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Nitrogen Fertilization of Gordo Bluestem in Southeast Texas

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Summary

Annual nitrogen (N) fertilizer rates of 0, 75, 150, 225, 300, 375, and 450 lb/A, split in three equal applications, were applied to a 'Gordo' bluestem (*Dichanthium aristatum*) hay meadow for 3 years. By the third year, plots fertilized with more than 225 lb N/A were invaded by Johnsongrass and grassy weeds. Gordo bluestem yields from these high N treatments were significantly less than those of the low N treatments. Results of this study indicate that the best N fertilization program would be 50 to 75 lb N/A in mid-May and after each harvest except the last. Under excellent moisture conditions, Gordo bluestem might respond to as much as 100 lb N per application.

Introduction

Gordo bluestem is used as a hay crop on the clay soils in southeast Texas. There is no published information on response of Gordo bluestem to N fertilizer or on what the best N fertilizer program should be. Nitrogen fertilization rates used by producers are only "guesstimates" considering past experiences and N response in other crops. In this study, Gordo bluestem's response to N fertilizer was determined for a 3-year period on an established hay meadow in Jackson County in southeast Texas.

Procedures

The study was conducted on a clay loam soil near Lake Texana in Jackson County from 1989 through 1991. Soil analysis indicated a pH of 7.0 with 1, 1, and 361 ppm of N, phosphorus (P), and potassium (K), respectively. Nitrogen fertilizer was surface-applied at 0, 75, 150, 225, 300, 375, and 450 lb/A, split in three equal increments. The first N application was made in the last half of April, the second

after the first harvest, and the third application after the second harvest. The drought in 1989 and 1991 allowed only two harvests and thus only two of the three N applications. At the time of the first N application, the study site was mowed to a 2-in. height to remove weeds and old bluestem growth. At that time, 70 lb/A of P were applied annually.

Experimental design was a complete randomized block with four replications. Plot size was 6 x 15 ft, from which a 3-ft strip was cut from the center of each plot at a 3-in. height to determine yield. A subsample of the harvested forage was dried at 150 °F for 48 hours to determine dry matter percentage. Protein content was determined on the dry matter subsample by the Kjeldahl procedure.

Results

1989 Season

There was no significant rainfall in 1989 until the last week of June (Fig. 1), which delayed the first harvest until August 16. Response was good to the 75-lb N rate and was followed by a gradual yield increase as N rate increased. Most of the N applied in late April may have been lost because of light showers and poor spring growth of Gordo bluestem (Evers, 1992). Yield ranged from 1,360 to 2,230 lb/A at the second harvest on November 15. Total yield in 1989 increased significantly from 0 to 50 lb N, maximum yield being at 200 lb N/A.

Protein percentage at the first harvest ranged from 5.5 to 6.9% (Table 1.) These low levels were due to the late maturity of forage at the first harvest and the lack of response to N. At the second harvest, protein percentage ranged from 7.5 to 10.7%, showing a distinct break between the 50- and 75-lb N rate.

1990 Season

Good rainfall occurred through most of the 1990 growing season, which was reflected in high yields (Fig. 2). At the first harvest on June 29, yields

