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# Texas Agricultural Experiment Station

A. B. CONNER, DIRECTOR

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DIVISION OF CHEMISTRY



# Chemical Composition of Soils of Texas

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

T. O. WALTON, President

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The analyses of several thousand samples of soils were averaged by types for about 100 of the most important soil series of Texas. The constituents of these soils as averaged by types are classified in five grades, according to the quantities present, Grade 1 being the highest and Grade 5 the lowest grade. The grades have been designated in such a way as to carry the highest possible significance permitted by the present state of our knowledge. Tables are given to show the composition of the various soils averaged by types, and their grades, as well as a very brief description of the soil series.

Maps showing the prevailing grades of the constituents of the upland surface soils in the various parts of the State are given for total nitrogen, active phosphoric acid, total phosphoric acid, active potash, acid-soluble potash, total potash, acid-soluble lime, basicity, acidity, and acid-soluble magnesia. These maps show that wide areas of Texas soils are low in phosphoric acid and in nitrogen, especially in the eastern part of the state. Potash is present in larger quantities than phosphoric acid. Lime is high in areas in the central and western part of the state. Lime is low in some areas in the eastern part of the state, and some of the soils in these areas may become sufficiently acid to require liming. Texas soils are not likely to be deficient in magnesia. Alluvial soils are better supplied with plant nutrients than upland soils. Variations in the composition of the soils in the areas are to be expected. The maps, tables of composition, and tables of grades give a good general idea of the chemical composition of the soils of Texas.

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BULLETIN NO. 549 JULY, 1937

# CHEMICAL COMPOSITION OF SOILS OF TEXAS

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**Division of Chemistry**

The chemical composition and properties of the soils of Texas have been studied by the Texas Agricultural Experiment Station for more than 33 years. Many analyses of soils have been made, chiefly of samples of soil types representing areas mapped by soil surveyors of the U. S. Department of Agriculture. Individual analyses of the various samples have been published, by counties, in 15 bulletins of the Texas Agricultural Experiment Station. It now seems desirable to present the average chemical composition of the various types of soil, to group these averages according to the areas they occupy, and to map them so as to show, in a general way, the chemical composition of the various areas of the surface soils of Texas. An outline of the present information relating to soil classifications and soil values in Texas with respect to their physical composition and location, and a brief description of about 100 of the most important series of soils in Texas, with the map showing where they occur, are given in Bulletin 431 (4).

The average chemical composition of the various types of soils are given in the Bulletin here presented. The system of classification outlined in Bulletin 431 is followed. The general average composition of surface soils of Texas is presented in 10 maps, based upon the map of the soil areas of Texas presented in Bulletin 431. The maps are necessarily in broad outline. There are differences in the composition of different samples of the same soil type and some differences between the soil types which cannot be shown in maps of this size. The maps can show the composition of the soils in a general way only, since there are differences between the types of soils in the same area, some being of lower and others, especially alluvial soils, of higher composition than is shown on the maps. Those interested in the details may consult the publications dealing with the composition of the soils of the various counties of the State (see Table 1), which contain more details than are possible in a publication of this kind.

The analyses and other chemical investigations were confined to the determination of those constituents and chemical conditions of soils which, by reason of their great variation and inadequacy in many soils for the proper growth of many kinds of economic crops, cause problems closely related to agriculture and provide basic means for studying methods of overcoming soil deficiencies in crop production.

The significance of the chemical composition and the interpretation of results are of as great importance as the analyses themselves and have received a great deal of attention of this Experiment Station. A number of bulletins have been published on these subjects. Our discussion of these relations must necessarily be in broad outline, leaving to those interested in the details the consultation of the various publications of this and other Experiment Stations.

## SAMPLES AND METHODS

The samples used in this work were taken by soil surveyors of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture from virgin land or uncultivated land and were such as were believed to be representative of the soil

**Table 1. Texas counties surveyed with date of survey and number of bulletin giving detailed chemical composition**

| | Date of survey | Analysis in Texas Bulletin Number | Reference number |
|---|---|---|---|
| Detailed county surveys | | | |
| Angelina (part) | 1903 | 125 | 7 |
| Archer | 1912 | 244 | 22 |
| Bell | 1916 | 301 | 28 |
| Brazoria | 1902, 1910 | 125 | 7 |
| Brazos | 1914 | 316 | 30 |
| Bowie | 1918 | 375 | 34 |
| Cameron | 1909, 1923 | 125, 430 | 7, 38 |
| Camp | 1908 | 316 | 30 |
| Cherokee (part) | 1903 | 125 | 7 |
| Coleman | 1922 | 430 | 38 |
| Collin | 1930 | 533 | 49 |
| Dallas | 1920 | 430 | 38 |
| Delta (part) | 1907 | 125 | 7 |
| Denton | 1918 | 375 | 34 |
| Eastland | 1916 | 337 | 32 |
| Ellis | 1910 | 316 | 30 |
| El Paso (part) | 1912 | 337 | 32 |
| Erath | 1920 | 430 | 38 |
| Franklin | 1908 | 244 | 22 |
| Freestone | 1918 | 375 | 34 |
| Frio | 1927 | 533 | 49 |
| Galveston | 1930 | 533 | 49 |
| Grayson | 1909 | 192 | 17 |
| Harris | 1922 | 430 | 38 |
| Harrison | 1912 | 244 | 22 |
| Henderson | 1923 | 482 | 41 |
| Hidalgo | 1909, 1925 | 125, 482 | 7, 41 |
| Jefferson | 1913 | 301 | 28 |
| Lamar | 1907 | 125 | 7 |
| Lavaca | 1905 | 125 | 7 |
| Lee | 1905 | 192 | 17 |
| Lubbock | 1917 | 337 | 32 |
| McLennan (part) | 1905 | 192 | 17 |
| Milam | 1925 | 482 | 41 |
| Midland | 1928 | 533 | 49 |
| Montgomery (part) | 1901 | 125 | 7 |
| Nacogdoches | 1925 | 125, 482 | 7, 41 |
| Navarro | 1927 | 482 | 41 |
| Potter | 1929 | 533 | 49 |
| Red River | 1919 | 375 | 34 |
| Reeves | 1922 | 430 | 38 |
| Robertson | 1907 | 125 | 7 |
| Rockwall | 1923 | 430 | 38 |
| Rusk (part) | 1906 | 125 | 7 |
| San Saba | 1916 | 337 | 32 |
| Smith | 1915 | 301 | 28 |
| Tarrant | 1920 | 430 | 38 |
| Taylor | 1915 | 301 | 28 |
| Titus | 1909 | 192 | 17 |
| Tyler (part) | 1903 | 192 | 17 |
| Van Zandt | 1928 | 533 | 49 |
| Victoria | 1927 | 482 | 41 |
| Washington | 1913 | 316 | 30 |
| Webb | 1909 | 125, 301 | 7, 28 |
| Wichita | 1924 | 482 | 41 |
| Willacy | 1926 | 482 | 41 |
| Wilson | 1907 | 125 | 7 |
| Regional Reconnaissance surveys | | | |
| General | ............... | 99 | 6 |
| South Texas | 1909 | 161 | 11 |
| Panhandle | 1910 | 173 | 13 |
| South Central | 1913 | 213 | 19 |
| Northwest | 1919 | 443 | 39 |
| West Central | 1922 | 443 | 39 |
| Trans-Pecos | 1928 | 533 | 49 |

types in the area being surveyed. The samples of surface soils were usually taken to a depth of about 7 inches. Analyses by areas (usually counties) have been published by the Texas Agricultural Experiment Station in the bulletins listed in Table 1 (6, 7, 11, 13, 17, 19, 22, 28, 30, 32, 34, 38, 39, 41, 49). Maps of the areas surveyed showing the location of the soil types, together with detailed descriptions and other information, have been published by the Bureau of Chemistry and Soils of the U. S. Department of Agriculture, Washington, D. C. In the course of time, due to the information secured during the progress of the soil survey work, some of the names originally used have been changed in order to conform to more recent soil correlations which have been established after more complete information has been accumulated. For this reason, the names used in the individual publ cations are not always the same as those used in Bulletin 431 or in this publication. This is somewhat confusing but is a necessary accompaniment of scientific progress.

The analyses averaged for the purpose of this bulletin, though made over a long period of years, were all made by practically the same methods. Nitrogen was determined by the Kjeldahl method (60). Total phosphoric acid ($P_2O_5$) was estimated after ignition with magnesium nitrate (60). Active phosphoric acid is the phosphoric acid ($P_2O_5$) dissolved by 0.2 N nitric acid (8, 61). Total potash ($K_2O$) was determined by the Lawrence-Smith method of fusion with ammonium chloride and calcium carbonate (33). Acid-soluble potash is that dissolved by boiling with hydrochloric acid of 1.115 sp. gr. for a period of 8 hours (33, 51, 61). Active potash is that dissolved by 0.2 N nitric acid (33, 61). Acid-soluble lime and magnesia are dissolved by the 1.115 sp. gr. hydrochloric acid, that is, with the acid-soluble potash (61). The quantities of iron and manganese given are those dissolved at the same time as the acid-soluble potash.

Basicity is the quantity of 0.2 N nitric acid neutralized by the bases of the soil in the estimation of active phosphoric acid and active potash, expressed as carbonate of lime (21, 43, 44). When the basicity was over 8 percent, 1.0 N nitric acid was used. The pH is the degree of acidity or alkalinity determined by the quinhydrone method (1).

Other analyses, such as iron, manganese, sulphur, material insoluble in 1.115 sp. gr. hydrochloric acid, phosphoric acid absorbed, potash absorbed, and base exchange capacity, and many pot experiments were made in connection with this work, and are briefly mentioned but are not averaged by soil types for the purpose of this Bulletin.

## CHANGES IN CHEMICAL COMPOSITION OF SOILS

The chemical composition of a soil does not remain constant. If the soil is under cultivation, there may be considerable losses due to cropping (5, 18), of leaching by water (12), and erosion. Cropping may remove considerable quantities of plant food, as shown in Table 2. On the whole, vast quantities of plant food and other materials are removed from Texas soils by the various crops grown (18, 31, 33). A crop of ½ bale of cotton will take up as much as 48 pounds of nitrogen, 19 pounds of phosphoric acid, and 31 pounds of potash in the seed, the leaves, and the stems of the plant. A crop of 3,000,000 bales of cotton, as was produced in 1935, requires about 144,000 tons of nitrogen, 57,000 tons of phosphoric acid, and 93,000 tons of potash. A crop of 100,000,000 bushels of corn, as was raised in 1935, would require about 75,000 tons of nitrogen, 31,250 tons of phosphoric acid, and 50,000 tons of potash. Some of the plant food in the leaves and stems is returned to the soil, but many of the leaves are blown away or washed into low places and lost. Other crops grown in Texas besides cotton and corn remove large quantities of plant food and lime from the soils, so that the soils are continually being depleted. Legume crops, if turned under, restore some of the nitrogen, but phosphoric acid, potash, lime, and other mineral constituents can be restored only through additions of these substances.

**Table 2. Estimated quantity of soil constituents taken up by crops (pounds per acre)**

| | Nitrogen | Phosphoric acid ($P_2O_5$) | Potash ($K_2O$) |
|---|---|---|---|
| Corn (40 bushels) total | 60 | 25 | 42 |
| Grain and cob | 38 | 19 | 13 |
| Stalk and leaves | 22 | 6 | 29 |
| Cotton (250 pounds lint) total | 48 | 19 | 31 |
| Seed | 16 | 7 | 8 |
| Stalk and leaves | 32 | 12 | 23 |
| Hay, Alfalfa (4 tons) | 183 | 50 | 143 |
| Hay, Cowpea (2 tons) | 100 | 22 | 70 |
| Hay, Mixed grasses (2 tons) | 60 | 16 | 54 |
| Oats, (40 bushels) total | 35 | 14 | 28 |
| Grain | 25 | 10 | 7 |
| Straw | 10 | 4 | 21 |
| Onions (15 tons) | 72 | 37 | 72 |
| Potatoes, Irish (100 bushels) | 20 | 10 | 36 |
| Potatoes, Sweet (200 bushels) | 28 | 20 | 72 |
| Rice (1900 pounds) total | 37 | 15 | 42 |
| Grain | 23 | 12 | 5 |
| Straw | 14 | 3 | 37 |
| Sorghum, green fodder (10 tons) | 60 | 24 | 60 |
| Sugar cane (20 tons) | 40 | 42 | 160 |
| Wheat (25 bushels) total | 42 | 18 | 23 |
| Grain | 29 | 13 | 9 |
| Straw | 13 | 5 | 14 |

Some of the plant food is replaced by that in fertilizers, but the quantity of fertilizers used in Texas (42) is small compared with the quantity of plant food removed. The 60,016 tons of fertilizer sold in 1936 would contain 3,008 tons of nitrogen, 6,730 tons of phosphoric acid, and 2,314 tons of potash, (corresponding to a 5-11-3.8 fertilizer). These quantities are only about 2 per cent of the nitrogen, 12 per cent of the phosphoric acid, and 2.5 per cent of the potash required for cotton alone. When the corn, grain sorghums, vegetables, and other crops are taken into consideration, the percentages of the plant food replaced by fertilizer are probably less than one-fourth of those given above.

Erosion removes the soil itself, and so reduces the depth of the surface soil, or it may remove all of it and expose the subsoil, which is generally lower in plant food, or it may produce gullies so that the land cannot be cultivated.

Percolation of water through the soil removes much nitrogen, and also some lime, magnesia, and potash (12, 18). The extent of loss by leaching depends upon the quantity of the rainfall, the permeability of the soil, and other factors.

Applications of fertilizer containing sulphate of ammonia or other acid-forming fertilizers may make acid soils more acid (54). The natural weathering of soils may make some Texas soils less acid (48). Weathering and other natural agencies gradually change the chemical composition and physical characteristics of soils. Soils do not remain constant in chemical composition or physical composition, but are constantly, though slowly, changing. Within the area of any soil type, there are areas higher or lower in plant food than the average, due to difference in cultivation, cropping, erosion and other factors. The analyses show the composition of the soil type in a generalized way but there may be decided variations within the type.

Under the present agricultural system, Texas soils are being depleted of nitrogen, phosphoric acid, potash, lime, magnesia, and other elements, and in some places the top soil is being washed away. The soils are thus becoming poorer.

Cropping and natural agencies tend to decrease the nitrogen, active potash, the lime, especially where it is low, and to a less extent, the active phosphoric acid. Where the soil is slightly acid, the acidity may increase in the course of time, due to the cropping and the percolation of water. The total phosphoric acid, total potash, acid-soluble potash, and basicity where it is high, are very slowly affected by cropping. Since some of the analyses included in this discussion were made 10 years or more ago, some of the soils, especially those under cultivation, are lower in nitrogen, active potash, active phosphoric acid, basicity, and may be more acid, than they were at the time the samples were taken.

## GRADES FOR CONSTITUENTS OF SOILS AND THEIR INTERPRETATION

In order to facilitate the study and discussion of the composition of Texas soils, the constituents have been grouped in 5 grades, according to the quantity present, in line with the general method of grading hays or other materials. Grade 1 is the highest; that is, it contains the highest quantities of the constituent grouped. Grade 5 is the lowest, while 2, 3, and 4 are intermediate in the order named. The use of the grades facilitate comparison of the quantities of the constituents in various soils and bring out the resemblances and differences between the quantities of the chemical constituents in them. The grade not only indicates the quantities present, but also the deficiency or strength of the soil in that particular constituent. The quantities placed in each grade have been adopted so as to have the greatest meaning possible with information at present available. Available information has been construed regarding the effect of the quantity of the constituent upon the properties of the soils, and its relation to deficiencies or possible deficiencies in plant food and fertility. The information available includes the results of pot experiments and their relation to the composition of soils (8, 9, 10, 23, 24, 33, 35, 45), field experiments (15, 20, 55, 56, 57, 58, 59), and other work in the agricultural literature (18).

The quantities of the constituent included in the limits of each grade and the relation between these quantities and other methods of interpretation previously used by us are given in Table 3. The corn possibility (8) for the various grades given in Table 3 is based upon the highest amount of the plant food in the limits of the class. For example, the 10 bushels for Grade 5 of nitrogen is for .030 per cent, the highest quantity for this grade. The corn possibility represents the average amount of plant food which was withdrawn by plants in a number of pot experiments from soils containing similar amounts of total nitrogen, active phosphoric acid, or active potash. It is expressed in bushels of corn per acre and assumes that a bushel of corn requires 1.5 pounds of nitrogen, 0.625 pounds of phosphoric acid, and 1.0 pounds of potash, and that an acre of soil to a depth of 6⅔ inches weighs 2,000,000 pounds. It does not take the subsoil into consideration. The

**Table 3. Limits and interpretations of Texas grades of constituents of soils**

| Grade Number | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| Nitrogen (total) | | | | | |
| Limits—Per cent | 0–.030 | .031–.060 | .061–.120 | .121–.180 | .181+ |
| Maximum corn possibility bushels per acre | 10 | 18 | 33 | 48 | 49+ |
| Maximum number of 40 bu. corn crops | 10 | 20 | 40 | 60 | 61+ |
| Pounds per two million | 0–600 | 620–1200 | 1220–2400 | 2420–3600 | 3620 up |
| Total phosphoric acid ($P_2O_5$) | | | | | |
| Limits—Per cent | 0–.025 | .026–.050 | .051–.100 | .101–.150 | .151+ |
| Interpretation | Low | Low to fair | Fair to good | Good | High |
| Maximum number of 40 bu. corn crops | 20 | 40 | 80 | 120 | 121+ |
| Pounds per two million | 0–500 | 520–1000 | 1020–2000 | 2020–3000 | 3020 up |
| Active phosphoric acid ($P_2O_5$) | | | | | |
| Limits—P.p.m. | 0–30 | 31–100 | 101–200 | 201–400 | 401+ |
| Maximum corn possibility | 18 | 40 | 45 | 50 | 51+ |
| Pounds per million | 0–60 | 62–200 | 202–400 | 402–800 | 802 up |
| Total potash ($K_2O$) | | | | | |
| Limits—Per cent | 0–.30 | .31–.60 | .61–1.20 | 1.21–1.80 | 1.81+ |
| Pounds per two million | 0–6000 | 6200–12000 | 12200–24000 | 24200–36000 | 36200 up |
| Acid-soluble potash ($K_2O$) | | | | | |
| Limits—Per cent | 0–.10 | .11–.20 | .21–.40 | .41–.80 | .81+ |
| Interpretation | Low | Low to fair | Fair to good | Good | High |
| Maximum number of 40 bu. corn crops | 50 | 100 | 200 | 400 | 401+ |
| Pounds per two million | 0–2000 | 2200–4000 | 4200–8000 | 8200–16000 | 16200 up |
| Active potash ($K_2O$) | | | | | |
| Limits—P.p.m. | 0–50 | 51–100 | 101–200 | 201–400 | 401+ |
| Maximum corn possibility | 26 | 50 | 94 | 171 | 172+ |
| Pounds per two million | 0–100 | 102–200 | 202–400 | 402–800 | 802 up |
| Acid-soluble lime (CaO) | | | | | |
| Limits—Per cent | 0–.10 | .11–.20 | .21–.40 | .41–2.00 | 2.01+ |
| Interpretation | Low | Low to fair | Fair to good | Good | High |
| Pounds per two million | 0–2000 | 2200–4000 | 4200–8000 | 8200–40000 | 40200 up |
| Basicity ($CaCO_3$) | | | | | |
| Limits—Per cent | 0–.30 | .31–.60 | .61–2.00 | 2.01–5.00 | 5.01+ |
| Pounds per two million | 0–6000 | 6200–12000 | 12200–40000 | 40200-100,000 | 100200 up |
| Acidity (pH) | | | | | |
| Limits | 0–5.0 | 5.1–5.5 | 5.6–6.0 | 6.1–7.5 | 7.6+ |
| Acidity | Very acid | Acid | Slightly acid | Practically neutral | Alkaline |
| Acid-soluble magnesia, (MgO), | | | | | |
| Limits per cent | 0–.07 | .08–.15 | 0.16–.30 | .31–.60 | .61+ |
| Pounds per two million | 0–1400 | 1600–3000 | 3200–6000 | 6200–12000 | 12200 up |

corn possibility does not indicate the possible yield from the soil, as this depends upon the rainfall and other conditions in addition to the fertility of the soil (49). The experiments on which the corn possibility is based and the method itself is discussed in detail elsewhere (8, 33).

The number of corn crops of 40 bushels each per acre as given for each grade in Table 3 is calculated from the maximum quantity of the constituent in the grade concerned. The average for the grade would be lower. The surface soil is assumed to weigh 2,000,000 pounds to the acre as with the corn possibility. A crop of 40 bushels of corn is assumed to require 60 pounds of nitrogen, 25 pounds of phosphoric acid, and 40 pounds of potash.

The interpretations "low," "low to fair," and so forth, given in Table 3 for total phosphoric acid, are based chiefly upon observations by Hilgard (51) and others (14, 26, 52) as to the wearing qualities of the soil.

Most of the total potash is highly insoluble and only of remote value for agricultural purposes, although it includes the acid-soluble potash and the active potash. Most of the total potash is in soil compounds so highly resistant (16, 25, 37, 40) that it may remain unavailable for plant growth for thousands of years. Inter-

*pretation of the analyses for total potash are not made, although on an average it* is related to the active potash and the acid-soluble potash (33).

Since some workers report these analyses in pounds per two million of soil (sometimes incorrectly calling this pounds per acre), the grades have been expressed in these terms also.

Soils whose nitrogen, active phosphoric acid, and active potash are found in Grade 5 are very likely to be deficient in these forms of plant food for all crops. Such constituents when given Grade 4 are often, but not always, deficient. The probability of a deficiency for field crops is much lower for constituents in Grade 3, but these soils may need fertilizers for truck crops, which require much plant food for rapid heavy growth. If graded 1 or 2, they are less likely to be deficient. Fertilizer experiments (59) indicate that cotton may respond to potash on Texas soils containing 134 parts per million of active potash, which is in Grade 3. However, the chemical analysis is not an infallible indicator of the needs of the soil. Acid-soluble lime, basicity and degree of acidity (pH) are related to one another (21, 43, 44, 47). Soils with lime or basicity in Grades may be acid or become acid. When the lime or basicity has Grades 1 or 2, the soils are limestone soils and high in lime.

Grades for degree of acidity (pH) are based on ranges of pH for satisfactory plant growth. Grade 1 (7.51+) is definitely alkaline, Grade 2 is practically neutral, and is satisfactory for good growth of most crops (Table 4). Grade 5 contains soils that are so acid that most crops, particularly legumes, will not grow well. Grade 3 contains soils which are suitable for many crops but which may be sufficiently acid to decrease growth of certain crops. Soils in Grades 4 or 5 usually require proper liming for best results with most crops. However, there are some crops which give best results with slightly acid soils.

The grade cannot always be accurately interpreted in terms of crop yields or possible fertilizer responses, since these are determined by rainfall, drainage, physical character of surface soil and subsoil and other factors in addition to chemical composition, upon which the above grades are based.

Magnesia (3) is deficient in certain soils of the eastern part of the United States which have been cultivated and highly fertilized for many years, and which have

**Table 4. pH of soils for different crops (from N. C. Bulletin 293) and corresponding grade for the highest acidity**

| | pH | Grade | | pH | Grade |
|---|---|---|---|---|---|
| Alfalfa | 6.5 – 7.5 | 2(?) | Oats | 5.0 – 6.0 | 4 |
| Alsike clover | 5.5 – 6.5 | 3 | Peanuts | 5.5 – 6.5 | 3 |
| Beets | 5.5 – 7.0 | 3 | Red clover | 6.5 – 7.5 | 2(?) |
| Blackberries | 5.0 – 6.0 | 4 | Rye | 5.0 – 6.0 | 4 |
| Buckwheat | 5.0 – 6.0 | 4 | Snap beans | 5.2 – 6.0 | 4 |
| Cabbage | 5.5 – 6.5 | 3 | Soybeans | 5.0 – 6.5 | 4 |
| Cantaloupes | 5.5 – 6.5 | 3 | Spinach | 6.0 – 6.5 | 2 |
| Carrots | 5.5 – 6.5 | 3 | Strawberries | 5.5 – 6.5 | 3 |
| Corn | 5.0 – 6.0 | 4 | Sweet clover | 6.5 – 7.5 | 2(?) |
| Cotton | 5.0 – 6.0 | 4 | Sweet potatoes | 5.0 – 5.4 | 4 |
| Cowpeas | 5.0 – 6.5 | 4 | Tobacco | 5.0 – 5.6 | 4 |
| Crimson clover | 5.5 – 6.5 | 3 | Tomatoes | 5.0 – 6.5 | 4 |
| Cucumbers | 5.5 – 6.5 | 3 | Velvet beans | 5.0 – 6.0 | 4 |
| Grapes (bunch) | 5.0 – 6.0 | 4 | Vetch | 5.0 – 6.0 | 4 |
| Grasses | 5.0 – 6.0 | 4 | Watermelons | 4.5 – 5.5 | 4 |
| Irish potatoes | 5.0 – 5.4 | 4 | Wheat | 5.0 – 6.0 | 4 |
| Lespedeza | 5.5 – 6.5 | 3 | White clover | 5.5 – 6.5 | 3 |
| Lettuce | 5.0 – 6.5 | 4 | | | |

produced heavy yields of crops. The data on which to base grades of magnesia are scanty and insufficient for use in interpreting the grades. Many soils in which magnesia has Grade 5 may not be deficient in magnesia. There is as yet no evidence to show that any Texas soils are deficient in magnesia. If there are any, they would likely be found among those where magnesia has Grade 5.

## VARIATIONS IN COMPOSITION AND GRADES OF CONSTITUENTS OF SOILS GROUPED BY TYPES

The average chemical analyses of soils grouped by types given in the tables are in most cases averages of a number of samples. Some variation in composition between samples of the same soil type is found. In most of the soil types, however, the variations are comparatively small, so that the averages given are fairly representative of what may be considered the composition of the type as a whole. In some cases, the quantity of a constituent in an individual sample may be considerably higher or lower than that in the most of the samples of that soil type. In such cases, the figure for that constituent in that sample has been omitted in calculating the average. For information regarding individual analyses, the bulletins dealing with the composition of soils of the various counties should be consulted.

Any grading according to quantity of the various constituents must necessarily contain some samples near the lowest limit and some near the highest limit. A soil type containing 3 parts per million of active phosphoric acid would be given Grade 5 the same as one containing 29 parts per million. Obviously, the soil containing 29 parts per million, although low in active phosphoric acid and therefore correctly graded 5, may have a higher capacity to furnish plants with phosphoric acid than has the soil type which contains only 3 parts per million. Such variations within a given grade may be relatively more important in Grades 4 and 5, where the quantity of the constituent is low, than in the higher grades where the plant may be able to secure as much plant food at the lower limit of the grade as at the higher limit. For the study of an individual soil type, reference must be made to the analysis of individual samples.

Some of the soil types discussed later are represented by only one or two samples. Such analyses give indications as to the quantities of the several constituents which may be found in the type, but cannot be considered as clearly representative of the soil type as a whole as where many samples of a soil type have been analyzed. As previously stated, some of the samples were analyzed over ten years ago, and there is a decrease in fertility of some of them, especially those cropped constantly, and also a possible increase in acidity of slightly acid soils.

## CHEMICAL COMPOSITION OF SOIL TYPES IN THE GEOGRAPHIC DIVISION OF TEXAS

Soils are the results of the action of weathering agencies, such as rain, temperature, wind and biological activity upon the parent material. Similarity of soil characteristics due to similar parent material and similar weathering agencies makes possible the division of Texas into a number of regions containing soils which are in many respects similar to one another. These regions have been presented and described in Bulletin 431 (4). The soil series in each region are closely related, many of them

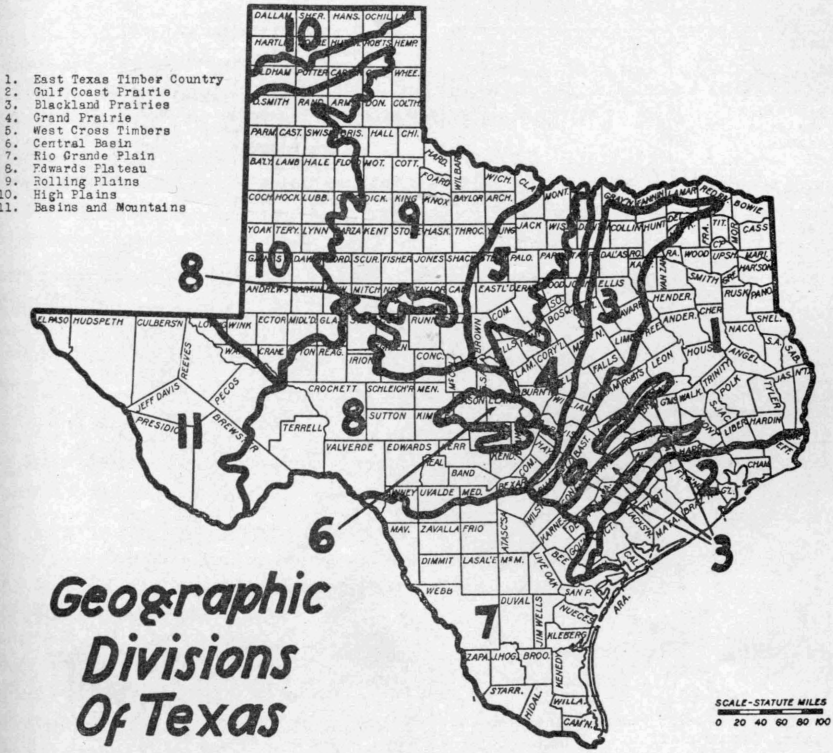


Figure 1.

are found only in this region, they have a similar origin, and were formed by similar natural agencies. The soil series in one region are related in some broad characteristics which differ, as a rule, from the broad characteristics of the soils of the other regions. The regions are indicated in Figure 1.

This classification brings together and compares soil types which are adjacent and related. The chemical composition and grades of constituents of the various soil types are discussed by regions in which the soils occur.

In each geographic area, the more closely related soil groups are indicated as comprising a number of soil series, each of which in turn includes one or more soil types. These are shown in Figure 2, and the legend indicates the general characteristics of the group by giving the name or names of one or more of the prominent soil series of the group.

The descriptions of the regions and of the soil series are given only in outline sufficient to identify them. More complete descriptions may be found in Bulletin 431 (4) and in the reports of the various soil surveys.

Most of the soils whose analyses are given in this Bulletin are those of considerable areal extent and importance. Soil surveys have listed more than 700 soil types in the State and only 25 per cent of the land area of Texas has been surveyed in detail.

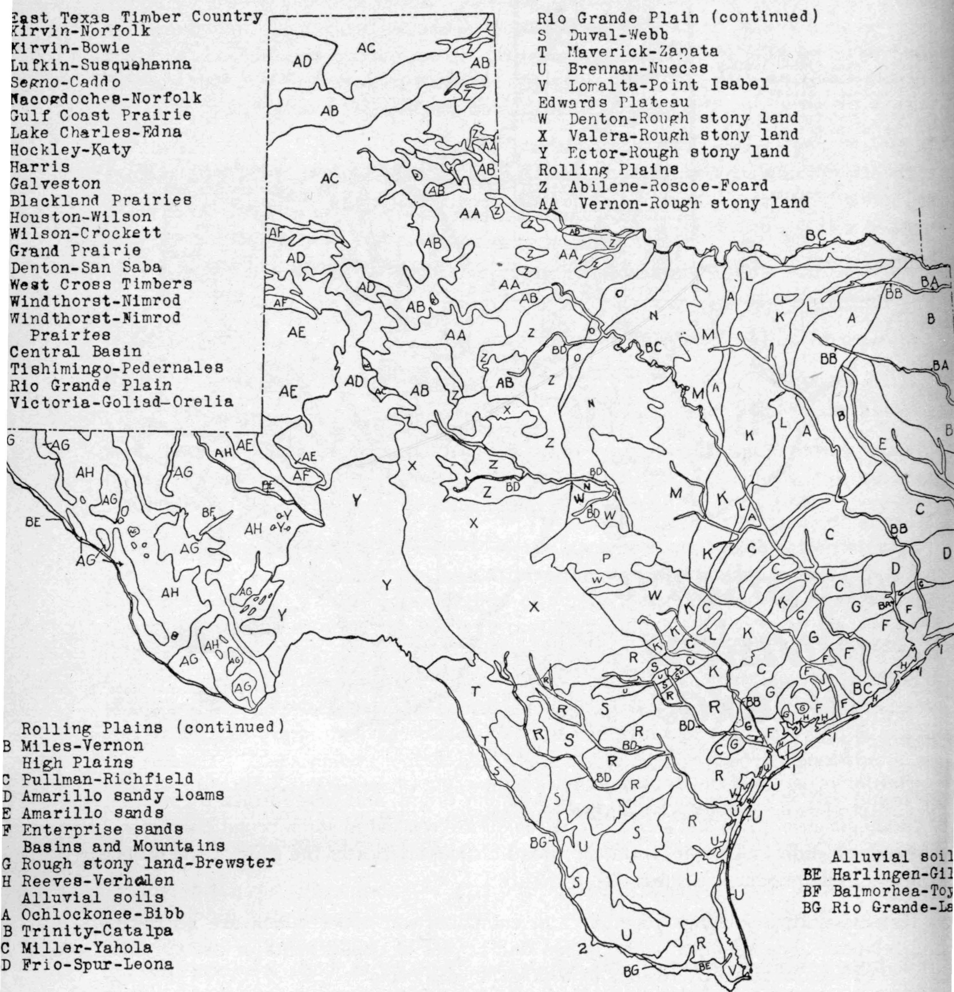


Figure 2. Principal groups of soil series in Texas.

## GULF COAST PRAIRIE

The Gulf Coast Prairie consists of a nearly flat strip of land varying from 20 to 80 miles wide, bordering the Gulf of Mexico, and extending from the Sabine river at the Louisiana line to the vicinity of the San Antonio River at the west edge of Victoria County. The area covers about 8,000,000 acres of land lying within, or partly within, 19 counties. Along the coast the surface is but a few feet above sea level; inland the surface rises very gradually and uniformly to elevations of more than 100 feet above sea-level in the more northerly sections. On the basis of the main soil characteristics, the soils of the Coast Prairie are divided into (1) dark-colored prairie soils, (2) light-colored prairie soils, (3) marshy and semi-marshy soils, and (4) flat stream bottom soils.

## Outline description of series

**Dark-colored prairie soils:**

**Lake Charles soils:** Black, dark-gray or brown, noncalcareous surface soils fairly tight on drying, with heavy subsoils slowly permeable to water.

**Light-colored prairie soils:**

**Crowley soils:** Bluish-gray to brownish-gray or brown to dark-brown surface soil mottled in many places 4 to 8 inches deep, with a bluish-gray heavy subsoil mottled with yellow or brown.

