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FACT SHEET

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CROP FERTILIZATION ON TEXAS HIGH PLAINS SOILS

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The High Plains of Texas is an isolated, broad, piedmont apron encompassing about 19 million acres (figure 1). About 7.8 million acres are in cropland and approximately 6 million acres are irrigated.

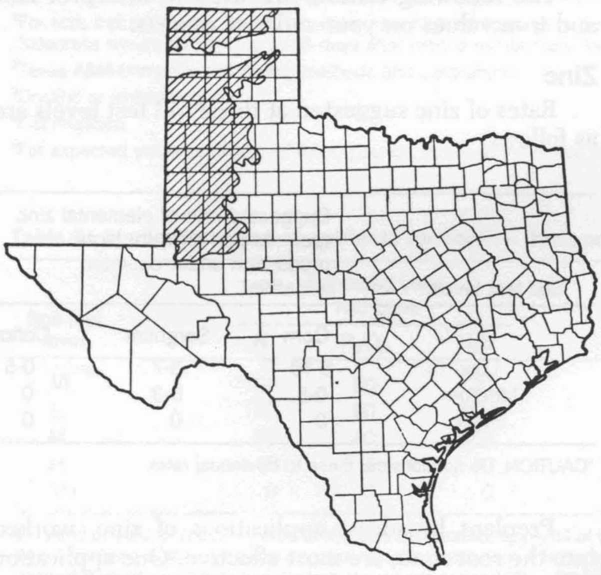

Figure 1. Location of High Plains region.

Soils and Soil Characteristics

Soils vary from loamy sand in the southwest to clay loams and silty clay loams in the northeast. High Plains soils vary not only in morphological characteristics but in native fertility levels and crop yield potential. Soils of this region are similar in that they have developed under grass vegetation in a subhumid climate.

Because of low rainfall, very little calcium carbonate (lime) has leached from these soils. At depths of 2½ to 5 feet, a zone of lime has accumulated.

These soils developed from mineral deposits high in potassium. Therefore, high amounts of mineral and exchangeable potassium persist even after extended cropping.

Drought and wind erosion are problems. Wind can remove substantial amounts of topsoil and alter the productive capacity of the soil if control measures are not taken. Hardpans occasionally occur under irrigation and require deep plowing or chiseling. Soil management to correct and improve the soil's physical condition for crop production is important in the High Plains region.

Soil Fertility Status

Soil fertility levels in High Plains soils vary widely due to previous fertilization, cropping and soil properties. This variability is illustrated by soil test summary data in table 1.

Table 1. Percentage distribution of High Plains soils in five ranges for pH, organic matter, phosphorus and potassium.

Soil test level[1]	Organic matter	Phos-phorus	Potas-sium %	Soil pH range	%
VL	28	36	0	Below 6.6	1
L	64	22	0	6.6-7.3	9
M	8	18	1	7.4-7.8	35
H	0	19	4	7.9-8.3	50
VH	0	5	95	8.4-9.7	5

[1]Soil test summary data from Texas Agricultural Extension Service Soil Testing Laboratories. (1971 to 1972).

Crop yields and fertilizer returns depend on the level of available nutrients in the soil. Soil tests provide information about nutrient levels in soils. These levels are related to probable response to

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nitrogen (estimated from soil nitrate-nitrogen analysis), phosphorus, potassium and other nutrients. When seeking maximum returns, producers utilizing high fertility rates should soil test their fields annually. For information about collecting soil samples and using soil testing services, contact your local county Extension agent.

N, P_2O_5 and K_2O for Major Crops

Although High Plains soils are relatively high in native fertility when compared with soil from other regions, the concept that nitrogen is the only nutrient required for sustained high production is not valid.

Nitrogen is generally the first nutrient to become deficient and is required in large quantities for most non-legume crops. Phosphorus is usually the second limiting nutrient in this production region. Occasionally, low levels of potassium, zinc, iron and copper are detected also.

Tables 2 through 8 present the amounts of nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) suggested to attain desired yield levels at various nutrient levels (as determined by soil tests). In addition to fertility, the expected yield is influenced by producer experience, management, climatic conditions and cultural practices.

To use these tables, first locate the appropriate crop, then find the soil test level for the nutrient on your soil test report: very low (VL), low (L), etc., in the left column. Next select the "Expected Yield" column and determine the rate of N, P_2O_5 and K_2O to apply. For example, using table 2, a soil with a low level of nitrogen, a low level of phosphorus and a very high level of potassium would show a 30-30-0 per acre for an expected yield of 1 bale per acre of cotton or 60-60-0 for a 2-bale-per-acre yield. In selecting an "Expected Yield," consider production and management inputs such as irrigated, cultural practices and any yield-limiting factor.

