are grown, but probably 99 percent of the land is used for pasture and for prairie hay. The native vegetation consists of a heavy and thick growth of sedges, marsh grass, saltgrasses, and some blue stems, accompanied by a few cottonwood and willow trees. Salt spots are common.

**NONARABLE SOILS**

The nonarable soils comprise several soil types, phases, and land types, which, owing to some characteristic or condition, are not suited for the profitable cultivation of farm crops. They occur in small
areas scattered over all parts of the county. The soils of this group, which, though not physically impossible of cultivation, are so lacking in productiveness and in moisture-holding ability as to be considered entirely submarginal for cultivated crops, are Enterprise fine sand, dune phase; Miles fine sand; Potter very fine sandy loam; Randall clay loam; and river wash. The land too rough for cultivation includes Vernon very fine sandy loam, eroded phase, and rough broken and stony land.

**Miles fine sand.**—Miles fine sand is the second most extensive soil in the county. It occurs in both large and small areas over much of the rolling plains section, and large areas are in the central part.

The topsoil is brownish-gray loose fine sand which grades into yellow loose fine sand or loamy fine sand. At a depth of about 30 inches, this material grades into pale reddish-yellow slightly loamy fine sand, and this, in turn, at a depth ranging from 40 to 60 inches, in many places grades into red fine sandy loam. In the higher areas the sand is several feet thick, but in the more smoothly rolling lower areas the deep subsoil is fine sandy loam.

Because of the very loose and incoherent character of this soil, where not protected it is badly eroded by the wind. Cultivation is carried on under great difficulties, and crop yields are very small in proportion to the time, labor, and money expended. No water erosion takes place, as all the rainfall immediately sinks into the soil, and the very free internal drainage and very slight water-holding capacity of the soil allows the water to be immediately absorbed. In the more favorable spots, as on the more smoothly rolling areas and at the bases of slopes where the heavier layers come close to the surface, this soil often produces good yields.

This soil in places is associated principally with Miles fine sandy loam and Miles loamy fine sand, but it also occurs in association with nearly every soil mapped, except the heavier and dark tight soils. In places the surface relief is ridgelike or hilly, but in general it is rolling or strongly rolling. Few drainageways have developed on this land, as the rain water is quickly absorbed, and run-off is slight or practically nonexistent.

The native vegetation consists largely of a fairly heavy growth of shin oak shrubs and sand sage, with considerable big bluestem, little bluestem, and other coarse bunch grasses, some needlegrass, and small quantities of side-oats grama, all of which provide excellent pasturage for range cattle the year round. Water is pumped from shallow wells for the use of livestock, and some creeks or springs are near many of the larger pastures. Some of the water is stored in tanks for future use.

On the smoother areas and on some of the lower slopes grapes do well on this soil, and wild plums are plentiful in places. Fruit trees do fairly well, but the soil is not sufficiently fertile to produce good yields.

**Enterprise fine sand, dune phase.**—Enterprise fine sand, dune phase, consists of deep loose fine sand. The grayish-brown topsoil ranges from 6 to 10 inches in thickness. It grades into fine sand of equally loose character but of yellow or reddish-yellow color, which extends downward unchanged to a depth of many feet.

The surface relief is rolling, and a large proportion of the land has a billowy dunelike configuration, owing to wind action, the
loose fine sand having been blown about and piled up to form the irregular bumpy surface. This soil supports a fairly heavy cover of native vegetation which holds the sand from further shifting so long as the natural protection is retained. In some stream-bottom or low valley areas, included with this soil in mapping, the dunes have been only recently stopped from shifting about by winds, and in such places vegetation has not become strongly and thickly fixed. Such areas have a very light gray loose fine sand surface soil.

The largest areas of this soil occur in the valley of North Fork Red River, where, in places, the intermound areas of alluvial sand are wet and contain small ponds and water holes.

The native vegetation consists largely of coarse bunch grasses—chiefly the bluestems—shin oak, sand sage, wild plums, grapevines, and some yucca plants. The land is used almost entirely for cattle grazing, as the coarse grasses afford some grazing, but it is not of very high value. The natural water holes and high water table in many of the flat areas between mounds render this land of value for pasturing range livestock.