**Edna soils:** Light-brown to gray, sandy surface with a dense, impervious gray clay subsoil.

**Galveston soils:** Gray, loose, incoherent sand with a yellow or gray subsoil.

**Hockley soils:** Light-brown and gray, sandy surface with a dense mottled gray and yellow clay subsoil.

**Katy soils:** Light-brown to gray, sandy surface with a dense mottled gray, red, and yellow subsoil.

**Marshy to semi-marshy prairies:**

**Harris soils:** Gray to brown surface with high salt content, and a gray or brown dense clay subsoil with a high water table.

**Flat stream-bottom soils:**

**Guadalupe soils:** Brown or ash-brown, calcareous surface with a light brown or yellowish-brown calcareous subsoil which is of light texture.

**Miller soils:** Reddish, friable, calcareous surface with red, crumbly subsoil heavier than the surface.

**Ochlockonee soils:** Brown or light-brown, noncalcareous surface with brown, yellow or gray or mottled noncalcareous subsoil.

**Pledger soils:** Brown or black friable, calcareous surface with red friable, calcareous subsoil.

**Trinity soils:** Black or dark gray, calcareous surface and subsoil.

**Yahola soils:** Reddish, friable, calcareous surface soils with subsoils lighter in texture than the surface soil.

## Composition of soil types

The composition of the soils is given in Table 5 and the grades of constitutents of surface soils in Table 6. The dark-colored prairie soils (Lake Charles series) have grades 2, 3, and 4 for nitrogen, potash, lime, and magnesia, but Grades 4 and 5 for phosphoric acid. The light-colored soils have mostly Grade 3 for nitrogen and magnesia and Grades 4 and 5 for potash, phosphoric acid, basicity, and lime. The calcareous river bottom soils are graded 3 to 1 for all constituents. Some of these soils may have become more acid since the analyses were made. The noncalcareous Ochlockonee soils have lower grades (4 and 5) for all constituents than the calcareous soils, particularly active phosphoric acid.

**Table 5. Analyses of soils of the Gulf Coast Prairie**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos. Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dark-colored prairie soils | | | | | | | | | | | |
| Lake Charles clay, surface | 40 | .118 | .036 | 35 | .84 | .53 | 180 | 1.17 | 1.83 | .46 | 6.5 |
| Lake Charles clay, subsoil | 40 | .073 | .030 | 17 | .73 | .40 | 140 | 1.32 | 1.83 | .55 | 6.4 |
| Lake Charles clay loam, surface | 10 | .102 | .030 | 21 | .60 | .22 | 85 | .43 | 1.07 | .31 | 6.6 |
| Lake Charles clay loam, subsoil | 10 | .061 | .033 | 12 | .75 | .22 | 104 | .55 | 1.19 | .45 | 6.7 |
| Lake Charles fine sand, surface | 1 | .120 | .129 | 458 | ........ | .20 | 428 | .34 | .62 | .11 | ........ |
| Lake Charles fine sand, subsoil | 1 | .042 | .69 | 239 | ........ | .18 | 138 | .59 | 1.41 | .15 | 7.1 |
| Lake Charles fine sandy loam, surface | 5 | .079 | .022 | 19 | .56 | .11 | 105 | .19 | .24 | .12 | 6.3 |
| Lake Charles fine sandy loam, subsoil | 5 | .060 | .016 | 9 | .82 | .15 | 95 | .20 | .63 | .17 | 6.6 |
| Lake Charles loam, surface | 1 | .094 | .013 | 23 | .31 | .57 | 133 | .46 | .92 | .22 | ........ |
| Lake Charles loam, subsoil | 1 | .055 | .018 | 10 | ........ | .79 | 80 | .52 | 1.02 | .13 | ........ |
| Lake Charles silty clay loam, surface | 4 | .125 | .039 | 17 | .45 | .19 | 105 | .61 | .94 | .25 | 6.3 |
| Lake Charles silty clay loam, subsoil | 4 | .056 | .042 | 6 | .50 | .22 | 112 | 1.18 | 1.86 | .35 | 6.1 |
| Lake Charles very fine sandy loam, surface | 8 | .070 | .021 | 18 | .24 | .10 | 103 | .24 | .52 | .21 | 6.6 |
| Lake Charles very fine sandy loam, subsoil | 8 | .051 | .017 | 13 | .50 | .14 | 81 | .27 | .66 | .23 | 6.7 |
| Light-colored prairie soils | | | | | | | | | | | |
| Crowley clay, surface | 3 | .164 | .041 | 16 | .53 | .21 | 106 | .36 | .75 | .17 | 5.8 |
| Crowley clay, subsoil | 3 | .088 | .037 | 10 | .54 | .27 | 141 | .41 | .78 | .33 | 5.7 |
| Crowley silt loam, surface | 2 | .108 | .046 | 8 | .29 | .14 | 99 | .57 | .17 | .25 | 6.4 |
| Crowley silt loam, subsoil | 2 | .079 | .034 | 5 | .58 | .29 | 92 | .33 | .77 | .44 | 6.5 |
| Edna clay, surface | 1 | .070 | .018 | 19 | .98 | ........ | 106 | ........ | .96 | ........ | 6.0 |
| Edna clay, subsoil | 1 | .137 | .031 | 16 | .93 | ........ | 182 | ........ | .75 | ........ | 5.3 |
| Edna fine sandy clay loam, surface | 1 | .086 | .024 | 22 | .22 | .10 | 88 | .19 | .47 | .15 | 5.8 |
| Edna fine sandy clay loam, subsoil | 1 | .041 | .015 | 9 | .30 | .09 | 57 | .27 | .51 | .18 | 6.3 |
| Edna fine sandy loam, surface | 12 | .074 | .018 | 19 | .65 | .24 | 122 | .27 | .64 | .24 | 6.2 |
| Edna fine sandy loam, subsoil | 12 | .048 | .023 | 9 | .61 | .34 | 114 | .31 | 1.08 | .30 | 6.4 |
| Edna loam, surface | 3 | .094 | .025 | 20 | 1.11 | .50 | 245 | .94 | .46 | .38 | ........ |
| Edna loam, subsoil | 2 | .061 | .007 | 3 | .99 | .68 | 240 | .41 | .60 | .63 | ........ |
| Edna silty clay loam, surface | 1 | .171 | .039 | 27 | .92 | ........ | 146 | ........ | .85 | ........ | 5.3 |
| Edna silty clay loam, subsoil | 1 | .061 | .018 | 9 | .85 | ........ | 82 | ........ | .62 | ........ | 5.6 |
| Edna very fine sandy loam, surface | 3 | .072 | .020 | 18 | .51 | .06 | 77 | .15 | .36 | .09 | 6.3 |
| Edna very fine sandy loam, subsoil | 3 | .040 | .013 | 10 | .73 | .05 | 84 | .18 | .50 | .11 | 6.6 |
| Galveston fine sand, surface | 2 | .056 | .034 | 12 | .81 | .12 | 154 | .57 | 1.03 | .18 | 7.6 |
| Galveston fine sand, subsoil | 2 | .029 | .034 | 16 | .43 | .05 | 60 | .20 | .33 | .10 | 6.7 |
| Hockley fine sandy loam, surface | 9 | .057 | .022 | 17 | .26 | .10 | 82 | .15 | .17 | .09 | 6.4 |
| Hockley fine sandy loam, subsoil | 9 | .046 | .010 | 8 | .31 | .14 | 72 | 1.74 | 1.28 | .21 | 6.1 |
| Katy fine sandy loam, surface | 10 | .074 | .024 | 17 | .64 | .12 | 99 | .16 | .43 | .11 | 6.2 |
| Katy fine sandy loam, subsoil | 10 | .053 | .019 | 10 | .44 | .19 | 86 | .23 | .46 | .16 | 6.2 |

## Table 5. Analyses of soils of the Gulf Coast Prairie—Continued

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos. Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat marshy to semi-marshy soils | | | | | | | | | | | |
| Harris clay, surface | 2 | .166 | .054 | 75 | 1.53 | .55 | 886 | .37 | .87 | .73 | 6.7 |
| Harris clay, subsoil | 2 | .068 | .042 | 43 | 1.64 | .60 | 851 | .27 | .85 | .91 | 7.1 |
| Harris fine sandy loam, surface | 1 | .094 | .041 | 55 | .52 | .10 | 129 | .15 | .11 | .14 | 6.2 |
| Harris fine sandy loam, subsoil | 1 | .026 | .017 | 19 | .38 | .09 | 128 | .08 | .45 | .08 | 6.5 |
| Tidal marsh, surface | 1 | .381 | .057 | ........ | .73 | .38 | ........ | .50 | ........ | .68 | 6.4 |
| Tidal marsh, subsoil | 1 | .149 | .032 | 60 | .90 | .38 | 568 | .35 | 1.10 | .66 | 6.7 |
| Flat stream bottom soils | | | | | | | | | | | |
| Guadalupe clay, surface | 2 | .159 | .089 | 64 | 1.36 | .68 | 358 | 13.25 | 24.05 | 1.14 | 7.2 |
| Guadalupe clay, subsoil | 2 | .129 | .088 | 47 | 1.21 | .70 | 410 | 13.71 | 24.60 | 1.18 | 7.4 |
| Guadalupe silty clay loam, surface | 2 | .113 | .075 | 97 | 1.43 | .31 | 284 | 6.42 | 15.15 | .70 | 7.5 |
| Guadalupe silty clay loam, subsoil | 2 | .083 | .048 | 42 | 1.30 | .30 | 130 | 6.67 | 15.70 | .57 | 7.6 |
| Miller clay, surface | 13 | .091 | .119 | 168 | 2.13 | 1.03 | 332 | 4.40 | 8.57 | 1.12 | 7.4 |
| Miller clay, subsoil | 13 | .072 | .097 | 141 | 1.94 | .79 | 258 | 4.87 | 8.52 | 1.05 | 7.6 |
| Miller clay loam, surface | 2 | .047 | .055 | 175 | 1.19 | .60 | 240 | 2.38 | 4.68 | .83 | 8.0 |
| Miller clay loam, subsoil | 2 | .046 | .074 | 171 | 1.68 | .84 | 230 | 2.52 | 5.44 | 1.12 | 8.4 |
| Miller fine sand, surface | 1 | .028 | .058 | 265 | 1.27 | .25 | 241 | 2.98 | 5.70 | .24 | 7.5 |
| Miller fine sandy loam, surface | 12 | .057 | .066 | 233 | 1.33 | .32 | 265 | 1.30 | 2.26 | .25 | 7.4 |
| Miller fine sandy loam, subsoil | 12 | .042 | .049 | 65 | 1.23 | .47 | 168 | 2.16 | 3.65 | .41 | 7.5 |
| Miller loam, surface | 2 | .072 | .058 | 172 | .65 | .47 | 476 | .73 | 1.54 | .63 | 7.4 |
| Miller loam, subsoil | 2 | .059 | .060 | 175 | .81 | .47 | 283 | 3.82 | 4.65 | .98 | 7.8 |
| Miller silt loam, surface | 3 | .094 | .095 | 311 | 1.62 | .60 | 348 | 4.04 | 8.10 | 1.69 | ........ |
| Miller silt loam, subsoil | 3 | .050 | .094 | 210 | 1.90 | .56 | 167 | 5.87 | 9.82 | 1.01 | ........ |
| Miller silty clay loam, surface | 8 | .084 | .082 | 284 | 2.02 | .67 | 470 | 3.12 | 5.36 | 1.04 | 7.4 |
| Miller silty clay loam, subsoil | 8 | .054 | .080 | 269 | 1.93 | .93 | 238 | 3.68 | 6.73 | 1.02 | 7.5 |
| Miller silty clay, surface | 1 | .136 | .160 | 131 | 2.18 | 1.19 | 311 | 8.37 | 10.+ | 1.11 | ........ |
| Miller silty clay, subsoil | 1 | .064 | .099 | 36 | 1.92 | .83 | 115 | 10.81 | 10.+ | 1.68 | ........ |
| Miller very fine sand, surface | 2 | .027 | .061 | 147 | 1.30 | .22 | 115 | 2.02 | 4.14 | .51 | 7.3 |
| Miller very fine sand, subsoil | 1 | .019 | .082 | 331 | 2.08 | .15 | 139 | 1.63 | 3.30 | .68 | 7.3 |
| Miller very fine sandy loam, surface | 7 | .055 | .062 | 228 | 1.53 | .31 | 216 | 1.39 | 2.71 | .46 | 7.3 |
| Miller very fine sandy loam, subsoil | 7 | .057 | .072 | 216 | 1.67 | .54 | 213 | 1.76 | 3.29 | .86 | 7.4 |
| Ochlockonee clay, surface | 6 | .143 | .088 | 72 | 1.43 | .34 | 275 | .88 | 1.59 | .48 | 6.5 |
| Ochlockonee clay, subsoil | 6 | .078 | .046 | 41 | 1.09 | .33 | 179 | .70 | 1.24 | .49 | 6.3 |
| Ochlockonee clay loam, surface | 1 | .066 | .038 | 26 | 1.35 | ........ | 161 | ........ | .79 | ........ | 6.7 |
| Ochlockonee clay loam, subsoil | 1 | .077 | .035 | 23 | 1.52 | ........ | 172 | ........ | 1.23 | ........ | 7.1 |
| Ochlockonee sand, surface | 1 | .040 | .022 | 17 | .49 | .05 | 46 | .20 | .19 | .11 | 5.5 |
| Ochlockonee sand, subsoil | 1 | .007 | .012 | 14 | .34 | .06 | 8 | .06 | .14 | .08 | 6.0 |
| Ochlockonee fine sand, surface | 2 | .047 | .036 | 68 | .81 | .07 | 89 | .16 | .31 | .11 | 6.3 |
| Ochlockonee fine sand, subsoil | 2 | .016 | .027 | 30 | 1.09 | .21 | 77 | .07 | .22 | .06 | 6.3 |

**Table 5. Analyses of soils of the Gulf Coast Prairie—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat stream bottom soils (Continued) | | | | | | | | | | | |
| Ochlockonee fine sandy loam, surface | 14 | .062 | .055 | 24 | .95 | .11 | 156 | .19 | .47 | .15 | 6.8 |
| Ochlockonee fine sandy loam, subsoil | 14 | .045 | .042 | 12 | 1.03 | .12 | 93 | .19 | .42 | .17 | 6.3 |
| Ochlockonee silt loam, surface | 3 | .122 | .088 | 84 | 1.05 | .19 | 320 | .31 | .84 | .19 | 6.8 |
| Ochlockonee silt loam, subsoil | 3 | .085 | .061 | 22 | 1.25 | .21 | 160 | .33 | .84 | .26 | 6.5 |
| Ochlockonee silty clay, surface | 1 | .133 | .205 | 14 | .92 | .61 | 261 | .51 | 1.30 | .54 | 6.6 |
| Ochlockonee silty clay, subsoil | 1 | .077 | .135 | 14 | 1.15 | .65 | 161 | .41 | 1.30 | .68 | 6.4 |
| Ochlockonee silty clay loam, surface | 5 | .144 | .090 | 78 | 1.29 | .30 | 233 | .46 | 1.51 | .44 | 6.7 |
| Ochlockonee silty clay loam, subsoil | 5 | .076 | .067 | 41 | 1.38 | .28 | 178 | .29 | .65 | .47 | 5.8 |
| Ochlockonee very fine sandy loam, surface | 2 | .071 | .052 | 18 | .84 | .12 | 107 | .50 | .43 | .17 | 6.4 |
| Ochlockonee very fine sandy loam, subsoil | 2 | .056 | .031 | 15 | .67 | .13 | 79 | .20 | .43 | .19 | 6.0 |
| Pledger clay, surface | 3 | .134 | .131 | 277 | 2.45 | 1.19 | 604 | 1.68 | 3.66 | .29 | 7.5 |
| Pledger clay, subsoil | 3 | .091 | .077 | 185 | 2.43 | 1.33 | 319 | 2.22 | 4.20 | 2.01 | 8.1 |
| Pledger silt loam, surface | 2 | .203 | .105 | 308 | 1.66 | .60 | 330 | .78 | 1.83 | .64 | ........ |
| Pledger silt loam, subsoil | 2 | .074 | .058 | 104 | 1.74 | .75 | 210 | 5.74 | 10.+ | .63 | ........ |
| Trinity clay, surface | 42 | .151 | .115 | 128 | 1.21 | .61 | 319 | 5.15 | 9.69 | .78 | 7.1 |
| Trinity clay, subsoil | 42 | .097 | .093 | 86 | 1.23 | .47 | 216 | 6.31 | 10.16 | .91 | 7.3 |
| Trinity fine sandy clay loam, surface | 1 | .096 | .088 | 310 | 1.02 | .33 | 233 | 6.02 | 10.70 | .53 | 7.6 |
| Trinity fine sandy clay loam, subsoil | 1 | .087 | .085 | 132 | 1.29 | .27 | 82 | 8.47 | 15.50 | .62 | 7.6 |
| Trinity fine sandy loam, surface | 4 | .089 | .065 | 164 | 1.20 | .22 | 222 | 3.17 | 6.01 | .25 | 7.8 |
| Trinity fine sandy loam, subsoil | 4 | .048 | .045 | 93 | 1.30 | 4.47 | 224 | 4.51 | 8.23 | .21 | 6.9 |
| Yahola clay, surface | 2 | .107 | .124 | 188 | 2.34 | .96 | 390 | 3.66 | 8.70 | 2.68 | 7.0 |
| Yahola clay, subsoil | 2 | .045 | .091 | 164 | 1.36 | ........ | 134 | 3.09 | 8.75 | 1.47 | 7.3 |
| Yahola clay loam, surface | 2 | .055 | .083 | 276 | 1.52 | .49 | 264 | .24 | 3.39 | .23 | ........ |
| Yahola fine sandy loam, surface | 4 | .058 | .071 | 312 | 1.63 | .38 | 353 | 2.63 | 4.60 | .53 | 7.9 |
| Yahola fine sandy loam, subsoil | 4 | .038 | .088 | 273 | 1.49 | .41 | 182 | 4.68 | 7.88 | .64 | 7.9 |
| Yahola loamy fine sand, surface | 1 | .010 | .057 | 311 | 1.24 | .33 | 116 | 4.50 | 2.60 | .40 | 7.4 |
| Yahola loamy fine sand, subsoil | 1 | .019 | .059 | 330 | 1.51 | .46 | 114 | 3.60 | 7.00 | .43 | 7.6 |
| Yahola loamy very fine sand, surface | 1 | .068 | .082 | 435 | 1.55 | .68 | 697 | 2.43 | 6.05 | .80 | 7.6 |
| Yahola loamy very fine sand, subsoil | 1 | .027 | .061 | 351 | 1.50 | .60 | 248 | 2.57 | 5.90 | 1.14 | 7.7 |
| Yahola silty clay loam, surface | 4 | .085 | .104 | 381 | 2.56 | 1.10 | 448 | 3.87 | 6.25 | .86 | 7.5 |
| Yahola silty clay loam, subsoil | 4 | .056 | .086 | 435 | 2.05 | .69 | 281 | 3.38 | 6.56 | 1.05 | 7.6 |
| Yahola silt loam, surface | 4 | .093 | .109 | 445 | 2.24 | .71 | 401 | 2.87 | 5.01 | 1.13 | 7.8 |
| Yahola silt loam, subsoil | 4 | .061 | .113 | 389 | 1.96 | .74 | 270 | 2.87 | 4.76 | 1.44 | 7.8 |
| Yahola very fine sandy loam, surface | 6 | .068 | .090 | 389 | 1.89 | .54 | 319 | 2.19 | 4.73 | .51 | 7.4 |
| Yahola very fine sandy loam, subsoil | 6 | .033 | .075 | 380 | 1.83 | .51 | 227 | 2.38 | 5.70 | .62 | 7.6 |

**Table 6. Grades of constituents of surface soils of the Gulf Coast Prairie**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dark-colored prairie soils | | | | | | | | | | | |
| Lake Charles clay | 40 | 3 | 4 | 4 | 3 | 2 | 3 | 2 | 3 | 2 | 2 |
| Lake Charles clay loam | 10 | 3 | 4 | 5 | 4 | 3 | 4 | 2 | 3 | 2 | 2 |
| Lake Charles fine sand | 1 | 3 | 2 | 1 | ........ | 4 | 1 | 3 | 3 | 4 | ........ |
| Lake Charles fine sandy loam | 5 | 3 | 5 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 2 |
| Lake Charles loam | 1 | 3 | 5 | 5 | 4 | 2 | 3 | 2 | 3 | 3 | ........ |
| Lake Charles silty clay loam | 4 | 2 | 4 | 5 | 4 | 4 | 3 | 2 | 3 | 3 | 2 |
| Lake Charles very fine sandy loam | 8 | 3 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 2 |
| Light-colored prairie soils | | | | | | | | | | | |
| Crowley clay | 3 | 2 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 3 | 3 |
| Crowley clay loam | 2 | 3 | 4 | 5 | 5 | 4 | 4 | 2 | 5 | 3 | 2 |
| Edna clay | 1 | 3 | 5 | 5 | 3 | ........ | 3 | ........ | 3 | ........ | 3 |
| Edna fine sandy clay loam | 1 | 3 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 3 |
| Edna fine sandy loam | 12 | 3 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Edna loam | 3 | 3 | 5 | 5 | 3 | 2 | 2 | 2 | 4 | 2 | ........ |
| Edna silty clay loam | 1 | 2 | 4 | 5 | 3 | ........ | 3 | ........ | 3 | ........ | 4 |
| Edna very fine sandy loam | 3 | 3 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 2 |
| Galveston fine sand | 2 | 4 | 4 | 5 | 3 | 4 | 3 | 2 | 3 | 3 | 1 |
| Hockley fine sandy loam | 9 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 2 |
| Katy fine sandy loam | 10 | 3 | 5 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 2 |
| Flat marshy to semi-marshy soils | | | | | | | | | | | |
| Harris clay | 2 | 2 | 3 | 4 | 2 | 2 | 1 | 3 | 3 | 4 | 2 |
| Harris fine sandy loam | 1 | 3 | 4 | 4 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| Tidal marsh | 1 | 3 | 3 | ........ | 3 | 3 | ........ | 2 | ........ | 4 | 2 |
| Flat stream bottom soils | | | | | | | | | | | |
| Guadalupe clay | 2 | 2 | 3 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| Guadalupe silty clay loam | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 1 | 1 | 1 | 2 |
| Miller clay | 13 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 2 |
| Miller clay loam | 2 | 4 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |
| Miller fine sand | 1 | 5 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 2 |
| Miller fine sandy loam | 12 | 4 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| Miller loam | 2 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 1 | 2 |
| Miller silt loam | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | ........ |
| Miller silty clay loam | 8 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 |
| Miller silty clay | 1 | 2 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | ........ |
| Miller very fine sand | 2 | 5 | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 |
| Miller very fine sandy loam | 7 | 4 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 |
| Ochlockonee clay | 6 | 2 | 3 | 4 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| Ochlockonee clay loam | 1 | 3 | 4 | 5 | 2 | ........ | 3 | ........ | 3 | ........ | 2 |

**Table 6. Grades of constituents of surface soils of the Gulf Coast Prairie—Continued**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat stream bottom soils—(Continued) | | | | | | | | | | | |
| Ochlockonee sand | 1 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 4 |
| Ochlockonee fine sand | 2 | 4 | 4 | 4 | 3 | 5 | 4 | 4 | 4 | 4 | 2 |
| Ochlockonee fine sandy loam | 14 | 3 | 3 | 5 | 3 | 4 | 3 | 4 | 4 | 4 | 2 |
| Ochlockonee silt loam | 3 | 2 | 3 | 4 | 3 | 4 | 2 | 3 | 3 | 3 | 2 |
| Ochlockonee silty clay | 1 | 2 | 1 | 5 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| Ochlockonee silty clay loam | 5 | 2 | 3 | 4 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| Ochlockonee very fine sandy loam | 2 | 3 | 3 | 5 | 3 | 4 | 3 | 2 | 4 | 3 | 2 |
| Pledger clay | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 2 |
| Pledger silt loam | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | ........ |
| Trinity clay | 42 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| Trinity fine sandy clay loam | 1 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 |
| Trinity fine sandy loam | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 1 |
| Yahola clay | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 2 |
| Yahola clay loam | 2 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | ........ |
| Yahola fine sandy loam | 4 | 4 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 1 |
| Yahola loamy fine sand | 1 | 5 | 3 | 2 | 2 | 3 | 3 | 1 | 2 | 2 | 2 |
| Yahola loamy very fine sand | 1 | 3 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Yahola silty clay loam | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Yahola silt loam | 4 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 |
| Yahola very fine sandy loam | 6 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |

## EAST TEXAS TIMBER COUNTRY

The East Texas Timber County is a continuation of the great coastal belt of timbered sandy land extending from New Jersey along the Atlantic and Gulf seaboard and extends southwestward into Texas as far as DeWitt and Wilson Counties. The soils are mostly of light texture and color and are low in organic matter. A narrow strip of timbered sandy soils lying 50 to 75 miles west of the East Texas Timber Country in the northern part of the State, known as the East Cross Timbers, is also included in the discussion of this region because of the similarity of soils. The two areas have a combined area of about 26,000,000 acres covering all or parts of 74 counties. The surface relief of the region is uneven, with a general slope from north to south. Elevations in the southern parts range from 100 to 200 feet and increase northward to 300 to 600 feet above sea-level. The land is generally undulating to rolling and hilly, and is deeply carved by stream erosion.

The soils consist mainly of light-colored or red fine sands and fine sandy loams underlain by subsoils which are heavier than the surface soils. The subsoils, mostly of clay or sandy clay, differ greatly in color and structure. The groups of series are (1) upland soils with friable subsoils, (2) terrace soils with friable subsoils, (3) upland soils with dense subsoils, (4) terrace soils with dense subsoils, and (5) flat stream-bottom soils.

### Outline description of series

**Upland soils with friable subsoils:**

**Bowie soils:** Gray to light-brown surface with a yellow subsurface and a yellow permeable subsoil mottled with gray or red.

**Caddo soils:** Gray surface with yellow subsurface and yellow, slowly permeable subsoils, mottled with gray in the lower part.

**Kirvin soils:** Light brown to grayish or slightly reddish surface with red, slowly permeable subsoil with some gray mottling in the lower part.

**Nacogdoches soils:** Red surface with ironstone fragments in many places, and a yellow permeable subsoil with red spots and ironstone pebbles.

**Norfolk soils:** Gray surface with yellow subsurface and yellow, very permeable and sandy subsoil.

**Orangeburg soils:** Gray to brownish-gray, noncalcareous surface with a red, friable, sandy clay subsoil.

**Ruston soils:** Light-brown to grayish surface with brown, yellowish or reddish subsurface soil and a reddish-yellow, reddish-brown, or light red, very permeable subsoil.

**Terrace soils with friable subsoils:**

**Amite soils:** Brown to reddish-brown noncalcareous surface with a red to dull-red, friable heavy subsoil.

**Bienville soils:** Brown to grayish-brown surface with a yellowish-brown or light-brown, friable subsoil.

**Cahaba soils:** Light-brown surface with reddish or yellowish subsurface and light-red, very permeable subsoil.

**Kalmia soils:** Light-brown or gray surface with yellow subsurface and yellow, very permeable subsoil.

**Upland soils with dense subsoils:**

**Acadia soils:** Light-brown, gray or slightly mottled surface, tight when dry, with a gray or slightly mottled dense clay subsoil.

**DeWitt soils:** Grayish-brown surface with dense, heavy yellow clay, mottled with gray or yellowish-brown and gray subsoil.

**Lufkin soils:** Gray surface, becoming tight on drying, with gray, dense, very slowly permeable subsoil.

**Morse soils:** Brown or dark-brown surface with a stiff clay subsoil, mottled with gray, yellow and some red.

**Oktibbeha soils:** Gray to brownish surface with red or mottled red, yellow and gray plastic subsoil, with underlying calcareous clay or marl.

**Susquehanna soils:** Light-brown to gray surface with yellow sub-surface and red and gray mottled, dense, very slowly permeable subsoil.

**Tabor soils:** Light-brown to gray surface with yellow subsurface and yellow rather dense, moderately permeable subsoil.

**Terrace soils with dense subsoils:**

**Leaf soils:** Light-brown surface with reddish or yellowish subsurface and dense, mottled red and gray, very slowly permeable subsoil.

**Myatt soils:** Gray surface, becoming tight on drying, with gray, dense, very slowly permeable subsoil.

**Flat stream-bottom soils:**

**Bibb soils:** Gray or slightly mottled surface with gray, slightly mottled subsoil

**Hannahatchee soils:** Red or brown surface with red subsoil.

**Ochlockonee soils:** Brown or light brown, noncalcareous surface with brown yellow, or gray or mottled, noncalcareous subsoil. Analyses and grades of constituents are given in Tables 5 and 6 for the Gulf Coast Prairie.

**Portland soils:** Chocolate-brown surface with light chocolate-brown or reddish-brown subsoil.

## Composition of soil types

The average composition of the soil types is given in Table 7 and the grades of the constituents of the surface soils in Table 8. Practically all of the upland soils have Grades 4 and 5 for all constituents except the total and active potash, for which most of the soil types have Grades 3 and 4. Most of the types have Grade 4 for nitrogen and magnesia and Grade 5 for active phosphoric acid and basicity. Although the basicity in most of the types is quite low, the most of the soils are not very acid, and have Grade 2 for pH values. It is possible some of these soils are more acid now than when these analyses were made. Very few significant differ-

**Table 7. Analyses of soils of the East Texas Timber Country**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils with friable subsoils | | | | | | | | | | | |
| Bowie fine sandy loam, surface | 7 | .034 | .031 | 22 | .90 | .08 | 135 | .11 | .17 | .09 | 6.9 |
| Bowie fine sandy loam, subsoil | 7 | .029 | .031 | 8 | .91 | .14 | 98 | .11 | .24 | .17 | 6.6 |
| Bowie very fine sandy loam, surface | 10 | .038 | .034 | 17 | .52 | .14 | 83 | .38 | .21 | .15 | 6.3 |
| Bowie very fine sandy loam, subsoil | 10 | .042 | .036 | 8 | .51 | .37 | 75 | .16 | .26 | .17 | 5.4 |
| Caddo fine sandy loam, surface | 12 | .040 | .027 | 23 | .77 | .09 | 130 | .11 | .17 | .11 | 6.6 |
| Caddo fine sandy loam, subsoil | 12 | .032 | .026 | 8 | .84 | .19 | 98 | .12 | .29 | .14 | 5.6 |
| Kirvin clay loam, surface | 2 | .100 | .109 | 11 | .46 | .20 | 257 | .11 | .84 | .13 | 6.6 |
| Kirvin clay loam, subsoil | 2 | .064 | .100 | 9 | .37 | .35 | 158 | .20 | .98 | .29 | 6.3 |
| Kirvin fine sandy loam, surface | 26 | .050 | .061 | 22 | .57 | .12 | 124 | .21 | .42 | .12 | 6.9 |
| Kirvin fine sandy loam, subsoil | 26 | .040 | .051 | 9 | .88 | .42 | 168 | .44 | .82 | .52 | 6.4 |
| Kirvin gravelly fine sandy loam, surface | 2 | .054 | .042 | 21 | .30 | .12 | 123 | .12 | .37 | .10 | 6.5 |
| Kirvin gravelly fine sandy loam, subsoil | 2 | .054 | .049 | 9 | .49 | .26 | 163 | .22 | .92 | .48 | 5.8 |
| Nacogdoches clay loam, surface | 1 | .045 | .052 | 16 | .52 | .22 | ........ | .11 | .24 | .02 | ........ |
| Nacogdoches fine sandy loam, surface | 5 | .039 | .072 | 14 | .56 | .10 | 148 | .09 | .28 | .09 | 6.5 |
| Nacogdoches fine sandy loam, subsoil | 4 | .037 | .082 | 10 | .71 | .17 | 98 | .15 | .35 | .12 | 6.2 |
| Nacogdoches gravelly clay loam, surface | 1 | .067 | .072 | 9 | .72 | ........ | 246 | ........ | .35 | ........ | 7.3 |
| Nacogdoches gravelly clay loam, subsoil | 1 | .055 | .109 | 8 | .75 | ........ | 216 | ........ | .50 | ........ | 6.2 |
| Nacogdoches gravelly fine sandy loam, surface | 2 | .042 | .057 | 16 | .57 | .11 | 165 | .16 | .15 | .08 | 7.1 |
| Nacogdoches gravelly fine sandy loam, subsoil | 2 | .044 | .054 | 11 | .64 | .46 | 168 | .27 | .37 | .21 | 5.9 |
| Norfolk fine sand, surface | 51 | .035 | .027 | 42 | .64 | .08 | 95 | .12 | .20 | .08 | 6.5 |
| Norfolk fine sand, subsoil | 48 | .020 | .023 | 25 | .72 | .14 | 87 | .10 | .14 | .09 | 6.5 |
| Norfolk fine sandy loam, surface | 29 | .043 | .029 | 30 | .46 | .13 | 106 | .13 | .19 | .08 | 6.6 |
| Norfolk fine sandy loam, subsoil | 29 | .030 | .030 | 15 | .54 | .15 | 111 | .25 | .22 | .10 | 6.2 |
| Norfolk sand, surface | 12 | .037 | .024 | 37 | .43 | .10 | 69 | .11 | .21 | .08 | 6.7 |
| Norfolk sand, subsoil | 8 | .016 | .021 | 17 | .37 | .08 | 38 | .10 | .09 | .07 | 6.5 |
| Norfolk sandy loam, surface | 4 | .032 | .028 | 24 | .35 | .06 | 60 | .14 | .13 | .06 | 6.9 |
| Norfolk sandy loam, subsoil | 3 | .027 | .016 | 10 | .70 | .13 | 59 | .39 | .15 | .14 | 6.6 |
| Norfolk very fine sandy loam, surface | 1 | .066 | .028 | 29 | .34 | .10 | 144 | .15 | .35 | .09 | 6.7 |
| Norfolk very fine sandy loam, subsoil | 1 | .027 | .018 | 13 | .30 | .08 | 84 | .03 | .15 | .07 | 6.8 |
| Orangeburg fine sand, surface | 9 | .033 | .023 | 13 | .73 | .13 | 127 | .19 | .21 | .10 | 6.8 |
| Orangeburg fine sand, subsoil | 8 | .038 | .027 | 18 | .62 | .26 | 139 | .30 | .27 | .18 | 6.3 |
| Orangeburg fine sandy loam, surface | 25 | .045 | .050 | 18 | .72 | .25 | 138 | .15 | .26 | .12 | 6.6 |
| Orangeburg fine sandy loam, subsoil | 25 | .039 | .038 | 17 | .75 | .24 | 129 | .16 | .51 | .21 | 6.2 |
| Orangeburg loamy sand, surface | 1 | .016 | .027 | 16 | 1.00 | .11 | 134 | .03 | .05 | .07 | 6.2 |
| Orangeburg loamy sand, subsoil | 1 | .013 | .021 | 7 | .64 | .23 | 141 | .05 | .20 | .10 | ........ |