If information on a soil test report differs from these general guidelines, an error is not necessarily indicated. Additional factors are evaluated when arriving at fertilizer use suggestions on the soil test report. Questions regarding the soil test report can be clarified by contacting your county Extension agents or the Soil Testing Laboratory.

Calcium, Magnesium and Sulfur

High Plains soils generally are high in calcium and magnesium and deficiencies of these nutrients are encountered rarely. These two nutrients are predominant in the soil and are responsible for the alkaline condition (pH 7.2 to 8.3) of most area soils. High pH values above 8.3 generally are caused by sodium accumulations. Sulfur, another secondary nutrient, also occurs as sulfates in irrigated water at levels sufficient to meet crop needs. Some fertilizers also are formulated with various sulfur materials. For these reasons, supplemental sulfur applications are not generally needed for crop production in this area. The extent to which this element gives yield responses is under study.

Micronutrients

Seven elements — iron, zinc, manganese, copper, boron, molybdenum and chlorine — are classified as micronutrients because of the small quantities required by crops. Numerous soil conditions affect the availability of micronutrients, and crops differ in their capacity to obtain these nutrients from the soil. Of the seven micronutrients, only iron and zinc are considered problems in the Texas High Plains. Iron deficiency, as characterized by yellowing between the veins of sorghum and other grass-type plants is common on high lime soils. Zinc deficiencies have been observed on corn, sorghum and cotton in isolated high lime soils, in areas that have received excessive applications of phosphates and in cut areas where topsoil has been removed.

Generally, crops grown on high lime (caliche) soils and/or those high in phosphorus are frequently deficient in iron or zinc. Also, some sandy soils are inherently low in some micronutrients.

The following criteria are used to interpret zinc and iron values on your soil test reports.

Zinc

Rates of zinc suggested at three soil test levels are as follows:

Soil test levels	Suggested rate of elemental zinc (pounds per acre) for high production under optimum irrigation*		
	Corn	Sorghum	Cotton
Low	5-10	3-7	0-5
Medium	0-5	0-3	0
High	0	0	0

*CAUTION: Do not consider these to be annual rates.

Preplant broadcast applications of zinc, worked into the root zone, are most effective. One application of 3 to 10 pounds of elemental zinc (15 to 30 pounds of 36 percent zinc sulfate or equivalent) should provide sufficient zinc for 3 to 4 years. Retest for zinc before applying more. If fertilizer banding is practiced, use lower rates.

To correct zinc deficiencies, consider using inorganic sources such as zinc sulfate. Blend this material with dry fertilizers or mix with suspension fertilizer. Zinc chelates may be used effectively at about one-fourth the elemental zinc rate of inorganic zinc materials.

Should symptoms of zinc deficiency be observed in growing crops, foliar application can be effective. See L-721, *Zinc Deficiency and Fertilization*, which is available at the office of your county Extension agent.

Table 2. Application rates of nutrients for cotton — four production levels.

Soil test level[1]	Expected yield[2] 1 bale/A			Expected yield [2,3] 1½ bales/A			Expected yield[3] 2 bales/A			Expected yield[3] 2½ bales/A		
	N	P_2O_5	K_20	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	40	40	30	60	60	50	80	80	80	100	80	80
L	30	30	20	40	40	40	60	60	60	80	60	60
M	20	20	20	20	20	20	40	40	40	60	40	40
H	0	0	0	0	0	0	0	0	0	0	0	0
VH	0	0	0	0	0	0	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Dryland or limited irrigation.

[3]Limited to full irrigation.

Table 3. Application rates of nutrients for grain sorghum — four production levels.

Soil test level[1]	Expected yield[3] 2,000 lb/A			Expected yield[3,4] 4,000 lb/A			Expected yield[4] 6,000 lb/A			Expected yield[4,5] 8,000 lb/A		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	30	20	20	80	40	80	120	60	100	160	80	120
L	20	20	20	60	40	50	100	40	80	140	60	100
M	0	0	0	40	0	0	80	20	60	120	40	80
H	0	0	0	0	0	0	40	0	40	80	0	40
VH	0	0	0	0	0	0	0	0	0	0	0	0

[1]For soils that take water rapidly or where very high nitrogen rates are to be banded, apply about half the N and all the P_2O_5 and K_2O where needed. Sidedress remainder of N within 35 days after crop is established. Avoid root pruning.