If this soil could be held from blowing and drifting, it could be used to produce some forage crops, such as sorgo, and some small fruits, grapes, and certain vine crops, though yields would be low, as the soil is low in natural fertility.

**Vernon very fine sandy loam, eroded phase.**—Vernon very fine sandy loam, eroded phase, has the general character and color of typical Vernon very fine sandy loam in many of the less eroded spots, but in most places it has been so eroded by water that the surface is very rolling and steep, and the land is so cut by gullies and draws that cultivation is impossible. The soil is nearly everywhere much shallower than the typical soil. The underlying parent “Red Beds” lie very near the surface and in many places are exposed. The native grass cover is heavy and nutritious, and the gullies and draws offer protection to cattle in winter, therefore the land is valuable for grazing. The vegetation consists of buffalo grass, grama grasses, some yucca and catclaw shrubs, and a few small mesquite trees. This soil occurs in association with and the areas merge into rough broken and stony land and areas of typical Vernon very fine sandy loam.

**Rough broken and stony land.**—Rough broken and stony land includes areas too rough or stony to cultivate. Most of it occurs in bodies associated with areas of Vernon very fine sandy loam, eroded phase. It differs from that soil in that it has little or no topsoil remaining and that it supports very little grass cover, except in very small patches in gullies and other protected spots. Between Shamrock and Twitty an area of gypsum rock outcrops in the “Red Beds,” where the grazing is fairly good, but most of the rough broken and stony land has very little grass cover, and few cattle can be supported on it. The surface relief is very steep and hilly, and the land is largely occupied by gullies and draws. This land is of no use except for grazing.

**River wash.**—River wash comprises all the river beach sand and river bed of North Fork Red River and some small areas along its larger creek tributaries. It consists of fine and medium calcareous sand many feet deep in the bed and adjacent to the river. This is covered by flood waters of the river during only short periods of
the year. The water table in few places lies at a greater depth than 1 foot beneath the surface. Most of the land supports no vegetation whatever, but in places small willow trees, saltgrass, and sedges are growing on it. The total area is not large, and the frequent inundations and the infertility of the sand render the land unfit for cultivation.

**Potter very fine sandy loam.**—The areas mapped as Potter very fine sandy loam include practically all the shallow soils of the steeply sloping land extending from the level of the high plains down to the level of the lower rolling plains. These soils have very thin dark-brown or gray immature soil layers over caliche which in many places is exposed, hardened, and broken to fine white fragments and the fragments scattered over the surface. Although mostly of fine sandy loam or very fine sandy loam texture, the soils are, in places, of somewhat heavier loam or clay loam texture.

Potter very fine sandy loam is brown calcareous very fine sandy loam containing fine white chips of caliche. The topsoil ranges from 6 to 10 inches in thickness and grades below into buff or yellowish-brown friable calcareous clay containing chalky fragments of calcium carbonate, some being of concretionary form. The depth and thickness of the surface soil and subsoil layers differ considerably, but in most places these layers are thin and of slight development. In places the topsoil rests on the white chalky beds, whereas in other places there is a thinly developed subsoil layer.

This soil occupies good-sized bodies of steep or moderately steep more or less eroded land in the northwestern part of the county, comprising the fairly well defined escarpment between the high plains and the rolling plains.

The soil supports a moderately thick grass cover consisting mainly of buffalo grass, with some grama and bluestem. The land is well suited to pasture for range livestock because of the nutritious grasses and rough surface relief which affords shelter in winter. It is all included in large ranch holdings and utilized predominantly for grazing. A few of the less sloping deeper soil areas are sometimes cultivated, and some grain sorghums or forage crops produce small yields in favorable seasons.

**Randall clay loam.**—The surface soil of Randall clay loam is black or gray heavy clay loam which grades, at a depth of about 12 inches, into heavy dense gray clay extending to a depth of several feet. Both surface soil and subsoil bake very hard and tight on thoroughly drying.