**Table 7. Analyses of soils of the East Texas Timber Country—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils with friable subsoils—(Continued) | | | | | | | | | | | |
| Orangeburg sandy loam, surface | 5 | .032 | .044 | 23 | .75 | .15 | 114 | .09 | .11 | .07 | 6.8 |
| Orangeburg sandy loam, subsoil | 4 | .038 | .034 | 10 | .62 | .18 | 128 | .09 | .24 | .09 | 6.5 |
| Orangeburg very fine sandy loam, surface | 1 | .029 | .024 | 21 | .73 | .04 | 55 | .24 | .15 | .07 | 6.3 |
| Orangeburg very fine sandy loam, subsoil | 1 | .023 | .022 | 8 | .75 | .25 | 150 | .32 | .30 | .28 | 5.2 |
| Ruston fine sand, surface | 4 | .031 | .035 | 20 | .49 | .05 | 72 | .12 | .18 | .10 | 6.7 |
| Ruston fine sand, subsoil | 4 | .020 | .041 | 17 | .55 | .04 | 76 | .06 | .12 | .09 | 6.7 |
| Ruston fine sandy loam, surface | 13 | .032 | .031 | 16 | .72 | .09 | 94 | .13 | .18 | .13 | 6.6 |
| Ruston fine sandy loam, subsoil | 13 | .029 | .030 | 7 | .68 | .22 | 113 | .11 | .26 | .17 | 6.1 |
| Ruston gravelly fine sandy loam, surface | 1 | .040 | .016 | 12 | .63 | .09 | 88 | .08 | .25 | .10 | ........ |
| Ruston gravelly fine sandy loam, subsoil | 1 | .042 | .034 | 7 | .95 | .25 | 146 | .20 | .35 | .23 | 5.6 |
| Ruston gravelly sandy loam, surface | 1 | .047 | .057 | 16 | 3.14 | .08 | 166 | .02 | .14 | .17 | 6.0 |
| Ruston, gravelly sandy loam, subsoil | 1 | .047 | .056 | 3 | ........ | .30 | 173 | .30 | .38 | .28 | 6.0 |
| Ruston very fine sandy loam, surface | 3 | .035 | .042 | 6 | .37 | .08 | 105 | .16 | .26 | .13 | 6.5 |
| Ruston very fine sandy loam, subsoil | 3 | .034 | .044 | 5 | .40 | .18 | 86 | .20 | .32 | .17 | 5.6 |
| Terrace soils with friable subsoils | | | | | | | | | | | |
| Amite fine sandy loam, surface | 1 | .038 | .035 | 19 | .54 | .17 | 84 | .23 | .25 | .12 | 7.1 |
| Amite fine sandy loam, subsoil | 1 | .041 | .034 | 7 | .96 | .25 | 147 | .18 | .15 | .18 | 6.7 |
| Bienville fine sand, surface | 2 | .044 | .060 | 130 | 1.54 | .09 | 148 | .26 | .26 | .15 | 6.9 |
| Bienville fine sand, subsoil | 2 | .021 | .053 | 52 | 1.37 | .08 | 153 | .17 | .35 | .14 | 6.6 |
| Cahaba clay loam, surface | 1 | .126 | .053 | 17 | 1.04 | .38 | 340 | .43 | .95 | .31 | 6.5 |
| Cahaba clay loam, subsoil | 1 | .062 | .034 | 14 | 1.43 | .67 | 220 | .59 | 2.75 | .96 | 7.3 |
| Cahaba fine sand, surface | 1 | .037 | .045 | 60 | .53 | .13 | 58 | .18 | .35 | .10 | 7.1 |
| Cahaba fine sand, subsoil | 2 | .017 | .028 | 35 | .44 | .09 | 45 | .12 | .42 | .05 | 7.2 |
| Cahaba fine sandy loam, surface | 8 | .044 | .034 | 44 | .64 | .09 | 89 | .23 | .31 | .09 | 7.0 |
| Cahaba fine sandy loam, subsoil | 8 | .031 | .032 | 12 | .76 | .19 | 146 | .29 | .35 | .17 | 6.7 |
| Kalmia fine sand, surface | 5 | .035 | .031 | 45 | .62 | .07 | 70 | .20 | .23 | .10 | 6.7 |
| Kalmia fine sand, subsoil | 5 | .014 | .028 | 21 | .52 | .06 | 57 | .10 | .11 | .09 | 6.8 |
| Kalmia fine sandy loam, surface | 5 | .051 | .028 | 18 | .49 | .08 | 86 | .14 | .26 | .12 | 6.5 |
| Kalmia fine sandy loam, subsoil | 5 | .028 | .021 | 16 | .65 | .15 | 102 | .12 | .39 | .14 | 6.4 |
| Kalmia sand, surface | 3 | .036 | .025 | 33 | .63 | .10 | 84 | .08 | .11 | .07 | 6.1 |
| Kalmia sand, subsoil | 3 | .012 | .018 | 31 | .46 | .09 | 73 | .06 | .07 | .07 | 6.1 |
| Upland soils with dense subsoils | | | | | | | | | | | |
| Acadia clay, surface | 4 | .117 | .050 | 16 | .40 | .21 | 72 | .43 | .54 | .27 | 5.7 |
| Acadia clay, subsoil | 4 | .084 | .037 | 13 | .41 | .32 | 139 | .63 | 1.13 | .33 | 6.2 |
| Acadia clay loam, surface | 3 | .063 | .026 | 21 | .47 | .13 | 41 | .42 | .40 | .19 | 6.6 |
| Acadia clay loam, subsoil | 3 | .038 | .019 | 11 | .45 | .19 | 50 | .56 | .68 | .29 | 7 2 |
| Acadia fine sandy loam, surface | 1 | .074 | .022 | 29 | .83 | .07 | 125 | .04 | .25 | .13 | 6.1 |
| Acadia fine sandy loam, subsoil | 1 | .031 | .013 | 18 | .82 | .11 | 93 | .08 | .10 | .17 | 5.6 |

**Table 7. Analyses of soils of the East Texas Timber Country—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils with dense subsoils—(Continued) | | | | | | | | | | | |
| Acadia very fine sandy loam, surface | 5 | .049 | .035 | 33 | .37 | .05 | 99 | .19 | .23 | .10 | 6.3 |
| Acadia very fine sandy loam, subsoil | 5 | .034 | .030 | 7 | .48 | .18 | 89 | .13 | .31 | .24 | 6.1 |
| DeWitt fine sandy loam, surface | 2 | .043 | .016 | 19 | .40 | .07 | 92 | .16 | .16 | .10 | 7.8 |
| DeWitt fine sandy loam, subsoil | 2 | .029 | .012 | 8 | .42 | .09 | 68 | .18 | .31 | .14 | 6.6 |
| Lufkin clay, surface | 9 | .086 | .049 | 26 | .59 | .29 | 145 | .35 | .87 | .44 | 6.3 |
| Lufkin clay, subsoil | 6 | .052 | .037 | 23 | .72 | .23 | 131 | .43 | .82 | .40 | 5.5 |
| Lufkin clay loam, surface | 5 | .063 | .021 | 30 | .63 | .17 | 92 | .31 | 1.35 | .21 | 6.3 |
| Lufkin clay loam, subsoil | 5 | .044 | .018 | 15 | .65 | .17 | 180 | .38 | .73 | .26 | 6.3 |
| Lufkin fine sand, surface | 5 | .050 | .032 | 43 | .63 | .10 | 119 | .13 | .27 | .21 | 6.1 |
| Lufkin fine sand, subsoil | 4 | .047 | .022 | 28 | .48 | .10 | 59 | .10 | .37 | .13 | 6.1 |
| Lufkin fine sandy loam, surface | 32 | .065 | .033 | 33 | .78 | .15 | 153 | .24 | .45 | .17 | 6.7 |
| Lufkin fine sandy loam, subsoil | 32 | .055 | .031 | 12 | .83 | .23 | 128 | .39 | .75 | .33 | 6.4 |
| Lufkin gravelly fine sandy loam, surface | 1 | .036 | .008 | 8 | .70 | .08 | ........ | .38 | .10 | .29 | 6.6 |
| Lufkin gravelly fine sandy loam, subsoil | 1 | .053 | .018 | 8 | .56 | .24 | 101 | .13 | ........ | .14 | 6.1 |
| Lufkin sand, surface | 2 | .032 | .014 | 18 | .67 | .05 | 84 | .15 | .27 | .09 | ........ |
| Lufkin sand, subsoil | 2 | .025 | .010 | 14 | .54 | .13 | 71 | .10 | .19 | .10 | ........ |
| Lufkin sandy loam, surface | 2 | .039 | .016 | 16 | .48 | .14 | 48 | .11 | .20 | .07 | ........ |
| Lufkin sandy loam, subsoil | 3 | .039 | .021 | 9 | .50 | .21 | 121 | .17 | .33 | .20 | ........ |
| Lufkin silt loam, surface | 5 | .051 | .035 | 15 | .41 | .11 | 84 | .22 | .23 | .11 | 5.5 |
| Lufkin silt loam, subsoil | 5 | .034 | .048 | 6 | .64 | .16 | 104 | .13 | .42 | .14 | 5.4 |
| Lufkin silty clay loam, surface | 3 | .076 | .044 | 24 | .25 | .07 | 110 | .30 | .56 | .15 | 6.0 |
| Lufkin silty clay loam, subsoil | 3 | .030 | .033 | 10 | .42 | .08 | 64 | .29 | .74 | .23 | 5.1 |
| Lufkin very fine sandy loam, surface | 2 | .035 | .033 | 13 | .44 | .08 | 102 | .19 | .25 | .12 | 6.7 |
| Lufkin very fine sandy loam, subsoil | 2 | .030 | .022 | 13 | .44 | .17 | 210 | .53 | .83 | .37 | 6.3 |
| Morse clay, surface | 2 | .152 | .044 | 39 | .73 | .20 | 188 | .43 | .78 | .41 | 6.3 |
| Morse clay, subsoil | 2 | .047 | .025 | 12 | .96 | .35 | 130 | .55 | 1.05 | .38 | 6.5 |
| Morse fine sandy loam, surface | 1 | .044 | .017 | 19 | .55 | .09 | 116 | .19 | .20 | .16 | 6.6 |
| Morse fine sandy loam, subsoil | 1 | .022 | .011 | 23 | .50 | .11 | 146 | .11 | .10 | .10 | 6.4 |
| Morse very fine sandy loam, surface | 3 | .077 | .034 | 30 | .29 | .19 | 125 | .36 | .57 | .26 | 6.3 |
| Morse very fine sandy loam, subsoil | 3 | .037 | .023 | 13 | .31 | .12 | 77 | .16 | .18 | .12 | 5.8 |
| Oktibbeha clay loam, surface | 2 | .051 | .024 | 10 | .55 | .20 | 158 | .38 | .98 | .56 | 5.7 |
| Oktibbeha clay loam, subsoil | 2 | .039 | .034 | 23 | .60 | .19 | 131 | .53 | 2.24 | 1.04 | 7.4 |
| Oktibbeha fine sandy loam, surface | 1 | .056 | .028 | 20 | .58 | ........ | 193 | ........ | .23 | ........ | 6.0 |
| Oktibbeha fine sandy loam, subsoil | 1 | .034 | .016 | 5 | .70 | ........ | 143 | ........ | 1.04 | ........ | 5.4 |
| Susquehanna clay, surface | 5 | .078 | .051 | 12 | .94 | .25 | 201 | .29 | .69 | .23 | 5.6 |
| Susquehanna clay, subsoil | 5 | .047 | .063 | 5 | .73 | .40 | 171 | .25 | .54 | .48 | 5.3 |
| Susquehanna clay loam, surface | 3 | .051 | .023 | 10 | .79 | .27 | 143 | .18 | .42 | .31 | 6.2 |
| Susquehanna clay loam, subsoil | 3 | .044 | .032 | 8 | .98 | .32 | 143 | .16 | .53 | .40 | 6.0 |

**Table 7. Analyses of soils of the East Texas Timber Country—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos. Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils with dense subsoils—(Continued) | | | | | | | | | | | |
| Susquehanna fine sand, surface | 1 | .018 | .020 | 8 | .44 | .10 | 91 | .05 | ....... | .07 | 6.4 |
| Susquehanna fine sand, subsoil | 1 | .026 | .033 | 47 | .45 | .41 | 196 | .11 | .45 | .15 | 5.7 |
| Susquehanna fine sandy loam, surface | 51 | .047 | .037 | 22 | .79 | .13 | 128 | .16 | .71 | .12 | 6.5 |
| Susquehanna fine sandy loam, subsoil | 51 | .043 | .036 | 13 | .88 | .26 | 132 | .21 | .53 | .33 | 6.0 |
| Susquehanna gravelly fine sandy loam, surface | 2 | .048 | .012 | 12 | .85 | .08 | 90 | .17 | .08 | .08 | ....... |
| Susquehanna gravelly fine sandy loam, subsoil | 2 | .057 | .046 | 5 | .85 | .03 | 251 | .10 | .75 | .18 | 5.6 |
| Susquehanna gravelly loam, surface | 3 | .056 | .037 | 37 | .50 | .11 | 161 | .14 | .21 | .10 | 6.3 |
| Susquehanna gravelly loam, subsoil | 3 | .031 | .035 | 11 | .58 | .18 | 109 | .15 | .15 | .22 | 6.7 |
| Susquehanna gravelly sandy loam, surface | 2 | .041 | .034 | 19 | .60 | .08 | 97 | .09 | .03 | .08 | 6.4 |
| Susquehanna gravelly sandy loam, subsoil | 2 | .035 | .055 | 5 | .60 | .37 | 147 | .10 | .30 | .22 | 5.3 |
| Susquehanna sandy loam, surface | 2 | .050 | .018 | 30 | .70 | .13 | 100 | .50 | 1.07 | .14 | ....... |
| Susquehanna sandy loam, subsoil | 2 | .040 | .021 | 4 | .71 | .25 | ....... | .37 | 1.06 | .42 | ....... |
| Susquehanna silt loam, surface | 2 | .066 | .062 | 10 | .55 | .14 | 120 | .09 | .38 | .20 | 5.8 |
| Susquehanna silt loam, subsoil | 2 | .037 | .048 | 7 | .74 | .23 | 126 | .16 | .23 | .14 | 5.6 |
| Susquehanna stony loam, surface | 1 | .065 | .049 | 76 | .70 | .11 | 281 | .07 | .19 | .19 | 6.5 |
| Susquehanna stony loam, subsoil | 1 | .061 | .038 | 15 | .85 | ....... | 171 | .40 | .20 | .23 | 5.6 |
| Susquehanna very fine sandy loam, surface | 5 | .044 | .038 | 15 | .52 | .09 | 99 | .23 | .22 | .13 | 6.1 |
| Susquehanna very fine sandy loam subsoil | 5 | .034 | .047 | 7 | .59 | .20 | 106 | .14 | .42 | .25 | 5.2 |
| Tabor fine sandy loam, surface | 16 | .041 | .042 | 23 | .67 | .09 | 116 | .18 | .24 | .14 | 7.0 |
| Tabor fine sandy loam, subsoil | 16 | .041 | .036 | 6 | .70 | .23 | 105 | .24 | .54 | .25 | 6.5 |
| Tabor sandy loam, surface | 1 | .031 | .012 | 15 | 1.11 | .06 | 108 | .21 | .10 | .08 | 6.1 |
| Tabor sandy loam, subsoil | 1 | .059 | .041 | 4 | 1.15 | .17 | 106 | .15 | .55 | .16 | 6.3 |
| Terrace soils with dense subsoils | | | | | | | | | | | |
| Leaf clay loam, surface | 2 | .087 | .068 | 9 | .81 | .30 | 184 | .52 | 1.01 | .29 | 7.3 |
| Leaf clay loam, subsoil | 2 | .075 | .047 | 4 | 1.04 | .54 | 121 | .63 | 1.38 | .47 | 6.9 |
| Leaf fine sandy loam, surface | 4 | .049 | .033 | 35 | .50 | .02 | 83 | .23 | .65 | .13 | 7.0 |
| Leaf fine sandy loam, subsoil | 4 | .033 | .026 | 10 | .73 | .35 | 127 | .41 | .88 | .34 | 6.5 |
| Leaf very fine sandy loam, surface | 1 | .044 | .057 | 40 | .34 | .07 | 74 | .14 | .45 | .13 | 6.2 |
| Leaf very fine sandy loam, subsoil | 1 | .029 | .032 | 10 | .74 | .10 | 58 | .11 | .30 | .16 | 5.6 |
| Myatt silty clay loam, surface | 3 | .074 | .045 | 24 | .93 | .17 | 129 | .19 | .38 | .26 | 5.5 |
| Myatt silty clay loam, subsoil | 3 | .044 | .045 | 17 | .78 | .32 | 138 | .28 | .78 | .37 | 5.5 |
| Flat stream-bottom soils | | | | | | | | | | | |
| Bibb clay loam, surface | 2 | .140 | .104 | ....... | 1.03 | .30 | 155 | .42 | .91 | .34 | 6.1 |
| Bibb clay loam, subsoil | 1 | .173 | .158 | 15 | 1.39 | .36 | 147 | .26 | .65 | .33 | 5.0 |
| Bibb fine sandy loam, surface | 1 | .063 | .034 | 19 | 1.47 | .09 | 66 | .14 | .20 | .10 | 5.8 |
| Bibb fine sandy loam, subsoil | 1 | .037 | .011 | 15 | 1.53 | .11 | 63 | .27 | .30 | .12 | 5.5 |

Table 7. Analyses of soils of the East Texas Timber Country—Continued

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat stream-bottom soils—(Continued) | | | | | | | | | | | |
| Bibb silty clay loam, surface | 1 | .169 | .053 | 56 | 1.70 | .20 | 286 | .08 | .15 | .12 | 4.9 |
| Bibb silty clay loam, subsoil | 1 | .104 | .044 | 38 | 1.79 | .14 | 182 | .15 | .09 | .16 | 4.8 |
| Hannahatchee fine sandy loam, surface | 3 | .114 | .101 | 17 | .87 | .20 | 141 | .28 | .52 | .24 | 6.5 |
| Hannahatchee fine sandy loam, subsoil | 3 | .071 | .093 | 8 | .68 | .19 | 84 | .23 | .63 | .31 | 5.9 |
| Portland clay, surface | 1 | .129 | .101 | 79 | 2.76 | 1.21 | 387 | .89 | 1.25 | 2.12 | 6.6 |
| Portland clay, subsoil | 1 | .052 | .048 | 15 | 2.54 | 1.23 | 417 | .30 | ........ | .59 | ........ |
| Portland clay loam, surface | 2 | .111 | .072 | 137 | 2.03 | .54 | 322 | .41 | .83 | .45 | 6.8 |
| Portland clay loam, subsoil | 2 | .072 | .057 | 69 | 1.62 | .39 | 204 | .40 | .90 | .55 | 6.9 |
| Portland silty clay loam, surface | 1 | .086 | .134 | 537 | 2.28 | .49 | 328 | 1.05 | 2.45 | .82 | 6.7 |
| Portland silty clay loam, subsoil | 1 | .077 | .094 | 120 | 2.42 | .59 | 199 | .51 | 1.30 | .21 | 6.6 |
| Portland very fine sandy loam, surface | 2 | .075 | .063 | 180 | 1.66 | .22 | 168 | .35 | .40 | .22 | 6.8 |
| Portland very fine sandy loam, subsoil | 2 | .051 | .069 | 179 | 1.77 | .31 | 222 | .25 | .45 | .51 | 6.4 |

**Table 8. Grades of constituents of surface soils of the East Texas Timber Country**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils with friable subsoils | | | | | | | | | | | |
| Bowie fine sandy loam | 7 | 4 | 4 | 5 | 3 | 5 | 3 | 4 | 5 | 4 | 2 |
| Bowie very fine sandy loam | 10 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 2 |
| Caddo fine sandy loam | 12 | 4 | 4 | 5 | 3 | 5 | 3 | 4 | 5 | 4 | 2 |
| Kirvin clay loam | 2 | 3 | 2 | 5 | 4 | 4 | 2 | 4 | 3 | 4 | 2 |
| Kirvin fine sandy loam | 26 | 4 | 3 | 5 | 4 | 4 | 3 | 3 | 4 | 4 | 2 |
| Kirvin gravelly fine sandy loam | 2 | 4 | 4 | 5 | 5 | 4 | 3 | 4 | 4 | 4 | 2 |
| Nacogdoches clay loam | 1 | 4 | 3 | 5 | 4 | 3 | ........ | 4 | 5 | 5 | ........ |
| Nacogdoches fine sandy loam | 5 | 4 | 3 | 5 | 4 | 5 | 3 | 5 | 5 | 4 | 2 |
| Nacogdoches gravelly clay loam | 1 | 3 | 3 | 5 | 3 | ........ | 2 | ........ | 4 | ........ | 2 |
| Nacogdoches gravelly fine sandy loam | 2 | 4 | 3 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 2 |
| Norfolk fine sand | 51 | 4 | 4 | 4 | 3 | 5 | 4 | 4 | 5 | 4 | 2 |
| Norfolk fine sandy loam | 29 | 4 | 4 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 2 |
| Norfolk sand | 12 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 2 |
| Norfolk sandy loam | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 2 |
| Norfolk very fine sandy loam | 1 | 3 | 4 | 5 | 4 | 5 | 3 | 4 | 4 | 4 | 2 |
| Orangeburg fine sand | 9 | 4 | 5 | 5 | 3 | 4 | 3 | 4 | 5 | 4 | 2 |
| Orangeburg fine sandy loam | 25 | 4 | 4 | 5 | 3 | 3 | 3 | 4 | 5 | 4 | 2 |
| Orangeburg loamy sand | 1 | 5 | 4 | 5 | 3 | 4 | 3 | 5 | 5 | 5 | 2 |
| Orangeburg sandy loam | 5 | 4 | 4 | 5 | 3 | 4 | 3 | 5 | 5 | 5 | 2 |
| Orangeburg very fine sandy loam | 1 | 5 | 5 | 5 | 3 | 5 | 4 | 3 | 5 | 5 | 2 |
| Ruston fine sand | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 2 |
| Ruston fine sandy loam | 13 | 4 | 4 | 5 | 3 | 5 | 4 | 4 | 5 | 4 | 2 |
| Ruston gravelly fine sandy loam | 1 | 4 | 5 | 5 | 3 | 5 | 4 | 5 | 5 | 4 | ........ |
| Ruston gravelly sandy loam | 1 | 4 | 3 | 5 | 1 | 5 | 3 | 5 | 5 | 3 | 3 |
| Ruston very fine sandy loam | 3 | 4 | 4 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| Terrace soils with friable subsoils | | | | | | | | | | | |
| Amite fine sandy loam | 1 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 5 | 4 | 2 |
| Bienville fine sand | 2 | 4 | 3 | 3 | 2 | 5 | 3 | 3 | 5 | 4 | 2 |
| Cahaba clay loam | 1 | 2 | 3 | 5 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| Cahaba fine sand | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| Cahaba fine sandy loam | 8 | 4 | 4 | 4 | 3 | 5 | 4 | 3 | 4 | 4 | 2 |
| Kalmia fine sand | 5 | 4 | 4 | 4 | 3 | 5 | 4 | 4 | 5 | 4 | 2 |
| Kalmia fine sandy loam | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 2 |
| Kalmia sand | 3 | 4 | 5 | 4 | 3 | 5 | 4 | 5 | 5 | 5 | 2 |
| Upland soils with dense subsoils | | | | | | | | | | | |
| Acadia clay | 4 | 3 | 4 | 5 | 4 | 3 | 4 | 2 | 4 | 3 | 3 |
| Acadia clay loam | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 2 | 4 | 3 | 2 |
| Acadia fine sandy loam | 1 | 3 | 5 | 5 | 3 | 5 | 3 | 5 | 5 | 4 | 2 |

**Table 8. Grades of constituents of surface soils of the East Texas Timber Country—Continued**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils with dense subsoils—(Continued) | | | | | | | | | | | |
| Acadia very fine sandy loam | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 2 |
| DeWitt fine sandy loam | 2 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 1 |
| Lufkin clay | 9 | 3 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 2 | 2 |
| Lufkin clay loam | 5 | 3 | 5 | 5 | 3 | 4 | 4 | 3 | 3 | 3 | 2 |
| Lufkin fine sand | 5 | 4 | 4 | 4 | 3 | 5 | 3 | 4 | 5 | 3 | 2 |
| Lufkin fine sandy loam | 32 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 2 |
| Lufkin gravelly fine sandy loam | 1 | 4 | 5 | 5 | 3 | 5 | ........ | 3 | 5 | 3 | 2 |
| Lufkin sand | 2 | 4 | 5 | 5 | 3 | 5 | 4 | 4 | 5 | 4 | ........ |
| Lufkin sandy loam | 2 | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 5 | ........ |
| Lufkin silt loam | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 5 | 4 | 4 |
| Lufkin silty clay loam | 3 | 3 | 4 | 5 | 5 | 5 | 3 | 3 | 4 | 4 | 3 |
| Lufkin very fine sandy loam | 2 | 4 | 4 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| Morse clay | 2 | 2 | 4 | 4 | 3 | 4 | 3 | 2 | 3 | 2 | 2 |
| Morse fine sandy loam | 1 | 4 | 5 | 5 | 4 | 5 | 3 | 4 | 5 | 3 | 2 |
| Morse very fine sandy loam | 3 | 3 | 4 | 5 | 5 | 4 | 3 | 3 | 4 | 3 | 2 |
| Oktibbeha clay loam | 2 | 4 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 2 | 3 |
| Oktibbeha fine sandy loam | 1 | 4 | 4 | 5 | 4 | ........ | 3 | ........ | 5 | ........ | 3 |
| Susquehanna clay | 5 | 3 | 3 | 5 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| Susquehanna clay loam | 3 | 4 | 5 | 5 | 3 | 3 | 3 | 4 | 4 | 2 | 2 |
| Susquehanna fine sand | 1 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | ........ | 5 | 2 |
| Susquehanna fine sandy loam | 51 | 4 | 4 | 5 | 3 | 4 | 3 | 4 | 3 | 4 | 2 |
| Susquehanna gravelly fine sandy loam | 2 | 4 | 5 | 5 | 3 | 5 | 4 | 4 | 5 | 4 | 2 |
| Susquehanna gravelly loam | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 5 | 4 | 2 |
| Susquehanna gravelly sandy loam | 2 | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 2 |
| Susquehanna sandy loam | 2 | 4 | 5 | 5 | 3 | 4 | 4 | 2 | 3 | 4 | ........ |
| Susquehanna silt loam | 2 | 3 | 3 | 5 | 4 | 4 | 3 | 5 | 4 | 3 | 3 |
| Susquehanna stony loam | 1 | 3 | 4 | 4 | 3 | 4 | 2 | 5 | 5 | 3 | 2 |
| Susquehanna very fine sandy loam | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 3 | 5 | 4 | 2 |
| Tabor fine sandy loam | 16 | 4 | 4 | 5 | 3 | 5 | 3 | 4 | 5 | 4 | 2 |
| Tabor sandy loam | 1 | 4 | 5 | 5 | 3 | 5 | 3 | 3 | 5 | 4 | 2 |
| Terrace soils with dense subsoils | | | | | | | | | | | |
| Leaf clay loam | 2 | 3 | 3 | 5 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| Leaf fine sandy loam | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 3 | 4 | 2 |
| Leaf very fine sandy loam | 1 | 4 | 3 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 2 |
| Myatt silty clay loam | 3 | 3 | 4 | 5 | 3 | 4 | 3 | 4 | 4 | 3 | 4 |
| Flat stream bottom soils | | | | | | | | | | | |
| Bibb clay loam | 2 | 2 | 2 | ........ | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| Bibb fine sandy loam | 1 | 3 | 4 | 5 | 2 | 5 | 4 | 4 | 5 | 4 | 3 |

**Table 8. Grades of constituents of surface soils of the East Texas Timber Country—Continued**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat stream bottom soils—(Continued) | | | | | | | | | | | |
| Bibb silty clay loam | 1 | 2 | 3 | 4 | 2 | 4 | 2 | 5 | 5 | 4 | 5 |
| Hannahatchee fine sandy loam | 3 | 3 | 2 | 5 | 3 | 4 | 3 | 3 | 4 | 3 | 2 |
| Portland clay | 1 | 2 | 2 | 4 | 1 | 1 | 2 | 2 | 3 | 1 | 2 |
| Portland clay loam | 2 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 2 | 2 |
| Portland silty clay loam | 1 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 |
| Portland very fine sandy loam | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 2 |

ences in composition are found between the upland soil types. The terrace soils are not significantly different in composition from the upland soils. The flat stream-bottom soils are somewhat higher in the various constituents than are the upland and terrace soils. This is especially true of the Portland soils which have Grades 2 and 3 for most constituents. The similarities between the soils of this area in chemical composition are remarkable.

## BLACKLAND PRAIRIES

The Blackland Prairies chiefly occupy a large, broad, wedge-shaped area extending southwest from near the Red River in northeastern Texas to the vicinity of San Antonio, over 300 miles in length and about 75 miles wide in the northern part and 20 miles in the southwestern end. A number of smaller interior prairies are separated from the main area, ranging from 10 to 20 miles across. The main body covers about 9,000,000 acres in all or portions of 30 counties, and the smaller areas cover about 2,000,000 acres in portions of 15 counties. The surface is generally rolling with some smoothly undulating and flat surfaces. Elevations above sea-level range from 400 to 800 feet on the main belt, and from 300 to 500 feet on the minor prairies. The predominating soils are very dark and of heavy clay texture, developed from soft calcareous parent materials. They may be divided into (1) calcareous prairie soils of granular structure, (2) noncalcareous prairie soils, which on drying become dense and tight, and (3) noncalcareous prairie soils of only moderate friability.

### Outline description of series

**Calcareous upland prairie soils:**

**Houston soils:** Black, dark-gray, or ashy-black to brown, friable surface with dark-gray, brown or yellowish, highly calcareous, moderately friable or crumbly subsoil.

**Sumter soils:** Brown or yellowish, friable surface with yellow to greenish-yellow, crumbly subsoil.

**Calcareous terrace soils:**

**Bell soils:** Black to dark-brown, friable surface with dark-gray to brown, crumbly subsoil.

**Lewisville soils:** Brown, friable surface with yellow or brown, crumbly subsoil.

**Calcareous flat stream-bottom soils:**

**Catalpa soils:** Brown, friable, permeable surface with brown or grayish, friable, permeable subsoil.

**Trinity soils:** Black or dark-gray, calcareous surface and subsoil. Analyses and grades of constituents for Trinity soils are given in Tables 5 and 6 for the Gulf Coast.

**Noncalcareous upland prairie soils:**

**Crockett soils:** Black to brown or spotted, moderately friable surface with reddish or yellowish or gray-mottled subsoil.

**Ellis soils:** Brown, moderately friable surface, with greenish-yellow, dense subsoil, which is calcareous in places.

**Grayson soils:** Dark gray or brown surface with a stiff yellow or mottled subsoil.

**Wilson soils:** Black to dark-gray surface, very tight when dry, with brown or dark gray, dense, tough subsoil.

**Noncalcareous terrace soils:**

**Irving soils:** Dark ashy-gray to black surface, very tight when dry, with dark gray or brown, dense, tough subsoil.

**Noncalcareous flat stream-bottom soils:**

**Johnston soils:** Black or very dark-brown, moderately friable surface with brown, black or dark-gray, moderately crumbly and permeable subsoil.

### Composition of soil types

The average composition of the soil types is given in Table 9 and the grades of constituents of surface soils in Table 10. The calcareous soils have Grades 1, 2, and 3 for all constituents except active phosphoric acid for which they have Grades 3, 4, and 5. Soils which are well supplied with lime and high in basicity may supply sufficient phosphoric acid to plants even though the quantity of active phosphoric acid in the soil is low. Most of the noncalcareous soils have Grade 3 for all constituents except total and active phosphoric acid (Grades 4 and 5) and magnesia and pH (Grade 2).

## GRAND PRAIRIE

The Grand Prairie lies immediately west of the main Blackland Prairie area and extends south from the Red River to the vicinity of the Colorado River, where it merges with the Edwards Plateau. The Grand Prairie occupies an area about 250 miles long and 20 to 75 miles wide and covers approximately 7,000,000 acres in 21 counties. The surface is high, rolling to hilly, deeply dissected, and crossed by a number of deep valleys through which rivers flow in narrow strips of bottomland. Elevations above sea-level range from 800 to 1200 feet. The soils are mostly dark; the deep surface soils are noncalcareous, but the shallow soils contain considerable limestone.

### Outline description of series

**Rolling upland prairie soils:**

**Brackett soils:** Brown or light-brown to grayish, friable, calcareous, shallow surface with a yellow or whitish, chalky, calcareous, friable, thin subsoil.

**Crawford soils:** Brown, red, or reddish brown surface with a red or brownish, crumbly subsoil which is calcareous in the lower part.

**San Saba soils:** Black or very dark-brown, friable surface with a dark-gray, yellow, or brown, crumbly subsoil.

**Bell soils:** Black to dark-brown, friable surface with a dark-gray to brown, crumbly subsoil. Analyses and grades of constituents for Bell soils are given in Tables 9 and 10 for the Blackland Prairies.

