ID # 22-39

STUBBLE HEIGHT EFFECTS ON LIMPOGRASS PASTURE CHARACTERISTICS AND PERFORMANCE OF BEEF HEIFERS

Y.C. Newman[1], L.E. Sollenberger[1], W.E. Kunkle[2], D.B. Bates[2],

C.G. Chambliss[1] and A.M. Fox[1].

[1]Agronomy Department, University of Florida, Gainesville, FL 32611-0900 USA [2]Animal Science Department, University of Florida, Gainesville, FL 32611-0910 USA.

Abstract

Limpograss (*Hemarthria altissima* [Poir.] Stapf. & C.E. Hubb.) is a C_4 species used in Florida beef production systems because of its cool-season growth, persistence on poorly drained soils, and high yield and digestibility. Animal performance on limpograss pastures, however, has been limited by low herbage crude protein (CP). This study evaluated the effect of canopy height of limpograss pastures and N supplementation of grazing cattle on sward characteristics and weight gain and blood urea N (BUN) concentration of yearling beef heifers. Under continuous stocking, six treatments were imposed that included all combinations of three stubble heights (20, 40, and 60 cm) and two N-supplement levels (S, supplemented; NS, unsupplemented). During 1998 and 1999, treatments were replicated twice and arranged in a completely randomized design. Seasonal (84 d) daily gains from heifers grazing limpograss pastures were not different (p=0.25) between the two years and averaged 522 g. For the intermediate stubble, 40-cm, there was no effect of supplementation

on daily gains (P= 0.1), but daily gain increased 40 and 70% due to supplementation (P < 0.01) of heifers on pastures grazed to 20 and 60 cm, respectively. These data show that limpograss stubble height has an impact on pasture nutritive value affecting daily gains. Stubble height of approximately 40 cm seems to provide optimum gains of animals receiving no N supplement on continuously stocked pastures.

Keywords: Grazing management, animal performance, plant-animal interface, forage quality

Introduction

Limpograss is a stoloniferous warm-season perennial used in Florida beef production systems primarily because of its cool-season growth and higher digestibility than most warm-season grasses. Gains of growing cattle grazing limpograss have been lower than expected and low herbage CP has been implicated (Holderbaum et al., 1991). Overseeding of summer-annual legumes, increasing nitrogen fertilizer rates applied to limpograss pasture, and protein supplementation of grazing livestock have increased animal gains (Holderbaum et al., 1991; Lima et al., 1999). Pronounced differences in vertical distribution of leaf, stem, and N in the strata of the canopy suggest that canopy stubble height may have a major effect on animal N status, daily gain, and response to supplementation (Holderbaum et al., 1992). These data suggest that lower grazing intensities would allow greater opportunity for diet selection contributing to a higher protein concentration of the herbage consumed, and likely, a lesser response of cattle to N supplementation. An experiment was conducted to determine the

potential for increasing cattle weight gain on limpograss pastures by using different grazing intensities and N supplementation.

Material and Methods

The experiment was conducted during 1998 (August-October) and 1999 (July-September) near Gainesville, FL (29°38' NL and 82°22'WL) USA. Average annual temperature is 21°C, and average annual rainfall is 1342 mm. Soils are poorly drained, sandy Spodosols of the Smyrna, Pomona and Wauchula series. Limpograss cv. Floralta pastures were well established. Based on soil analysis all pastures were fertilized with 17 kg P ha^{-1} and 66 kg K ha^{-1}. All P and K were applied in April with 40 kg N ha^{-1}. The remaining N (120 kg ha^{-1}) was split in three equal applications made 28 days before the experimental period began and on Days 28 and 56 of the experimental period.

Six treatments were imposed and were replicated twice in a completely randomized design. Treatments were all combinations of three stubble heights (20, 40, and 60 cm) of the continuously stocked swards and two N supplements (not supplemented and supplemented). Supplement composition was a corn-urea mixture, with 40% digestible intake protein, the same utilized and described by Lima et al. (1999), and was administered daily at a rate of 0.6 kg (DM basis) per head. The experimental units in the study were 0.5-ha pastures. The sampling units for BUN and daily gain were the individual tester animals.

Two crossbred (3/4 Angus X Brahman) yearling heifers of similar initial weight and medium frame, were assigned to each pasture as testers; they remained in the pastures during the entire season. The experimental period was from 15 July to 7 Oct. 1998 and 24 June to 16

Sep. 1999. Additional grazers were added or removed as needed to achieve the target treatment stubble height for each pasture. Tester animals were assigned to pastures one week prior to the beginning of the experimental period each year, during which time they were fed gradually increasing amounts of supplement until the full daily ration was being consumed. At the end of the preliminary period and every 4 wk following, shrunk weights were collected and blood samples were drawn for BUN analysis. Pasture stubble height was measured weekly at 50 random locations per pasture. Hand-plucked samples of the grazed portion of the canopy were collected bi-weekly for nutritive value assessments.

Micro-Kjeldahl CP and in vitro organic matter digestibility (IVOMD) (described by Moore and Mott, 1974) analyses were conducted on hand-plucked samples. Data from animals and nutritive value samples were analyzed using mixed model methodology through PROC MIXED (SAS Institute Inc., 1996). In all models, effects of year, stubble height, and supplementation were considered fixed effects. All means reported in the text are least square means.