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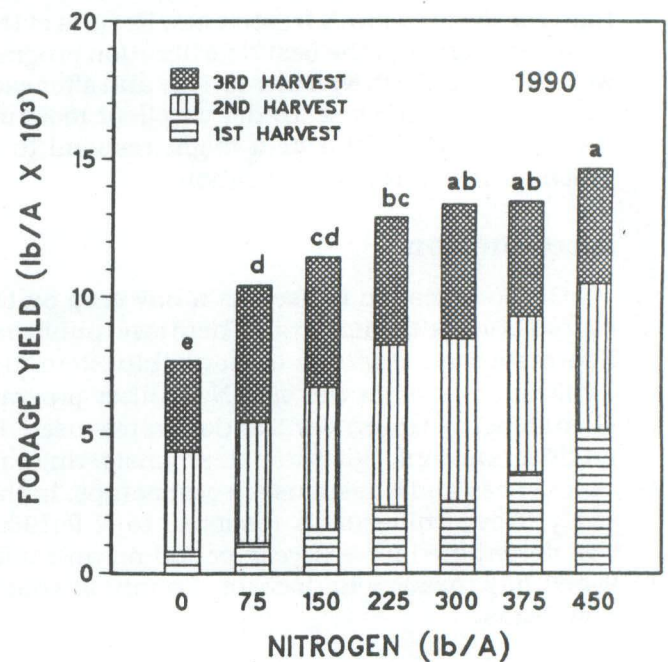
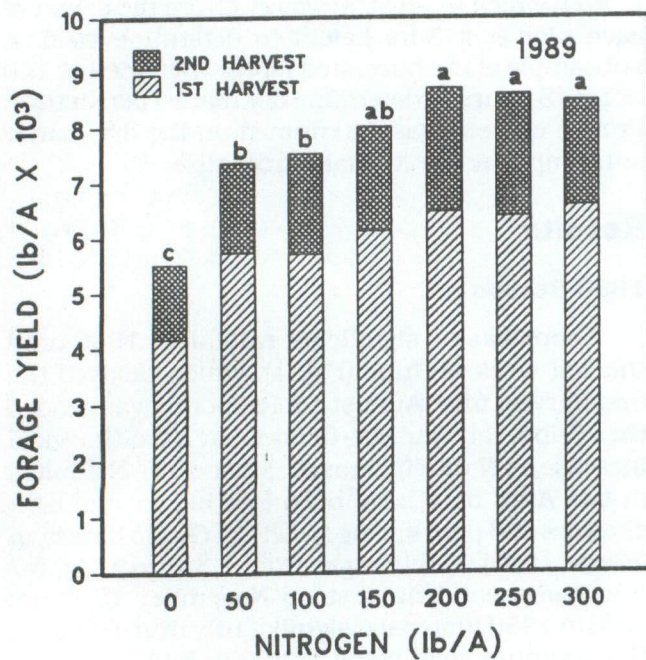
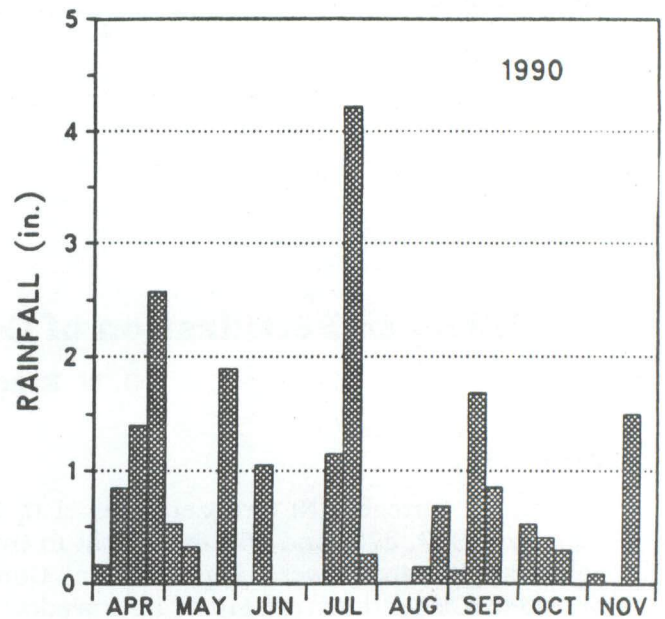
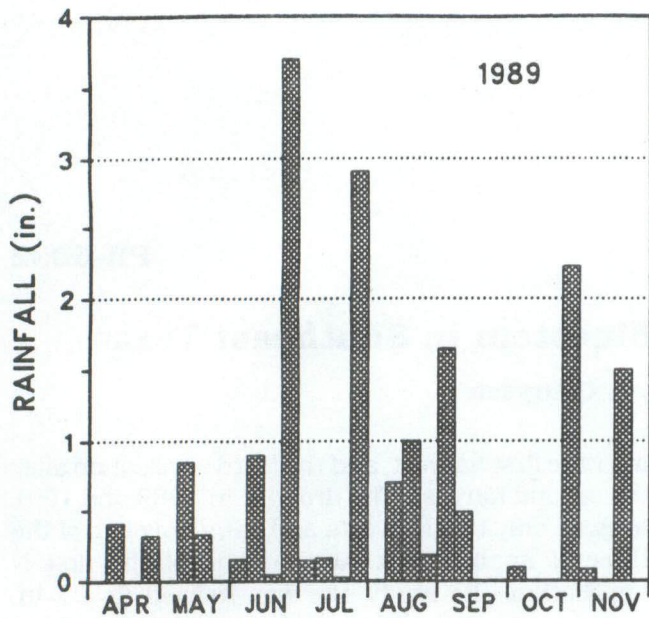