This soil occupies very small basins or lake beds termed “playa lakes.” After rains, water remains for a long time, as the dense subsoil material allows very slow underdrainage. The soil comprises fine soil particles washed in by surface water from the adjacent gentle slopes. These lake beds support a small amount of short grasses during some seasons, which afford some pasturage. The soil is difficult to work, and, because of this and of the possibility of flooding, it is not cultivated.

**AGRICULTURAL METHODS AND MANAGEMENT**

Agriculture is the principal industry in Wheeler County. Livestock raising and ranching are important branches, with dairy-
ing, swine raising, and poultry raising becoming increasingly important. The total value of all domestic animals on farms is more than one-third of the value of all crops grown. Cattle raising and fattening is becoming increasingly closely related to farming, as many of the beef cattle raised are fattened for market on the ranches, as nearly all ranchers grow some feed to supplement the range forage. Many yearlings are sold for fattening in other States.

Thirty-five farms are listed as being between 1,000 acres and more than 5,000 acres in extent. These are ranches for beef cattle. Hereford is the popular breed of beef cattle, but a few herds of Aberdeen-Angus and Shorthorns are raised. A number of herds are composed of registered cattle and are headed by registered sires. The most common and best practice to keep up and enhance the quality of the herds is the use of purebred bulls.

The cattle are grazed on the range throughout the year, the number of cattle that can be fed on a section depending on the vegetation, the short-grass range being the best. Many of the cattle are fed cottonseed cake, grain sorghums, prairie hay, or other forage to supplement the reduced grazing during the winter, and this supplemental feeding carries the cows through the winter in good condition and assures healthier and more numerous calves dropped in the spring.

The most common practice is to allow the calves to run with their mothers during the spring and summer and then feed them for a period in the fall for market. The best practice, however, is to feed the spring calves in creep feeders, which insures full feeding at the cheapest and best time for growth. About 40 percent of the calves in the county are fed in this way. Many of the calves are sold in the fall as feeders, and some cutbacks from these are sold the year around as yearlings. The feeders usually are sold to buyers in Missouri and Iowa for finishing, and a few are sold to local cottonseed-oil mill operators for fattening within the county.

About 50 percent of the cattle marketed are sold as well-finished fat cattle. These cattle are finished on the ranch on local feeds (forage and concentrates) and are usually sold at Kansas City, although some are sold at Fort Worth, Oklahoma City, and Wichita. Water on the range is abundant in streams, in water holes, and in wells from which it is pumped by windmills. As the grazing is good, forage easily grown on the ranch, and cottonseed products produced locally, cattle are profitably raised and fattened for market.

Dairying is another branch of agriculture that has proved profitable to many farmers, largely as an adjunct to general farming, as dairying may be carried on with the advantages of easily grown forage and grain sorghums, year-round grazing, mild weather, and good water. The Jersey is the popular dairy breed, most of the herds being composed of grade Jerseys. There are two purebred herds in the county. Registered bulls are being obtained to improve the quality of the herds. The local outlet for whole milk is limited, but cream is collected and carried to creameries at Pampa, Tex., and Sayre, Okla. Local experience seems to be that dairying is profitable, even with a low price on butterfat.

Sheep raising and swine raising are of minor importance. Sheep are not very popular, although they are easily raised and make fair profits on the range. Swine raising and feeding as an agricultural
pursuit is practiced to some extent. A few hogs are a part of nearly every farmer’s livestock, and surpluses are sold on local markets.

Poultry raising is increasing gradually. Chickens and turkeys are usually raised in small flocks for home use, and the surplus eggs and turkeys are sold to produce houses for storage and for the Thanksgiving and Christmas markets. Chickens do well on the grain produced on the farms, and local conditions favor the production of chickens and eggs. Turkeys do well on the range and require little care or feeding in the sandy soils sections.

