Texas Agricultural Extension Service
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Fertilizing Summer Perennial Pastures

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There are more than 20 million acres of perennial summer pastures in Texas, such as bermudagrass, bahiagrass, buffelgrass, kleingrass, bluestem and other introduced grass species. Most of the acreage is on soils which are low in native fertility. Much of the acreage formerly was cropland which had become unprofitable from mismanagement.

Fertilizer must be applied on these low fertility soils for sustained forage quality and growth.

Advantages of Fertilization

There are several reasons for fertilizing summer pastures:

- Increased forage production
- Improved forage quality, especially protein
- Improved root system and sod density
- Reduced weed density
- Reduced soil erosion
- Improved efficiency of rainfall and/or irrigation

Fertilization enables the landowner/manager to grow more forage on fewer acres, thereby increasing income potential.

The perennial warm season grass species have high yield potential but are the lowest quality of all forage species. Without fertilization, most perennial pasture grasses become stemmy, coarse, low in protein (4 to 8 percent), and weeds become prevalent because of stand reduction.

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Table 1. shows the effect of nitrogen on yield, protein control, production and water efficiency.

Improved Water Efficiency

With adequate fertilization, the efficiency of rainfall and/or irrigation water is greatly enhanced. Numerous research and demonstration tests show that without fertilization 16 to 20 inches of water is necessary to produce one ton of low quality forage. With adequate fertilization, one ton of good quality forage can be produced with 4 to 6 inches of water. This means that for an area receiving 34 inches annual rainfall (Table 2), two tons of forage per acre would be considered maximum production without fertilization. With adequate amounts of fertilizer, 7 to 8 tons of forage could be produced most years with 34 inches of rainfall. Thus, adequate fertilization provides *three* to *four* times as much forage on the same acrage and the forage will be better quality.

Table 2. Forage production at various levels of annual rainfall.

Annual Rainfall Inches	Tons Forage Per Year, Potential* Without Fertilizer	Adequate Fertilizer
30	1.0-1.5	5-7
35	1.5-2.0	7-8
40	2.0	8-10
45	2.5	10

*Assumes drainage, soil depth and other conditions satisfactory for grass growth.

Table I. Effect of nitrogen on yield, protein content and water use.

Annual Rate of Nitrogen	Tons of Hay Per Acre	Percent Crude Protein in Hay	Pounds of Protein Per Acre	Inches of Water Per Ton of Hay
0	2.67	8.0	420	17.6
100	4.38	9.1	800	10.7
200	5.93	10.5	1240	7.9
400	8.59	11.7	2010	5.5

Improved Protein Content

Protein is one indicator of quality. Generally, a higher protein forage means a more digestible forage. Grass growing on unfertilized areas generally produces a total of 1½ tons of forage with 6 percent or less protein.

Nitrogen content of the forage is a direct measure of its protein content. Forage analysis in the laboratory is for total nitrogen. The nitrogen content is multiplied by 6.25 and reported as percent crude protein. Thus, a forage containing 1 percent nitrogen contains 6.25 percent crude protein. A forage containing 2 percent nitrogen contains 12.50 percent crude protein.

Table 3 shows the amount of protein contained in forage at various production levels and nitrogen contents. For example: six tons of hay with 12.5 percent protein contains 240 pounds of nitrogen in the stems and leaves. This means that more than 240 pounds of nitrogen must be available to provide for nitrogen in the forage, roots and losses from leaching and volatilization. As a rule of thumb, apply 50 pounds of nitrogen for each ton of forage you expect to produce.

Other Nutrients Necessary

Although nitrogen usually enhances green color and rate of growth, other nutrients are essential for optimum forage growth and quality.

Many soils in Texas are low in native *phosphorus*. Grasses recover phosphorus inefficiently. Much of the applied phosphorus becomes unavailable to plant roots because of chemical tie-up in the soil.

Most forages use as much *potassium* as nitrogen; in some cases even more. Many pasture soils had satisfactory levels of soil potassium under native conditions. However, with increased grazing and haying, soil potassium levels have declined. This is especially true on sandy soils in east and central Texas and certain other parts of the state.

Test Soils and Analyze Plants

Many nutrients are needed for optimum growth and quality of forages. Each ton of good quality forage contains approximately 40-12-35 ($N\text{-}P_2O_5\text{-}K_2O$), in addition to sulfur, magnesium, calcium, zinc, iron, boron and other nutrients. A soil test is the best way to determine which nutrients and amounts are needed for optimum growth. Current soil tests are revealing nutrient deficiencies in some areas of Texas which previously were thought to be adequately supplied with these nutrients.