Results And Discussion

Seasonal (84 d) daily gains from yearling heifers grazing limpograss pastures were not different ($P= 0.25$) between the two years and averaged 522 g. There was no stubble height or supplement treatment X year interaction ($P= 0.61$ and $P= 0.88$) for seasonal daily gain, but there was an interaction ($P < 0.01$) between stubble height and supplementation treatments (Table 1). Gains of unsupplemented heifers increased as stubble height increased from 20 to 40 cm, but decreased thereafter (Table 1). Gains of supplemented heifers were not affected by

stubble height. On pastures grazed to 20- and 60-cm stubble heights, daily gains were greater for supplemented than unsupplemented heifers ($P \leq 0.01$). The increase in daily gain due to supplementation at the 20-cm stubble was 40%, while at the 60-cm stubble it was 70%. For the intermediate stubble, 40-cm, there was no effect of supplementation on daily gains ($P= 0.1$). The unsupplemented, 40-cm treatment daily gains were 644 g, similar to those reported by Holderbaum et al. (1991) when rotationally stocked limpograss was grazed to a stubble of 30 cm.

There was no stubble height X supplement treatment interaction ($P= 0.25$) for BUN. There were, however, supplementation effects ($P < 0.01$) with greater BUN for supplemented heifers versus unsupplemented (18 and 15 mg 100 mL^{-1}, respectively). There were also stubble height effects ($P < 0.01$) with greater BUN at the 20- and 40-cm stubbles (17 mg 100 mL^{-1}, Table 1) than the 60-cm stubble (15 mg 100 mL^{-1}). Cattle BUN concentrations of 9 to 12 mg 100 mL^{-1} are in a transition range below which daily gain response to N supplementation has been greater and above which the daily gain response has been less (Hammond et al., 1993). In this study, BUNs were all above 12 mg 100 mL^{-1}, thus N status of the animal would not appear to explain the response to supplement.

For herbage CP, IVOMD, and digestible organic matter : crude protein ratio (DOM:CP) there was no effect of supplementation or interaction of year and supplementation treatment ($P> 0.42$), but there was a year X stubble height interaction ($P < 0.01$; Table 2). Crude protein and IVOMD were higher and DOM:CP ratio lower in 1999 compared to 1998. Herbage CP decreased with increasing stubble height in both years, while IVOMD decreased

only in 1999 (Table 2). The DOM:CP ratio increased with increasing stubble height in both years.

These data suggest that pasture stubble height is an important factor affecting gains of heifers grazing limpograss. On continuously stocked swards, highest daily gains of unsupplemented heifers appear to occur with a stubble height of approximately 40 cm.

References

Hammond, A.C., Kunkle W.E., Bates D.B. and Sollenberger L.E. (1993). Use of blood urea nitrogen concentration to predict response to protein or energy supplementation in grazing cattle. In: Baker M.J., Crush J.R., and Humphreys L.R. (eds) Proceedings of the XVII International Grassland Congress, 1993. Australia. pp. 1989-1991.

Holderbaum, J.F., Sollenberger L.E., Moore J.E., Kunkle W.E., Bates D.B. and Hammond A.C. (1991). Protein supplementation of steers grazing limpograss pasture. Journal of Production Agriculture, **4**: 437-441.

Holderbaum, J.F., Sollenberger L.E., Quesenberry K.H., Moore J.E. and Jones C.S. Jr. (1992). Canopy structure and nutritive value of limpograss pastures during mid-summer to early autumn. Agronomy Journal, **84**: 11-16.

Lima, G.F. da C., Sollenberger L.E., Kunkle W.E., Moore J.E. and Hammond A.C. (1999). Nitrogen fertilization and supplementation effects on performance of beef heifers grazing limpograss. Crop Science, **39**: 1853-1858.

Moore, J.E. and Mott, G.O. (1974). Recovery of residual organic matter from *in vitro* digestion of forages. Journal of Dairy Science, **57**: 1258-1259.

SAS Institute Inc. (1996). SAS/STAT Software: Changes and enhancements through release 6.11, Cary, NC: SAS Institute Inc. pp. 531-656.

Table 1 - Average daily gain (ADG) and blood urea N (BUN) of yearling beef heifers in response to stubble height of limpograss pasture and nitrogen supplementation.

	ADG			BUN		
Stubble Height	No Suppl	Suppl	p-value	No Suppl	Suppl	Mean
cm	g			mg 100 mL^{-1}		
20	448	624	0.01	16	21	17 a†
40	644	536	0.10	17	17	17 a
60	327	555	<0.01	14	17	15 b
Mean				15§	18	
Contrast	Q‡	NS				

†= BUN means across supplement levels; means followed by the same letter are not different ($p>0.05$)
‡Orthogonal polynomial contrasts for the effect of stubble height on daily gain; NS= not significant; Q= quadratic, $p<0.01$
§= BUN means across stubble height are different ($p<0.01$)

Table 2 - Limpograss herbage nutritive value in response to canopy stubble height treatment during 1998 and 1999.

Stubble Height	Herbage CP		Herbage IVOMD		Herbage DOM:CP	
	1998	1999	1998	1999	1998	1999
cm	g kg^{-1}		g kg^{-1}			
	---		---			
20	92	138	521	661	5.6	4.8
40	85	131	515	663	6.1	5.1
60	87	114	523	637	6.0	5.6
+Contrast	L, Q	L, Q	NS	LQ	LQ	L

+Orthogonal polynomial contrasts for the effect of stubble height on nutritive value; NS= not significant; L= linear, Q= quadratic, $p<0.01$.