Figure 1. Weekly rainfall and forage dry matter yield of Gordo bluestem receiving 0, 50, 100, 150, 200, 250, or 300 lb N/A in 1989. Total forage yields with the same letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

Figure 2. Weekly rainfall and forage dry matter yield of Gordo bluestem receiving 0, 75, 150, 225, 300, 375, or 450 lb N/A in 1990. Total forage yields with the same letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

ranged from 760 to 5,130 lb/A and increased as N rate increased. Second harvest yields on August 15 increased to the 150-lb N rate and then leveled off until another increase at the 450-lb N rate. At the third harvest on October 31, maximum yields were reached at the 75-lb N rate. Total yield increased as

N rate increased, but increases were small above the 225-N rate.

Differences among N rates in protein percentages were not significant at the first harvest in 1990 (Table 1). Protein percentages did increase with N rate at the second and third harvests.

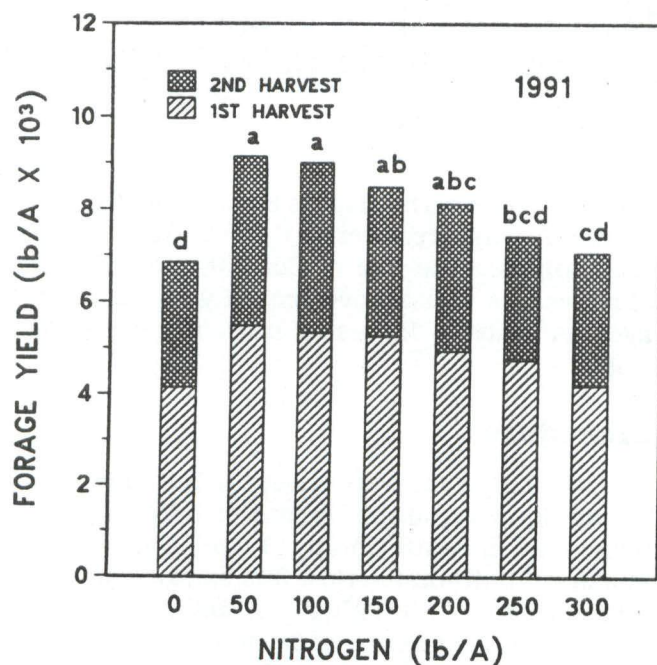
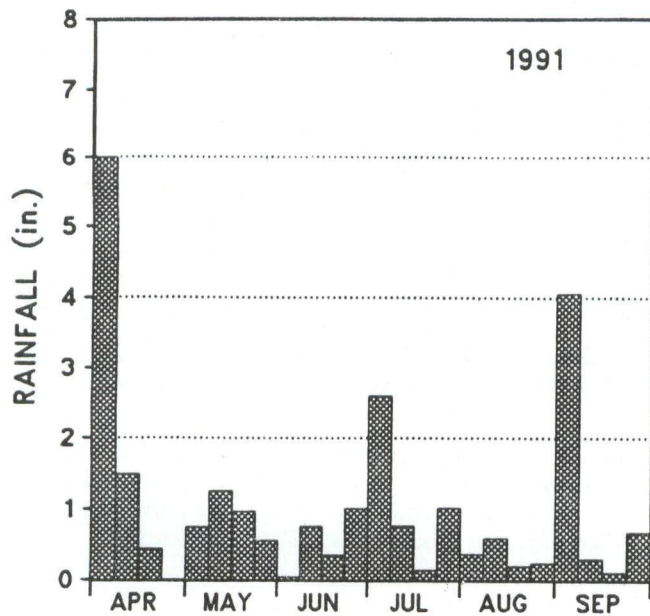


