



Fertilizing Bermudagrass

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Bermudagrass (*Cynodon dactylon*) is the dominant introduced warm-season perennial forage grass in southern Oklahoma and northern Texas. It has many characteristics that make it a desirable forage base for cattle – it responds well to fertilizer, thrives in a variety of soil conditions, tolerates heavy grazing pressure and persists through adverse environmental conditions. There are many strategies to consider in fertilizing bermudagrass. The goal of the producer is paramount. If he desires to run the maximum number of cattle on his operation, the Noble Foundation helps accomplish this goal with an aggressive and targeted fertilization program on bermudagrass. If he wants to produce fewer cattle with limited inputs, the Foundation manipulates fertilizer rates to accomplish this goal. Bermudagrass is an excellent species to use to manage cattle numbers by varying fertilizer rates.

Soil Testing

Noble Foundation fertilization recommendations begin with the use of soil testing. A good soil test allows producers to determine whether or not to lime and how much phosphorus (P) and potassium (K) to use. Soil testing can also determine if enough residual nitrogen (N) is in the soil to reduce N fertilizer recommendations. Soil testing can further determine if toxic levels of some substances, such as salt, are present in the soil.

A good soil testing program is dependent upon taking a good sample. The Foundation recommends testing every field of introduced forages at least once every three years. A sampling depth of 0 to 6 inches is recommended. Cores should be collected from a minimum of 12 places within the field and thoroughly mixed to make up one sample. An additional 6- to 12-inch sampling depth is recommended if there is interest in determining whether residual nitrogen exists. Problem areas should be sampled separately.

The Noble Foundation has a video, "Unless You Test It's Just a Guess," that examines the need for soil testing and demonstrates correct sampling procedures.

Liming

The Noble Foundation recommends liming forage legumes and alfalfa when the soil pH drops below 6.0. The Foundation recommends liming bermudagrass when the soil pH drops below 5.0, and all other species when the soil pH drops below 5.5.

Some believe that the Foundation's critical pH for bermudagrass is too low. However, research (Table 1) in both Texas and Louisiana (Hillard, et al., Haby, and Eichhorn, et al.) shows that bermudagrass is very acid tolerant. The Foundation feels that inputs are better spent on fertilizer than lime until the soil pH drops below 5.0 on bermudagrass.

Table 1. A brief summary of research on response of bermudagrass to lime.

Location	Researcher	Finding
Arkansas	Phillips, et al.	No response to lime on bermudagrass at pH 5.9
Texas	Hillard, et al.	No response to lime on bermudagrass at pH 4.7
Texas	Haby	No response to lime on bermudagrass at pH 4.3, but ryegrass responded to lime at pH 5.3
Louisiana	Eichhorn	No response to lime on bermudagrass at pH 4.9

Much of the bermudagrass acreage in our area is also managed for annual ryegrass, and the Foundation recommends liming this production system when the pH drops below 5.5 for optimum production of the ryegrass.

Nitrogen Rate

Usually, the most limiting nutrient in bermudagrass production is nitrogen. Nitrogen is vital to plants for optimum growth. Deficiencies of nitrogen appear as pale green color in the plants, very poor growth and yield and low protein.

The optimum nitrogen rate for a particular situation is dependent upon a producer's goals. Cattle carrying capacity can be manipulated by varying the amount of nitrogen used on bermudagrass.

There have been many research studies on the response of bermudagrass to varying rates of nitrogen. Most of this research shows ranges in bermudagrass response to nitrogen from 20 to 40 lbs. of dry matter production per pound of nitrogen above that produced with no nitrogen. The Foundation uses an average figure of 30 lbs. of bermudagrass dry matter produced per pound of nitrogen above the amount of grass produced with no nitrogen when determining stocking rates.

As can be seen in the following tables (Tables 2 through 4), the nitrogen use efficiency of bermudagrass production declines as the amount used increases. Also, it can be noted that N use efficiency increases in relationship with the amount of rainfall received. Evidence of this is that Overton, Texas, and Homer, La., are both areas higher in rainfall than Ardmore, Okla., and both had better nitrogen use efficiencies.

The Foundation's recommendations for nitrogen on bermudagrass vary according to the productivity of the soil and the producer's goals. In general, a flat, deep soil with good water holding capability can efficiently use a

higher rate of nitrogen than a thin soil, or one with steep slopes. For grazing only, the Foundation's nitrogen recommendations will usually range from 0 to 150 lbs. actual nitrogen per acre. For hay production on very productive sites, we may increase these rates to as much as 200 to 400 lbs. actual N per acre.