**Table 9. Analyses of soils of the Blackland Prairies**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcareous rolling upland prairie soils | | | | | | | | | | | |
| Houston black clay, surface | 45 | .125 | .081 | 109 | .94 | .51 | 317 | 6.05 | 6.71 | .73 | 7.4 |
| Houston black clay, subsoil | 45 | .084 | .070 | 71 | .88 | .39 | 193 | 7.60 | 8.72 | .61 | 7.4 |
| Houston black clay loam, surface | 2 | .144 | .070 | 84 | 1.47 | .66 | 657 | 2.68 | 6.87 | .66 | ........ |
| Houston black clay loam, subsoil | 1 | .092 | ........ | 71 | 1.22 | ........ | 315 | ........ | 2.63 | ........ | ........ |
| Houston clay, surface | 33 | .128 | .121 | 81 | 1.22 | .55 | 225 | 14.21 | 19.65 | .82 | 7.4 |
| Houston clay, subsoil | 32 | .076 | .100 | 72 | 1.16 | .42 | 114 | 16.86 | 25.85 | .98 | 7.6 |
| Houston clay loam, surface | 9 | .095 | .055 | 126 | .82 | .47 | 370 | 1.19 | 4.46 | .38 | 7.3 |
| Houston clay loam, subsoil | 9 | .059 | .049 | 116 | .88 | .51 | 212 | 2.24 | 4.38 | .43 | 7.4 |
| Houston gravelly clay, surface | 2 | .080 | .034 | 63 | .88 | .54 | 481 | 2.62 | 4.28 | .24 | ........ |
| Houston gravelly clay, subsoil | 2 | .080 | .057 | 42 | .92 | .53 | 374 | 2.45 | 4.71 | .35 | ........ |
| Houston loam, surface | 16 | .095 | .034 | 27 | .77 | .30 | 258 | 1.37 | 1.94 | .33 | 6.8 |
| Houston loam, subsoil | 14 | .062 | .031 | 19 | .76 | .34 | 104 | 3.50 | 3.64 | .43 | 7.2 |
| Sumter clay, surface | 6 | .134 | .091 | 97 | 1.68 | .50 | 283 | 5.35 | 11.45 | .83 | 7.3 |
| Sumter clay, subsoil | 6 | .086 | .104 | 46 | 1.43 | .51 | 146 | 10.72 | 16.25 | .93 | 7.6 |
| Sumter clay loam, surface | 2 | .077 | .032 | 11 | 1.83 | .14 | 256 | .19 | .90 | .21 | 6.2 |
| Sumter clay loam, subsoil | 1 | .044 | .054 | 16 | 2.51 | ........ | 223 | ........ | 2.25 | ........ | 7.7 |
| Calcareous terrace soils | | | | | | | | | | | |
| Bell clay, surface | 17 | .111 | .075 | 146 | 1.06 | .55 | 325 | 2.43 | 4.10 | .68 | 7.3 |
| Bell clay, subsoil | 17 | .077 | .059 | 82 | .96 | .53 | 195 | 3.47 | 4.57 | .64 | 7.5 |
| Lewisville clay, surface | 10 | .124 | .077 | 68 | 1.09 | .41 | 192 | 3.33 | 3.31 | .50 | 6.9 |
| Lewisville clay, subsoil | 10 | .065 | .060 | 28 | 1.09 | .39 | 108 | 6.82 | 4.33 | .52 | 7.1 |
| Calcareous flat stream bottom soils | | | | | | | | | | | |
| Catalpa clay, surface | 17 | .119 | .108 | 46 | 1.19 | .51 | 276 | 4.91 | 9.09 | .65 | 7.4 |
| Catalpa clay, subsoil | 17 | .096 | .099 | 44 | 1.14 | .61 | 152 | 7.45 | 21.99 | .96 | 7.5 |
| Catalpa silty clay loam, surface | 2 | .099 | .131 | 397 | 1.77 | .83 | 347 | .88 | 1.66 | .84 | 7.1 |
| Catalpa silty clay loam, subsoil | 2 | .097 | .100 | 159 | 1.84 | .56 | 332 | .79 | 1.54 | .32 | 7.1 |
| Noncalcareous rolling upland prairie soils | | | | | | | | | | | |
| Crockett clay, surface | 2 | .140 | .063 | 12 | .90 | .41 | 280 | .63 | 1.88 | .92 | 7.2 |
| Crockett clay, subsoil | 2 | .102 | .053 | 9 | .86 | .31 | 194 | .41 | 1.54 | 1.72 | 6.7 |
| Crockett clay loam, surface | 9 | .100 | .040 | 11 | .92 | .23 | 180 | .38 | .82 | .31 | 6.2 |
| Crockett clay loam, subsoil | 8 | .073 | .035 | 10 | .96 | .41 | 173 | .88 | 1.21 | .44 | 6.4 |
| Crockett fine sandy loam, surface | 11 | .077 | .038 | 27 | .80 | .12 | 163 | .31 | .56 | .18 | 6.6 |
| Crockett fine sandy loam, subsoil | 11 | .065 | .032 | 14 | .76 | .28 | 139 | .53 | 1.09 | .39 | 6.8 |
| Crockett loam, surface | 3 | .104 | .039 | 31 | .62 | .23 | 335 | 30 | .86 | .32 | 6.5 |
| Crockett loam, subsoil | 3 | .051 | .034 | 39 | 1.05 | .44 | 187 | 1.00 | 1.94 | .60 | 6.4 |
| Crockett very fine sandy loam, surface | 2 | .076 | .028 | 9 | 1.16 | .20 | 101 | .19 | .41 | .18 | 5.9 |
| Crockett very fine sandy loam, subsoil | 2 | .066 | .030 | 12 | 1.25 | .40 | 124 | .56 | .65 | .71 | 6.0 |

**Table 9. Analyses of soils of the Blackland Prairies—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Noncalcareous rolling upland prairie soils—(Continued) | | | | | | | | | | | |
| Ellis clay, surface | 4 | .123 | .084 | 25 | 2.05 | .70 | 397 | 1.31 | 2.58 | 1.29 | 6.9 |
| Ellis clay, subsoil | 4 | .085 | .094 | 36 | 2.15 | .81 | 357 | 3.88 | 4.44 | 1.26 | 7.2 |
| Grayson clay loam, surface | 1 | .139 | .065 | 30 | .88 | .42 | 190 | .65 | .71 | .41 | ........ |
| Grayson clay loam, subsoil | 1 | .050 | .046 | 6 | .33 | .12 | 99 | .16 | .35 | .18 | ........ |
| Wilson clay, surface | 18 | .105 | .047 | 32 | .78 | .32 | 236 | .91 | 1.62 | .47 | 6.7 |
| Wilson clay, subsoil | 18 | .069 | .034 | 21 | .74 | .28 | 143 | 1.30 | 2.05 | .53 | 6.8 |
| Wilson clay loam, surface | 20 | .105 | .048 | 38 | .82 | .29 | 216 | 1.25 | 1.58 | .44 | 6.8 |
| Wilson clay loam, subsoil | 20 | .080 | .041 | 40 | .75 | .28 | 154 | 1.33 | 1.77 | .63 | 6.8 |
| Wilson fine sandy loam, surface | 13 | .064 | .031 | 31 | .63 | .14 | 126 | .29 | .56 | .25 | 6.5 |
| Wilson fine sandy loam, subsoil | 13 | .055 | .024 | 15 | .66 | .23 | 113 | .46 | 1.67 | .42 | 6.7 |
| Wilson loam, surface | 6 | .093 | .033 | 39 | 1.16 | .36 | 115 | .38 | .78 | .32 | 6.7 |
| Wilson loam, subsoil | 6 | .067 | .039 | 38 | .97 | .33 | 135 | .59 | .98 | .54 | 6.6 |
| Wilson silt loam, surface | 2 | .123 | .042 | 23 | .73 | .28 | 114 | .35 | .93 | .54 | 6.3 |
| Wilson silt loam, subsoil | 2 | .076 | .033 | 9 | .73 | .35 | 155 | .55 | 1.93 | .97 | 7.1 |
| Wilson silty clay loam, surface | 1 | .084 | .033 | 4 | .88 | .26 | 144 | .51 | 1.11 | .45 | 6.2 |
| Wilson silty clay loam, subsoil | 1 | .045 | .034 | ........ | .53 | .35 | ........ | .82 | 1.57 | .63 | 7.6 |
| Wilson very fine sandy loam, surface | 3 | .077 | .032 | 27 | 1.16 | .21 | 121 | .33 | .67 | .25 | 6.0 |
| Wilson very fine sandy loam, subsoil | 2 | .084 | .031 | 27 | 1.14 | .24 | 113 | .49 | .79 | .37 | 6.4 |
| Noncalcareous terrace soils | | | | | | | | | | | |
| Irving clay, surface | 12 | .102 | .053 | 55 | .87 | .40 | 221 | .94 | 1.43 | .44 | 7.1 |
| Irving clay, subsoil | 12 | .069 | .040 | 30 | .86 | .39 | 148 | 1.00 | 1.51 | .60 | 7.1 |
| Irving clay loam, surface | 5 | .075 | .040 | 44 | 1.50 | .33 | 230 | .56 | 1.04 | .30 | 6.7 |
| Irving clay loam, subsoil | 5 | .065 | .051 | 79 | 1.31 | .43 | 164 | .97 | 1.93 | .40 | 7.3 |
| Irving fine sandy loam, surface | 5 | .058 | .033 | 31 | .67 | .24 | 198 | .27 | .38 | .19 | 6.8 |
| Irving fine sandy loam, subsoil | 5 | .059 | .030 | 11 | 1.13 | .60 | 233 | .44 | 1.07 | .50 | 6.5 |
| Irving silt loam, surface | 1 | .057 | .029 | 28 | .56 | .19 | 121 | .31 | 1.68 | .17 | 6.2 |
| Irving silt loam, subsoil | 1 | .033 | .023 | 13 | .76 | .32 | 71 | .62 | 2.90 | .43 | 6.3 |
| Noncalcareous flat stream bottom soils | | | | | | | | | | | |
| Johnston clay, surface | 1 | .118 | .068 | 44 | 1.93 | .54 | 300 | 1.02 | 1.95 | .33 | 5.8 |
| Johnston clay, subsoil | 1 | .035 | .035 | 31 | 1.80 | .35 | 228 | .76 | 1.58 | .38 | 6.7 |

**Table 10. Grades of constituents of surface soils of the Blackland Prairies**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcareous rolling upland prairie soils | | | | | | | | | | | |
| Houston black clay | 45 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 |
| Houston black clay loam | 2 | 2 | 3 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | ........ |
| Houston clay | 33 | 2 | 2 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| Houston clay loam | 9 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| Houston gravelly clay | 2 | 3 | 4 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | ........ |
| Houston loam | 16 | 3 | 4 | 5 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| Sumter clay | 6 | 2 | 3 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| Sumter clay loam | 2 | 3 | 4 | 5 | 1 | 4 | 2 | 4 | 3 | 3 | 2 |
| Calcareous terrace soils | | | | | | | | | | | |
| Bell clay | 17 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 |
| Lewisville clay | 10 | 2 | 3 | 4 | 3 | 2 | 3 | 1 | 2 | 2 | 2 |
| Calcareous flat stream-bottom soils | | | | | | | | | | | |
| Catalpa clay | 17 | 3 | 2 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 2 |
| Catalpa silty clay loam | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 1 | 2 |
| Non-calcareous rolling upland prairie soils | | | | | | | | | | | |
| Crockett clay | 2 | 2 | 3 | 5 | 3 | 2 | 2 | 2 | 3 | 1 | 2 |
| Crockett clay loam | 9 | 3 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Crockett fine sandy loam | 11 | 3 | 4 | 5 | 3 | 4 | 3 | 3 | 4 | 3 | 2 |
| Crockett loam | 3 | 3 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| Crockett very fine sandy loam | 2 | 3 | 4 | 5 | 3 | 4 | 3 | 4 | 4 | 3 | 3 |
| Ellis clay | 4 | 2 | 3 | 5 | 1 | 2 | 2 | 2 | 2 | 1 | 2 |
| Grayson clay loam | 1 | 2 | 3 | 5 | 3 | 2 | 3 | 2 | 3 | 2 | ........ |
| Wilson clay | 18 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| Wilson clay loam | 20 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| Wilson fine sandy loam | 13 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 2 |
| Wilson loam | 6 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Wilson silt loam | 2 | 2 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Wilson silty clay loam | 1 | 3 | 4 | 5 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| Wilson very fine sandy loam | 3 | 3 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Non-calcareous terrace soils | | | | | | | | | | | |
| Irving clay | 5 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| Irving clay loam | 2 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |
| Irving fine sandy loam | 2 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 2 |
| Irving silt loam | 1 | 4 | 4 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 2 |
| Non-calcareous flat stream bottom soils | | | | | | | | | | | |
| Johnston clay | 1 | 3 | 3 | 4 | 1 | 2 | 2 | 2 | 3 | 2 | 3 |

**Lewisville soils:** Brown, friable surface, with yellow or brown, crumbly subsoil. Analyses and grades of constituents are given in Tables 9 and 10 for the Blackland Prairies.

**Flat stream bottom soils:**

**Catalpa soils:** Brown, friable, permeable surface with brown or grayish, friable, permeable subsoil. Analyses and grades of constituents for Catalpa soils are given in Tables 9 and 10 for the Blackland Prairies.

**Trinity soils:** Black or dark-gray, calcareous surface and subsoil. Analyses and grades of constituents for Trinity soils are given in Tables 5 and 6 for the Gulf Coast Prairie.

### Composition of soil types

The average composition of the soil types is given in Table 11, and the grades of constituents of the surface soils in Table 12. Most of the soils have Grade 1 for acid-soluble lime and magnesia, basicity, and pH, Grade 2 (some in Grade 3) for nitrogen, acid-soluble potash, and active potash, Grade 3 for total phosphoric acid and total potash, and Grades 4 and 5 in active phosphoric acid. Although the content of active phosphoric acid is low, the soils may still have the capacity to supply sufficient phosphoric acid to plants because of the high lime content.

## WEST CROSS TIMBERS

The West Cross Timbers area is a timbered region in central-northern Texas about 200 miles long and in places more than 50 miles wide, covering about 7,000,000 acres in 21 counties. The surface ranges from ,ently rolling to very rolling, with smoothly undulating broad divides and considerable areas of hilly and rough stony land in some sections. Elevations above sea-level range from 1,000 to 1,200 feet. The soils are largely of sandy texture and from noncalcareous parent material, although in many places considerable bodies of dark-colored soils of heavy texture from limestone parent material occur.

### Outline descriptions of series

**Rolling upland prairie soils:**

**Nimrod soils:** Light-brown or gray surface with a yellowish friable subsurface and a yellow friable, sandy subsoil.

**Windthorst soils:** Brown, reddish-brown, or red, friable surface with a red, heavy but crumbly subsoil.

**Terrace soils:**

**Bastrop soils:** Chocolate-brown, calcareous surface with a chocolate red subsoil.

**Bell soils:** Black to dark-brown, calcareous, friable surface with dark-gray to brown, crumbly calcareous subsoil. Analyses and grades of constituents for Bell soils are given in Tables 9 and 10 for the Blackland Prairies.

**Lewisville soils:** Brown, friable, calcareous surface with yellow or brown, crumbly, calcareous subsoil. Analyses and grades of constituents for Lewisville soils are given in Tables 9 and 10 for the Blackland Prairies.

## Table 11. Analyses of soils of the Grand Prairie

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils | | | | | | | | | | | |
| Brackett clay, surface | 2 | .104 | .093 | 49 | .89 | .67 | 403 | 21.16 | 38.79 | 1.72 | 7.3 |
| Brackett clay, subsoil | 2 | .056 | .072 | 52 | 1.16 | .63 | 428 | 26.10 | 46.64 | .87 | 7.8 |
| Brackett fine sandy loam, surface | 5 | .070 | .045 | 52 | .95 | .34 | 260 | 3.43 | 5.32 | .83 | 7.4 |
| Brackett fine sandy loam, subsoil | 5 | .049 | .044 | 29 | 1.13 | .46 | 215 | 12.75 | 16.96 | 1.12 | 7.6 |
| Brackett gravelly clay, surface | 1 | .220 | ........ | ........ | .74 | ........ | ........ | ........ | ........ | ........ | ........ |
| Brackett gravelly clay, subsoil | 1 | .030 | .027 | 6 | .56 | .36 | 14 | 38.26 | 68.10 | .72 | 7.5 |
| Brackett gravelly loam, surface | 4 | .124 | .058 | 15 | .90 | .35 | 158 | 10.78 | 21.51 | 1.14 | 7.4 |
| Brackett gravelly loam, subsoil | 4 | .031 | .015 | 12 | .23 | .09 | 53 | 14.85 | 32.03 | 6.36 | 7.7 |
| Brackett loam, surface | 4 | .135 | .079 | 56 | .93 | .39 | 334 | 8.68 | 15.20 | 1.48 | 7.3 |
| Brackett loam, subsoil | 4 | .070 | .064 | 8 | .66 | .29 | 253 | 12.95 | 28.90 | 2.22 | 7.7 |
| Brackett silt loam, surface | 1 | .139 | .062 | 8 | 1.22 | .28 | 145 | 22.20 | 10+ | .16 | 7.0 |
| Brackett silt loam, subsoil | 1 | .144 | .013 | 8 | .80 | .17 | 58 | 30.74 | 10+ | .36 | 7.2 |
| Brackett silty clay loam, surface | 4 | .121 | .071 | 34 | 1.62 | .64 | 449 | 11.64 | 22.76 | .58 | 7.2 |
| Brackett silty clay loam, subsoil | 4 | .078 | .068 | 28 | 1.65 | .51 | 143 | 9.47 | 18.28 | .77 | 6.1 |
| Brackett stony clay loam, surface | 1 | .095 | .023 | 10 | .90 | .24 | 45 | 28.45 | 10+ | .26 | ........ |
| Crawford clay, surface | 7 | .140 | .104 | 31 | .95 | .57 | 365 | 3.00 | 5.74 | .29 | 6.8 |
| Crawford clay, subsoil | 7 | .089 | .078 | 21 | 1.12 | .64 | 261 | 3.77 | 7.53 | .52 | 7.2 |
| Crawford clay loam, surface | 2 | .151 | .110 | ........ | 1.32 | .60 | ........ | .36 | 2.09 | .96 | 7.6 |
| Crawford clay loam, subsoil | 2 | .134 | .108 | ........ | 1.48 | .71 | ........ | 1.56 | 4.94 | 1.81 | 7.7 |
| Crawford gravelly clay loam, surface | 2 | .141 | .054 | 26 | 1.36 | .47 | 322 | .52 | 1.14 | .24 | 6.7 |
| Crawford gravelly clay loam, subsoil | 2 | .077 | .057 | 5 | 1.13 | .63 | 209 | .56 | .96 | .29 | 6.8 |
| Crawford loam, surface | 1 | .058 | .040 | 54 | .74 | .26 | 280 | .34 | .39 | .25 | ........ |
| Crawford loam, subsoil | 1 | .050 | .028 | 14 | .50 | .27 | 246 | .35 | .59 | .21 | ........ |
| Crawford silty clay, surface | 4 | .158 | .107 | 64 | 1.43 | .70 | ........ | 2.65 | 5.46 | 2.20 | ........ |
| Crawford silty clay, subsoil | 4 | .108 | .070 | 20 | 1.43 | .94 | ........ | 2.82 | 5.86 | 3.25 | ........ |
| Crawford stony clay. surface | 3 | .169 | .108 | 40 | 1.20 | .66 | 460 | .85 | 2.44 | .35 | 6.8 |
| Crawford stony clay, subsoil | 3 | .191 | .051 | 40 | 1.91 | .74 | 432 | 1.81 | 3.05 | .29 | 6.9 |
| Darnoc clay, surface | 5 | .142 | .146 | 64 | 2.43 | .92 | 418 | 9.02 | 10+ | .81 | 7.3 |
| Darnoc clay, subsoil | 5 | .094 | .132 | 40 | 1.90 | 1.03 | 271 | 10.18 | 10+ | .76 | 7.5 |
| Denton clay, surface | 15 | .150 | .087 | 53 | 1.11 | .46 | 208 | 6.06 | 8.25 | .57 | 7.3 |
| Denton clay, subsoil | 15 | .079 | .060 | 13 | .88 | .44 | 99 | 11.34 | 16.86 | .61 | 7.6 |
| Denton clay loam, surface | 1 | .154 | .072 | 44 | 1.32 | .69 | 420 | .72 | 1.64 | .55 | 7.0 |
| Denton clay loam, subsoil | 1 | .117 | .059 | 18 | ........ | .85 | 250 | .94 | .44 | .65 | 7.1 |
| Denton fine sandy loam, surface | 2 | .123 | .089 | 14 | .90 | .33 | 157 | 7.47 | 13.43 | .39 | 7.3 |
| Denton fine sandy loam, subsoil | 2 | .106 | .096 | 66 | .94 | .37 | 182 | 15.41 | 27.65 | .37 | 7.5 |
| Denton loam, surface | 1 | .118 | .067 | 58 | 1.17 | .47 | 276 | .76 | 1.26 | .37 | 7.1 |
| Denton loam, subsoil | 1 | .098 | .086 | 43 | 1.23 | .45 | 550 | 6.05 | 3.85 | .48 | 7.5 |

**Type 11. Analyses of the Grand Prairie—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils—(Continued) | | | | | | | | | | | |
| San Saba clay, surface | 16 | .145 | .074 | 45 | 1.16 | .69 | 240 | 5.60 | 9.35 | .76 | 7.7 |
| San Saba clay, subsoil | 12 | .075 | .058 | 20 | 1.09 | .51 | 140 | 9.81 | 10+ | .71 | 7.6 |
| San Saba silty clay loam, surface | 1 | .092 | .041 | 12 | .83 | .32 | 150 | .47 | .85 | .36 | 7.0 |
| San Saba silty clay loam, subsoil | 1 | .068 | .044 | 18 | .66 | .48 | ........ | .56 | 1.90 | .81 | ........ |

**Table 12. Grades of constituents of surface soils of the Grand Prairie**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils | | | | | | | | | | | |
| Brackett clay | 2 | 3 | 3 | 4 | 3 | 2 | 1 | 1 | 1 | 1 | 2 |
| Brackett fine sandy loam | 5 | 3 | 4 | 4 | 3 | 3 | 2 | 1 | 1 | 1 | 2 |
| Brackett gravelly clay | 1 | 1 | ........ | ........ | 3 | ........ | ........ | ........ | ........ | ........ | ........ |
| Brackett gravelly loam | 4 | 2 | 3 | 5 | 3 | 3 | 3 | 1 | 1 | 1 | 2 |
| Brackett loam | 4 | 2 | 3 | 4 | 3 | 3 | 2 | 1 | 1 | 1 | 2 |
| Brackett silt loam | 1 | 2 | 3 | 5 | 2 | 3 | 3 | 1 | 1 | 3 | 2 |
| Brackett silty clay loam | 4 | 2 | 3 | 4 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| Brackett stony clay loam | 1 | 3 | 5 | 5 | 3 | 3 | 5 | 1 | 1 | 3 | ........ |
| Crawford clay | 7 | 2 | 2 | 4 | 3 | 2 | 2 | 1 | 1 | 3 | 2 |
| Crawford clay loam | 2 | 2 | 2 | ........ | 2 | 2 | ........ | 3 | 2 | 1 | 1 |
| Crawford gravelly clay loam | 2 | 2 | 3 | 5 | 2 | 2 | 2 | 2 | 3 | 3 | 2 |
| Crawford loam | 1 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 3 | ........ |
| Crawford silty clay | 4 | 2 | 2 | 4 | 2 | 2 | ........ | 1 | 1 | 1 | ........ |
| Crawford stony clay | 3 | 2 | 2 | 4 | 3 | 2 | 1 | 2 | 2 | 2 | 2 |
| Darnoc clay | 5 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Denton clay | 15 | 2 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| Denton clay loam | 1 | 2 | 3 | 4 | 2 | 2 | 1 | 2 | 3 | 2 | 2 |
| Denton fine sandy loam | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 1 | 1 | 2 | 2 |
| Denton loam | 1 | 3 | 3 | 4 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| San Saba clay | 16 | 2 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| San Saba silty clay loam | 1 | 3 | 4 | 5 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |

**Milam soils:** Brown or reddish-brown, friable surface with a red, heavy, crumbly, permeable subsoil.

**Flat stream-bottom soils:**

**Catalpa soils:** Brown, friable, permeable, calcareous surface with brown or grayish, friable, permeable, calcareous subsoil. Analyses and grades of constituents are given in Tables 9 and 10 for the Blackland Prairies.

**Frio soils:** Grayish-brown, calcareous, friable surface with a grayish-brown, calcareous, crumbly subsoil.

**Ochlockonee soils:** Brown or light-brown noncalcareous surface with brown, yellow or gray or mottled, noncalcareous subsoil. Analyses and grades of constituents are given in Tables 5 and 6 for the Gulf Coast Prairie.

### Composition of soil types

The average composition of the soil types is given in Table 13 and the grades of constituents of surface soils in Table 14. The principal upland soils of the area are the Windthorst fine sandy loam and the Nimrod fine sand. The Windthorst fine sandy loam has Grade 3 for total potash, active potash, acid-soluble lime and magnesia, and basicity, Grade 4 for nitrogen, total phosphoric acid, and acid-soluble potash, and Grade 5 for active phosphoric acid. The Nimrod fine sand has Grades 4 and 5 for all constituents except acidity (pH) (Grade 2). The Milam fine sandy loam of the terraces has Grade 5 for all constituents except potash (Grade 3) and pH (Grade 2). With the exception of the Bastrop fine sand (Grades 4 and 5 for most constituents) and the soils of the Ochlockonee series, the soils of the flat stream-bottoms have Grades 1 and 2 for all constituents except total and active phosphoric acid, in which they have Grades 3, 4, and 5.

## CENTRAL BASIN

The Central Basin occupies about 2,000,000 acres in 8 counties in central Texas. The surface is rolling to hilly, with relatively smooth valleys and broad gently rolling lowlands interspersed with stony hills and rough lands. The elevations range from about 800 to 1300 feet. The soils are predominantly red, noncalcareous, and sandy with heavy subsoils.

### Outline description of series

**Rolling upland prairie soils:**

**Lancaster soils:** Brown to slightly reddish-brown surface with a yellow or mottled, crumbly subsoil in thin layers.

**Pedernales soils:** Bright red, friable surface with a dark red, crumbly subsoil in thin layers.

**Pontotoc soils:** Dark reddish-brown to nearly black moderately friable surface with a reddish-brown to brown, rather stiff subsoil.

**Tishomingo soils:** Brown to reddish-brown, friable surface with a red or mottled, dense subsoil in thin layers.

## Table 13. Analyses of soils of the West Cross Timbers

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos. Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils | | | | | | | | | | | |
| Nimrod fine sand, surface | 7 | .027 | .018 | 16 | .43 | .10 | 97 | .11 | .32 | .09 | 6.6 |
| Nimrod fine sand, subsoil | 6 | .028 | .017 | 11 | .65 | .34 | 71 | .20 | .38 | .22 | 6.6 |
| Windthorst clay loam, surface | 4 | .088 | .054 | 22 | 1.25 | .59 | 288 | .38 | .91 | .27 | 6.6 |
| Windthorst clay loam, subsoil | 4 | .077 | .066 | 7 | 1.32 | .72 | 210 | .46 | .70 | .57 | 6.7 |
| Windthorst fine sandy loam, surface | 17 | .050 | .031 | 10 | .80 | .17 | 149 | .23 | .70 | .18 | 6.9 |
| Windthorst fine sandy loam, subsoil | 17 | .049 | .037 | 10 | 1.10 | .55 | 202 | .41 | 1.35 | .49 | 6.6 |
| Windthorst gravelly clay loam, surface | 1 | .101 | .053 | 14 | 1.41 | .69 | 494 | .39 | .80 | .36 | 6.8 |
| Windthorst gravelly clay loam, subsoil | 1 | .079 | .037 | 10 | 1.54 | .96 | 426 | .58 | 1.16 | .44 | 6.7 |
| Windthorst gravelly sandy loam, surface | 1 | .022 | .022 | 6 | .74 | .11 | 78 | .07 | .20 | .22 | 6.9 |
| Windthorst gravelly sandy loam, subsoil | 1 | .035 | .032 | 6 | 1.06 | .57 | 193 | .20 | .70 | .43 | ....... |
| Windthorst stony fine sandy loam, surface | 1 | .077 | .055 | 14 | .99 | .25 | 72 | 16.61 | 31.60 | .31 | 7.6 |
| Windthorst stony fine sandy loam, subsoil | 1 | .041 | .026 | 7 | .50 | .14 | 98 | 4.58 | 7.03 | .24 | 7.4 |
| Terrace soils | | | | | | | | | | | |
| Bastrop clay, surface | 2 | .099 | .110 | 60 | 1.22 | .87 | 307 | 5.29 | 10+ | 2.22 | 6.8 |
| Bastrop clay, subsoil | 1 | .042 | .072 | 61 | 1.36 | .09 | 124 | 1.36 | 2.80 | .17 | ....... |
| Bastrop fine sand, surface | 1 | .030 | .021 | 20 | .31 | .08 | 55 | .12 | .20 | .07 | 6.8 |
| Bastrop fine sand, subsoil | 1 | .010 | .016 | 7 | .27 | .09 | 53 | .10 | .05 | .14 | 6.9 |
| Bastrop fine sandy loam, surface | 8 | .046 | .042 | 19 | 1.05 | .23 | 166 | .33 | .62 | .32 | 6.9 |
| Bastrop fine sandy loam, subsoil | 8 | .049 | .044 | 12 | 1.04 | .51 | 207 | .43 | .70 | .73 | 7.2 |
| Bastrop loam, surface | 2 | .073 | .052 | 92 | 1.04 | .41 | 376 | .87 | 1.74 | .38 | 7.1 |
| Bastrop loam, subsoil | 2 | .060 | .053 | 70 | 1.40 | .60 | 230 | 2.81 | 5.35 | .72 | 7.6 |
| Bastrop sand, surface | 2 | .030 | .035 | 35 | .64 | .11 | 128 | .28 | .27 | .12 | 8.0 |
| Bastrop sand, subsoil | 2 | .020 | .031 | 66 | .71 | .10 | 107 | .17 | .04 | .14 | 7.6 |
| Bastrop sandy loam, surface | 2 | .075 | .059 | 235 | 1.71 | .40 | 511 | .58 | .83 | .37 | ....... |
| Bastrop sandy loam, subsoil | 2 | .070 | .035 | 45 | 1.91 | .57 | 409 | .68 | .48 | .53 | ....... |
| Bastrop silty clay loam, surface | 3 | .111 | .083 | 104 | 1.54 | .89 | 641 | 3.79 | 6.84 | 1.35 | 7.4 |
| Bastrop silty clay loam, subsoil | 3 | .061 | .055 | 24 | 1.34 | .87 | 187 | 5.80 | 8.48 | 2.08 | 8.2 |
| Milam fine sandy loam, surface | 4 | .019 | .C25 | 27 | .45 | .08 | 102 | .12 | .20 | .08 | 6.8 |
| Milam fine sandy loam, subsoil | 4 | .030 | .033 | 18 | .62 | .24 | 127 | .20 | .44 | .17 | 6.3 |
| Milam gravelly fine sandy loam, surface | 2 | .084 | .041 | 39 | 1.59 | .39 | 215 | .86 | 1.10 | .16 | ....... |
| Milam gravelly fine sandy loam, subsoil | 2 | .065 | .040 | 42 | 1.41 | .41 | 126 | .49 | 1.03 | .16 | ....... |
| Flat stream bottom soils | | | | | | | | | | | |
| Frio clay, surface | 12 | .157 | .144 | 31 | 1.53 | .77 | 334 | 7.81 | 16.31 | 1.26 | 7.3 |
| Frio clay, subsoil | 12 | .096 | .115 | 47 | 1.40 | .72 | 122 | 8.81 | 16.53 | .72 | 7.9 |
| Frio clay loam, surface | 2 | .107 | .119 | 375 | 1.43 | .48 | 507 | 1.84 | 5.84 | .60 | 7.4 |
| Frio clay loam, subsoil | 2 | .075 | .102 | 136 | 1.18 | .42 | 174 | 5.84 | 9.55 | .66 | 7.7 |
| Frio fine sandy loam, surface | 11 | .061 | .055 | 87 | 1.00 | .30 | 166 | .88 | 1.79 | .15 | 7.3 |
| Frio fine sandy loam, subsoil | 11 | .053 | .044 | 61 | 1.16 | .40 | 210 | 1.49 | 2.34 | .33 | 7.3 |

**Table 13. Analyses of soils of the West Cross Timbers—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frio gravelly clay, surface | 1 | .123 | .092 | 25 | 1.00 | .46 | 205 | 32.11 | 57.56 | 1.02 | 7.9 |
| Frio gravelly clay, subsoil | 1 | .047 | .046 | 7 | .89 | .30 | 40 | 34.36 | 61.86 | .86 | 7.9 |
| Frio loam, surface | 11 | .117 | .094 | 104 | 1.42 | .50 | 559 | 5.02 | 6.70 | .94 | 7.3 |
| Frio loam, subsoil | 11 | .080 | .077 | 89 | 1.26 | .47 | 342 | 7.18 | 5.88 | .90 | 7.5 |
| Frio silt loam, surface | 4 | .127 | .120 | 374 | 1.59 | .65 | 665 | 9.15 | 10+ | .42 | 7.5 |
| Frio silt loam, subsoil | 4 | .073 | .113 | 244 | 1.63 | .64 | 355 | 9.58 | 12.58 | .43 | 7.7 |
| Frio silty clay, surface | 1 | .149 | .085 | 14 | ........ | ........ | 242 | ........ | 10+ | ........ | ........ |
| Frio silty clay, subsoil | 1 | .105 | .089 | 8 | ........ | ........ | 144 | ........ | 10+ | ........ | ........ |
| Frio silty clay loam, surface | 11 | .120 | .104 | 120 | 1.45 | .73 | 485 | 10.32 | 10+ | .51 | 7.7 |
| Frio silty clay loam, subsoil | 11 | .082 | .091 | 51 | 1.49 | .77 | 202 | 9.74 | 12.57 | .68 | 7.2 |
| Frio very fine sandy loam, surface | 2 | .140 | .189 | 237 | 1.21 | .34 | 430 | 1.97 | 3.05 | .35 | 7.2 |
| Frio very fine sandy loam, subsoil | 2 | .054 | .092 | 240 | 1.21 | .43 | 554 | .73 | 1.22 | .41 | 7.4 |

Table 14. Grades of constituents of surface soils of the West Cross Timbers

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils | | | | | | | | | | | |
| Nimrod fine sand | 7 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 2 |
| Windthorst clay loam | 4 | 3 | 3 | 5 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| Windthorst fine sandy loam | 17 | 4 | 4 | 5 | 3 | 4 | 3 | 3 | 3 | 3 | 2 |
| Windthorst gravelly clay loam | 1 | 3 | 3 | 5 | 2 | 2 | 1 | 3 | 3 | 2 | 2 |
| Windthorst gravelly sandy loam | 1 | 5 | 5 | 5 | 3 | 4 | 4 | 5 | 5 | 3 | 2 |
| Windthorst stony fine sandy loam | 1 | 3 | 3 | 5 | 3 | 3 | 4 | 1 | 1 | 2 | 1 |
| Terrace soils | | | | | | | | | | | |
| Bastrop fine sand | 1 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 2 |
| Bastrop fine sandy loam | 8 | 4 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Bastrop loam | 2 | 3 | 3 | 4 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| Bastrop sand | 2 | 5 | 4 | 4 | 3 | 4 | 3 | 3 | 5 | 4 | 1 |
| Bastrop sandy loam | 2 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 2 | ........ |
| Bastrop silty clay loam | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 |
| Bastrop clay | 2 | 3 | 2 | 4 | 2 | 1 | 2 | 1 | 1 | 1 | 2 |
| Milam fine sandy loam | 4 | 5 | 5 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| Milam gravelly fine sandy loam | 2 | 3 | 4 | 4 | 2 | 3 | 2 | 2 | 3 | 3 | ........ |
| F at stream bottom soils | | | | | | | | | | | |
| Frio clay | 12 | 2 | 2 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| Frio silt loam | 4 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| Frio silty clay | 1 | 2 | 3 | 5 | ........ | ........ | 2 | ........ | 1 | ........ | ........ |
| Frio silty clay loam | 11 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 |
| Frio very fine sandy loam | 2 | 2 | 1 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 |
| Frio clay loam | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 4 | 2 |
| Frio fine sandy loam | 11 | 3 | 3 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 2 |
| Frio gravelly clay | 1 | 2 | 3 | 5 | 3 | 2 | 1 | 2 | 1 | 1 | 1 |
| Frio loam | 11 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 2 |

