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FACT SHEET

L-1411

FIELD AND FORAGE CROP FERTILIZATION IN THE RIO GRANDE PLAINS

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The Rio Grande Plains is an important agricultural region containing about 19 million acres as outlined in figure 1. Most agricultural land is used for field and forage crops, vegetables, citrus and rangeland for cattle.

Soil characteristics

Surface soils vary from coarse sands to clays. Subsoils also vary, but most are high in clay. Due to lowered annual rainfall from east to west and its erratic distribution, crop yield potential varies greatly within the region. Most soils are alkaline and many contain free calcium carbonate. Some local areas are acid and require limestone. Both physical and chemical properties of soil vary throughout the region. Inadequate drainage, salinity, acidity, alkalinity and low nitrogen (N) and phosphorus (P_2O_5) levels are problems that must be overcome for profitable agricultural production.

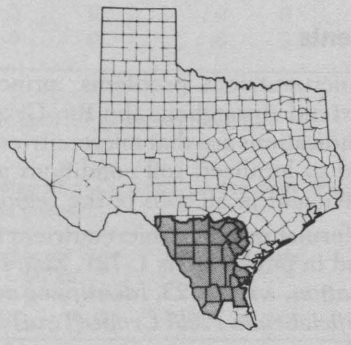

Fig. 1. Location of Rio Grande Plains

*Welch and Gray — Extension soil chemists, College Station; Pennington and Colburn — area Extension agronomists, Weslaco and Uvalde respectively; Hoverson — area Extension forage specialist, Weslaco; and Mulkey — assistant professor, Texas Agricultural Experiment Station, Uvalde, all in The Texas A&M University System.

Soil fertility status

Soil characteristics, past fertilization and cropping practices account for a wide range of nutrient levels throughout the region. Soil test summary data are available for each major crop-producing county and are useful for identifying general soil fertility problems.

The distribution of soil samples in nutrient levels and pH ranges is shown in table 1. Nitrogen levels are not shown but are generally low, except after a fallow period following legume production or high nitrogen fertilization.

Phosphorus is the second most commonly deficient nutrient. Slightly more than 50 percent of the samples tested were low or very low, while 30 percent were high. The latter percentage is significant because it indicates that extra phosphorus is not needed for most crops. However, to properly determine the

Table 1. Percentage distribution of Rio Grande Plains soils in 5 levels for calcium (Ca), Magnesium (Mg), Phosphorus (P) and Potassium (K) and 5 pH ranges (1553 samples).

Soil test level*	Percentage of samples at each level				Soil pH range	Percent
	Ca	Mg	P	K		
VL	0	–	33	1	Below 5.0	0
L	1	2	19	3	5.1 - 5.5	1
M	7	14	18	6	5.6 - 6.0	2
H	23	84	21	23	6.1 - 6.5	10
VH	69	–	9	67	Above 6.5	87

*From Texas Agricultural Extension Service Soil Testing Laboratory 1970-72.

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phosphorus status of soils, it is necessary to test a sample from each field. Potassium (K_2O) was high or very high for 90 percent of the samples.

Rates of N, P_2O_5 and K_2O for major crops

The wide range in rainfall, soil fertility levels and cultural and irrigation management practices in the Rio Grande Plains region results in considerable variation in rates of added nutrients required for economical production. Soil tests, calibrated to express available nutrients and correlated with crop response, are the best guide to profitable fertilization. Two important criteria for selecting the profitable rate of each nutrient are (1) the level of available nutrient in the soil, and (2) the expected yield or production potential.

Rates of N, P_2O_5 and K_2O at varying soil test levels and expected yields for major crops are shown in tables 2 through 11. Tables are based on soil tests conducted at Texas A&M University or with the same methods. Suggested rates of application are valid only if tests were made by these procedures.

Table 2. Rates of N for grain sorghum cotton and corn at varying yield levels and soil conditions.

Crop and yield level	Productive soils that have been fallow 6 months or more	Sandy soils and immediately after another crop
Grain Sorghum		
lbs/acre		
3000	0	50
4500	25	75*
6000	50	100*
Cotton		
bales/acre		
¾-1	0	50
1½	25	75*
2	50	100*
Corn		
bu/acre		
60	0	60
90	40	90*
120	80	120*

*May be applied ½ preplant - ½ sidedressed.