Table 2. Bermudagrass Response to N in Oklahoma. Osborne, et al, OSU Ardmore, OK (1993-95)

N Rate (lbs./A)	Yield (lbs./A)	Lbs. DM Produced Above Check per Pound of N
0	3015	---
200	6351	17
400	9384	16
600	10479	12
1200	10632	6

Table 3. Bermudagrass Response to N in NE Texas. Haby, et al, Texas A&M Overton, TX (1984-86)

N Rate (lbs./A)	Yield (tons/A)	Lbs. DM Produced Above Check per Pound of N
0	5200	---
160	12200	44
320	15200	31
480	16000	23

Table 4. Effect of N Rate on Bermudagrass Yield and Crude Protein Content in North Central Louisiana. Eichhorn, et al, LSU Homer, LA (1972-82)

N Rate (lbs./A)	Forage Yield (lbs./A)	Crude Protein (%)	Lbs. DM Produced Above Check per Pound of N
0	2077	8.6	---
100	5807	9.9	37
200	9244	10.8	36
300	11319	11.5	31
400	13562	12.7	29

Nitrogen Source

The best nitrogen source for fertilizing summer pastures is often debated. Urea can suffer volatilization losses if applied to the soil surface in hot weather and no rain occurs within three days. Losses can be as high as 30% of the total N applied. Urea-ammonium nitrate (UAN) solutions contain one-half urea and the urea portion is subject to the volatilization loss. Most of the research conducted around the region shows little urea volatilization loss when urea is applied in April. Losses increase as urea is applied later in the summer. When losses occurred in these research tests, they were seldom more than 15 to 20 percent. Tables 5 and 6 show N source comparisons from research in Oklahoma.

In general, urea can be used with little or no loss if the ground will be tilled within two to three days after application, if a rainfall event of more than 0.25 inches occurs within two to three days, or if the temperature is below 75 degrees. Ammonium nitrate may be a better choice for summer fertilization.

N Source	Yield (tons/A)
Anhydrous Ammonia	4.07
UAN Solution	4.56
Urea	4.25
Ammonium Sulfate	4.61

N Source	150 lbs. N All April	150 lbs. N Split
Urea	6618	7143
Ammonium Nitrate	6579	7622

Nitrogen Timing

The optimum time for applying fertilizer to bermudagrass has been researched in several locations, with particular attention paid to whether it is better to apply all the N in the spring, or to split the amount into two or more applications. Most of the research (Tables 7 and 8) suggests that split applications are preferable when the total N rate exceeds 100 lbs. per acre.

If the total nitrogen application is recommended to be more than 100 lbs. N per acre, the Foundation usually recommends that 100 lbs. N per acre be applied in late April or early May to take advantage of the more predictable spring rains. The balance can be applied during the summer.

Even considering the additional application expense, the advantages of splitting applications of more than 100 lbs. actual nitrogen usually outweigh the cost.

N Rate (lbs./A)	Single Application	4 Way Split
180	6140	8344
360	10052	12800
540	16152	16152

N Rate (lbs./A)	Single Application	1/2 April, 1/2 June
150	6579	7622

The Foundation sometimes recommends applying 40 to 50 lbs. N in August to grow fall bermudagrass. The purpose of this is to stockpile the forage for the fall/early winter season and decrease the amount of hay that needs to be fed.

Phosphorus and Potassium Fertilization

The Foundation recommends fertilizing with phosphorus (P) and potassium (K) based on soil test results. These recommendations are based on field research studies for a particular location and are superior to general fertilizer recommendations. Using soil testing as a basis for determining the need for these nutrients is cost-effective and prudent.

Bermudagrass removes relatively large amounts of phosphate (P_2O_5) and potash (K_2O) when harvested for hay. The Potash and Phosphate Institute reports that bermudagrass hay removes 12 lbs. of P_2O_5 and 50 lbs. of K_2O per ton of hay.

Phosphorus Fertilization

Most of the soils in our service area are very deficient in phosphorus (P). Phosphorus is vital in plants for developing a healthy root system and reaching optimum yield. Nitrogen fertilizer is not used efficiently in plants that are deficient in P.

Data on P fertilization of bermudagrass are limited. The existing data show that when soil test P is low or very low, a good response to P fertilizer is obtained. Most data show a yield increase of about 1 ton of forage per acre when soil test P is low and P is applied at the recommended rate. Most sites show little to no increase to P fertilizer when soil test P levels are medium or higher, although some sites show inconsistent increases even when soil test P is high.

Potassium Fertilization

Potassium is essential in plants to fight off diseases. It also aids in water translocation in plants and makes bermudagrass less susceptible to winter kill. Deficiencies of potassium (K) can cause both yield losses and stand losses. Research has shown that stands of bermudagrass are about half as good where potassium is deficient as

compared to where it is sufficient. There was also an increase of about 2 tons in forage yield per acre where K was applied at recommended levels on a soil testing very low in K.

If high rates of potash (more than 120 lbs. K_2O per acre) are called for by soil tests, it is better to split the application than to apply it all at once. The reason is that bermudagrass will take in more potassium than it needs if an abundant supply is present. This is called luxury consumption. It is not harmful to the grass, but it is an inefficient way to use potassium.

K_2O Rate (lbs./A)	Yield (lbs./A)	BG Stand Yr 1 (%)	BG Stand Yr 6 (%)
0	8919	57	29
100	12399	47	84
200	13583	45	89
400	14341	41	88

* 400 pounds N/acre were applied to all plots

Summary

The goal of the Noble Foundation is to help cattle producers meet their production goals. Bermudagrass responds well to fertilizer, and applications can be targeted to meet producer's needs for hay production or cattle carrying capacity. Recommendations are based on Noble Foundation and land grant university research with overall farm productivity and producer goals in mind.