**Table 15. Analyses of soils of the Central Basin**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils | | | | | | | | | | | |
| Lancaster sandy loam, surface | 1 | .031 | .035 | 15 | 1.85 | .12 | 133 | .14 | .25 | .11 | ........ |
| Pedernales loam, surface | 1 | .068 | .027 | 14 | 1.58 | .57 | 408 | .33 | .95 | .24 | ........ |
| Pedernales loam, subsoil | 1 | .058 | .027 | 11 | 1.92 | .89 | 493 | .42 | .75 | ........ | ........ |
| Pedernales sandy loam, surface | 3 | .043 | .026 | 11 | 1.89 | .40 | 247 | .25 | .57 | .16 | ........ |
| Pedernales sandy loam, subsoil | 3 | .030 | .025 | 3 | 1.85 | .95 | 276 | .30 | .87 | .28 | ........ |
| Pedernales stony fine sandy loam, surface | 1 | .083 | .111 | 397 | 1.56 | .30 | 299 | .86 | 1.91 | .17 | ........ |
| Pedernales stony loam, surface | 1 | .128 | .097 | 49 | 1.83 | .32 | ........ | ........ | 10+ | .30 | ........ |
| Pontotoc clay loam, surface | 1 | .070 | .081 | 171 | 2.20 | .52 | 501 | .22 | .70 | .10 | 7.0 |
| Pontotoc clay loam, subsoil | 1 | .051 | .082 | 14 | 2.57 | .89 | 419 | .40 | .70 | .36 | 6.3 |
| Pontotoc sandy loam, surface | 2 | .043 | .172 | 364 | 2.63 | .28 | 290 | .14 | .50 | .15 | ........ |
| Pontotoc sandy loam, subsoil | 2 | .048 | .167 | 159 | 2.41 | .33 | 243 | .15 | .53 | ........ | 6.9 |
| Pontotoc stony loam, surface | 1 | .122 | .335 | 779 | 3.62 | .83 | 78 | 9.71 | 7.82 | .10 | 7.5 |
| Tishomingo fine sandy loam, surface | 1 | .047 | .110 | 322 | 3.64 | .41 | 50 | .22 | .51 | .34 | ........ |
| Tishomingo fine sandy loam, subsoil | 1 | .052 | .148 | 231 | 3.46 | .67 | 74 | .29 | .72 | .47 | ........ |
| Tishomingo gravelly sandy loam, surface | 1 | .061 | .041 | 32 | 4.61 | .19 | 235 | .22 | .25 | .08 | ........ |
| Tishomingo gravelly sandy loam, subsoil | 1 | .038 | .043 | 8 | 2.10 | .63 | ........ | .20 | .80 | ........ | ........ |
| Tishomingo loam, surface | 1 | .071 | .041 | 33 | 2.12 | .34 | 279 | .38 | .60 | .27 | ........ |
| Tishomingo loam, subsoil | 1 | .048 | .100 | 9 | 1.51 | .83 | 209 | .45 | 1.26 | .38 | ........ |
| Tishomingo sandy loam, surface | 5 | .037 | .067 | 11 | 3.20 | .22 | 158 | .49 | .81 | .25 | 6.7 |
| Tishomingo sandy loam, subsoil | 5 | .055 | .074 | 12 | 2.58 | .55 | 196 | .49 | .87 | .53 | 6.2 |
| Tishomingo stony clay loam, surface | 1 | .072 | .050 | 10 | 2.84 | .61 | 613 | .86 | .80 | .61 | ........ |
| Tishomingo stony clay loam, subsoil | 1 | .079 | .079 | 4 | 1.88 | 1.00 | 756 | .71 | 1.10 | .65 | ........ |
| Tishomingo stony sandy loam, surface | 1 | .050 | .084 | 9 | 3.52 | .33 | 243 | .19 | .50 | .24 | ........ |
| Tishomingo stony sandy loam, subsoil | 1 | .055 | .032 | ........ | 1.68 | .45 | ........ | .44 | ........ | .32 | ........ |

**Table 16. Grades of constituents of surface soils of the Central Basin**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling upland prairie soils | | | | | | | | | | | |
| Lancaster sandy loam | 1 | 4 | 4 | 5 | 1 | 4 | 3 | 4 | 5 | 4 | ........ |
| Pedernales loam | 1 | 3 | 4 | 5 | 2 | 2 | 1 | 3 | 3 | 3 | ........ |
| Pedernales sandy loam | 3 | 4 | 4 | 5 | 1 | 3 | 2 | 3 | 4 | 3 | ........ |
| Pedernales stony fine sandy loam | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | ........ |
| Pedernales stony loam | 1 | 2 | 3 | 4 | 1 | 3 | ........ | ........ | 1 | 3 | ........ |
| Pontotoc clay loam | 1 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 3 | 4 | 2 |
| Pontotoc sandy loam | 2 | 4 | 1 | 2 | 1 | 3 | 2 | 4 | 4 | 4 | ........ |
| Pontotoc stony loam | 1 | 2 | 4 | 1 | 1 | 1 | 4 | 1 | 1 | 4 | 2 |
| Tishomingo fine sandy loam | 1 | 4 | 2 | 2 | 1 | 2 | 5 | 3 | 4 | 2 | ........ |
| Tishomingo gravelly sandy loam | 1 | 3 | 4 | 4 | 1 | 4 | 2 | 3 | 5 | 4 | ........ |
| Tishomingo loam | 1 | 3 | 4 | 4 | 1 | 3 | 2 | 3 | 1 | 3 | ........ |
| Tishomingo sandy loam | 5 | 4 | 3 | 5 | 1 | 3 | 3 | 2 | 3 | 3 | 2 |
| Tishomingo stony clay loam | 1 | 3 | 4 | 5 | 1 | 2 | 1 | 2 | 3 | 1 | ........ |
| Tishomingo stony sandy loam | 1 | 4 | 3 | 5 | 1 | 3 | 2 | 4 | 4 | 3 | ........ |

### Composition of soil types

The average composition of the soil types is given in Table 15 and the grades of the constituents of the surface soils in Table 16. All soils have Grade 1 for total potash, but most soils have Grades 2 and 3 for acid-soluble potash and active potash. Most soils have Grades 3 and 4 for nitrogen, Grades 3 and 4 for total phosphoric acid, Grades 4 and 5 for active phosphoric acid and Grades 3 and 4 for magnesia and basicity. Only one sample of many of the types has been analyzed, so that the figures given for those types can only be taken as indications of their composition.

## RIO GRANDE PLAIN

The Rio Grande Plain comprises a wedge-shaped area covering about 22,000,000 acres in 34 counties in the extreme southern and southwestern parts of Texas. The area consists of a broad undulating to rolling plain with a general regional slope to the southeast, and elevations are from 200 to 700 feet above sea-level. The soils, developed under a climate of relatively high temperature and light rainfall, are grouped into (1) dark-colored soils, (2) light-brown soils (3) light colored soils, (4) red soils, (5) semi-marshy soils, and (6) flat stream-bottom soils.

### Outline description of series

**Upland plains, dark-colored soils:**

**Goliad soils:** Dark-brown or black, noncalcareous, friable surface with a red or reddish-brown subsoil, calcareous in lower part.

**Hidalgo soils:** Brown, calcareous, friable surface with a brown or yellowish, calcareous, crumbly subsoil.

**Miguel soils:** Brown, noncalcareous surface, tight when dry, with a red, noncalcareous, tough subsoil, dense when dry.

**Orelia soils:** Dark-brown or black, noncalcareous surface, tight and crusty when dry, with a dark-brown or dark-gray, dense, heavy noncalcareous subsoil.

**San Antonio soils:** Dark-brown, noncalcareous surface, tight when dry, with a brown or reddish-brown, dense, heavy, noncalcareous subsoil.

**Tiocano soils:** Dark ashy-gray clay surface extending to 3 to 4 feet without change, very tough when dry and plastic when wet.

**Victoria soils:** Black to very dark-brown or dark-grayish-brown, calcareous, friable surface with a dark-gray, brown or yellowish, calcareous, crumbly subsoil.

**Willacy soils:** Brown, noncalcareous, friable surface with a brown or yellowish, crumbly subsoil, calcareous in the lower part.

**Upland plains, light-brown soils:**

**Delfina soils:** Brown or reddish-brown, friable, noncalcareous surface with tough heavy gray or yellow, almost impervious, subsoil.

**Maverick soils:** Light brown, calcareous, thin, friable surface with a brown or yellow, thin, crumbly, calcareous subsoil.

**Uvalde soils:** Light brown or grayish, calcareous, friable surface with a light brown, grayish, or yellow, calcareous, crumbly subsoil.

**Upland plains, light-colored soils:**

**Brennan soils:** Very light grayish brown or gray, noncalcareous, friable surface with a yellow, noncalcareous, crumbly subsoil.

**Nueces soils:** Gray, friable surface with a gray or yellowish, noncalcareous, friable subsoil.

**Upland plains, red soils:**

**Duval soils:** Red or reddish-brown, noncalcareous, friable surface with a red, crumbly subsoil noncalcareous except where thin.

**Webb soils:** Red or reddish-brown, noncalcareous surface with a red or brownish-red, rather heavy and dense, noncalcareous subsoil.

**Semi-marshy and associated soils:**

**Lomalta soils:** These occur on the flat coast border. Brown, calcareous, friable surface (wet salty land) with a brown or gray, calcareous, salty subsoil with a high water table.

**Point Isabel soils:** These occur on flat to dune-like ridges. Gray to ashy-brown, calcareous, salty, friable surface with a yellow, calcareous, salty subsoil.

**Flat stream-bottom soils:**

**Blanco soils:** Gray or light-gray, calcareous, friable surface with a light-gray or yellowish, calcareous, crumbly subsoil.

**Cameron soils:** Black or very dark-brown, calcareous, heavy surface with a dark-gray or black, calcareous, heavy subsoil.

**Harlingen soils:** Dark-gray to dark-brown, calcareous, heavy surface with a dark-gray or brown, calcareous, heavy subsoil.

**Laredo soils:** Brown, calcareous, friable surface with a brown or yellow calcareous, crumbly subsoil.

**Raymondville soils:** Gray to brownish-gray calcareous surface with light-gray, ash-brown, or yellowish calcareous subsoil with poor natural drainage.

**Rio Grande soils:** Light-brown or gray, calcareous, friable surface with a gray to light-brown or yellowish calcareous crumbly subsoil.

## Composition of soil types

The average composition of the soil types is given in Table 17 and the grades of constituents of surface soils in Table 18. The Victoria and Hidalgo soils, the principal dark-colored upland soils of the area, have Grades 1 to 3 for all constituents. San Antonio and Goliad soils, and the lighter textured, dark-colored soils have Grades 3 and 4 for nitrogen, and Grades 4 and 5 for total and active phosphoric acid. Most of the light-brown soils have Grade 4 for nitrogen and total phosphoric acid and Grades 4 and 5 for active phosphoric acid. The Brennan, Nueces, and Duval series have Grades 4 and 5 for basicity. All of the soils are well supplied with potash, acid-soluble lime, acid-soluble magnesia, and are not acid. The

**Table 17. Analyses of soils of the Rio Grande Plain**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland plains dark-colored soils | | | | | | | | | | | |
| Goliad clay loam, surface | 2 | .147 | .030 | 41 | .65 | .25 | 290 | 1.71 | 2.21 | .58 | 7.4 |
| Goliad clay loam, subsoil | 2 | .070 | .021 | 13 | .70 | .24 | 96 | 5.49 | 9.59 | .70 | 7.5 |
| Goliad fine sand, surface | 1 | .039 | .013 | 14 | .59 | .17 | ........ | .11 | .15 | .10 | ........ |
| Goliad fine sand, subsoil | 1 | .024 | .003 | 11 | .61 | .34 | 136 | .25 | .25 | .26 | ........ |
| Goliad fine sandy clay loam, surface | 2 | .107 | .026 | 50 | .82 | .32 | 413 | .74 | 1.37 | .35 | 7.7 |
| Goliad fine sandy clay loam, subsoil | 2 | .108 | .021 | 20 | .88 | .33 | 329 | .81 | 1.50 | .47 | 7.6 |
| Goliad fine sandy loam, surface | 4 | .099 | .024 | 22 | .88 | .29 | 251 | .68 | 1.17 | .32 | 7.4 |
| Goliad fine sandy loam, subsoil | 4 | .081 | .017 | 10 | .90 | .33 | 145 | .94 | 1.44 | .36 | 7.1 |
| Goliad loam, surface | 7 | .118 | .034 | 75 | .83 | .60 | 429 | 3.35 | 5.35 | .46 | ........ |
| Goliad loam, subsoil | 7 | .082 | .046 | 31 | .84 | .54 | 235 | 5.80 | 6.25 | .39 | ........ |
| Goliad sand, surface | 1 | .035 | .020 | 23 | .70 | .14 | 125 | .25 | .29 | .10 | ........ |
| Goliad sand, subsoil | 1 | .048 | .025 | 23 | .64 | .47 | 108 | .35 | .64 | .46 | ........ |
| Goliad sandy loam, surface | 2 | .101 | .020 | 20 | .77 | .38 | 363 | .87 | 1.21 | .26 | ........ |
| Goliad sandy loam, subsoil | 2 | .073 | .016 | 15 | .94 | .20 | 261 | .66 | 1.22 | .35 | ........ |
| Hidalgo clay loam, surface | 3 | .126 | .086 | 61 | 1.17 | .86 | 704 | 3.68 | 7.18 | .43 | 7.3 |
| Hidalgo clay loam, subsoil | 3 | .081 | .084 | 30 | 1.45 | .90 | 483 | ........ | 7.10 | .53 | 7.3 |
| Hidalgo fine sandy clay loam, surface | 1 | .098 | .054 | 126 | .85 | ........ | 1026 | ........ | 1.25 | ........ | 7.0 |
| Hidalgo fine sandy clay loam, subsoil | 1 | .074 | .042 | 67 | 1.03 | .74 | 726 | .75 | 1.23 | .47 | 7.2 |
| Hidalgo fine sandy loam, surface | 3 | .066 | .053 | 60 | 1.16 | .40 | 396 | 4.20 | 7.46 | .36 | 7.7 |
| Hidalgo fine sandy loam, subsoil | 3 | .059 | .055 | 70 | 1.41 | .42 | 300 | 5.86 | 10.68 | .52 | 5.3 |
| Hidalgo silty clay loam, surface | 1 | .115 | .127 | 531 | 2.18 | .97 | 1070 | 4.91 | 9.00 | .35 | 7.3 |
| Hidalgo silty clay loam, subsoil | 1 | .082 | .095 | 132 | 2.08 | 1.00 | 688 | 6.77 | 16.60 | .36 | 7.3 |
| Miguel fine sandy loam, surface | 1 | .056 | .042 | 43 | .84 | .39 | 193 | .22 | .36 | .23 | ........ |
| Miguel fine sandy loam, subsoil | 1 | .059 | .033 | 12 | 1.04 | .46 | 255 | .35 | 1.00 | .57 | ........ |
| Orelia clay loam, surface | 1 | .101 | .035 | 18 | 1.16 | .41 | 258 | 1.11 | 2.06 | .76 | ........ |
| Orelia clay loam, subsoil | 1 | .084 | .040 | 47 | 1.17 | .49 | 200 | 1.90 | 3.51 | .91 | ........ |
| Orelia fine sandy loam, surface | 1 | .067 | .044 | 116 | ........ | .37 | 461 | .40 | .60 | .30 | ........ |
| Orelia fine sandy loam, subsoil | 1 | .066 | .046 | 116 | ........ | .44 | 508 | .41 | .74 | .38 | ........ |
| San Antonio clay loam, surface | 1 | .097 | .033 | 18 | ........ | ........ | 296 | ........ | 1.00 | ........ | ........ |
| San Antonio clay loam, subsoil | 1 | .079 | .037 | 20 | ........ | ........ | 179 | ........ | 4.35 | ........ | ........ |
| San Antonio fine sandy loam, surface | 1 | .075 | .025 | 7 | .86 | ........ | 298 | ........ | .61 | ........ | ........ |
| San Antonio fine sandy loam subsoil | 1 | .074 | .024 | 4 | .86 | ........ | 205 | ........ | .70 | ........ | ........ |
| San Antonio silty clay loam, surface | 8 | .086 | .090 | 26 | 1.03 | .56 | 307 | 22.34 | 10+ | 1.07 | ........ |
| San Antonio silty clay loam, subsoil | 7 | .063 | .053 | 10 | .99 | .66 | 113 | 24.72 | 10+ | .52 | 7.5 |
| Tiocana clay, surface | 2 | .123 | .125 | 591 | 1.95 | .79 | 719 | 1.63 | 3.01 | .67 | 8.3 |
| Tiocano clay, subsoil | 1 | .057 | .033 | 31 | 1.19 | ........ | 555 | ........ | 1.07 | ........ | 7.1 |
| Victoria clay, surface | 15 | .127 | .050 | 93 | 1.00 | .63 | 351 | 1.72 | 3.06 | .76 | 7.4 |
| Victoria clay, subsoil | 13 | .092 | .040 | 112 | 1.28 | .69 | 250 | 1.96 | 4.30 | .98 | 7.2 |

**Table 17. Analyses of soils of the Rio Grande Plain—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland plains dark-colored soils—(Continued) | | | | | | | | | | | |
| Victoria clay loam, surface | 7 | .135 | .133 | 432 | 2.15 | .95 | 729 | 1.28 | 3.44 | .71 | 7.5 |
| Victoria clay form, subsoil | 7 | .076 | .112 | 376 | 2.40 | .86 | 502 | 3.71 | 6.17 | .79 | 7.6 |
| Victoria fine sandy clay loam, surface | 3 | .138 | .084 | 208 | 2.36 | .76 | 954 | .67 | 1.52 | .57 | 7.3 |
| Victoria fine sandy clay loam, subsoil | 3 | .085 | .065 | 123 | 1.96 | .82 | 663 | 1.54 | 2.63 | .67 | 7.3 |
| Victoria fine sandy loam, surface | 14 | .081 | .068 | 137 | 1.71 | .49 | 584 | .49 | 1.10 | .45 | 6.7 |
| Victoria fine sandy loam, subsoil | 13 | .057 | .051 | 108 | 1.58 | .51 | 451 | .79 | 1.73 | .47 | 7.6 |
| Victoria sandy clay loam, surface | 1 | .123 | .077 | 745 | 2.32 | .60 | 268 | .56 | 1.10 | .42 | 7.4 |
| Victoria sandy clay loam, subsoil | 1 | .052 | .050 | 118 | 1.14 | .59 | 576 | 1.17 | 1.90 | .50 | 7.6 |
| Victoria loam, surface | 3 | .103 | .033 | 76 | 1.32 | .52 | 472 | 1.28 | 3.73 | .40 | ........ |
| Victoria loam, subsoil | 3 | .071 | .060 | 47 | 1.11 | .50 | 404 | 1.23 | 2.30 | .70 | ........ |
| Willacy fine sandy loam, surface | 3 | .104 | .041 | 95 | 1.67 | .32 | 625 | .45 | .79 | .18 | 7.2 |
| Willacy fine sandy loam, subsoil | 3 | .061 | .029 | 38 | 2.15 | .36 | 497 | .41 | .60 | .25 | 7.1 |
| Upland plains light-brown soils | | | | | | | | | | | |
| Delfina fine sandy loam, surface | 2 | .026 | .024 | 26 | .94 | .22 | 228 | .20 | .45 | .23 | 7.2 |
| Delfina fine sandy loam, subsoil | 1 | .035 | .027 | 42 | 1.07 | .26 | 198 | .22 | .43 | .25 | 7.2 |
| Maverick clay loam, surface | 3 | .109 | .045 | 48 | .93 | .37 | 330 | .41 | 1.07 | .44 | ........ |
| Maverick clay loam, subsoil | 2 | .084 | .075 | 7 | ........ | .41 | 191 | 1.87 | ........ | .25 | ........ |
| Maverick fine sandy loam, surface | 1 | .096 | .043 | 13 | .48 | .15 | 48 | 6.57 | 12.30 | .47 | ........ |
| Maverick fine sandy loam, subsoil | 1 | .082 | .045 | 6 | .42 | .11 | 16 | 8.99 | 16.20 | .43 | ........ |
| Maverick loam, surface | 3 | .124 | .068 | 267 | 1.31 | .69 | 1340 | 1.98 | 5.00 | .38 | ........ |
| Uvalde silty clay loam, surface | 4 | .131 | .092 | 35 | 1.18 | .53 | 329 | 8.37 | 10+ | 8.74 | ........ |
| Uvalde silty clay loam, subsoil | 4 | .088 | .107 | 31 | 1.10 | .56 | 165 | 11.39 | 10+ | 8.26 | ........ |
| Upland plains light-colored soils | | | | | | | | | | | |
| Brennan fine sandy loam, surface | 5 | .093 | .031 | 37 | 1.15 | .41 | 416 | .35 | .53 | .35 | ........ |
| Brennan fine sandy loam, subsoil | 5 | .048 | .028 | 19 | 1.49 | .36 | 377 | .27 | .45 | .25 | 7.6 |
| Brennan loamy fine sand, surface | 1 | .031 | .029 | 49 | 1.63 | .32 | 393 | .32 | .57 | .22 | 7.5 |
| Brennan loamy fine sand, subsoil | 1 | .030 | .029 | 57 | 1.55 | .29 | 378 | .31 | .55 | .14 | 7.3 |
| Nueces fine sand, surface | 11 | .031 | .026 | 16 | .99 | .11 | 118 | .10 | .14 | .18 | 6.7 |
| Nueces fine sand, subsoil | 11 | .026 | .017 | 12 | .93 | .16 | 125 | .13 | .26 | .21 | 6.9 |
| Upland plains red soils | | | | | | | | | | | |
| Duval fine sand, surface | 2 | .035 | .041 | 14 | 1.10 | .28 | 139 | .35 | .20 | .19 | ........ |
| Duval fine sand, subsoil | 1 | .050 | .020 | ........ | 1.20 | .55 | ........ | .22 | ........ | .32 | ........ |
| Duval fine sandy loam, surface | 18 | .049 | .031 | 26 | .94 | .29 | 218 | .32 | .44 | .22 | 6.6 |
| Duval fine sandy loam, subsoil | 18 | .041 | .036 | 19 | 1.01 | .32 | 191 | 2.51 | 1.62 | .29 | 7.0 |
| Duval loam, surface | 3 | .072 | .036 | 13 | .69 | .23 | 231 | .30 | .51 | .18 | 7.1 |
| Duval loam, subsoil | 3 | .051 | .023 | 10 | .69 | .28 | 204 | .45 | .53 | .19 | 7.5 |
| Duval sandy loam, surface | 1 | .044 | .025 | 36 | .93 | .24 | 190 | .26 | .46 | .16 | ........ |
| Duval sandy loam, subsoil | 1 | .073 | .033 | 3 | .86 | .36 | 98 | .42 | .92 | .27 | ........ |

**Table 17. Analyses of soils of the Rio Grande Plain—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland plains red soils—(Continued) | | | | | | | | | | | |
| Webb fine sand, surface | 5 | .054 | .033 | 70 | 1.15 | .43 | 338 | .36 | 1.05 | .31 | ........ |
| Webb fine sand, subsoil | 5 | .060 | .049 | 35 | 1.18 | .50 | 368 | 1.17 | 1.05 | .52 | ........ |
| Webb fine sandy loam, surface | 13 | .060 | .045 | 69 | 1.20 | .39 | 339 | .55 | .80 | .39 | 7.5 |
| Webb fine sandy loam, subsoil | 13 | .054 | .043 | 21 | 1.20 | .45 | 319 | .72 | 1.29 | .43 | 7.3 |
| Webb gravelly sandy loam, surface | 2 | .130 | .045 | 41 | 1.68 | .64 | 479 | .39 | 1.13 | .50 | ........ |
| Webb gravelly sandy loam, subsoil | 2 | .113 | .365 | 109 | 1.67 | .57 | ........ | .43 | .75 | .42 | ........ |
| Semi-marshy and associated soils | | | | | | | | | | | |
| Lomalta clay, surface | 8 | .116 | .070 | 38 | 1.52 | .77 | 183 | 3.58 | 7.06 | .70 | 7.6 |
| Lomalta clay, subsoil | 7 | .054 | .046 | 26 | 1.45 | .74 | 244 | 4.01 | 7.71 | .63 | 7.8 |
| Lomalta clay loam, surface | 2 | .039 | .043 | 124 | 2.28 | .41 | 536 | .32 | 1.77 | .55 | 7.4 |
| Lomalta clay loam, subsoil | 2 | .032 | .043 | 85 | 2.32 | .52 | 596 | .41 | 2.38 | .64 | 7.7 |
| Lomalta fine sandy loam, surface | 2 | .050 | .015 | 31 | 1.16 | .19 | 104 | .15 | .31 | .12 | 6.8 |
| Lomalta fine sandy loam, subsoil | 2 | .041 | .021 | 25 | 1.17 | .43 | 97 | .29 | .98 | .33 | 6.8 |
| Point Isabel clay, surface | 2 | .056 | .101 | 185 | 1.57 | .73 | 285 | 7.94 | 10+ | 1.50 | 7.6 |
| Point Isabel clay, subsoil | 1 | .067 | .080 | 146 | 1.73 | .78 | 290 | 7.29 | 10+ | .87 | 7.6 |
| Point Isabel fine sandy loam, surface | 2 | .068 | .065 | 216 | 2.07 | .56 | 648 | 2.24 | 3.43 | .23 | 7.4 |
| Point Isabel fine sandy loam, subsoil | 2 | .066 | .080 | 332 | 2.16 | .61 | 505 | 3.13 | 5.39 | .33 | 7.6 |
| Flat stream bottom soils | | | | | | | | | | | |
| Blanco fine sandy loam, surface | 1 | .035 | .065 | 16 | .51 | .26 | 124 | 40.70 | 10+ | .54 | ........ |
| Blanco fine sandy loam, subsoil | 1 | .017 | .066 | 6 | .54 | .28 | 53 | 39.94 | 10+ | .68 | ........ |
| Blanco loam, surface | 1 | .110 | .064 | 36 | .98 | .05 | 158 | 34.91 | 10+ | .91 | ........ |
| Blanco loam, subsoil | 1 | .070 | .089 | ........ | .72 | .40 | ........ | 34.44 | 10+ | .48 | ........ |
| Blanco silt loam, surface | 1 | .062 | .064 | 12 | .68 | .41 | 159 | 37.94 | 10+ | .16 | ........ |
| Blanco silt loam, subsoil | 1 | .042 | .058 | 9 | .60 | .35 | 121 | 39.18 | 10+ | .14 | ........ |
| Blanco silty clay loam, surface | 1 | .115 | .091 | 17 | .73 | .33 | 261 | 33.51 | 10+ | .99 | ........ |
| Blanco silty clay loam, subsoil | 1 | .069 | .084 | 17 | .65 | .27 | 102 | 34.62 | 10+ | 1.07 | ........ |
| Cameron clay, surface | 2 | .100 | .179 | ........ | 2.53 | 1.23 | 196 | 9.76 | 15.60 | 1.51 | 7.9 |
| Cameron clay, subsoil | 2 | .061 | .134 | ........ | 2.27 | 1.11 | 131 | 10.68 | 23.20 | 1.37 | 8.5 |
| Harlingen clay, surface | 6 | .122 | .165 | 94 | 2.12 | .95 | 333 | 12.27 | 24.55 | .85 | 7.7 |
| Harlingen clay, subsoil | 6 | .133 | .139 | 188 | 1.85 | .83 | 441 | 11.67 | 18.92 | .88 | 8.2 |
| Laredo clay, surface | 6 | .184 | .197 | 78 | 2.09 | .92 | 519 | 6.75 | 10+ | 1.19 | 7.5 |
| Laredo clay, subsoil | 6 | .088 | .133 | 73 | 1.61 | .80 | 132 | 10.15 | 10+ | 1.01 | 7.7 |
| Laredo clay loam, surface | 7 | .090 | .116 | 330 | 1.86 | .80 | 548 | 2.54 | 4.76 | .81 | ........ |
| Laredo clay loam, subsoil | 7 | .086 | .097 | 474 | 2.17 | .74 | 453 | 3.43 | 4.17 | .71 | ........ |
| Laredo fine sandy loam, surface | 1 | .090 | .112 | 410 | 1.82 | .36 | 304 | 4.87 | 5.80 | .54 | 7.6 |
| Laredo fine sandy loam, subsoil | 1 | .047 | .107 | 10 | 2.50 | .23 | 156 | 10.42 | 14.30 | .55 | 7.8 |
| Laredo loam, surface | 1 | .098 | .137 | 373 | 2.33 | .49 | 471 | 5.82 | 9.60 | .67 | 7.7 |
| Laredo loam, subsoil | 1 | .070 | .118 | 38 | 1.91 | .47 | 210 | 10.26 | 19.83 | .85 | 7.7 |

**Table 17. Analyses of soils of the Rio Grande Plain—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat stream bottom soils—(Continued) | | | | | | | | | | | |
| Laredo silt loam, surface | 16 | .074 | .119 | 312 | 1.77 | .61 | 451 | 5.46 | 6.14 | .94 | 7.5 |
| Laredo silt loam, subsoil | 13 | .134 | .105 | 232 | 1.26 | .58 | 347 | 6.40 | 7.58 | .59 | 7.5 |
| Laredo silty clay loam, surface | 7 | .156 | .186 | 568 | 1.94 | .89 | 538 | 5.49 | 12.07 | .78 | 7.6 |
| Laredo silty clay loam, subsoil | 5 | .065 | .155 | 126 | 1.65 | .52 | 200 | 11.46 | 22.98 | .70 | 8.2 |
| Leona clay, surface | 2 | .124 | .082 | 347 | 1.29 | .59 | 607 | 1.44 | 2.53 | .67 | 7.4 |
| Leona clay, subsoil | 2 | .096 | .077 | 298 | 1.31 | .60 | 365 | 1.86 | 3.35 | .78 | 7.2 |
| Leona clay loam, surface | 3 | .112 | .027 | 49 | .89 | .37 | 494 | .86 | 1.66 | .54 | 7.7 |
| Leona clay loam, subsoil | 3 | .105 | .028 | 32 | .90 | .37 | 403 | .91 | 1.72 | .56 | 7.7 |
| Raymondville clay loam, surface | 1 | .262 | .193 | 814 | 2.46 | 1.06 | 1173 | 2.52 | 4.53 | .38 | 7.5 |
| Raymondville clay loam, subsoil | 1 | .130 | .164 | 713 | 2.31 | 1.05 | 848 | 4.52 | 2.40 | .61 | 7.5 |
| Raymondville fine sandy clay loam, surface | 1 | .136 | .118 | 424 | 2.31 | 1.06 | 1113 | 1.37 | 2.51 | .40 | 7.3 |
| Raymondville fine sandy clay loam, subsoil | 1 | .096 | .116 | 332 | 2.46 | 1.04 | 918 | 2.74 | 4.83 | .79 | 7.4 |
| Rio Grande clay, surface | 3 | .162 | .186 | 187 | 2.12 | .90 | 513 | 11.35 | 20.30 | .91 | 7.5 |
| Rio Grande clay, subsoil | 3 | .095 | .153 | 136 | 2.05 | .85 | 376 | 11.21 | 20.13 | 1.01 | 7.6 |
| Rio Grande loamy very fine sand, surface | 1 | .034 | .088 | 28 | 2.57 | .39 | 270 | 6.57 | 10.76 | .51 | 8.9 |
| Rio Grande loamy very fine sand, subsoil | 1 | .023 | .084 | 521 | 2.68 | .33 | 288 | 5.27 | 8.49 | .76 | 9.0 |
| Rio Grande silty clay loam, surface | 6 | .098 | .134 | 49 | 2.12 | .85 | 429 | 10.73 | 20.10 | 1.14 | 7.6 |
| Rio Grande silty clay loam, subsoil | 4 | .078 | .147 | 71 | 1.95 | .56 | 259 | 10.66 | 22.83 | .86 | 7.7 |
| Rio Grande very fine sandy loam, surface | 3 | .048 | .115 | 46 | 1.59 | .56 | 258 | 8.47 | 14.95 | .88 | 8.1 |
| Rio Grande very fine sandy loam, subsoil | 3 | .033 | .082 | 84 | 2.20 | .55 | 126 | 7.63 | 13.09 | .70 | 7.9 |