Some special crops are grown for shipment as cash crops. Peanuts, grain sorghums, broomcorn, and hay are sometimes shipped from the county, and all the cotton is sold to buyers for outside manufacture. Peanuts are grown to some extent as a commercial crop, but most of them are used locally. The surplus is sold to candy factories. Grain sorghums and corn are sometimes sold, but about as much or more of these crops is imported as is shipped out. In earlier days, prairie hay was baled and shipped to outside markets, but, with increased feeding of cattle, this practice has been discontinued and now nearly all the forage is used within the county. Broomcorn was once successfully produced on the loose sandy soils but the drop in price of this commodity has caused the abandonment of the crop, except on a very small acreage.

Owing to the generally sandy texture and loose friable character of most of the soils, they are cultivated without difficulty, and most of them, even though plowed when wet, do not bake or clod. The most successful farmers plow their land during the winter, either flat breaking it or using a lister, and plant their crops in the spring with a planter by breaking out the ridges left after listing.

The two important problems to consider in cultivating the soils of Wheeler County are the collection and retention of moisture and the prevention of wind and water erosion. The loose sandy land is not so seriously reduced in productivity by lack of moisture or by water erosion as by blowing and drifting in the high winds of spring and early summer, which shift the loose sandy topsoil in unprotected spots. In some years drifting is so severe as to cover parts of the growing crops and to blow the topsoil completely away from the roots of plants in other parts of the field. This condition is combated by leaving the stalks of the previous crop standing in the field all winter and as late as possible in the spring and then listing the land in rows running at right angles to the direction of the prevailing winds which are usually from the north and the south. An improvement on this method is to add humus to the topsoil by plowing under barnyard manure, cotton burs, or green-manure crops, which will reduce the tendency of the soil to blow, as well as increase its productiveness. A few farmers have reported that the use of cotton burs and refuse from the gins added to the soil have given very excellent results in preventing soil drifting during windstorms, and some have plowed their land sufficiently deep to turn up some of the heavier clay subsoil which, when mixed with the topsoil, is said to satisfactorily hold the soil from drifting and to increase the yields of crops to some extent.
Terracing to prevent gullyng and sheet erosion is recommended for many of the sloping areas. Terraces largely prevent run-off of rain water and cause it to soak into the surface soil and subsoil, where it can be held in reserve for the use of crops in dry seasons. This is especially important on the heavier soils, as their tight structure allows only very slow penetration of rainfall, and the run-off water, being so much greater in volume than on the sandy land, quickly gullies and washes the cropped land.\(^{3}\)

The arable soils are fairly well supplied with most of the essential plant nutrients, and this is apparent in the yields of crops where soil moisture is adequate and is substantiated by chemical examinations of some of the soils of this section of the State.\(^{4}\) The loose light sandy soils seem to be somewhat deficient in nitrogen and phosphoric acid, but under good moisture conditions even these loose soils produce fair yields of some crops. They can probably be improved and the fertility maintained by keeping a good supply of organic matter in the topsoil and by growing such legumes as field peas. The results of commercial fertilizers are uncertain in a region of low rainfall such as this, as it is essential that ample moisture be present for the fertilizers to be most effective. Until results from some experiments with fertilizers have been obtained throughout several seasons it will not be possible to make definite recommendations for such treatment of the soils. Those desiring to test commercial fertilizers on the soils should study the latest bulletin on commercial fertilizers issued by the Texas Agricultural Experiment Station.\(^{5}\)

General or diversified farming is recommended for the agricultural program of this county. Farm gardens are successful and yield well, and vegetables can be grown both for summer and winter use. Cows, hogs, chickens, turkeys, ducks, and geese are easily raised and furnish the farmer with food and some surplus for sale. Cotton, the principal crop, is planted on all the soils in cultivation and to a greater or less extent on every farm. It does well on all soils and is practically free from disease and insects. Cotton root rot has not been reported in the county, but the flea and leaf worm do some damage to the growing crop. Gin-run seed of short-staple varieties is planted from May 15 to June 15, depending on the type of land and weather conditions. The crop is cultivated to keep out weeds but is not chopped, or thinned. The stalk does not grow high, but good yields are obtained, the average acre yield for the county being about one-third of a bale. The cotton is picked over once or twice, and the later cotton is either pulled as bollies or sledded off. Melon is one of the most productive varieties grown.

