Influence of Age, Nitrogen Fertilizer, and Season on Growth, Leaf Percentage, and Protein of Gordo Bluestem

G. W. Evers and J. L. Gabrysch

Summary

'Gordo' bluestem (*Dichanthium aristatum*) fertilized with 0, 50, 100, or 150 lb nitrogen (N)/A was harvested after 2, 4, 6, 8, and 10 weeks of growth during the early, mid-season, and late season growing periods for 1 year. Forage production was greatest during the mid-season period when temperatures were high. Crude protein percentage increased as N rate increased, but yield did not increase above 50 lb N/A. There was no consistent trend between protein percentage and plant maturity. Leaf blade percentage decreased with plant maturity and growth rate.

Introduction

Gordo bluestem is used as a hay crop in southeast Texas (Evers, 1992). There is no published information on the effect of plant maturity and season on the growth of Gordo bluestem, which would be helpful in producing high-quality hay. Work with other old world bluestems (*Bothriochloa* spp.) under irrigation in Oklahoma indicated that maximum yield occurred at 10 weeks or later depending on variety and year (Dabo et al., 1987). In vitro dry matter disappearance and protein percentage decreased with plant maturity (Dabo et al., 1988). The objectives of this study were to examine the influence of plant maturity, season, and N fertilizer rate on Gordo bluestem growth, leaf blade percentage, and crude protein.

Keywords: Gordo bluestem / southeast Texas / hay production.

Procedure

The test site was a Gordo bluestem hay meadow on a clay loam soil near Lake Texana in Jackson County in southeast Texas. The early season, mid-season, and late season growth periods were initiated on April 19, July 3, and September 15, respectively. At the beginning of each growth period, previous growth was removed from the area at a 2-in. height with a flail mower, and 75 lb phosphorus (P)/A were surface-applied. Experimental design was a split-plot with four replications. Nitrogen rates of 0, 50, 100, and 150 lb N/A were the main plots, and growth periods of 2, 4, 6, 8, and 10 weeks were the subplots. Subplot size was 6 x 15 ft from which a 3-ft strip was harvested to determine yield. A subsample of the harvested forage was dried at 150 °F for 48 hours to determine dry matter percentage. Crude protein was estimated by the Kjeldahl procedure on the dry matter sample. Immediately before harvest, another sample was collected, which was hand-separated into green leaf blade and stem (including leaf sheath). An arcsin transformation was performed on leaf blade percentages before statistical analysis. Untransformed data are reported.

Results and Discussion

The early growing season was dry until 1 in. of rain fell in early June and about 2 in. in late June. Green top growth, which was mostly leaf blade (Table 2), decreased from the 2- to the 6-week sampling (Table 1). Weight loss was due to senescence of green leaves and lack of new leaf initiation because of poor soil moisture. The rapid yield increase from the 8- to 10-week harvest is due to

Literature Cited

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Dabo, S. M., C. M. Taliaferro, S. W. Coleman, F. P. Horn, and P. L. Claypool. 1988. Chemical composition of old world bluestem grasses as affected by cultivar and maturity. J. Range Manage. 41:40-48.

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Table 1. Influence of nitrogen rate, plant maturity, and season on growth of Gordo bluestem.

Date	Week	Nitrogen (lb/A) 0	50	100	150	Mean
		Yield (lb/A)				
		Early season (April 19 - July 3)				
May 3	2	907	1213	914	633	917 B†
May 19	4	632	636	809	569	662 C
May 31	6	131	230	322	250	233 E
June 15	8	387	466	433	519	451 D
July 3	10	711	1458	1800	1686	1414 A
Mean		554 b‡	801 a	856 a	732 a	
		Mid-season (July 3 - Sept. 14)				
July 17	2	1154	1221	1254	1458	1272 E
Aug. 2	4	2222	1900	2032	2038	2048 D
Aug. 16	6	2551	3559	3419	3391	3230 C
Aug. 29	8	3466	4556	4519	4664	4301 B
Sept. 14	10	3893	4396	4824	5228	4585 A
Mean		2657 b	3126 a	3210 a	3355 a	
		Late season (Sept. 6 - Nov. 15)				
Sept. 20	2	534	829	830	757	738 C
Oct. 3	4	514	635	625	669	611 D
Oct. 17	6	748	769	864	909	822 C
Oct. 31	8	929	1522	1486	1633	1393 B
Nov. 15	10	1115	1427	1757	2015	1579 A
Mean		768 b	1036 a	1112 a	1197 a	

† Means in a column within season followed by the same upper case letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

‡ Means in a row within season followed by the same lower case letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

the late June rain. Yield did not increase above 50 lb N/A. Leaf blade percentage decreased with plant maturity but was still 84% at 10 weeks averaged across N rates. Averaged across harvest dates, crude protein percentage increased with N rate. The lack of relationship between plant maturity and protein percentage may be due to poor growth of Gordo bluestem during cool spring temperatures and moisture stress.