Figure 3. Weekly rainfall and forage dry matter yield of Gordo bluestem receiving 0, 50, 100, 150, 200, 250, or 300 lb N/A in 1991. Total forage yields with the same letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

1991 Season

Rainfall during the 1991 season was frequent but in small amounts, which resulted in below-

optimum soil moisture conditions during most of the growing period (Fig. 3). Only two harvests were taken on July 10 and October 1. Response to N fertilizer was very poor; yields ranged from 4,140 to 5,470 lb/A at the first harvest and from 2,690 to 3,680 lb/A at the second harvest. Total yield increased significantly at the 50-lb N rate but then decreased as N rate increased. Over the 3-year period, grassy weeds and Johnsongrass encroachment increased as N rate increased and reduced the Gordo bluestem stand.

Protein percentage in the harvested forage ranged from 4.3 to 8.0% at the first harvest and 4.2 to 6.8% at the second harvest, the protein percentage increasing with N fertilizer rate. At most harvest dates over the 3-year period, at least 75 lb N/A were required to influence protein percentage.

Discussion

Gordo bluestem was responsive to high N fertilizer rates in only 1 year out of 3. Invasion of grassy weeds and Johnsongrass by the third year on the high-N plots indicates that Gordo bluestem is neither responsive to nor competitive for N. The poor response to the late April N application was probably due to the slow spring growth of the Gordo bluestem (Evers, 1992). First harvests were not made until August 16, 1989, June 29, 1990, and July 10, 1991, suggesting that the first N fertilizer application should be delayed until mid-May. Grazing Gordo hay meadows in spring until the initial N fertilizer application should reduce weed competition.

Gordo bluestem was most responsive to the lowest N rate (25 lb N/A/application) used in this study, and smaller yield increases were obtained up to about 100 lb N/A/application with good moisture. Rates in excess of this amount are probably not profitable and would encourage invading species and deterioration of the Gordo bluestem stand over time. Optimum N fertilization for hay production should be about 50 to 75 lb/A in mid-May and after each hay cutting except the last in autumn. A minimum of 75 lb N/A was needed to influence protein percentage. However, good moisture conditions and harvesting at an early growth stage would increase protein content (Evers and Gabrysch, 1992). In this study, harvested forage was from 2 to 3.5 months of age.

Acknowledgment

We thank the Lavaca-Navidad River Authority for providing the test site and the rainfall data.

Table 1. Crude protein percentage of Gordo bluestem fertilized at different N rates.

Nitrogen application	1989		1990			1991	
	Aug. 16	Nov. 15	June 29	Aug. 15	Oct. 31	July 10	Oct. 1
lb/A Crude protein (%).....						
0	5.95 ab*	7.50 b	8.64	5.15 d	4.18 b	4.33 d	4.26 c
25	5.46 b	7.82 b	8.27	5.65 cd	4.02 b	5.00 cd	4.24 c
50	5.85 ab	7.70 b	7.53	5.97 c	4.68 b	5.27 c	4.80 c
75	6.60 ab	10.76 a	7.77	6.22 c	5.71 a	5.21 cd	5.74 b
100	6.53 ab	9.17 ab	8.27	7.05 b	5.94 a	6.44 b	6.23 ab
125	6.00 ab	10.09 a	8.43	8.28 a	5.93 a	6.42 b	6.12 ab
150	6.89 a	10.31 a	8.13	8.62 a	5.94 a	8.03 a	6.82 a

*Values in a column followed by the same letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

Literature Cited

Evers, G. W. 1992. Evaluation of bluestem plant introductions in southeast Texas. *In* Forage Research in Texas, 1992. This publication.

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