Corn is either planted early (about April 15) or late (about June 15). Mexican Jure, Reid Yellow Dent, Silvermine, and Surcopper are the leading varieties, with Mexican June leading in production. Acre yields range from 20 to 40 bushels. Some farmers plant cow- peas in every other row or every third row between the corn rows for soil improvement, and very satisfactory results are obtained.


Grain sorghums are very important feed crops, both for grain and for forage. Kafir, milo, hegari, and feterita are grown, and farmers report yields of threshed grain ranging from 20 to 40 bushels an acre in good seasons.

Wheat is still grown on a fairly large scale on the heavier soils. Kanred, Turkey, and Tennmarq are the leading varieties. Winter wheat, sown in September, after disking or flat breaking the stubble, attains sufficient size to pasture cattle during the fall and in the spring, when the ground is not too wet. This pasturing does not seem to reduce the yield and furnishes valuable green forage at a time when most needed. Yields usually are not high, especially in dry years. Barley, millet, oats, and rye are grown on small acreages for local consumption and are handled much the same as wheat, but yields are only moderate.

Sudan grass, alfalfa, and sweetclover are grown for forage in small fields and produce very high yields. Sudan grass is reported to yield 10 tons of forage an acre on the heavier soils in some seasons. Alfalfa does well on some of the alluvial soils and on soils that are subirrigated to some extent. Sweetclover makes a heavy growth on the wet soils along some streams. In dry seasons alfalfa is difficult to seed, but if planted in the fall, when the ground is not too dry, good stands are obtained. Sorgo is planted for forage and for sirup in small plots in the low-lying moister soils, and good yields are obtained.

Vine plants, tubers, and most vegetables grow well, especially on the sandy upland soils and on the alluvial soils. Fruit trees thrive and produce good fruit if the buds are not injured by frost in the spring. Such fruits as apples, peaches, cherries, plums, apricots, currants, dewberries, blackberries, raspberries, gooseberries, strawberries, and grapes grow well and produce good yields. All the fruits and vegetables grown are for consumption on the farm, for canning, or for sale in the local towns.

Diversification and rotation of crops, with the aim of retaining and enhancing the fertility of the soil is practiced by few farmers. The growing of cowpeas in the cornfields seems to be about the only practice designed to improve soil fertility. Cotton is planted year after year on the same field, and this same practice is very general with other crops.

As has been stated previously, the staple crops—cotton, corn, grain sorghums, and vegetables—are grown to greater or less extent on nearly all the arable soils, but cotton yields best on the dark-colored loose sandy soils, forage crops and vegetables give larger yields on the light-colored sandy soils, and wheat yields better on the heavy dark tight soils and on the red tight soils.

An experiment station, a branch of the Texas Agricultural Experiment Station, is located at Chillicothe, about 75 miles south-east of Wheeler County, and results obtained in agricultural research there are fairly applicable to many of the soils and farms in Wheeler County.

SOILS AND THEIR INTERPRETATION

The soils of Wheeler County have been developed under subhumid climatic conditions, and the outstanding features are a rather light
and irregular rainfall, long warm summers, and short winters during which periods of freezing weather alternate with moderately cold spells. All the soils have developed under a grass cover. Some of the grasses belong to the short-grass communities, and others comprise a thick growth of the coarse bunch grasses.

The parent materials from which the soils have developed are of three general kinds: (1) The moderately heavy calcareous clay from which the dark soils have developed, (2) the red calcareous sands and sandy clay beds, and (3) deep slightly calcareous very sandy beds of ancient sedimentary materials.

The soils are pedocalic, that is, the outstanding characteristic of the normal soils is a thick layer of accumulated calcium carbonate in the soil profile, a product of soil development in an area of light rainfall.

The normal regional soil profile is well developed in the heavier soils and consists of a granular dark-brown noncalcareous topsoil underlain by a heavier but crumbly, slowly permeable subsoil, also noncalcareous, which is underlain, at a depth ranging from 4 to 6 feet, by soft chalky calcium carbonate in lumps and streaks within soft friable calcareous clay, and this, at a depth ranging from 5 to 8 feet, grades into friable very permeable marl which contains less calcium carbonate than the layer above.