Table 3. Rates of P_2O_5 and K_2O for grain sorghum at varying soil levels and expected yields.

Soil level	Expected yield 3,000 lbs.		Expected yield 4,500 lbs.		Expected yield 6,000 lbs.*	
	P_2O_5	K_2O**	P_2O_5	K_2O**	P_2O_5	K_2O**
VL	40	30-40	50	40-50	60	50-60
L	30	20-30	40	30-40	50	40-50
M	20	0-30	30	0-30	40	30-40
H	0	0	0	0	30	0-30
VH	0	0	0	0	0	0

*Irrigated.

**Only sandy soils are expected to be low.

An estimate of expected yield should be based on past experience, anticipated rainfall and irrigation, management, cultural practices and other factors that affect yields. The expected yield should reflect the best judgement of the producer and his advisors about the potential for the production system.

To use these tables, select the nutrient level from the left column and read across to the expected yield column to determine the amount of nutrient needed. For example, in tables 2 and 3 a soil low (L) in nitrogen, medium (M) in phosphorus and high (H) in potassium would have a suggested rate of 40-20-0 for ¾ bale of cotton and 75-40-0 for 4,500 pounds of grain sorghum.

Calcium, magnesium and sulfur

Approximately 90 percent of the samples tested rated high in calcium, while 84 percent rated high in magnesium. Thus, deficiencies are not widespread. These two nutrients are associated with soil clays and are responsible for the alkaline condition (up to pH 8.3) of most soils. Higher pH values generally indicate the presence of exchangeable sodium.

Sulfur, the third secondary nutrient, occurs in irrigation water in sulfate form. Sulfur needs for crops in the Rio Grande Plains have not been identified. It is added to the soil in several ways. Some sulfur enters the soil from waste released into the atmosphere by industrial plants and by the use of fertilizers made from materials containing sulfur.

The use of higher rates of major nutrients coupled with the use of sulfur-free fertilizer materials and the use of irrigation water low in sulfates may result in more future concern for this nutrient in the Rio Grande Plains.

Micronutrients

Some micronutrient problems, principally iron and zinc, extend throughout the Rio Grande Plains. However, indications are that micronutrient problems are confined to localized soil conditions and are not generally deficient in all soils of the region.

More information about micronutrient fertilization can be found in publications L-721, *Zinc Deficiencies and Fertilization*, and L-723, *Identifying and Correcting Iron Deficiency in Field Crops* (Texas Agricultural Extension Service).

Conversion Factors

Fertilizers containing phosphorus and potassium are labeled as percent P_2O_5 and K_2O and soil test values are reported in these terms. However, plant analyses results usually are reported as *percentages of the element*. For this reason, the following factors are

presented for use in converting from one form to the other:

From P_2O_5	to P	multiply P_2O_5	by .44
From P	to P_2O_5	multiply P	by 2.3
From K_2O	to K	multiply K_2O	by .83
From K	to K_2O	multiply K	by 1.2.

Salinity and sodium

A substantial acreage in the Rio Grande Plains is affected by soluble salts (salinity) or sodium, or possibly both.

A salt-affected (salinity or saline) soil is one that contains enough water-soluble salt to affect the growth of plants. Improvement generally requires eliminating the source of salt and leaching the salt below the root zone. Soil salinity tests can be obtained from the Extension Soil and Water Testing Laboratory at Texas A&M University. For sampling instructions, obtain a copy of form D-616, *Information Sheet for Salinity Analysis of Soil Samples* (Texas Agricultural Extension Service) from your county Extension office.

Sodium-affected soil is high enough in sodium to cause compaction, poor aeration and other undesirable physical conditions. Improvement requires addition of gypsum and leaching to remove the sodium.

Before investing in reclamation practices for either salt-affected or sodium-affected soils, make a thorough study of the problem and its causes.

Table 4. Rates of P_2O_5 and K_2O for cotton at varying soil levels and expected yields.

Soil level	Expected yield ¾ - 1 bale		Expected yield 1½ bales*		Expected yield 2 bales*	
	P_2O_5	K_2O**	P_2O_5	K_2O**	P_2O_5	K_2O**
VL	30-40	30-40	50	40-50	70	50-60
L	20-30	20-30	40	30-40	50	40-50
M	0	0	30	20-30	30	30-40
H	0	0	0	0	20	0-30
VH	0	0	0	0	0	0

*Irrigated.