Good moisture conditions during the mid-season growing period resulted in a significant yield increase in each succeeding harvest when averaged across N rates (Table 1). Forage yields at the 2-week harvest in mid-season were similar to those at the 10-week harvest in the early season period. Even under good growing conditions, yield did not increase significantly above 50 lb N/A when averaged across harvest dates. Leaf blade percentage dropped more rapidly with plant maturity during the mid-season growing period because of stem elongation (Table 2). Crude protein percentage increased as N fertilizer rate increased for each harvest date (Table 3). Protein percentage dropped 4% from the 4- to 6-week harvest and then remained fairly constant.

Growth during the late season period was limited by poor moisture conditions until late October (Table 1). Yields were similar to those observed in the early growing period. Gordo bluestem grew best during the high-temperature period from mid-June to mid-September if moisture was available. As in the other growing periods, yield was maximized at 50 lb N/A. Leaf blade percentage decreased significantly with each succeeding harvest (Table 2). Leaf blade percentage decreased slowly with plant maturity until late October (8-week harvest) when rainfall stimulated growth and stem elongation. Crude protein percentage decreased through the 6-week harvest and then increased (Table 3). This increase may be due to initiation of new growth and greater N uptake with the late October rainfall. These data are from only 1 year. Moisture and temperature differences between years will affect Gordo bluestem growth.

Acknowledgment

We wish to thank the Lavaca-Navidad River Authority for providing the research site and the rainfall data.

Table 2. Influence of nitrogen rate, plant maturity, and season on leaf blade percentage of Gordo bluestem.

Date	Week	Nitrogen (lb/A) 0	50	100	150	Mean
		Leaf in top growth (%)				
		Early season (April 19 - July 3)				
May 3	2	100	100	100	100	100 A†
May 19	4	99	99	99	98	99 B
May 31	6	98	97	93	93	95 C
June 15	8	95	91	81	85	88 D
July 3	10	94	88	78	77	84 E
Mean		97 a‡	95 b	90 c	90 c	
		Mid-season (July 3 - Sept. 14)				
July 17	2	93	94	94	93	94 A
Aug. 2	4	89	85	81	82	84 B
Aug. 16	6	79	68	73	66	72 C
Aug. 29	8	68	60	59	63	62 D
Sept. 14	10	57	53	54	52	54 E
Mean		77 a	72 b	72 b	72 b	
		Late season (Sept. 6 - Nov. 15)				
Sept. 20	2	100	99	100	99	100 A
Oct. 3	4	96	97	98	99	98 B
Oct. 17	6	91	93	92	92	92 C
Oct. 31	8	89	85	75	86	86 D
Nov. 15	10	58	52	64	53	57 E
Mean		87 a	83 a	86 a	86 a	

†Means in a column within season followed by the same upper case letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

‡Means in a row within season followed by the same lower case letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

Table 3. Influence of nitrogen rate, plant maturity, and season on crude protein percentage of Gordo bluestem.

Date	Week	Nitrogen (lb/A) 0	50	100	150	Mean
		Crude protein percentage of whole plant dry matter				
		Early season (April 19 - July 3)				
May 3	2	7.1	7.5	7.9	9.4	8.0 E†
May 19	4	8.9	10.7	12.0	12.9	11.1 C
May 31	6	9.3	11.3	13.1	13.0	11.7 B
June 15	8	7.5	8.8	10.6	11.0	9.5 D
July 3	10	10.7	14.0	17.1	19.1	15.2 A
Mean		8.7 d‡	10.5 c	12.1 b	13.1 a	
		Mid-season (July 3 - Sept. 14)				
July 17	2	9.0	9.5	10.0	10.6	9.8 B
Aug. 2	4	8.2	11.5	12.6	13.6	11.5 A
Aug. 16	6	5.4	7.0	8.7	9.4	7.7 C
Aug. 29	8	4.9	6.5	7.3	7.3	6.5 D
Sept. 14	10	5.7	7.1	7.6	8.9	7.3 C
Mean		6.7 d	8.3 c	9.3 b	10.0 a	
		Late season (Sept. 6 - Nov. 15)				
Sept. 20	2	10.5	12.8	14.7	15.0	13.3 A
Oct. 3	4	5.4	7.5	8.2	9.3	7.6 D
Oct. 17	6	4.4	6.3	7.1	7.5	6.3 E
Oct. 31	8	5.8	7.6	9.7	9.2	8.1 C
Nov. 15	10	8.2	10.1	11.8	13.0	10.7 B
Mean		6.9 c	8.8 b	10.3 a	10.8 a	

†Means in a column within season followed by the same upper case letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

‡Means in a row within season followed by the same lower case letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.