Forage or plant analyses throughout the growing season can show if the forage contains adequate amounts of nutrients for efficient production. Recycling of nutrients when cattle are grazing at high stocking rates can reduce fertilizer needs after several years of grazing and high levels of fertilization. A soil test is a good tool to help establish annual fertilizer needs.

Soil pH and Limestone Application

Soil pH is a measure of soil reaction or acidity or alkalinity. A pH of 6.0 to 7.2 is desirable for root growth and fertilizer efficiency for most crops. As the pH decreases, fertilizer nutrients are less efficient and root growth is restricted. As soil pH decreases, aluminum, manganese and some other nutrients are more soluble and may become toxic to plant roots. Applying limestone and incorporating it into the soil is an effective way to correct soil acidity. Use a high quality, finely ground limestone for fastest results. Table 4 shows how low pH (acid soil) restricts fertilizer efficiency.

Soil acidity is most likely to occur on sandy soils in high rainfall areas, but recent soil analyses from other parts of the state indicate soil acidity to be a potential problem under certain conditions.

Table 4. Soil pH affects efficiency of fertilizer nutrients.

	Relative Nutrient Efficiency Percent Applied		
Soil pH	Nitrogen	Phosphate	Potash
4.5	30	25	35
5.0	55	35	50
5.5	75	50	75
6.0	90	50	100
7.0	100	100	100

Time to Apply Fertilizer

Fertilizer should be applied to pastures before rainfall occurs. Waiting for a rain before applying fertilizer is a mistake. Producers in the drier areas of Texas (west of interstate highway 35) where rainfall is less predictable, are experiencing favorable results by applying high rates of fertilizer in the spring. This encourages grass growth by utilizing spring rainfall.

Table 3. Nitrogen and protein content of forage at various production levels.

Hay Content Percent		Pounds of Nitrogen Contained in Tons of Hay			
Nitrogen	Protein	2 Tons	4 Tons	6 Tons	8 Tons
1	6.25	40	80	120	160
2	12.50	80	160	240	320
3	18.75	120	240	360	480

In the area of Texas where spring rainfall generally is abundant, withholding fertilizer until most of the spring rains have occurred is a good way to minimize leaching and reduce excess forage growth, while encouraging growth during the drier season.

Suggestions for applying specific nutrients include:

Nitrogen (N). Generally, nitrogen is used with greater efficiency than most other nutrients. Grass production is more uniform if 50 to 80 pounds of nitrogen are applied every 4 to 8 weeks throughout the growing season rather than heavier amounts less often. Three applications of 80 pounds of nitrogen per acre in the spring, early summer and later summer can provide enough grass for a stocking rate of one and a half to two animal units for the grazing season (240 days). Fertilized grass should be grazed within a 4- to 6-week period or the excess forage should be harvested for hay.

For optimum forage quality, apply 50 to 70 pounds nitrogen every 21 to 26 days, cut hay or graze heavily, and shred the grass short to remove coarse stems and allow for fresh new growth.

Phosphorus (P_2O_5). Phosphorus may be applied at one time in the spring, or in smaller amounts with each nitrogen application. The latter method will improve fertilizer efficiency and maintain more uniform quality. Because phosphorus moves slowly into clay soils, application during moist conditions promotes root growth and better production. Fall and winter applications are satisfactory where small grains or legumes are to be grown in the winter season. Phosphorus application in the fall should be high if you want to have good legume growth.

Potassium (K_2O). Forages usually contain 30 or more pounds of potassium per ton of dry forage. Low soil potassium levels result in decreased growth, thin stands, disease and winter kill. High rates of potash are a must when haying and should be split into several applications through the season along with nitrogen. If grazed only, potassium needs are greatly reduced.

Other nutrients. Sulphur, magnesium, zinc and boron should be applied as indicated by soil or plant tests. Remember, for production of large quantities of quality forages, all nutrients must remain in balance.

Pasture Management Important

Growing forage by applying fertilizer is one of the easiest management practices the forage producer experiences. During seasons of abundant rainfall, forage grows rapidly and becomes low quality if not utilized properly. The highest quality forage is the leafy, immature material. When excess growth occurs, harvest forage as good quality hay. This encourages new leaf growth and improves livestock performance. Apply herbicides to control weeds and insecticides to control insects.

Decide how much forage is needed for the number of cattle to be grazed. Green pastures are pretty, but can be very costly if the forage is used inefficiently.

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