[2]Texas A&M University soil testing methods and calibrations.

[3]Dryland or limited irrigation.

[4]Full irrigation.

[5]For expected yields in excess of 8,000 pounds, increase the N rate by 20 pounds for each 1,000 pounds.

Table 4. Application rates of nutrients for corn — three production levels under irrigation.[1,2]

Soil test level	Expected yield 100 bu/A			Expected yield 150 bu/A			Expected yield 200 bu/A		
	N	P_2O_5	K_20	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	120	80	130	180	80	140	240	100	180
L	100	60	100	140	60	120	160	80	140
M	80	40	80	100	40	100	120	50	100
H	40	0	40	60	0	60	80	20	40
VH	0	0	0	0	0	0	40	0	0

[1]On sand or soils where high rates of N are to be banded, apply all of P_20_5, K_20 and part of N preplant. Sidedress N before initiation of fourth to fifth leaf. When applying N through pivot irrigation system, apply one-third preplant, one-third sidedress and one-third through irrigation system. Nitrogen rates applied through pivot irrigation system should not exceed 20 to 25 lb/A of N per given irrigation.

[2]Texas A&M University soil testing method and calibration.

Table 5. Application rates of nutrients for alfalfa — three production levels.[1,2]

Soil test level	Expected yield 4 tons/A			Expected yield 6 tons/A			Expected yield 8 tons/A		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_20
VL	0	60	120	0	100	160	0	140	200
L	0	40	80	0	80	120	0	120	160
M	0	40	40	0	50	80	0	100	120
H	0	0	0	0	40	40	0	80	80
VH	0	0	0	0	0	0	0	40	40

[1]Texas A&M University soil testing methods and calibrations.

[2]Include 20 to 30 pounds of N per acre for new planting.

Table 6. Application rates of nutrients for wheat — four production levels with moderate grazing.[1]

Soil test level[2]	Expected yield[3] 20-30 bu/A			Expected yield [3,4] 40 bu/A			Expected yield [4] 60 bu/A			Expected yield[4] 80 bu/A		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	30	20	20	80	40	40	120	50	50	140	60	60
L	20	0	0	60	20	20	100	40	40	120	50	50
M	0	0	0	40	0	0	60	30	30	100	40	40
H	0	0	0	0	0	0	40	0	0	60	0	0
VH	0	0	0	0	0	0	0	0	0	0	0	0

[1]For sand, apply all the P_2O_5 and K_2O and part of the N preplant. Topdress remainder of N before joint stage. For clay, apply all the fertilizer before planting. On sprinkle irrigated soils, apply one-third of N preplant and apply remainder of N through irrigation system. N rates applied through system should not exceed 20 to 25 lb/A per given irrigation.

[2]Texas A&M University soil testing methods and calibrations.

[3]Dryland or limited irrigation.

[4]Full irrigation.

Table 7. Application rates of nutrients for established common and improved hybrid bermudagrass — two production levels.[1]

Soil test level[2]	Expected yield 4 tons/A			Expected yield 8 tons/A		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	120	80	100	300	100	200
L	100	60	80	180	80	160
M	60	0	40	140	60	120
H	0	0	0	80	0	60
VH	0	0	0	0	0	0

[1]Apply 100 pounds N, all the P_2O_5 and half the K_2O where K_2O rates are heavier than 80 pounds in the spring ahead of irrigation. Apply remainder of nitrogen in 50- to 70-pound increments after each time grass is grazed or cut. Remove cattle before fertilizing and defer grazing for at least a week after irrigation is complete.

[2]Texas A&M University soil testing methods and calibrations.

Table 8. Application rates of nutrients for forage sorghums and sudan-sorghum types — two production levels.[1,2,3]

Soil test level	Medium production			High production		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	80	40	40	140	80	80
L	60	30	30	100	60	60
M	40	0	0	60	40	40
H	0	0	0	30	0	0
VH	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Divide N application into 40- to 60-pound applications with one application preplant and an additional similar application after each time grass is cut or grazed and just before irrigation.

[3]If grazed, allow time for regrowth after top dressing.

Iron

Soil test values for iron below 2.5 parts per million (low) normally are deficient in iron. Susceptible crops such as sorghum, sudan and soybeans exhibit chlorosis symptoms at these soil iron levels. Certain corn hybrids also may show chlorosis. The only proven and practical control of iron deficiency is through foliar iron application, since soil applications of iron have generally been ineffective. See Extension leaflet L-723, *Identifying and Correcting Iron Deficiency in Field Crops,* for information on correcting iron deficiency problems.

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