**Only sandy soils are expected to be low.

Table 5. Rates of P_2O_5 and K_2O for corn at varying soil levels and expected yields.

Soil level	Expected yield 60 bu.		Expected yield 90 bu.*		Expected yield 120 bu.*	
	P_2O_5	K_2O*	P_2O_5	K_2O**	P_2O_5	K_2O**
VL	60	50-70	70	60-80	80	70-90
L	50	40-60	60	50-70	70	60-80
M	40	30-50	50	40-60	60	50-70
H	0	0	40	30-50	50	40-60
VH	0	0	0	0	0	0

*Irrigated.

**Only sandy soils are expected to be low.

Table 6. Fertilization of peanuts – irrigated and dryland.

Soil test level	Dryland			Irrigated		
	N	P_2O_5	K_2O*	N	P_2O_5	K_2O*
VL	0	40	30-40	0	60	50-60
L	0	30	20-30	0	40	40-50
M	0	0	0	0	30	30-40
H	0	0	0	0	0	0
VH	0	0	0	0	0	0

*Only sandy soils may be medium or low.

Table 7. Fertilization of small grain for grain and grazing.

Soil test level	Small grains for grain only			Small grains for grazing only or grazing plus grain		
	N	P_2O_5	K_2O**	N*	P_2O_5	K_2O**
VL	60	40	30-40	120-180	60	50-60
L	40	30	0-20	80-120	40	40-50
M	30	20	0	60	30	0-30
H	0	0	0	0	0	0
VH	0	0	0	0	0	0

*Use the higher rate of nitrogen under irrigated production. Apply half of nitrogen at planting and the remainder in early February.

**Only very sandy soils may be medium or low.

Table 8. Fertilization of spring wheat for grain.

Soil test level	Mexican spring wheat for grain		
	N*	P_2O_5	K_2O**
VL	60-90	50	40-50
L	50-70	40	30-40
M	40-60	30	0-30
H	0	0	0
VH	0	0	0

*Use the higher rate on fully irrigated wheat.

**Only very sandy soils may be medium or low.

Table 9. Total annual rates of N to produce varying yields of 8 to 10% crude protein hay for summer perennial grasses.*

Yield tons/acre**	Deep alluvial productive soil***	Average soil***
4	120	180
6	210	240
8	320	360
10	410	480
12	560	600

*Includes Coastal, Coast Cross I, Star, Klein, Buffel, Bell Rhodes and other similar grasses. Results of demonstrations show that unfertilized yields are 1½ to 2 tons per acre.

**Eight tons can only be expected under more favorable rainfall and 12 tons under irrigation. Extrapolate for other yield levels.

***Rates above 60 lbs. should be divided into two or more applications.

Table 10. Rates of P_2O_5 and K_2O for varying yields of perennial grasses growing on soils with different soil levels.*

Soil level	Expected yield 4 tons		Expected yield 8 tons**		Expected yield 12 tons**	
	P_2O_5	K_2O	P_2O_5	K_2O	P_2O_5	K_2O
VL	40	30-50	80	70-90	120	110-130
L	30	20-40	60	50-70	90	80-100
M	0	0	40	30-50	60	50-70
H	0	0	0		30	30-40
VH	0	0	0		0	0

*For Coastal, Coast Cross I, Star, Klein, Buffel, Bell Rhodes and other productive grasses.

**Eight tons can only be expected under more favorable rainfall and 12 tons under irrigation. Extrapolate for other yield levels.

Table 11. Application rates of nutrients for forage sorghums—dryland and irrigated.

Soil test level	Dryland			Irrigated		
	N	P_2O_5	K_2O**	N*	P_2O_5	K_2O**
VL	60	40	40-50	150	80	80-120
L	50	30	30-40	120	60	60-80
M	40	20	0-30	100	40	40-60
H	0	0	0	0	0	0-40
VH	0	0	0	0	0	0

*Should be divided into 50-60 pound applications with one application preplant and additional application after each time hay is cut or grazed down and just ahead of irrigation.

**Only sandy soils may be medium or low.

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