The dark soils have the smoothest surface relief and show the most complete development of a soil profile. They are soils of the Richfield, Zita, and Abilene series. These soils, however, are by no means the most extensive in the county.

The Richfield soils occur on the high plains, mostly in very flat or slightly depressed areas having very slow drainage. These soils have black or very dark brown topsoils which do not effervesce with hydrochloric acid. The upper subsoil layers are also very dark, very slightly granular, and noncalcareous, and they grade into less dark, less granular, heavy noncalcareous clay; and this material, in turn, at a depth ranging from 3 to 4 feet, grades into brown or gray calcareous clay which becomes more calcareous with depth and is the layer of soft calcium carbonate accumulation. In the extreme northwestern corner of the county Richfield silty clay loam shows the following profile:

0 to 4 inches, very dark brown silty clay loam which is noncalcareous and rests on or passes through a very short transitional zone into the material below.
4 to 8 inches, very dark brown or nearly black clay which is crumbly but not very friable, noncalcareous, and very slightly granular.
8 to 16 inches, dark-brown noncalcareous clay which breaks into irregular slick clods with no granulation.
16 to 30 inches, brown claydy noncalcareous clay.
30 inches+, brown calcareous clay.

The Zita soils are dark-brown normal granular soils of the high-plains section. They occupy smooth very gently sloping areas and do not, as a rule, have such thickly developed soil layers as the Richfield soils. Following is a description of a profile of Zita silty clay loam as observed near Mount Zion School:

0 to 2 inches, dark-brown noncalcareous silty clay loam.
2 to 14 inches, dark-brown noncalcareous granular clay which cracks vertically to form irregular clods composed of dark somewhat rounded granular particles which are lighter brown within.
14 to 30 inches, brown heavy cloddy noncalcareous clay. The clods are angular and slick, and some are cubical in form.
30 to 70 inches, brown friable calcareous crumbly clay.
70 inches+, yellowish-brown calcareous clay.

Developed on smooth surfaces of the "Red Beds" or on calcareous clay beds over "Red Beds" are the Abilene soils, which, in places, have been deeply developed, and a slight red color remains in some layers. Following is a description of a profile of Abilene clay loam as observed near Twitty:

0 to 8 inches, noncalcareous, granular, and very friable dark-brown clay loam.
8 to 18 inches, very dark brown noncalcareous granular clay, in which the grains are rough and reddish brown on the insides and very dark brown on the surfaces.
18 to 30 inches, reddish-brown noncalcareous clay which is less granular than that in the layer above.
30 inches+, noncalcareous red clay which becomes calcareous at a depth ranging from 3 to more than 4 feet.

These dark soils, which have developed from the finer textured highly calcareous clay or marl, largely under a short-grass vegetation, are the heaviest soils in the county and in general are higher in inherent productiveness. Though well suited to many of the crops of this section, they do not give up soil moisture so readily to plants as some of the coarser textured soils and, therefore, are somewhat less drought resistant than some soils of coarser texture, although the deep heavy clay subsoil layers afford a large reservoir for soil moisture, and when a good supply is stored therein the crops withstand long periods of dry weather without serious injury.

The proportion of dark soils in this county is not so large as in many other counties of western Texas. Where the soils have developed on very smooth areas they show normal characteristics, but some bodies have been so severely eroded that only very immature soil layers remain, and, agriculturally, most of this kind of land is of very slight value. The soils of such areas belong to the Potter series. Potter very fine sandy loam comprises the chief soil of this character and occupies the main areas of slopes leading down from the high plains to the rolling plains.