**Table 18. Grades of constituents of surface soils of the Rio Grande Plain**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland plains dark-colored soils | | | | | | | | | | | |
| Goliad clay loam | 2 | 2 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| Goliad fine sand | 1 | 4 | 5 | 5 | 4 | 4 | ........ | 4 | 5 | 4 | ........ |
| Goliad fine sandy clay loam | 2 | 3 | 4 | 4 | 3 | 3 | 1 | 2 | 3 | 2 | 1 |
| Goliad fine sandy loam | 4 | 3 | 5 | 5 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| Goliad loam | 7 | 3 | 4 | 4 | 3 | 2 | 1 | 1 | 1 | 2 | ........ |
| Goliad sand | 1 | 4 | 5 | 5 | 3 | 4 | 3 | 3 | 5 | 4 | ........ |
| Goliad sandy loam | 2 | 3 | 5 | 5 | 3 | 3 | 2 | 2 | 3 | 3 | ........ |
| Hidalgo clay loam | 3 | 2 | 3 | 4 | 3 | 1 | 1 | 1 | 1 | 2 | 2 |
| Hidalgo fine sandy clay loam | 1 | 3 | 3 | 3 | 3 | ........ | 1 | ........ | 3 | 2 | 2 |
| Hidalgo fine sandy loam | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 1 | 1 | 2 | 1 |
| Hidalgo silty clay loam | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| Miguel fine sandy loam | 1 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | ........ |
| Orelia clay loam | 1 | 3 | 4 | 5 | 3 | 2 | 2 | 2 | 2 | 1 | ........ |
| Orelia fine sandy loam | 1 | 3 | 4 | 3 | ........ | 3 | 1 | 3 | 4 | 3 | ........ |
| San Antonio clay loam | 1 | 3 | 4 | 5 | ........ | ........ | 2 | ........ | 3 | ........ | ........ |
| San Antonio fine sandy loam | 1 | 3 | 5 | 5 | 3 | ........ | 2 | ........ | 3 | ........ | ........ |
| San Antonio silty clay loam | 8 | 3 | 3 | 5 | 3 | 2 | 2 | 1 | 1 | 1 | ........ |
| Tiocano clay | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 |
| Victoria clay | 15 | 2 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 1 | 2 |
| Victoria clay loam | 7 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| Victoria fine sandy clay loam | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 2 |
| Victoria fine sandy loam | 14 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 3 | 2 | 2 |
| Victoria sandy clay loam | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 2 | 3 | 2 | 2 |
| Victoria loam | 3 | 3 | 4 | 4 | 2 | 2 | 1 | 2 | 2 | 2 | ........ |
| Willacy fine sandy loam | 3 | 3 | 4 | 4 | 2 | 3 | 1 | 2 | 3 | 3 | 2 |
| Upland plains light-brown soils | | | | | | | | | | | |
| Delfina fine sandy loam | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 2 |
| Maverick clay loam | 3 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 2 | ........ |
| Maverick fine sandy loam | 1 | 3 | 4 | 5 | 4 | 4 | 5 | 1 | 1 | 2 | ........ |
| Maverick loam | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | ........ |
| Uvalde silty clay loam | 4 | 2 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | ........ |
| Upland plains light-colored soils | | | | | | | | | | | |
| Brennan fine sandy loam | 4 | 4 | 4 | 4 | 3 | 2 | 1 | 3 | 4 | 2 | ........ |
| Brennan loamy fine sand | 1 | 4 | 4 | 4 | 2 | 3 | 2 | 3 | 4 | 3 | 2 |
| Nueces fine sand | 11 | 4 | 4 | 5 | 3 | 4 | 3 | 5 | 5 | 3 | 2 |

Table 18. Grades of constituents of surface soils of the Rio Grande Plain—Continued

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland plains red soils | | | | | | | | | | | |
| Duval fine sand | 2 | 4 | 4 | 5 | 3 | 3 | 3 | 3 | 5 | 3 | ........ |
| Duval fine sandy loam | 18 | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 4 | 3 | 2 |
| Duval loam | 3 | 3 | 4 | 5 | 3 | 3 | 2 | 3 | 4 | 3 | 2 |
| Duval sandy loam | 1 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | ........ |
| Webb fine sand | 5 | 4 | 4 | 4 | 3 | 2 | 2 | 3 | 3 | 2 | ........ |
| Webb fine sandy loam | 13 | 4 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| Webb gravelly sandy loam | 2 | 2 | 4 | 4 | 2 | 2 | 1 | 3 | 3 | 2 | ........ |
| Semi-marshy and associated soils | | | | | | | | | | | |
| Lomalta clay | 8 | 3 | 3 | 4 | 2 | 2 | 3 | 1 | 1 | 1 | 1 |
| Lomalta clay loam | 2 | 4 | 4 | 3 | 1 | 2 | 1 | 3 | 3 | 2 | 2 |
| Lomalta fine sandy loam | 2 | 4 | 5 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 2 |
| Point Isabel clay | 2 | 4 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Point Isabel fine sandy loam | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 3 | 2 |
| Flat stream-bottom soils | | | | | | | | | | | |
| Blanco fine sandy loam | 1 | 4 | 3 | 5 | 4 | 3 | 3 | 1 | 1 | 2 | ........ |
| Blanco loam | 1 | 3 | 3 | 4 | 3 | 5 | 3 | 1 | 1 | 1 | ........ |
| Blanco silt loam | 1 | 3 | 3 | 5 | 3 | 2 | 3 | 1 | 1 | 3 | ........ |
| Blanco silty clay loam | 1 | 3 | 3 | 5 | 3 | 3 | 2 | 1 | 1 | 1 | ........ |
| Cameron clay | 2 | 3 | 1 | ........ | 1 | 1 | 3 | 1 | 1 | 1 | 1 |
| Harlingen clay | 6 | 2 | 1 | 4 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Laredo clay | 6 | 1 | 1 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Laredo clay loam | 7 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | ........ |
| Laredo fine sandy loam | 1 | 3 | 2 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 1 |
| Laredo loam | 1 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Laredo silt loam | 16 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 |
| Laredo silty clay loam | 7 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Leona clay | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | ........ |
| Leona clay loam | 3 | 3 | 4 | 4 | 3 | 3 | 1 | 2 | 3 | 2 | 1 |
| Raymondville clay loam | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| Raymondville fine sandy clay loam | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Rio Grande clay | 3 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Rio Grande loamy very fine sand | 1 | 4 | 3 | 5 | 1 | 3 | 2 | 1 | 1 | 2 | 1 |
| Rio Grande silty clay loam | 6 | 3 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rio Grande very fine sandy loam | 3 | 4 | 2 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |

flat stream-bottom soils as a rule have Grades 1 and 2 for total phosphoric acid, total, acid-soluble, and active potash, acid-soluble lime and magnesia, basicity, and pH. Most of the soils have Grade 3 for nitrogen. The soils are quite variable with respect to active phosphoric acid, the Laredo soils having Grades 1 and 2 while the remaining soils have Grades 4 and 5.

## EDWARDS PLATEAU

The Edwards Plateau is a greatly dissected high limestone plain covering about 22,500,000 acres in 43 counties in central-western Texas. The regional slope is to the east with some of the western portions lying 4,000 feet above sea-level while most of it is well over 2,000 feet. The soils of the region are mostly of clay or clay loam textures developed from limestone alone or from rock with interbedded limestone layers. The differentiation of the various soil groups is produced principally by differences in the rainfall of the region, which is fairly high in the eastern section and decreases westward until semi-arid conditions prevail.

### Composition of soil types

The average composition of the soil types is given in Table 19 and the grades of constituents of surface soils in Table 20. The soils of the central and western sections have Grades 1 and 2 in total, acid-soluble, and active potash, acid-soluble lime and magnesia, basicity, and pH. The Valera soils have Grade 1 for nitrogen, while the Reagan soils have only Grade 3 in this respect. The soils have Grades 3 and 4 in total phosphoric acid, and are quite variable in active phosphoric acid, this constituent ranging from Grade 1 to 5. Five of the eight types given in the tables are represented by only one sample.

## ROLLING PLAINS

The Rolling Plains regions covers about 24,500,000 acres in 58 counties in northwestern Texas. The region has a rolling surface with a general regional slope from west to east. Elevations above sea-level range from more than 2,500 feet in the western part to around 1,500 feet in the eastern part, and in some areas in the Canadian Valley exceed 3,000 feet. The soils of the region differ greatly in color, texture, depth and thickness of soil layers. They have developed mostly from unconsolidated beds of clay or sandy clay which is more or less calcareous. The upland soils are included in groups based on the predominating color: (1) dark-colored soils, (2) red soils, and (3) brownish-red soils.

### Outline description of series

**Dark-colored upland soils:**

**Abilene soils:** Brown or dark-brown, noncalcareous, friable surface with a brown or yellowish, crumbly subsoil, calcareous in lower part.

**Foard soils:** Very dark-brown or black, noncalcareous surface, tight when dry, with a brown or dark-gray, noncalcareous, dense and tough subsoil.

**Roscoe soils:** Very dark-brown or black, noncalcareous, friable surface with a dark-brown to dark-gray, heavy but crumbly, noncalcareous subsoil.

**Table 19. Analyses of soils of the Edwards Plateau**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils of the Central (Subhumid) Section | | | | | | | | | | | |
| Valera clay, surface | 5 | .140 | .074 | 71 | 1.58 | .83 | 443 | 5.10 | 9.31 | .74 | 7.2 |
| Valera clay, subsoil | 5 | .089 | .059 | 45 | 1.57 | .57 | 288 | 7.75 | 12.85 | .71 | 7.5 |
| Valera stony clay, surface | 1 | .354 | .103 | 16 | .93 | .32 | ........ | 19.43 | 10+ | .62 | 7.5 |
| Upland soils of the Western (Semiarid) Section | | | | | | | | | | | |
| Ector gravelly clay loam, surface | 1 | .105 | .068 | 58 | 1.28 | .73 | 581 | .77 | 1.51 | .62 | 7.2 |
| Reagan fine sandy loam, surface | 4 | .058 | .040 | 49 | 1.93 | .44 | 587 | 1.75 | 2.92 | .48 | 7.9 |
| Reagan fine sandy loam, subsoil | 4 | .046 | .038 | 79 | 1.78 | .51 | 535 | 3.58 | 6.24 | .49 | 9.1 |
| Reagan gravelly loam, surface | 1 | .099 | .048 | 460 | 2.68 | .41 | 279 | 5.26 | 7.25 | .80 | 8.4 |
| Reagan gravelly loam, subsoil | 1 | .067 | .075 | 55 | 2.22 | .32 | 60 | 11.56 | 19.60 | .72 | ........ |
| Reagan gravelly silty clay loam, surface | 1 | .105 | .072 | 59 | 1.14 | ........ | 109 | ........ | 17.00 | ........ | 7.8 |
| Reagan gravelly silty clay loam, subsoil | 1 | .070 | .063 | 49 | ........ | ........ | 52 | ........ | 23.80 | ........ | 7.8 |
| Reagan loam, surface | 2 | .066 | .058 | 111 | 1.67 | .40 | 307 | 5.65 | 9.70 | .38 | 7.8 |
| Reagan loam, subsoil | 2 | .052 | .061 | 76 | 1.32 | .38 | 168 | 9.58 | 17.11 | .59 | 7.7 |
| Reagan silty clay loam, surface | 6 | .135 | .091 | 197 | 2.45 | .90 | 535 | 7.68 | 13.65 | 2.10 | 8.0 |
| Reagan silty clay loam, subsoil | 6 | .082 | .087 | 145 | 2.23 | .80 | 287 | 10.76 | 18.56 | .94 | 8.0 |

**Table 20. Grades of constituents of surface soils of the Edwards Plateau**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland soils of the Central (Subhumid) Section | | | | | | | | | | | |
| Valera clay | 5 | 2 | 3 | 4 | 2 | 1 | 1 | 1 | 1 | 1 | 2 |
| Valera stony clay | 1 | 1 | 2 | 5 | 3 | 3 | ........ | 1 | 1 | 1 | 2 |
| Upland soils of the Western (Semiarid) Section | | | | | | | | | | | |
| Ector gravelly clay loam | 1 | 3 | 3 | 4 | 2 | 2 | 1 | 2 | 3 | 1 | 2 |
| Reagan fine sandy loam | 4 | 4 | 4 | 4 | 1 | 2 | 1 | 2 | 2 | 2 | 1 |
| Reagan gravelly loam | 1 | 3 | 4 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Reagan gravelly silty clay loam | 1 | 3 | 3 | 4 | 3 | ........ | 3 | ........ | 1 | ........ | 1 |
| Reagan loam | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 1 |
| Reagan silty clay loam | 6 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Red upland soils:**

**Fowlkes soils:** Red or reddish-brown, calcareous surface, tight when wet, with a red, calcareous, tight and dense subsoil.

**Vernon soils:** Red or reddish-brown, calcareous, friable surface with a red, calcareous, friable subsoil.

**Weymouth soils:** Reddish-brown, calcareous, granular, friable surface with a reddish-brown, highly calcareous, heavy subsoil resting on carbonate of lime.

**Brownish-red upland soils:**

**Enterprise soils:** Brown or dull-reddish, noncalcareous, friable surface with a brown, red, or yellowish, noncalcareous crumbly subsoil.

**Miles soils:** Reddish-brown or brownish-red, noncalcareous, friable surface with a red or brownish-red, noncalcareous, crumbly subsoil.

**Terrace soils:**

**Calumet soils:** Brown surface with a chocolate-brown or yellow stiff, dense, noncalcareous clay subsoil.

**Wichita soils:** Red or brown, noncalcareous, friable, surface with a red noncalcareous, crumbly subsoil.

**Flat stream-bottom soils:**

**Miller soils:** Reddish, friable, calcareous surface with red, crumbly subsoil heavier than the surface. Analyses and grades of constituents for these soils are given in Tables 5 and 6 for the Gulf Coast Prairie.

**Spur soils:** Brown or chocolate-brown, calcareous, friable surface with a chocolate-brown, calcareous, crumbly subsoil.

**Yahola soils:** Reddish, friable, calcareous surface with subsoils lighter than the surface. Analyses and grades of constituents for these soils are given in Tables 5 and 6 for the Gulf Coast Prairie.

### Composition of soil types

The average composition of the soil types is given in Table 21, and grades of constituents of the surface soils in Table 22. The soils have Grades 1 and 2 and occasionally Grade 3 for total, acid-soluble, and active potash, acid-soluble lime and magnesia, and basicity, and Grades 1 and 2 for reaction (pH). The dark-colored and red upland soils and the soils of the Wichita and Spur series have chiefly Grade 3 for nitrogen, while many of the brownish-red soils have Grade 4. All of the soils have Grades 3 and 4 for total phosphoric acid, and most soils have Grades 4 and 5 for active phosphoric acid.

## HIGH PLAINS

The High Plains region covers about 21,000,000 acres in 46 counties of northwest Texas lying west of the Rolling Plains. The smooth surface of the region has a very uniform general slope from northwest to southeast which averages 10 to 15 feet per mile. The soils are mostly brown or red, are open and friable, and are readily penetrated by water. The predominant textures are clay loams in the

**Table 21. Analyses of soils of the Rolling Plains**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland dark-colored soils | | | | | | | | | | | |
| Abilene clay, surface | 15 | .129 | .093 | 18 | 1.08 | .60 | 240 | 13.67 | 25.98 | 2.29 | 7.3 |
| Abilene clay, subsoil | 15 | .112 | .084 | 14 | .81 | .65 | 149 | 15.56 | 32.00 | 2.16 | 7.5 |
| Abilene clay loam, surface | 11 | .125 | .067 | 87 | 1.41 | .64 | 586 | 1.71 | 1.46 | .62 | 7.1 |
| Abilene clay loam, subsoil | 11 | .101 | .064 | 98 | 1.60 | .67 | 396 | 2.74 | 3.71 | .61 | 7.3 |
| Abilene fine sandy loam, surface | 1 | .101 | .055 | 56 | 1.66 | .39 | 215 | .41 | .15 | .50 | ........ |
| Abilene fine sandy loam, subsoil | 1 | .070 | .046 | 42 | 1.53 | .43 | 215 | .42 | .20 | .64 | 7.2 |
| Abilene gravelly clay, surface | 1 | .136 | .086 | 7 | 1.71 | .49 | 564 | .57 | 1.26 | .40 | ........ |
| Abilene gravelly clay, subsoil | 1 | .112 | .083 | 5 | 1.89 | 1.17 | 416 | 2.28 | 4.50 | .38 | ........ |
| Abilene loam, surface | 1 | .079 | .046 | 47 | .72 | .43 | 343 | .65 | 1.20 | .49 | 7.2 |
| Abilene loam, subsoil | 1 | .058 | .042 | 25 | .95 | .47 | 189 | 4.63 | 8.15 | .79 | 7.6 |
| Abilene silty clay loam, surface | 10 | .134 | .065 | 57 | 1.31 | .55 | 508 | 1.35 | 3.87 | .65 | 7.2 |
| Abilene silty clay loam, subsoil | 10 | .097 | .075 | 16 | 1.28 | .72 | 402 | 5.73 | 7.85 | 1.10 | 7.5 |
| Foard clay, surface | 2 | .099 | .083 | 54 | 2.12 | .90 | 202 | .76 | 1.60 | 1.00 | 7.6 |
| Foard clay, subsoil | 2 | .069 | .080 | 149 | 1.83 | .99 | 379 | 2.34 | 3.60 | 1.02 | 7.8 |
| Foard clay loam, surface | 2 | .094 | .051 | 70 | 1.24 | .45 | 282 | .44 | 1.02 | .33 | 6.9 |
| Foard clay loam, subsoil | 2 | .066 | .040 | 44 | 1.39 | .58 | 163 | .58 | 1.64 | .62 | 7.2 |
| Foard fine sandy loam, surface | 2 | .050 | .017 | 25 | ........ | .47 | ........ | .27 | .59 | .38 | ........ |
| Foard very fine sandy loam, surface | 3 | .079 | .045 | 67 | 1.26 | .29 | 202 | .27 | .47 | .37 | 6.7 |
| Foard very fine sandy loam, subsoil | 3 | .057 | .043 | 38 | .92 | .47 | 165 | 1.70 | 1.99 | .80 | 7.3 |
| Roscoe clay, surface | 6 | .105 | .064 | 110 | 1.21 | .66 | 534 | 3.00 | 6.13 | .75 | 7.4 |
| Roscoe clay, subsoil | 5 | .066 | .057 | 70 | 1.30 | .82 | 342 | 3.53 | 5.38 | 1.09 | 7.3 |
| Upland red soils | | | | | | | | | | | |
| Fowlkes very fine sandy loam, surface | 1 | .071 | .043 | 51 | 1.25 | .32 | 279 | .35 | .70 | .42 | 7.2 |
| Fowlkes very fine sandy loam, subsoil | 1 | .061 | .036 | 20 | 1.02 | .52 | 180 | .64 | 1.15 | .48 | 7.4 |
| Vernon clay, surface | 13 | .091 | .081 | 162 | 1.32 | .77 | 470 | 3.12 | 3.62 | 1.03 | 7.3 |
| Vernon clay, subsoil | 13 | .061 | .069 | 215 | 1.61 | .82 | 259 | 2.99 | 4.46 | 1.11 | 7.6 |
| Vernon stony clay, surface | 1 | .145 | .090 | 30 | 1.17 | .27 | 109 | 16.38 | 30.00 | .72 | 7.6 |
| Vernon stony clay, subsoil | 1 | .054 | .056 | 50 | 1.76 | .29 | 87 | 12.59 | 24.10 | 1.52 | 7.7 |
| Vernon clay loam, surface | 12 | .105 | .067 | 179 | 2.08 | .61 | 375 | 1.57 | 2.80 | .84 | 7.3 |
| Vernon clay loam, subsoil | 11 | .072 | .074 | 166 | 2.39 | .64 | 208 | 3.47 | 4.46 | 1.09 | 7.5 |
| Vernon fine sandy loam, surface | 13 | .064 | .047 | 81 | 1.05 | .33 | 398 | .44 | .94 | .30 | 7.1 |
| Vernon fine sandy loam, subsoil | 13 | .055 | .053 | 34 | 1.27 | .51 | 314 | 1.20 | 2.10 | .49 | 7.5 |
| Vernon gravelly clay loam surface | 3 | .083 | .056 | 46 | 1.07 | .62 | 133 | 9.92 | 10+ | 1.30 | 7.5 |
| Vernon gravelly clay loam, subsoil | 3 | .035 | .063 | 117 | 1.60 | .93 | 175 | 2.02 | 7.61 | 1.09 | 7.7 |
| Vernon loam, surface | 6 | .082 | .072 | 138 | 1.09 | .57 | 416 | .56 | .62 | .57 | 7.2 |
| Vernon loam, subsoil | 6 | .057 | .062 | 54 | 1.55 | .49 | 226 | .62 | 1.10 | .54 | 7.3 |
| Vernon very fine sandy loam, surface | 6 | .073 | .057 | 50 | 1.79 | .44 | 235 | .29 | .53 | .70 | 7.0 |
| Vernon very fine sandy loam, subsoil | 6 | .057 | .051 | 72 | 1.56 | .38 | 163 | .44 | .85 | .94 | 7.1 |

**Table 21. Analyses of soils of the Rolling Plains—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland red soils—(Continued) | | | | | | | | | | | |
| Weymouth clay loam, surface | 1 | .121 | .075 | 207 | ........ | ........ | 383 | 2.68 | 4.53 | .82 | 8.2 |
| Weymouth clay loam, subsoil | 1 | .067 | .067 | 188 | ........ | .65 | 338 | 2.49 | 4.43 | .92 | 8.2 |
| Upland brownish-red soils | | | | | | | | | | | |
| Enterprise loamy very fine sand, surface | 2 | .048 | .065 | 231 | 1.73 | .24 | 213 | .27 | .44 | .36 | 7.0 |
| Enterprise loamy very fine sand, subsoil | 2 | .035 | .059 | 175 | 1.64 | .25 | 132 | .27 | .46 | .40 | 7.0 |
| Enterprise loamy fine sand, surface | 1 | .035 | .045 | 66 | .73 | .15 | 170 | .17 | .40 | .22 | 6.5 |
| Enterprise loamy fine sand, subsoil | 1 | .036 | .046 | 32 | 1.85 | .25 | 147 | .20 | .50 | .32 | 6.7 |
| Miles clay, surface | 1 | .095 | .105 | 408 | 1.49 | 1.07 | 421 | 4.01 | 6.75 | 1.49 | 7.4 |
| Miles clay, subsoil | 1 | .053 | .089 | 415 | 1.51 | .87 | 173 | 4.27 | 7.35 | 1.21 | 7.5 |
| Miles clay loam, surface | 9 | .096 | .059 | 39 | 1.64 | .65 | 411 | 1.27 | 2.91 | .60 | 7.2 |
| Miles clay loam, subsoil | 9 | .062 | .049 | 30 | 1.78 | .66 | 248 | 1.77 | 2.94 | .78 | 7.5 |
| Miles fine sand, surface | 3 | .029 | .019 | 31 | .91 | .08 | 80 | .13 | .22 | .11 | 7.0 |
| Miles fine sand, subsoil | 3 | .031 | .031 | 13 | 1.22 | .19 | 64 | .18 | .27 | .24 | 6.7 |
| Miles fine sandy loam, surface | 15 | .058 | .039 | 47 | 1.16 | .26 | 276 | .32 | .86 | .22 | 7.2 |
| Miles fine sandy loam, subsoil | 15 | .053 | .040 | 27 | 1.37 | .49 | 228 | .65 | 1.24 | .52 | 7.2 |
| Miles gravelly clay loam, surface | 2 | .095 | .057 | 12 | .76 | .58 | ........ | 1.97 | 3.19 | 1.02 | 7.5 |
| Miles gravelly clay loam, subsoil | 2 | .070 | .057 | 18 | .86 | .57 | ........ | .84 | 1.34 | .78 | 7.5 |
| Miles loam, surface | 3 | .097 | .053 | 25 | 1.39 | .45 | 323 | .40 | .58 | .37 | 6.9 |
| Miles loam, subsoil | 3 | .077 | .043 | 8 | 1.42 | .84 | 328 | .59 | 1.04 | .45 | 7.3 |
| Miles sandy loam, surface | 2 | .058 | .053 | 19 | .90 | .24 | 250 | .18 | .25 | .16 | 6.6 |
| Miles sandy loam, subsoil | 2 | .055 | .044 | 9 | 1.33 | .83 | 233 | .18 | .55 | .37 | 6.7 |
| Miles silty clay loam, surface | 2 | .090 | .040 | 28 | 1.00 | .46 | 383 | .31 | .58 | .34 | 6.9 |
| Miles silty clay loam, subsoil | 2 | .074 | .044 | 10 | 1.16 | .77 | 357 | .53 | 1.07 | .72 | 7.4 |
| Miles very fine sandy loam, surface | 1 | .050 | .030 | 73 | 1.81 | .21 | 202 | .36 | .59 | .38 | 7.6 |
| Miles very fine sandy loam, subsoil | 1 | .052 | .047 | 57 | 1.77 | .24 | 90 | 1.71 | 2.18 | .56 | 7.7 |
| Terrace soils | | | | | | | | | | | |
| Calumet fine sandy loam, surface | 1 | .079 | .043 | 44 | .99 | .16 | 310 | .19 | .40 | .26 | 7.1 |
| Calumet fine sandy loam, subsoil | 1 | .072 | .039 | 23 | 1.24 | .22 | 210 | .28 | .65 | .27 | 6.8 |
| Calumet silty clay loam, surface | 1 | .091 | .061 | 109 | 1.97 | .63 | 420 | .49 | .90 | .27 | 6.7 |
| Calumet silty clay loam, subsoil | 1 | .044 | .045 | 79 | 2.05 | .54 | 231 | .51 | 1.15 | .70 | 7.1 |
| Calumet very fine sandy loam, surface | 2 | .078 | .042 | 72 | 1.35 | .27 | 295 | .29 | .27 | .54 | 7.0 |
| Calumet very fine sandy loam, subsoil | 2 | .061 | .046 | 21 | 1.58 | .64 | 255 | .51 | 1.00 | .32 | 7.2 |
| Wichita clay loam, surface | 2 | .108 | .086 | ........ | 1.58 | .63 | 590 | 1.18 | 2.00 | .61 | 7.3 |
| Wichita clay loam, subsoil | 2 | .065 | .050 | 55 | 1.76 | .69 | 165 | 2.84 | 2.10 | .95 | 7.6 |
| Wichita fine sandy loam, surface | 1 | .072 | .049 | 78 | 1.61 | .16 | 398 | .20 | .24 | .24 | 7.1 |
| Wichita fine sandy loam, subsoil | 1 | .073 | .051 | 17 | 2.22 | .58 | 957 | .24 | .65 | .30 | 7.1 |

**Table 21. Analyses of soils of the Rolling Plains—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos. Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Terrace soils—(Continued) | | | | | | | | | | | |
| Wichita sand loam, surface | 1 | .046 | .039 | 10 | 1.51 | .24 | 230 | .15 | .40 | .27 | 7.2 |
| Wichita sandy loam, subsoil | 1 | .053 | .043 | 5 | 1.23 | .39 | 210 | .24 | .60 | .36 | 7.1 |
| Wichita very fine sandy loam, surface | 4 | .078 | .046 | 61 | 1.57 | .39 | 353 | .28 | .51 | .35 | 6.9 |
| Wichita very fine sandy loam, subsoil | 4 | .069 | .044 | 22 | 1.74 | .72 | 244 | .47 | .83 | .59 | 7.1 |
| Flat stream-bottom soils | | | | | | | | | | | |
| Spur clay loam, surface | 4 | .134 | .108 | 379 | 2.04 | .73 | 618 | 1.39 | 1.97 | .76 | 7.5 |
| Spur clay loam, subsoil | 4 | .079 | .084 | 292 | 1.88 | .66 | 380 | 2.16 | 2.73 | .75 | 7.6 |
| Spur fine sandy loam, surface | 2 | .099 | .062 | 188 | 1.58 | .47 | 287 | 2.20 | 2.07 | .65 | 7.8 |
| Spur fine sandy loam, subsoil | 2 | .069 | .056 | 180 | 2.05 | .38 | 253 | 3.66 | 4.50 | .59 | 7.9 |
| Spur loam, surface | 2 | .098 | .096 | 334 | 1.57 | .55 | 455 | 4.48 | 6.44 | .67 | 7.5 |
| Spur loam, subsoil | 2 | .058 | .080 | 166 | 1.54 | .56 | 218 | 7.28 | 9.57 | .76 | 7.9 |
| Spur loamy fine sand, surface | 1 | .049 | .049 | 125 | 1.64 | .21 | 125 | 2.30 | 2.36 | .43 | 7.3 |
| Spur loamy fine sand, subsoil | 1 | .036 | .041 | 150 | 1.69 | .20 | 114 | 2.90 | 4.15 | .43 | 7.5 |
| Spur very fine sandy loam, surface | 2 | .083 | .075 | 372 | 1.69 | .39 | 495 | 1.92 | 2.75 | .79 | 7.3 |
| Spur very fine sandy loam, subsoil | 2 | .053 | .074 | 217 | 2.05 | .43 | 413 | 1.09 | 5.99 | .88 | 7.5 |

**Table 22. Grades of constituents of surface soils of the Rolling Plains**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dark-colored upland soils | | | | | | | | | | | |
| Abilene clay | 15 | 2 | 3 | 5 | 3 | 2 | 2 | 1 | 1 | 1 | 2 |
| Abilene clay loam | 11 | 2 | 3 | 4 | 2 | 2 | 1 | 2 | 3 | 1 | 2 |
| Abilene fine sandy loam | 1 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 | 2 | ........ |
| Abilene gravelly clay | 1 | 2 | 3 | 5 | 2 | 2 | 1 | 2 | 3 | 2 | ........ |
| Abilene loam | 1 | 3 | 4 | 4 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| Abilene silty clay loam | 10 | 2 | 3 | 4 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| Foard clay | 2 | 3 | 3 | 4 | 1 | 1 | 2 | 2 | 3 | 1 | 1 |
| Foard clay loam | 2 | 3 | 3 | 4 | 2 | 2 | 2 | 2 | 3 | 1 | 2 |
| Foard fine sandy loam | 2 | 4 | 5 | 5 | ........ | 2 | ........ | 3 | 4 | 2 | ........ |
| Foard very fine sandy loam | 3 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 4 | 2 | 2 |
| Roscoe clay | 6 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| Red upland soils | | | | | | | | | | | |
| Fowlkes very fine sandy loam | 1 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |
| Vernon clay | 13 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 |
| Vernon stony clay | 1 | 2 | 3 | 5 | 3 | 3 | 3 | 1 | 1 | 1 | 1 |
| Vernon clay loam | 12 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 1 | 2 |
| Vernon fine sandy loam | 13 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |
| Vernon gravelly clay loam | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 1 | 1 | 1 | 2 |
| Vernon loam | 6 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 |
| Vernon very fine sandy loam | 6 | 3 | 3 | 4 | 2 | 2 | 2 | 3 | 4 | 1 | 2 |
| Weymouth clay loam | 1 | 2 | 3 | 2 | ........ | ........ | 2 | 1 | 2 | 1 | 1 |
| Brownish-red upland soils | | | | | | | | | | | |
| Enterprise loamy very fine sand | 2 | 4 | 3 | 2 | 2 | 3 | 2 | 3 | 4 | 2 | 2 |
| Enterprise loamy fine sand | 1 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 3 | 2 |
| Miles clay | 1 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 |
| Miles clay loam | 9 | 3 | 3 | 4 | 2 | 2 | 1 | 2 | 2 | 2 | 2 |
| Miles fine sand | 3 | 5 | 5 | 4 | 3 | 5 | 4 | 4 | 5 | 4 | 2 |
| Miles fine sandy loam | 15 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| Miles gravelly clay loam | 2 | 3 | 3 | 5 | 3 | 2 | ........ | 2 | 2 | 1 | 2 |
| Miles loam | 3 | 3 | 3 | 5 | 2 | 2 | 2 | 3 | 4 | 2 | 2 |
| Miles sandy loam | 2 | 4 | 3 | 5 | 3 | 3 | 2 | 4 | 5 | 3 | 2 |
| Miles silty clay loam | 2 | 3 | 4 | 5 | 3 | 2 | 2 | 3 | 4 | 2 | 2 |
| Miles very fine sandy loam | 1 | 4 | 4 | 4 | 1 | 3 | 2 | 3 | 4 | 2 | 1 |
| Terrace soils | | | | | | | | | | | |
| Calumet fine sandy loam | 1 | 3 | 4 | 4 | 1 | 4 | 2 | 4 | 4 | 3 | 2 |
| Calumet silty clay loam | 1 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 3 | 2 |
| Calumet very fine sandy loam | 2 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 5 | 2 | 2 |
| Wichita clay loam | 2 | 3 | 3 | ........ | 2 | 2 | 1 | 2 | 3 | 1 | 2 |

**Table 22. Grade of constituents of surface soils of the Rolling Plains—Continued**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Terrace soils—(Continued) | | | | | | | | | | | |
| Wichita fine sandy loam | 1 | 3 | 4 | 4 | 2 | 4 | 2 | 4 | 5 | 3 | 2 |
| Wichita sandy loam | 1 | 4 | 4 | 5 | 2 | 3 | 2 | 4 | 4 | 3 | 2 |
| Wichita very fine sandy loam | 4 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 4 | 2 | 2 |
| Flat stream bottom soils | | | | | | | | | | | |
| Spur clay loam | 4 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 1 | 2 |
| Spur fine sandy loam | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 |
| Spur loam | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 |
| Spur loamy fine sand | 1 | 4 | 4 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 |
| Spur very fine sandy loam | 2 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 1 | 2 |

northern section and sands and fine sandy loams in the southern and western portions. The soils are well developed from deep beds of friable calcareous clays and sandy clays, although the surface and upper subsoils are not calcareous in the normally developed soils, and are underlain at 4 or 5 feet with a layer of accumulated calcium carbonate.

## Outline description of series

**Dark-colored upland soils:**

**Potter soils:** Brown or light-brown, calcareous, friable surface in thin layers, with a light-brown or yellowish, calcareous, crumbly subsoil in thin layers.

**Pullman soils:** Brown or dark-brown, noncalcareous, friable surface with a dark-brown or chocolate-brown (slightly reddish in places), crumbly subsoil, noncalcareous in upper part.

**Richfield soils:** Dark-brown or black, noncalcareous, friable surface with a dark-brown to dark-gray, noncalcareous, crumbly subsoil.

**Red upland soils:**

**Amarillo soils:** Red, brown, or reddish-brown, noncalcareous, friable, surface with a red, crumbly subsoil, noncalcareous in upper part.

**Springer soils:** Light-brown or reddish-brown, noncalcareous surface with brownish-red, cloddy but friable, noncalcareous subsoil.

**Light-colored upland soils:**

**Dunesand:** Gray, loose, windblown, shifting sand surface with a pale yellow or gray, loose, incoherent subsoil.

**Enterprise soils:** These soils, occurring over considerable areas along the western boundary of the State, are light-brown or gray loose fine sands grading below into pale-yellow fine sand many feet deep. They correspond in soil characteristics, native vegetation, and agricultural use much more closely with the dune sand than they do with the more fertile Enterprise soils of the Rolling Plains.

**Flat stream-bottom soils:**

**Randall soils:** Nearly black or dark-gray, noncalcareous surface with a dark-gray, noncalcareous subsoil.

**Spur soils:** Brown or chocolate-brown, calcareous, friable surface with a chocolate-brown, calcareous, crumbly subsoil. Analyses and grades of constituents for Spur soils are given in Tables 21 and 22 for the Rolling Plains.

## Composition of soil types

The average composition of the soil types is given in Table 23 and the grades of constituents of the surface soils in Table 24. The dark-colored upland soils have principally Grades 1 and 2 for total, acid-soluble, and active potash, acid-soluble lime and magnesia, and Grades 1 and 2 for reaction (pH). The calcareous Potter soils have Grade 1 for basicity while the Richfield and Pullman soils have Grades 2, 3, and 4. The Pullman silty clay loam and Potter clay loam have Grade 2 for nitrogen and active phosphoric acid. The other dark-colored upland soils have Grades 3 and 4 for nitrogen, total phosphoric acid, and active phosphoric acid.

**Table 23. Analyses of soils of the High Plains**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dark-colored upland soils | | | | | | | | | | | |
| Potter clay loam, surface | 3 | .175 | .098 | 214 | 1.94 | .57 | 285 | 3.91 | 7.79 | .56 | 8.1 |
| Potter clay loam, subsoil | 3 | .131 | .102 | 8 | 1.73 | .46 | 91 | 15.35 | 26.80 | .85 | 8.1 |
| Potter fine sandy loam, surface | 1 | .109 | .040 | 79 | 1.36 | ........ | 273 | ........ | 6.20 | ........ | 8.1 |
| Potter fine sandy loam, subsoil | 1 | .096 | .036 | 10 | 1.16 | ........ | 120 | ........ | 9.98 | ........ | 8.1 |
| Pullman clay loam, surface | 1 | .119 | .068 | 118 | 1.99 | .49 | 482 | .42 | .58 | .42 | 7.4 |
| Pullman clay loam, subsoil | 1 | .098 | .063 | 85 | 1.96 | .56 | 493 | .55 | .95 | .58 | 7.4 |
| Pullman fine sandy loam, surface | 3 | .076 | .037 | 50 | 1.47 | .27 | 263 | .27 | .51 | .30 | 7.6 |
| Pullman fine sandy loam, subsoil | 3 | .071 | .032 | 28 | 1.45 | .30 | 259 | .28 | .53 | .32 | 7.4 |
| Pullman silty clay loam, surface | 12 | .138 | .096 | 245 | 2.09 | .58 | 520 | .54 | .90 | .55 | 7.0 |
| Pullman silty clay loam, subsoil | 12 | .096 | .069 | 125 | 2.28 | .78 | 530 | .77 | 1.41 | .76 | 7.5 |
| Richfield clay loam, surface | 4 | .107 | .059 | 59 | 1.49 | .73 | 572 | 2.08 | 2.79 | 1.00 | 7.3 |
| Richfield clay loam, subsoil | 4 | .075 | .067 | 65 | 1.40 | .54 | 438 | 1.67 | 3.45 | .88 | 7.4 |
| Richfield fine sandy loam, surface | 2 | .051 | .037 | 38 | 1.31 | .41 | 334 | .41 | 1.38 | .35 | 8.0 |
| Richfield fine sandy loam, subsoil | 2 | .058 | .037 | 48 | 1.30 | .41 | 386 | .41 | .76 | .35 | 7.9 |
| Richfield loam, surface | 1 | .087 | .046 | 38 | 1.38 | .58 | 538 | .49 | .86 | .39 | 7.3 |
| Richfield loam, subsoil | 1 | .053 | .034 | 25 | 1.57 | .53 | 417 | .36 | .65 | .26 | 7.3 |
| Richfield silty clay loam, surface | 10 | .118 | .086 | 154 | 1.64 | .63 | 509 | .82 | 2.07 | .60 | 7.1 |
| Richfield silty clay loam, subsoil | 13 | .079 | .082 | 128 | 1.73 | .80 | 473 | 1.72 | 3.83 | .77 | 7.2 |
| Red upland soils | | | | | | | | | | | |
| Amarillo clay loam, surface | 7 | .109 | .060 | 69 | 1.46 | .53 | 512 | .66 | 3.22 | .45 | 7.3 |
| Amarillo clay loam, subsoil | 7 | .070 | .069 | 48 | 1.83 | .63 | 496 | 1.41 | 2.85 | .63 | 7.3 |
| Amarillo fine sand, surface | 2 | .008 | .018 | 22 | .56 | .09 | 86 | .09 | .05 | .08 | 7.1 |
| Amarillo fine sand, subsoil | 2 | .014 | .019 | 10 | .96 | .10 | 89 | .11 | .09 | .09 | 7.2 |
| Amarillo fine sandy loam, surface | 16 | .069 | .043 | 33 | 1.14 | .44 | 299 | .35 | .60 | .34 | 7.1 |
| Amarillo fine sandy loam, subsoil | 15 | .055 | .041 | 22 | 1.16 | .33 | 293 | 1.30 | 2.41 | .66 | 7.2 |
| Amarillo loam, surface | 4 | .101 | .045 | 61 | 1.44 | .37 | 285 | .41 | .58 | .31 | 7.1 |
| Amarillo loam, subsoil | 4 | .076 | .045 | 35 | 1.22 | .43 | 130 | .74 | .60 | .28 | 6.6 |
| Amarillo silty clay loam, surface | 9 | .125 | .062 | 137 | 1.77 | .59 | 506 | .48 | .38 | .72 | 6.8 |
| Amarillo silty clay loam, subsoil | 8 | .093 | .057 | 81 | 1.82 | .79 | 386 | 1.28 | 1.11 | .71 | 7.1 |
| Amarillo loamy fine sand, surface | 2 | .038 | .014 | 198 | ........ | .05 | 90 | .10 | .43 | .04 | 7.3 |
| Amarillo loamy fine sand, subsoil | 1 | .039 | ........ | 173 | ........ | ........ | 255 | ........ | .70 | ........ | 7.2 |
| Amarillo sand, surface | 3 | .053 | .029 | 33 | 1.60 | .13 | 359 | .19 | .65 | .11 | 6.6 |
| Amarillo sand, subsoil | 3 | .041 | .026 | 31 | 1.21 | .30 | 182 | .21 | .71 | .21 | 7.0 |
| Amarillo sandy loam, surface | 10 | .076 | .043 | 68 | 1.44 | .33 | 286 | .31 | .49 | .25 | 6.8 |
| Amarillo sandy loam, subsoil | 10 | .062 | .051 | 39 | 1.39 | .46 | 276 | .38 | .83 | .31 | 7.6 |
| Springer clay loam, surface | 1 | .091 | .088 | 71 | ........ | .61 | 504 | .56 | 1.07 | .61 | 6.9 |
| Springer clay loam, subsoil | 1 | .101 | .074 | 19 | ........ | ........ | 431 | ........ | 1.31 | ........ | 7.0 |

**Table 23. Analyses of soils of the High Plains—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Red upland soils—(Continued) | | | | | | | | | | | |
| Springer fine sand, surface | 2 | .008 | .018 | 22 | .46 | .09 | 86 | .09 | .05 | .08 | 7.1 |
| Springer fine sand, subsoil | 2 | .014 | .019 | 10 | .72 | .10 | 89 | .11 | .09 | .09 | 7.2 |
| Springer fine sandy loam, surface | 12 | .033 | .027 | 28 | 1.00 | .30 | 290 | .24 | .41 | .24 | 7.3 |
| Springer fine sandy loam, subsoil | 12 | .033 | .028 | 17 | 1.13 | .45 | 289 | .30 | .51 | .34 | 7.2 |
| Springer loam, surface | 3 | .053 | .044 | 18 | 1.37 | .45 | 395 | .35 | .66 | .38 | 7.2 |
| Springer loam, subsoil | 3 | .053 | .043 | 18 | 1.40 | .47 | 355 | .34 | .62 | .39 | 7.0 |
| Light-colored upland soils | | | | | | | | | | | |
| Dune sand, surface | 1 | .009 | .012 | 9 | 1.45 | .07 | 68 | .11 | .41 | .07 | 6.7 |
| Dune sand, subsoil | 1 | .009 | .012 | 8 | 1.51 | .06 | 56 | .06 | .42 | .06 | 6.8 |
| Flat stream-bottom soils | | | | | | | | | | | |
| Randall clay, surface | 6 | .088 | .115 | 373 | 2.14 | .94 | 838 | 1.35 | 1.57 | .48 | 7.0 |
| Randall clay, subsoil | 6 | .053 | .095 | 396 | 2.26 | .98 | 766 | .96 | 1.43 | .81 | 7.2 |

**Table 24. Grades of constituents of surface soils of the High Plains**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dark-colored upland soils | | | | | | | | | | | |
| Potter clay loam | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 |
| Potter fine sandy loam | 1 | 3 | 4 | 4 | 2 | ........ | 2 | ........ | 1 | ........ | 1 |
| Pullman clay loam | 1 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 4 | 2 | 2 |
| Pullman fine sandy loam | 3 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 4 | 3 | 1 |
| Pullman silty clay loam | 12 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 2 |
| Richfield clay loam | 4 | 3 | 3 | 4 | 2 | 2 | 1 | 1 | 2 | 1 | 2 |
| Richfield fine sandy loam | 1 | 4 | 4 | 4 | 2 | ........ | 2 | ........ | 2 | ........ | 1 |
| Richfield loam | 1 | 3 | 4 | 4 | 2 | 2 | 1 | 2 | 3 | 2 | 2 |
| Richfield silty clay loam | 10 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 |
| Richfield fine sandy loam | 1 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 3 | 2 | 1 |
| Red upland soils | | | | | | | | | | | |
| Amarillo clay loam | 9 | 3 | 3 | 4 | 2 | 2 | 1 | 2 | 2 | 2 | 2 |
| Amarillo fine sand | 2 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 2 |
| Amarillo fine sandy loam | 31 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| Amarillo loam | 7 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |
| Amarillo silty clay loam | 21 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 | 1 | 2 |
| Amarillo loamy fine sand | 2 | 4 | 5 | 3 | ........ | 5 | 4 | 5 | 4 | 5 | 2 |
| Amarillo sand | 3 | 4 | 4 | 4 | 2 | 4 | 2 | 4 | 3 | 4 | 2 |
| Amarillo sandy loam | 10 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 4 | 3 | 2 |
| Springer clay loam | 1 | 3 | 3 | 4 | ........ | 2 | 1 | 2 | 3 | 1 | 2 |
| Springer fine sand | 2 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 2 |
| Springer fine sandy loam | 12 | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 4 | 3 | 2 |
| Springer loam | 3 | 4 | 4 | 5 | 3 | 2 | 2 | 3 | 4 | 2 | 2 |
| Light-colored upland soils | | | | | | | | | | | |
| Dune sand | 1 | 5 | 5 | 5 | 2 | 5 | 4 | 4 | 4 | 5 | 2 |
| Flat stream-bottom soils | | | | | | | | | | | |
| Randall clay | 6 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2 |

The red upland soils of the Amarillo and Springer series, with the exception of the fine sand, have Grades 2 and 3 for total, acid-soluble, and active potash; in the fine sands, they have Grades 4 and 5. The nitrogen, phosphoric acid, lime and magnesia vary from Grades 2 to 5 and basicity from Grades 3 to 5.

## MOUNTAINS AND BASINS

The Mountains and Basins region occupies mainly the Trans-Pecos area in the extreme western part of Texas, and covers over 17,000,000 acres in 10 counties. The elevation of the almost flat basins and plains sections ranges from 2,500 to 4,000 feet, and the adjacent mountains and roughlands are from 1,000 to 5,000 feet higher. The normal soils of the region are those which have been developed on the smooth surfaces of the basins and plains, covering about 12,500,000 acres. The soils are light-colored, very calcareous, contain little organic matter, have a pronounced open granular structure, and are underlain by a well-developed layer of calcium carbonate which is in some places accompanied by soft gypsum.

### Outline description of series

**Smooth soils of basins and plains:**

**Ector soils:** Light-brown or brown, calcareous, friable, stony surface with a light-brown or yellowish, calcareous, stony subsoil. Analyses and grades of constituents for Ector soils are given in Tables 19 and 20 for the Edwards Plateau.

**Reagan soils:** Brown or light-brown, calcareous, friable surface with a light-brown or yellowish, calcareous, crumbly subsoil. Analyses and grades of constituents for Reagan soils are given in Tables 19 and 20 for the Edwards Plateau.

**Reeves soils:** Light-brown, calcareous, friable surface with a light-brown or yellowish, calcareous, friable subsoil containing some gypsum.

**Verhalen soils:** Brown or reddish-brown, calcareous, friable surface with a red or reddish-brown, calcareous, crumbly subsoil.

**Terrace soils:**

**Anthony soils:** Light-brown, very calcareous, friable surface with a yellow, calcareous, crumbly subsoil.

**Flat stream-bottom soils:**

**Arno soils:** Chocolate-red or dark-red, calcareous, friable surface and subsoil, both containing some salt.

**Balmorhea soils:** Black or very dark-brown, calcareous, friable surface with a brown, calcareous, crumbly subsoil.

**Gila soils:** Light-brown or grayish, calcareous, friable surface and subsoil, both containing some salt.

**Patrole soils:** Gray calcareous, friable surface containing some salt, with a chocolate-red, dense, heavy, calcareous subsoil containing salt.

**Pecos soils:** Brown or gray, calcareous, friable surface with a dark-gray or chocolate-red, calcareous subsoil containing gypsum and some salt.

**Toyah soils:** Brown or dark-brown, calcareous surface and subsoil.

## Table 25. Analyses of soils of Mountains and Basins

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid Soluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Smooth soils of basins and plains | | | | | | | | | | | |
| Reeves chalk, surface | 3 | .041 | .023 | 70 | .94 | .13 | 80 | 6.78 | 2.63 | .34 | 7.3 |
| Reeves chalk, subsoil | 1 | .008 | .023 | 74 | .92 | ........ | 151 | ........ | 2.59 | ........ | 7.7 |
| Reeves fine sand, surface | 2 | .025 | .028 | 104 | 2.10 | .18 | 270 | 1.90 | 4.93 | .34 | 8.3 |
| Reeves fine sand, subsoil | 2 | .022 | .025 | 39 | 1.88 | .12 | 114 | 7.53 | 11.28 | .41 | 8.4 |
| Reeves fine sandy loam, surface | 6 | .054 | .080 | 243 | 1.30 | .50 | 345 | 5.11 | 9.08 | .50 | 7.7 |
| Reeves fine sandy loam, subsoil | 6 | .037 | .077 | 143 | 1.24 | .53 | 221 | 7.59 | 14.52 | .51 | 7.7 |
| Reeves gravelly fine sandy loam, surface | 1 | .043 | .049 | ........ | 1.32 | .23 | ........ | 6.57 | ........ | .28 | 7.7 |
| Reeves gravelly fine sandy loam, subsoil | 1 | .039 | .046 | 153 | 1.32 | .19 | 270 | 7.57 | 13.40 | .28 | 8.3 |
| Reeves gravelly loam, surface | 3 | .059 | .067 | 178 | 1.87 | .32 | 298 | 10.28 | 12.60 | .54 | 8.5 |
| Reeves gravelly loam, subsoil | 3 | .033 | .045 | 30 | 1.05 | .16 | 130 | 21.65 | 36.01 | .59 | 8.1 |
| Reeves loam, surface | 1 | .078 | .060 | 314 | .96 | ........ | 590 | ........ | 5.30 | ........ | 7.9 |
| Reeves loam, subsoil | 1 | .060 | .076 | 294 | 1.85 | ........ | 436 | ........ | 8.52 | ........ | 7.8 |
| Reeves loamy fine sand, surface | 1 | .023 | .023 | 49 | ........ | .23 | 246 | 1.01 | 1.65 | .42 | ........ |
| Reeves loamy fine sand, subsoil | 1 | .039 | .043 | 19 | ........ | .27 | 130 | 15.13 | 34.40 | .27 | ........ |
| Reeves sand, surface | 1 | .017 | .033 | 183 | 1.42 | .16 | 9 | 7.12 | 3.15 | .96 | 7.3 |
| Reeves silty clay loam, surface | 14 | .085 | .132 | 262 | 2.07 | .69 | 394 | 10.74 | 17.78 | 1.06 | 8.1 |
| Reeves silty clay loam, subsoil | 13 | .056 | .094 | 140 | 1.72 | .66 | 253 | 12.98 | 21.69 | .95 | 8.0 |
| Verhalen clay, surface | 5 | .071 | .088 | 378 | 2.96 | 1.02 | 652 | 3.72 | 7.31 | .98 | 7.8 |
| Verhalen clay, subsoil | 3 | .068 | .101 | 299 | 3.20 | .94 | 641 | 4.82 | 8.03 | 1.18 | 7.9 |
| Verhalen gravelly clay loam, surface | 1 | .046 | .047 | 73 | 3.61 | .55 | 639 | 1.36 | .35 | .65 | 7.2 |
| Verhalen gravelly clay loam, subsoil | 1 | .051 | .039 | ........ | 3.20 | .48 | ........ | 2.50 | ........ | .69 | 8.2 |
| Verhalen loamy fine sand, surface | 2 | .110 | .090 | 466 | 2.71 | .51 | 406 | 6.71 | 9.28 | 1.26 | 8.5 |
| Verhalen loamy fine sand, subsoil | 1 | .022 | .050 | 88 | 2.36 | .23 | 169 | 9.09 | 14.60 | .32 | 8.5 |
| Terrace Soils | | | | | | | | | | | |
| Anthony fine sandy loam, surface | 1 | .019 | .068 | 432 | ........ | .23 | 158 | 1.55 | 2.05 | .29 | ........ |
| Anthony gravelly sandy loam, surface | 1 | .012 | .059 | 344 | ........ | .14 | 107 | 1.03 | 1.48 | .31 | ........ |
| Flat stream-bottom soils | | | | | | | | | | | |
| Arno clay, surface | 2 | .063 | .145 | 342 | 1.73 | .99 | 406 | 9.73 | 10+ | 1.53 | 8.2 |
| Arno clay, subsoil | 2 | .055 | .136 | 146 | 1.97 | 1.01 | 366 | 10.44 | 10+ | 2.02 | 8.3 |
| Arno very fine sandy loam, surface | 1 | .014 | .073 | 244 | 1.93 | .12 | 79 | 4.65 | 6.93 | .90 | 7.7 |
| Arno very fine sandy loam, subsoil | 1 | .054 | .133 | 61 | 2.32 | .68 | 200 | 11.70 | 10+ | 1.34 | 7.3 |
| Balmorhea clay, surface | 1 | .205 | .175 | 142 | 2.20 | .66 | 433 | 12.33 | 10+ | 1.44 | 8.4 |
| Balmorhea clay, subsoil | 1 | .041 | .100 | 406 | 2.87 | .84 | 530 | 5.45 | 4.56 | 1.23 | 8.4 |
| Gila clay, surface | 2 | .048 | .133 | 351 | ........ | .84 | 298 | 4.42 | 7.45 | .88 | ........ |
| Gila clay, subsoil | 1 | .019 | .115 | 577 | ........ | ........ | 391 | 1.64 | 3.13 | 1.25 | ........ |
| Gila clay adobe, surface | 1 | .056 | .129 | 382 | ........ | .25 | 436 | 5.33 | 8.50 | 1.04 | ........ |
| Gila fine sand, surface | 1 | .073 | .100 | 743 | ........ | .41 | 524 | 2.71 | 5.15 | .49 | ........ |

**Table 25. Analyses of soils of Mountains and Basins—Continued**

| Type Name | No. of Soils | Nitrogen Per Cent | Total Phos. Acid Per Cent | Active Phos.Ac. Per Million | Total Potash Per Cent | Acid Soluble Potash Per Cent | Active Potash Per Million | Acid oluble Lime Per Cent | Basicity Per Cent | Acid Soluble Magnesia Per Cent | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flat stream-bottom soils—(Continued) | | | | | | | | | | | |
| Gila fine sandy loam, surface | 3 | .134 | .081 | 760 | 2.40 | .42 | 593 | 3.46 | 6.39 | .75 | 8.5 |
| Gila fine sandy loam, subsoil | 2 | .025 | .101 | 656 | 2.36 | .28 | 502 | 3.56 | 6.57 | .83 | 8.3 |
| Gila silt loam, surface | 2 | .069 | .135 | 647 | 2.31 | .57 | 479 | 5.11 | 8.46 | 1.01 | 8.6 |
| Gila silt loam, subsoil | 1 | .040 | .126 | 498 | 2.42 | .71 | 576 | 6.19 | 9.62 | 1.47 | 8.7 |
| Patrole silty clay loam, surface | 1 | .034 | .075 | 131 | 1.31 | .19 | 186 | 14.31 | 10+ | 1.21 | 7.5 |
| Patrole silty clay loam, subsoil | 1 | .018 | .082 | 68 | 1.47 | .30 | 201 | 11.12 | 10+ | 1.27 | 7.7 |
| Pecos clay, surface | 2 | .086 | .117 | 84 | 2.08 | 1.03 | 300 | 13.19 | 22.60 | 2.47 | 7.3 |
| Pecos clay, subsoil | 2 | .040 | .170 | 155 | 2.07 | 1.12 | 238 | 11.77 | 21.30 | 2.48 | 7.8 |
| Pecos silty clay loam, surface | 2 | .097 | .147 | 305 | 1.97 | .67 | 246 | 8.03 | 14.88 | 1.65 | 8.1 |
| Pecos silty clay loam, subsoil | 2 | .059 | .145 | 327 | 1.94 | .76 | 276 | 11.40 | 19.30 | 1.05 | 7.6 |
| Toyah clay loam, surface | 1 | .034 | .165 | 499 | 4.32 | .40 | 654 | .97 | 1.41 | .36 | 8.5 |
| Toyah clay loam, subsoil | 1 | .040 | .148 | 319 | 4.02 | .38 | 802 | 1.78 | 2.97 | .42 | 8.8 |
| Toyah fine sandy loam, surface | 1 | .082 | .126 | 90 | 3.24 | .56 | 372 | 3.26 | 10+ | .64 | ........ |
| Toyah fine sandy loam, subsoil | 1 | .060 | .115 | 489 | 2.93 | .59 | 748 | 7.08 | 7.17 | .85 | ........ |
| Toyah loam, surface | 1 | .092 | .110 | 686 | 3.33 | .50 | 913 | 3.03 | 5.30 | .76 | 7.3 |
| Toyah loam, subsoil | 1 | .046 | .120 | 681 | 3.35 | .65 | 836 | 2.82 | 4.70 | 1.16 | 7.5 |
| Toyah silty clay loam, surface | 1 | .108 | .165 | 913 | 3.49 | .78 | 939 | 1.81 | 3.10 | 1.03 | 7.2 |
| Toyah silty clay loam, subsoil | 1 | .063 | .106 | 495 | 3.49 | .60 | 835 | 3.66 | 5.85 | .95 | 7.7 |

**Table 26. Grades of constituents of surface soils of Mountains and Basins**

| Type Name | No. of Soils | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Smooth soils of basins and plains | | | | | | | | | | | |
| Reeves chalk | 3 | 4 | 5 | 4 | 3 | 4 | 4 | 1 | 2 | 2 | 2 |
| Reeves fine sand | 1 | 5 | 4 | 3 | 1 | 4 | 2 | 1 | 1 | 2 | 1 |
| Reeves fine sandy loam | 6 | 4 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 |
| Reeves gravelly fine sandy loam | 1 | 4 | 4 | ........ | 2 | 3 | ........ | 1 | ........ | 3 | 1 |
| Reeves gravelly loam | 3 | 4 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 1 |
| Reeves loam | 1 | 3 | 3 | 2 | 3 | ........ | 1 | ........ | 1 | ........ | 1 |
| Reeves loamy fine sand | 1 | 5 | 5 | 4 | ........ | 3 | 2 | 2 | 3 | 2 | ........ |
| Reeves sand | 1 | 5 | 4 | 3 | 2 | 4 | 5 | 1 | 2 | 1 | 2 |
| Reeves silty clay loam | 14 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Verhalen clay | 5 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Verhalen gravelly clay loam | 1 | 4 | 4 | 4 | 1 | 2 | 1 | 2 | 4 | 1 | 2 |
| Verhalen loamy fine sand | 2 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Terrace soils | | | | | | | | | | | |
| Anthony fine sandy loam | 1 | 5 | 3 | 1 | ........ | 3 | 3 | 2 | 2 | 3 | ........ |
| Anthony gravelly sandy loam | 1 | 5 | 3 | 2 | ........ | 4 | 3 | 2 | 3 | 2 | ........ |
| Flat stream-bottom soils | | | | | | | | | | | |
| Arno clay | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Arno very fine sandy loam | 1 | 5 | 3 | 2 | 1 | 4 | 4 | 1 | 1 | 1 | 1 |
| Balmorhea clay | 1 | 1 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Gila clay | 2 | 4 | 2 | 2 | ........ | 1 | 2 | 1 | 2 | 1 | ........ |
| Gila clay adobe | 1 | 4 | 2 | 2 | ........ | 3 | 1 | 1 | 1 | 1 | ........ |
| Gila fine sand | 1 | 3 | 3 | 1 | ........ | 2 | 1 | 1 | 1 | 1 | ........ |
| Gila fine sandy loam | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Gila silt loam | 2 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Patrole silty clay loam | 1 | 4 | 3 | 3 | 2 | 4 | 3 | 1 | 1 | 1 | 2 |
| Pecos clay | 2 | 3 | 2 | 4 | 1 | 1 | 2 | 1 | 1 | 1 | 2 |
| Pecos silty clay loam | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Toyah clay loam | 1 | 4 | 1 | 1 | 1 | 3 | 1 | 2 | 3 | 2 | 1 |
| Toyah fine sandy loam | 1 | 3 | 2 | 4 | 1 | 2 | 2 | 1 | 1 | 1 | ........ |
| Toyah loam | 1 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 |
| Toyah silty clay loam | 1 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 2 |

**Table 27. Sulphur, ferric oxide, manganese, total exchange capacity, and phosphoric acid absorbed, in some groups of Texas soils**

| | Sulphur (S) | | Ferric oxide | | Manganese | | Total exchange capacity | | Phosphoric acid absorbed | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Surface per cent | Subsoil per cent | Surface per cent | Subsoil per cent | Surface per cent | Subsoil per cent | Surface M.E. in 100 gm. | Subsoil M.E. in 100 gm. | Surface per cent | Subsoil per cent |
| Gulf Coast Prairie | | | | | | | | | | |
| Upland | .019 | .016 | 3.27 | 3.62 | .034 | .024 | 17.5 | 15.6 | 52 | 71 |
| Alluvial | .035 | .032 | 3.33 | 3.15 | .048 | .046 | 28.3 | 29.3 | 49 | 51 |
| East Texas Timber Country | .012 | .012 | .66 | 1.72 | .031 | .023 | 6.5 | 11.5 | 29 | 49 |
| Blackland Prairies | | | | | | | | | | |
| Upland, calcareous | .033 | .026 | 3.39 | 2.72 | .116 | .089 | 41.5 | 43.5 | 68 | 66 |
| Upland, noncalcareous | .038 | .039 | 2.17 | 2.39 | .026 | .037 | 26.2 | 29.6 | 47 | 67 |
| Alluvial | .032 | .033 | 3.02 | 3.96 | .048 | .046 | 35.1 | 38.0 | 56 | 48 |
| Grand Prairie | .027 | .032 | ...... | ...... | .066 | .092 | 37.1 | 37.7 | 62 | 84 |
| West Cross Timbers | | | | | | | | | | |
| Upland | .013 | .015 | ...... | ...... | ...... | ...... | 4.6 | 13.3 | 36 | 73 |
| Alluvial | .023 | .031 | ...... | ...... | .034 | .034 | 18.5 | 18.8 | 70 | 79 |
| Central Basin | .008 | .011 | ...... | ...... | ...... | ...... | ...... | ...... | 42 | 86 |
| Rio Grande Plain | | | | | | | | | | |
| Dark-colored, upland | .026 | .029 | 2.32 | 2.60 | .020 | .022 | 14.3 | 13.1 | 54 | 70 |
| Light-colored, upland | .026 | .022 | .97 | 1.14 | .021 | .022 | 9.2 | 11.0 | 46 | 57 |
| Alluvial | .027 | .024 | 3.46 | 3.40 | .036 | .032 | 22.3 | 18.3 | 63 | 65 |
| Rolling Plains | | | | | | | | | | |
| Upland | .020 | .025 | ...... | ...... | .046 | .047 | 18.4 | 26.3 | 50 | 59 |
| Alluvial | .034 | .028 | ...... | ...... | ...... | ...... | 16.2 | 20.0 | 59 | 66 |
| High Plains | .017 | .015 | ...... | ...... | .013 | .011 | 13.9 | 16.9 | 50 | 72 |

**Table 28. Grades of constituents in surface soils of various soil groups**

| Area Letter in Fig. 2 | Soil Group | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | East Texas Timber Country | | | | | | | | | | |
| A | Kirvin—Norfolk | 4 | 4 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| B | Kirvin—Bowie | 4 | 4 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| C | Lufkin—Susquehanna | 4 | 4 | 5 | 3 | 4 | 3 | 4 | 5 | 4 | 2 |
| D | Segno—Caddo | 4 | 4 | 5 | 3 | 5 | 3 | 4 | 5 | 4 | 2 |
| E | Nacogdoches—Norfolk | 4 | 4 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 2 |
| | Gulf Coast Prairie | | | | | | | | | | |
| F | Lake Charles—Edna | 3 | 4 | 5 | 4 | 3 | 3 | 2 | 3 | 3 | 2 |
| G | Hockley—Katy | 3 | 5 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 2 |
| H | Harris | 2 | 3 | 4 | 3 | 2 | 3 | 3 | 4 | 4 | 2 |
| I | Galveston | 4 | 4 | 5 | 3 | 4 | 3 | 3 | 3 | 3 | 1 |
| | Blackland Prairies | | | | | | | | | | |
| K | Houston—Wilson | 2 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| L | Wilson—Crockett | 3 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| | Grand Prairie | | | | | | | | | | |
| M | Denton—San Saba | 2 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| | West Cross Timbers | | | | | | | | | | |
| N | Windthorst—Nimrod | 4 | 4 | 5 | 3 | 4 | 3 | 3 | 3 | 3 | 2 |
| O | Windthorst—Nimrod Prairies | 4 | 4 | 5 | 3 | 4 | 3 | 3 | 3 | 3 | 2 |
| | Central Basin | | | | | | | | | | |
| P | Tishomingo—Pedernales | 3 | 3 | 5 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| | Rio Grande Plain | | | | | | | | | | |
| R | Victoria—Goliad—Orelia | 3 | 4 | 4 | 3 | 2 | 1 | 2 | 3 | 3 | 2 |
| S | Duval—Webb | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| T | Maverick—Zapata | 2 | 4 | 4 | 3 | 2 | 2 | 1 | 2 | 2 | 1 |
| U | Brennan—Nueces | 4 | 4 | 4 | 3 | 3 | 2 | 4 | 4 | 3 | 2 |
| V | Lomalta—Point Isabel | 3 | 4 | 4 | 2 | 2 | 3 | 1 | 2 | 3 | 2 |
| | Edwards Plateau | | | | | | | | | | |
| W | Denton—Rough stony land | 2 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| X | Valera—Rough stony land | 2 | 3 | 4 | 2 | 1 | 1 | 1 | 1 | 1 | 2 |
| Y | Ector—Rough stony land | 3 | 3 | 4 | 2 | 1 | 1 | 2 | 2 | 1 | 2 |
| | Rolling Plains | | | | | | | | | | |
| Z | Abilene—Roscoe—Foard | 2 | 3 | 4 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| AA | Vernon—Rough stony land | 3 | 3 | 4 | 3 | 2 | 2 | 2 | 2 | 1 | 2 |
| AB | Miles—Vernon | 3 | 3 | 4 | 3 | 2 | 2 | 2 | 3 | 1 | 2 |
| | High Plains | | | | | | | | | | |
| AC | Pullman—Richfield | 3 | 4 | 4 | 2 | 2 | 1 | 2 | 2 | 2 | 2 |
| AD | Amarillo sandy loams | 4 | 4 | 4 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |
| AE | Amarillo sands | 4 | 4 | 4 | 2 | 3 | 2 | 4 | 3 | 2 | 2 |
| AF | Enterprise sands | 5 | 5 | 5 | 2 | 5 | 4 | 4 | 4 | 5 | 2 |

**Table 28. Grades of constituents in surface soils of various soil groups—Continued**

| Area Letter in Fig. 2 | Soil Group | Nitrogen | Total Phos. Acid | Active Phos. Acid | Total Potash | Acid Soluble Potash | Active Potash | Acid Soluble Lime | Basicity | Acid Soluble Magnesia | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Basins and Mountains | | | | | | | | | | |
| AG | Rough stony land—Brewster | 4 | 3 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 2 |
| AH | Reeves—Verhalen | 4 | 3 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| | Alluvial Soils | | | | | | | | | | |
| BA | Ochlockonee—Bibb | 3 | 3 | 4 | 3 | 4 | 2 | 3 | 3 | 3 | 2 |
| BB | Trinity—Catalpa | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 |
| BC | Miller—Yahola | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| BD | Frio—Spur—Leona | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 2 |
| BE | Harlingen—Gila | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| BF | Balmorhea—Toyah | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| BG | Rio Grande—Laredo | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |

### Composition of soil types

The average composition of the soil types is given in Table 25 and grades of constituents of the surface soils in Table 26. Most of the soils have Grades 1 and 2 for active phosphoric acid, total, acid-soluble and active potash, acid-soluble lime and magnesia, basicity, and reaction (pH). Most of the soils have Grades 3, 4, and 5 for nitrogen, and Grades 1, 2, and 3 for total phosphoric acid, although 5 types in the Reeves series have Grades 4 and 5 in this constituent. These soils are all in the arid region of the state, and moisture, rather than capacity of the soils to supp y plant food elements, is the determining factor in crop production.

## OTHER CONSTITUENTS OF THE SOILS

The soil constituents considered heretofore are those to which we have giv^n the most attention. A number of analyses to which we have given less extensive attention have also been made. These include sulphur, manganese, ferric oxide, total exchange capacity, and phosphoric acid absorbed. With the exception of ferric oxide, these constituents have been discussed in detail in other bulletins (2, 29, 36, 44, 46, 53). Many more soils have been analyzed for nitrogen, phosphoric acid, potash, and lime than for these constituents. A brief summary of the data is therefore all that is given in the following sections. The data are given n Table 27.

### Sulphur

A detailed study of the needs of Texas soils for sulphur has been reported by the Division of Chemistry (36, 53), while a study of the effect of sulphur on the yield of certa n crops has been reported by the Division of Agronomy (56). With the exception of the soils of the Blackland Prairies and the alluvial soils of the Gulf Coast Prairie and the Rolling Plains, the average sulphur (as $SO_3$) content is below .030 per cent. Very few crop increases were secured by the addition of sulphur to Texas soils under greenhouse conditions or in the field. Insofar as crop growth is concerned, very few Texas soils are deficient in sulphur. Such a deficiency may, however, deve op in the course of years. Sulphur s brought down by rain in appreciab e quantities, and is contained in ordinary fertilizers. Hence sulphur is supplied at the same time as nitrogen or phosphoric acid in fertilizers.

### Ferric oxide

The average iron content calculated to ferric oxide is given in Table 27. The soils of the East Texas Timber Country and the light-colored soils of the Rio Grande Plain contain smaller percentages of ferric oxide than soils of the other groups. However, no particular symptoms of a lack of available iron in plants grown in these regions has ever been noted, and it is probable that all Texas soils contain sufficient quantities of iron for satisfactory crop growth. Chlorosis due to insufficient iron taken up by the plants may develop in limestone soils. The lime seems to prevent the iron from being effective in some spots.