The Vernon soils are immature red soils that have developed from Permian or Triassic "Red Beds" of the plains, and the parent material consists of red very fine sandy material rich in calcium carbonate and calcium sulphate. The "Red Beds" material consists very largely of very fine sand and silt, a combination of fine-earth particles which erode very rapidly; hence, the surface relief is rolling and steeply sloping over large areas, and the soil material has not lain in place a sufficient time to develop a normal profile. These soils do not contain a well-defined layer of calcium carbonate accumulation. The resultant soils are composed of red calcareous material occurring in thin layers, merging gradually below with the unchanged parent material which lies near the surface. Following is a description of a typical profile of Vernon very fine sandy loam as observed near Wheeler:

0 to 8 inches, reddish-brown friable granular calcareous very fine sandy loam.
8 to 18 inches, red calcareous friable highly granular clay loam, the granules being somewhat rounded and having rough edges. The material contains many worm casts. When dry it separates into fragile rough clods with a white film on the surfaces and throughout the mass.
18 to 30 inches, friable but not granular bright-red calcareous clay loam.
30 inches+, "Red Beds" material, a geological formation but slightly weathered and consisting of calcareous very fine sandy loam which is very permeable and friable. It contains thin layers of somewhat hardened calcareous material, most of which is probably calcium carbonate and calcium sulphate.

The Vernon soils have developed under a short-grass cover intermixed with some bunch grasses. Where the land is smooth and the moisture supply adequate, crops grow well and produce good yields, but, owing to the sloping surface of much of the land, most of the rain water runs off, and the soil contains no large reserve of soil moisture. The very sloping areas, in which much erosion and gullying have occurred, are shown separately on the soil map as Vernon very fine sandy loam, eroded phase, and where erosion has been extremely devastating the land is mapped as rough broken and stony land.

The greater part of the county is occupied by loose fine sandy soils which have developed from beds of sandy clay materials laid down over the "Red Beds" which constitute geological formations of the Tertiary or Quaternary periods. These soils have developed under a coarse-grass vegetation. Owing to excessive leaching, the finer soil particles, the calcium carbonate, and the organic matter have been leached out, leaving loose light-colored surface soils and, in places, equally light loose subsoils.

In one subdivision of the light-colored loose soils are Miles fine sandy loam and Miles loamy fine sand, which are extensively developed over the rolling plains area throughout many counties of northwestern Texas. The loose surface soils are underlain by red sandy clay layers at a depth ranging from 1 to 3 feet, and below this, in places, some calcium carbonate has accumulated, but, owing to the very sandy character of the underlying parent material, much of the calcium carbonate has been leached from the solum. Following is a description of a profile of Miles fine sandy loam, as observed near Center School:

0 to 10 inches, noncalcareous grayish-brown fine sand which is very loose and contains very little organic matter. In places the topsoil is slightly red when dry.
10 to 20 inches, noncalcareous red fine sandy clay which is heavy but crumbly.
20 to 40 inches+, yellowish-red fine sandy clay which is much more sandy than the clay in the layer above, the sand content increasing with depth. In many places the material ranges from slightly calcareous to very calcareous and chalky at a depth ranging from 4 to 6 feet below the surface.

Miles fine sand consists of a gray or grayish-brown loose fine sand thin topsoil and a yellow or reddish-brown loose sand subsoil which continues to a depth of many feet. In places where such soil has been drifted by the wind into dunelike forms, it is shown on the map as Enterprise fine sand, dune phase. These deep loose fine sands constitute a thoroughly leached solum with very little remaining except a mass of siliceous particles containing a very small quantity of plant nutrients.

The Yahola, Lincoln, Spur, and Sweetwater soils, and river wash are alluvial soils of the narrow flood plains. The soil materials have
been washed from nearby upland soils. As they have no developed characteristics and comprise recently deposited soil materials, they are differentiated into the several series on the basis of their color and the character of the original upland soil material. The Yahola soils are composed mainly of materials washed from the Vernon soils and the "Red Beds" formations, the Lincoln soils mainly of materials washed from the Miles soils, and the Spur and Sweetwater soils of materials washed from the dark upland soils.

Table 5 gives the pH values of several soils in Wheeler County. These determinations were made in the laboratories of the Bureau of Chemistry and Soils by the hydrogen-electrode method.

**Table 5.—pH determinations of several soils from Wheeler County, Tex.**

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