### Manganese

The results of a detailed study of manganese in Texas soils have been presented elsewhere (2). Some averages for the several soil groups of the State show that alluvial soils in general contain more manganese than corresponding upland soils. The calcareous upland soils of the Blackland Prairies contain the most manganese and the soils of the High Plains, the least. Very few Texas soils respond to the addition of manganese.

### Total exchange capacity

The total exchange capacities of a large number of Texas soils, determined by leaching with neutral, normal ammonium acetate solution, have been given (46). Some phases of the importance of exchange capacity have been discussed in detail (44, 46, 48, 50) elsewhere. The average total exchange capacities of a number of soil groups are given in Table 27. In general, alluvial soils have higher exchange capacity than upland soils of the corresponding area, and calcareous soils have higher exchange capacities than noncalcareous soils. East Texas Timber Country soils have the lowest exchange capacities, while the Blackland Prairies soils have the highest. The Grand Prairie has calcareous soils whose exchange capacities are only slightly smaller than those of the soils of the Blackland Prairies. The other geographical areas have soils whose average exchange capacities are slightly greater than those of the East Texas Timber Country, but considerably smaller than those of the soils of the Blackland Prairies.

### Phosphoric acid absorbed

The capacity of the soil to absorb phosphoric acid from a solution with which it is placed in contact has been discussed in some detail in earlier Bulletins (27, 29) and the study is being continued. When the percentage of phosphoric acid absorbed by a soil increases, the capacity of the soil to provide available phosphoric acid to the plant may decrease. Soils which fix or absorb a high percentage of phosphoric acid may require larger amounts of phosphoric fertilizer to produce a given increase in yield, since both the soil and the plant are competing for the phosphoric acid added to the soil. The average percentages of phosphoric acid absorbed by the soils of several geographic areas are given n Table 27. The light, sandy soils of the upland surface soils of the East Texas Timber Country are lowest, while the heavy calcareous soils of the Blackland Prairies are highest, with the soils of the other areas absorbing about 50 per cent. The subsoils usually absorb much larger quantities than do the corresponding surface soils. The surface alluvial soils usually absorb much more phosphoric acid than do the surface upland soils of the same region, and the differences between the quantities absorbed by the surface soils as compared with the subsoils are usually much smaller with the alluvial soils than with the upland soils.

## AVERAGE COMPOSITION OF SURFACE SOILS OF TEXAS BY GENERALIZED AREAS

It seemed desirable to secure a general idea of the composition of the surface soils of the various regions of Texas. In such a general grouping, only the broad average outlines can be given. Deviations from the average of the various soil types given in the preceding sections must be allowed for. Still greater variations are to be expected when general maps are presented.

The composition is indicated by the grade given the quantity of the constituent concerned. The map of the various areas covered by different groups of soil series of Texas (Figure 2) was used as a basis. The grades of the constituents in soil types in each area as given in the preceding tables were studied and the average grade which should be given to each constituent in each area shown in Figure 2 was estimated. Some types of a higher grade and some of a lower grade than that decided upon were usually present. The important extensive types were given the most weight in the decision. The classification of each soil group area by grade is given in Table 28. Alluvial soils are not included except where they occupy extensive areas.

After the grades for the constituents of all the soil group areas had been decided upon, these grades were mapped upon the base map (Figure 1). In this process many of the divisions between the areas disappeared. New maps were then drawn showing the outlines of the areas having the various grades of each constituent. The maps so prepared are Figures 3 to 12, inclusive, and are discussed briefly below.

## Total nitrogen

Grading of the areas with respect to total nitrogen is shown in Figure 3. The Enterprise sands group on the High Plains is the only area given Grade 5. The East Texas Timber Country, West Cross Timbers, and parts of the Rio Grande Plain, High Plains, and Mountains and Basins region average Grade 4. The Central

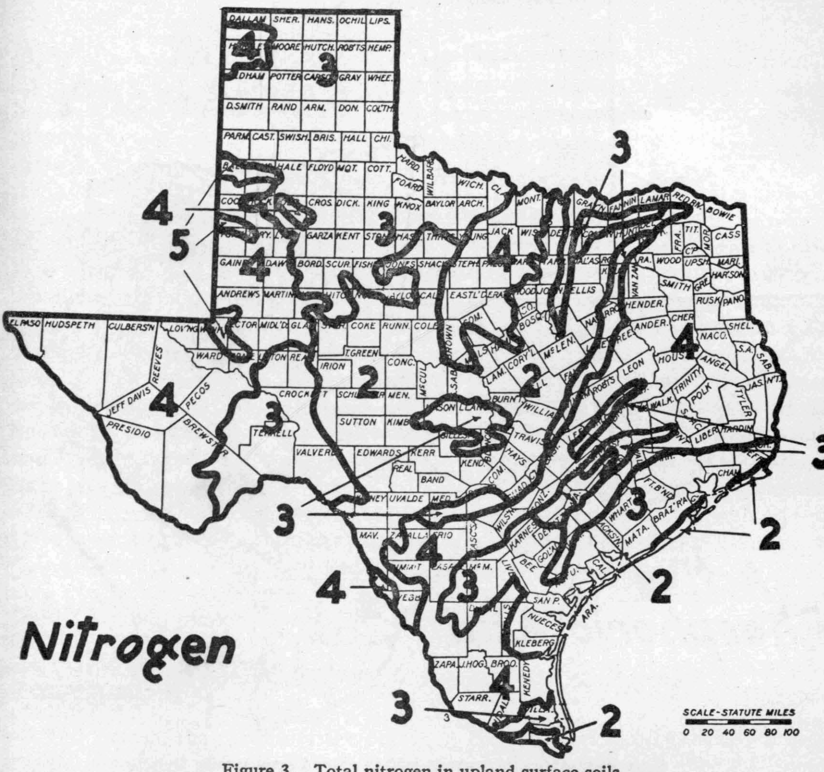


Figure 3. Total nitrogen in upland surface soils.
Grade 5, 0 to .030 per cent (deficient); Grade 4, .031 to .060 (often deficient); Grade 3, .061 to .120 (sometimes deficient); Grade 2, .121 to .180 (good); Grade 1, .181 and up (high).

Basin, Gulf Coast Prairie, the remainder of the Rio Grande Plain, and the Ector soils of the Edwards Plateau average Grade 3. Rainfall in these western areas is probably a much more important limiting factor for the growth of crops than is the supply of available nitrogen. The Grand Prairie, the calcareous soils of the Blackland Prairies, and the most of the Edwards Plateau have Grade 2. A few small areas along the coast and a small area of alluvial soil in Cameron and Hidalgo Counties have Grade 2. No area of the state is sufficiently high in nitrogen to receive Grade 1. There are, however, individual soil types having this grade.

### Active phosphoric acid and total phosphoric acid

A large part of Texas has Grade 5 for active phosphoric acid (Figure 4) which is the lowest grade. Exceptions are the soils of the Mountains and Basins region having Grade 3, and an area of alluvial soils in the southern tip of the Rio Grande Plain in Hidalgo and Cameron Counties having Grade 1. Where a considerable quantity of lime is in the soil, such as in the Blackland Prairies, a low quantity of active phosphoric acid is not nearly so important, insofar as crop yields or response to phosphatic fertilization is concerned, as where the quantity of lime is also low.

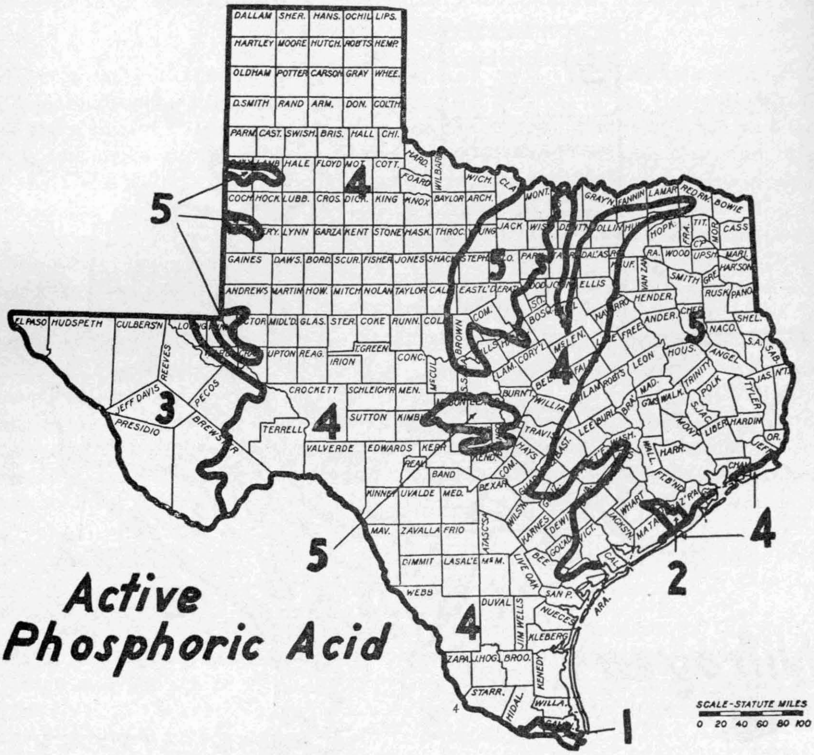


Figure 4. Active phosphoric acid in upland surface soils.

Grade 5, 0 to 30 parts per million (deficient); Grade 4, 31 to 100 (often deficient); Grade 3, 101 to 200 (sometimes deficient); Grade 2, 201 to 400 (good); Grade 1, 401 parts per million and up (high)

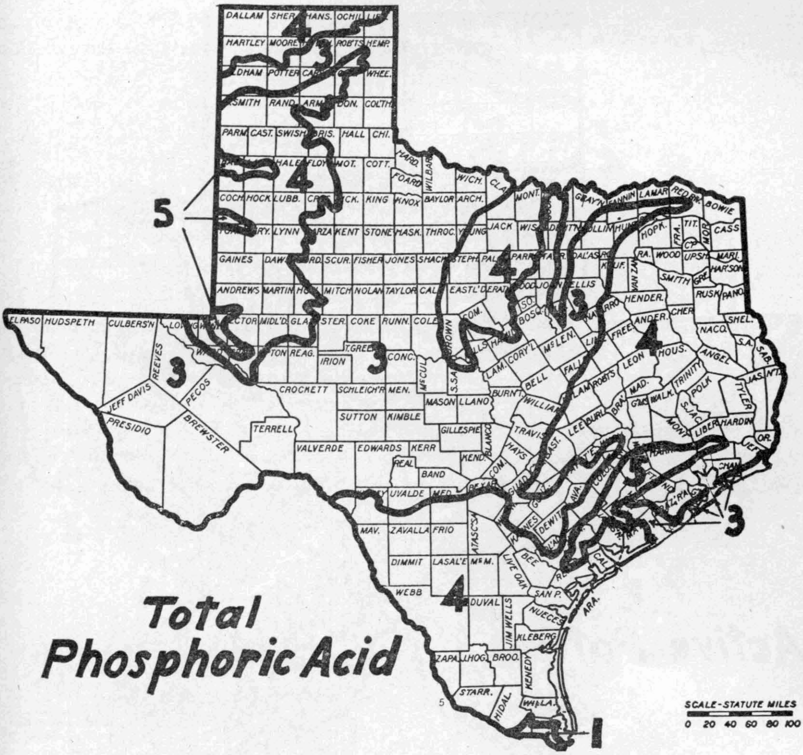


Figure 5. Total phosphoric acid in upland surface soils.
Grade 5, 0 to .025 per cent; Grade 4, .026 to .050; Grade 3, .051 to .100; Grade 2, .101 to .150; Grade 1, .151 per cent and up.

Total phosphoric acid in Texas soils (Figure 5) is generally of Grades 1 to 3, although the Hockley-Katy group of soils in the Gulf Coast Prairie region has Grade 5. The East Texas Timber Country, Rio Grande Plain, West Cross Timbers, the High Plains in West Texas with the exception of the Enterprise sands (Grade 5), and the noncalcareous upland soils of the Crockett-Wilson group in the Blackland Prairies have Grade 4. The soils of the High Plains area and the Rio Grande Plain area probably contain sufficient phosphoric acid to produce the maximum crops which can be produced with the limited supply of moisture available in that region where irrigation is not used. The remainder of the state, including the Grand Prairie, Central Basin, Edwards Plateau, Rolling Plains, the Trans-Pecos, or Mountains and Basins regions, and the calcareous soils of the Blackland Prairies, has Grade 3 for total phosphoric acid.

## Active potash, acid-soluble potash, and total potash

Active potash, the portion of the potash of the soil most closely related to crop growth, is mapped in Figure 6. There is no area of Grade 5, and only the Enterprise sands group of the High Plains and the Hockley-Katy group of the Gulf Coast

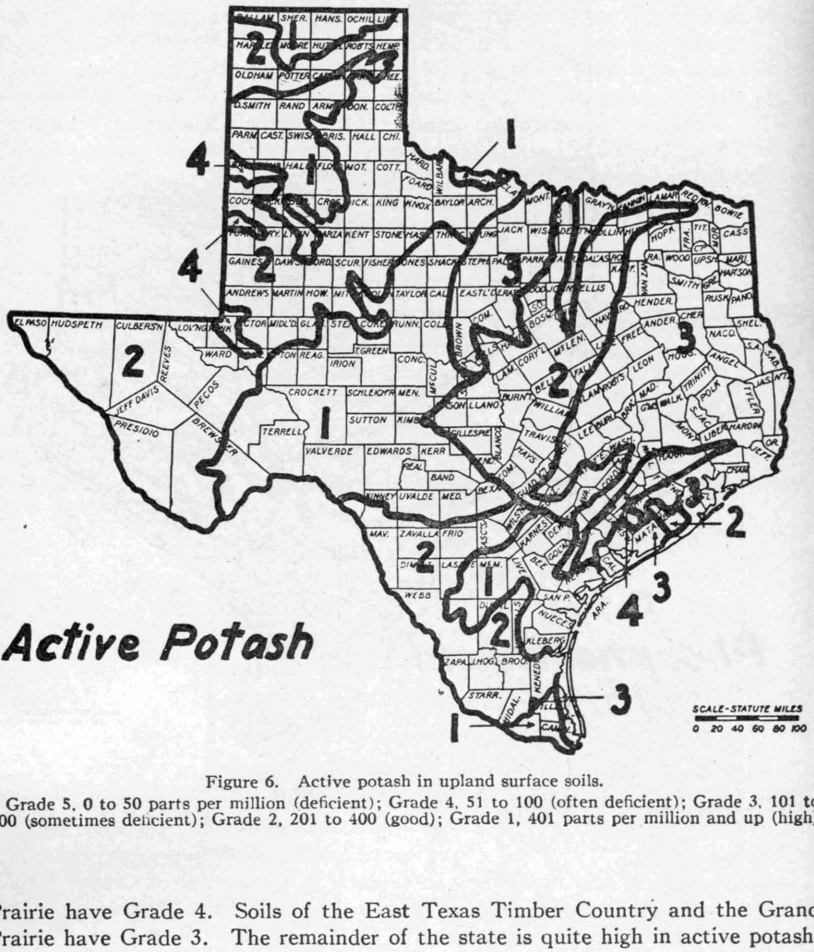


Figure 6. Active potash in upland surface soils.
Grade 5, 0 to 50 parts per million (deficient); Grade 4, 51 to 100 (often deficient); Grade 3, 101 to 200 (sometimes deficient); Grade 2, 201 to 400 (good); Grade 1, 401 parts per million and up (high)

Prairie have Grade 4. Soils of the East Texas Timber Country and the Grand Prairie have Grade 3. The remainder of the state is quite high in active potash, with large areas having Grade 1.

Acid-soluble potash is mapped in Figure 7. The light, sandy soils of the East Texas Timber Country and the Enterprise sands of the High Plains have Grade 5. The Lufkin-Susquehanna group of soils in the East Texas Timber Country, the soils of the Grand Prairie, and the Hockley-Katy group of the Gulf Coast Prairie have Grade 4. Most of the Edwards Plateau has Grade 1. The remainder of the state has either Grade 2 or Grade 3.

Total potash is mapped in Figure 8. No area has Grade 5. The light, sandy soils of the East Texas Timber Country and the Lake Charles-Edna group of the Gulf Coast Prairie are the only areas having Grade 4. The remainder of the areas in the humid region of the state, in the Rio Grande Plain, and the Vernon soils of the Rolling Plains have Grade 3. The Edwards Plateau and the High Plains have Grade 2, while most of the Mountains and Basins region has Grade 1. With the exception of the light sandy soils of the East Texas Timber Country and the Lake

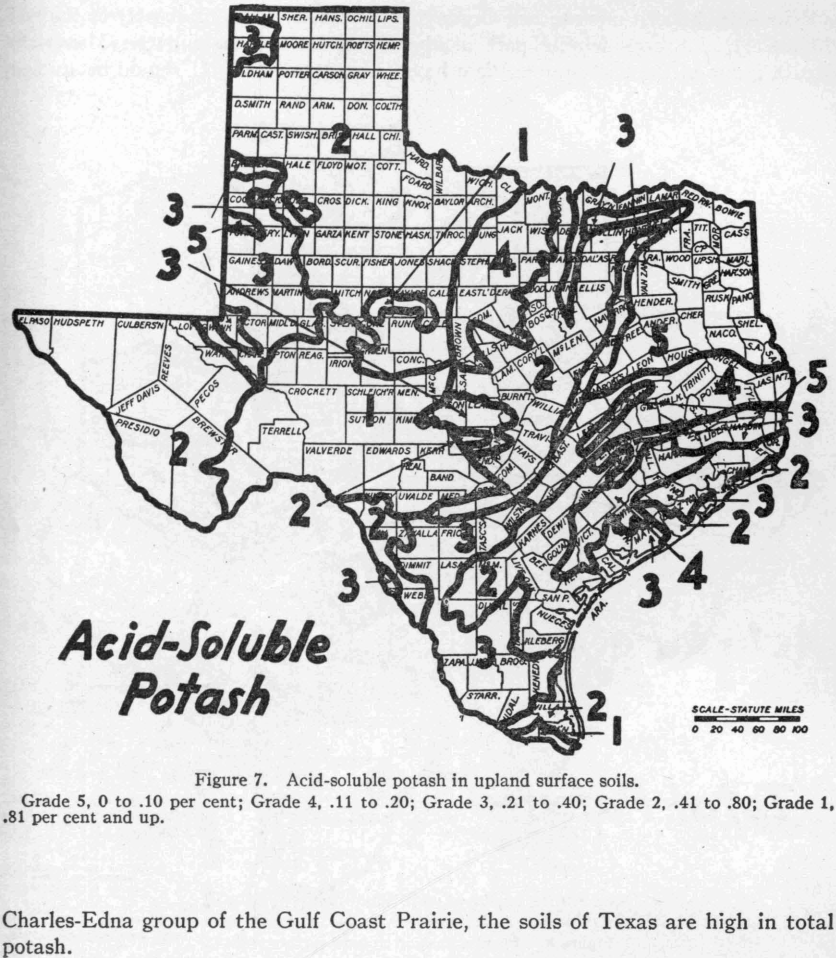


Figure 7. Acid-soluble potash in upland surface soils.
Grade 5, 0 to .10 per cent; Grade 4, .11 to .20; Grade 3, .21 to .40; Grade 2, .41 to .80; Grade 1, .81 per cent and up.

Charles-Edna group of the Gulf Coast Prairie, the soils of Texas are high in total potash.

### Acid-soluble lime, basicity, and acidity

Acid-soluble lime (Figure 9) in the soils of Texas is relatively high. The East Texas Timber Country, the Amarillo sands and Enterprise soils of the High Plains, and the Brennan-Nueces group of the Rio Grande Plain have Grade 4. The West Cross Timbers, the Wilson-Crockett group of the Blackland Prairies, and a few very small areas elsewhere in the state have Grade 3. The remainder of the state has either Grade 1 or 2.

Basicity of Texas soils (Figure 10) is, in general, relatively high, except the East Texas Timber Country and the West Cross Timbers soils which have Grade 5. The principal area having Grade 4 is the Hockley-Katy group of the Gulf Coast Prairie. A large part of the High Plains and Rio Grande Plain, the Wilson-Crockett group of the Blackland Prairies, and the Lake Charles-Edna group of the Gulf Coast Prairie have Grade 3, while the remainder of the state has Grade 1 or 2.

Practically all of the state has Grade 2 for intensity of acidity (pH) of the soil (Figure 11). A considerable part of the Trans-Pecos area and the Maverick-Zapata group of the Rio Grande Plain have Grade 1. Figure 11 should be studied

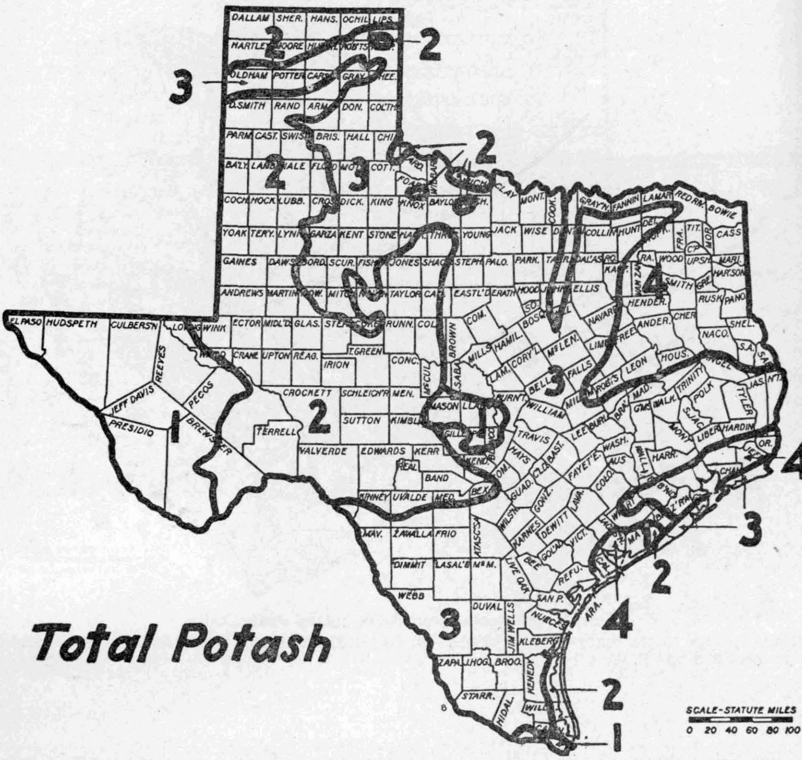


Figure 8. Total potash in upland surface soils.
Grade 5, 0 to .30 per cent; Grade 4, .31 to 60; Grade 3, .61 to 1.20; Grade 2, 1.21 to 1.80; Grade 1 1.81 per cent and up.

in conjunction with Figure 10, giving the basicity of the areas. For example, while the soils of the East Texas Timber Country are at present practically neutral (Grade 2), the basicity of these soils is so low (Grade 5) that after continued cropping, particularly with the use of acid-forming fertilizers, the soil may become sufficiently acid to require liming for certain crops. A slight degree of acidity is beneficial to many crops.

## Acid-soluble magnesia

Acid-soluble magnesia (Figure 12) is relatively high in most of the soils. The Enterprise sands group in the High Plains is the only area of the State which is sufficiently low in magnesia to have Grade 5, and only the soils of the East Texas Timber Country and a few small areas along the Gulf of Mexico have Grade 4.

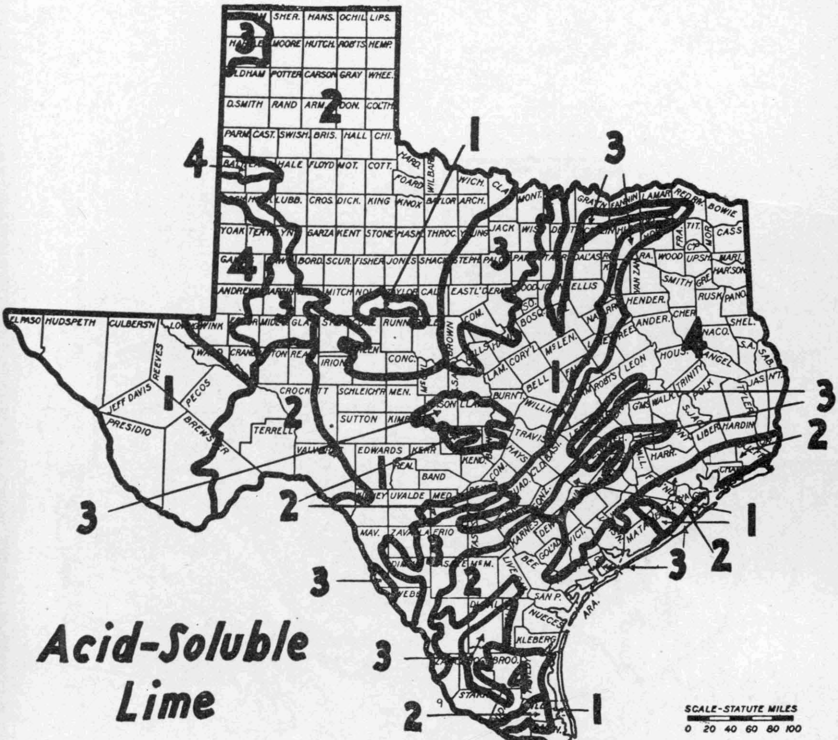


Figure 9. Acid-soluble lime in upland surface soils.

Grade 5, 0 to .10 per cent; Grade 4, .11 to .20; Grade 3, .21 to .40; Grade 2, .41 to 2.00; Grade 1 2.01 per cent and up.

The soils of the West Cross Timbers and the Central Basin and part of the Rio Grande Plain have Grade 3. All the remaining areas of the state have either Grade 1 or 2.

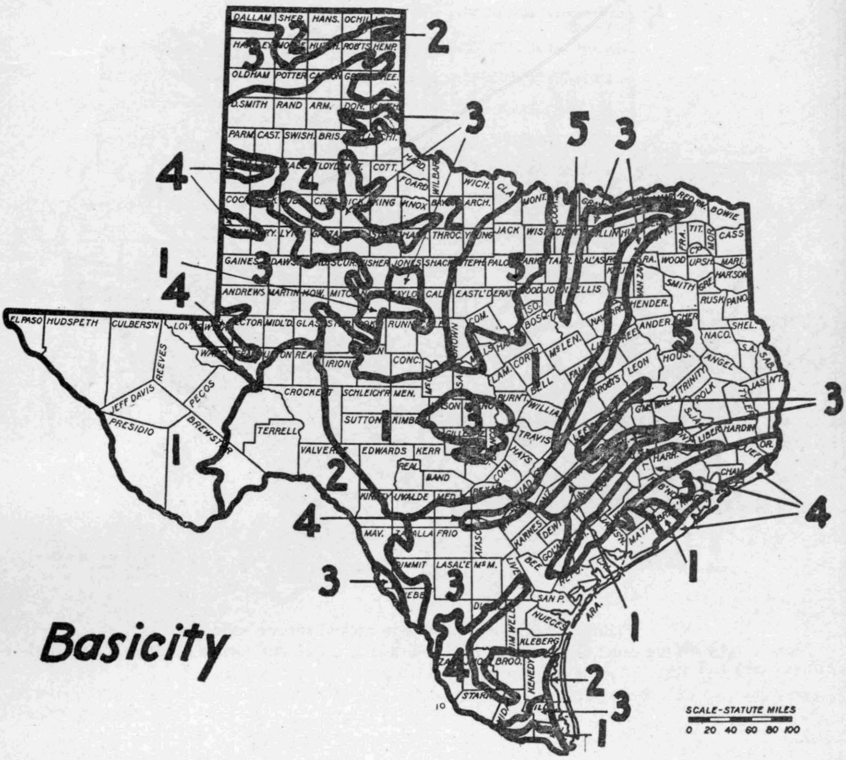


Figure 10. Basicity of upland surface soils.

Grade 5, 0 to .30 per cent; Grade 4, .31 to .60; Grade 3, .61 to 2.00; Grade 2, 2.01 to 5.00; Grade 1, 5.01 per cent and up.

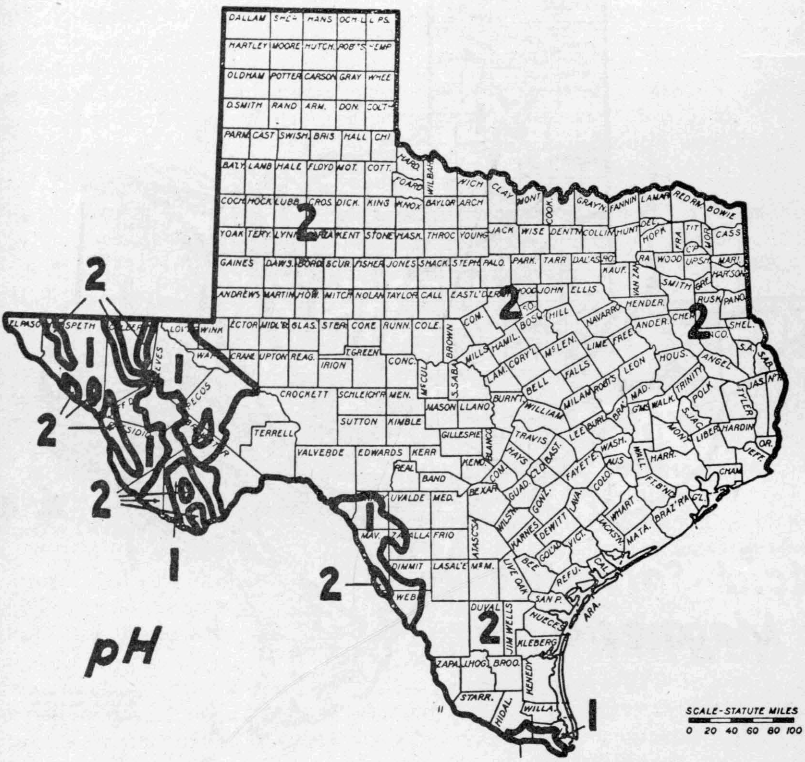


Figure 11. Intensity of acidity or alkalinity (pH) of upland surface soils. Grade 2, pH 6.1 to pH 7.5 (practically neutral); Grade 1, pH 7.6 and up (alkaline).

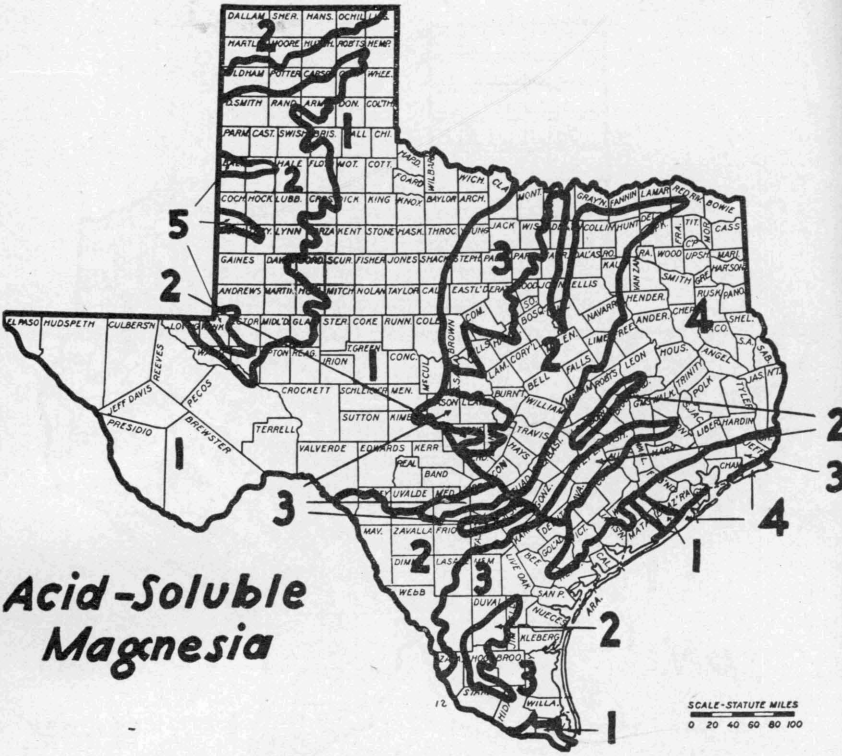


Figure 12. Acid-soluble magnesia in upland surface soils.
Grade 5, 0 to .07 per cent; Grade 4, .08 to .15; Grade 3, .16 to .30; Grade 2, .31 to .60; Grade 1 61 per cent and up.

## SUMMARY

The average chemical composition of soils of about 100 of the most important soil series in Texas is presented and discussed. These averages are derived from the analyses of several thousand samples of soils.

The constituents of these soils are classified in five grades, according to the quantity present, Grade 1 being the highest and Grade 5 the lowest grade. The grades have been designated in such a way as to carry the highest possible significance permitted by the present state of our knowledge. Nitrogen, phosphoric acid and potash are most likely to be deficient for plant growth when the quantities of total nitrogen, the active phosphoric acid and the active potash in the soil have Grade 5. Grade 1 for these constituents indicates that the soils are quite fertile provided the physical and environmental factors are also favorable for plant growth. The soils are more likely to become acid when the basicity of lime has Grade 5, and soils with the degree of acidity expressed by pH of Grade 5 will certainly need liming. Soils of Grade 1 or 2 in lime or basicity will probably not need liming.

The composition of the soil types of the Gulf Coast Prairie, East Texas Timber Country, the Blackland Prairies, the Grand Prairie, the West Cross Timbers, the Central Basin, the Rio Grande Plain, the Edwards Plateau, the Rolling Plains, the High Plains, and the Mountains and Basins, as well as classifications of their constituents by grades, are given in a number of tables. The average composition in sulphur, ferric oxide, manganese, total exchange capacity, and phosphoric acid absorbed are given for some of the areas.

Maps showing the prevailing grades of the constituents of the upland surface soils in the various parts of the State are given for total nitrogen, active phosphoric acid, total phosphoric acid, active potash, acid-soluble potash, total potash, acid-soluble lime, basicity, acidity, and acid-soluble magnesia. These maps show that Texas has large areas of soils low in phosphoric acid and nitrogen, as well as some areas high in these constituents. Areas low in potash are smaller than those low in nitrogen and phosphoric acid and the areas high in potash are larger. The western part and the extreme southern part of the state are usually higher in nitrogen, phosphoric acid and potash than the eastern part. In general, Texas soils are well supplied with lime. Areas high in lime are found in the central and western parts of the state. Some areas in the eastern part of the state are low in lime, and some of the soils of these areas may become sufficiently acid to require liming. Texas soils are not likely to be deficient in magnesia, iron, or manganese. Alluvial soils (not shown on the map) are better supplied with plant food than are upland soils of the same region.

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