1998 Animal Science Research Report

Heavy vs Light Weight Steers Grazing Old World Bluestem at Three Stocking Rates: II. Diet Quality, Forage Intake, and Grazing Time

Pages 181-186

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Story in Brief

Two-hundred fourteen mixed breed light weight steers (average initial wt: 311 ± 37 lb) and 115 mixed breed heavier weight steers (average initial weight: 584 ± 37 lb) were used to evaluate the effects of stocking rate on weight gain of steers grazing Plains old world bluestem (OWB) from May 29, 1997 through August 5, 1997. Three stocking rates were used; 1.5, 1.1, and .7 acres/500 lb of initial steer live weight for light, moderate, and heavy stocking rates. In addition to steer live weight gain, forage diet quality, intake, and standing crop data were collected. Additionally, grazing time was measured for the heavy steers. Steers in the heavy stocked pastures had lower ADG (2.27 lb/d) than steers in the other two stocking rates (2.57 and 2.49 lb/d for light and moderate stocking, respectively). Diet quality varied only slightly between June, July, and August, and there were no differences in diet quality among stocking rates. There were no differences in OM intake (% of BW) among stocking rates. Light weight steers consumed more OM (3.2 vs 2.5% of BW for light and heavy cattle, respectively) than heavy steers. Heavy steers in the heavy stocking rate pastures spent more time grazing (10.2 h) than steers in the light stocking rate pastures (8.7 h) while steers in the moderate stocking rate pastures grazed a similar amount of time (9.6 h) to both other rates. August standing crop was 7811, 7364, and 4065 lb DM/acre for light, moderate, and heavy stocking rate pastures, respectively. The decline in ADG as stocking rate increased may have been due to increased grazing time rather than differences in diet quality or OM intake.

(Key Words: Growing Cattle, Summer, Stocking Rate, Old World Bluestem.)

Introduction

Forage quality, quantity, intake, and environmental influences are all factors that influence weight gain of grazing animals. Forage quality of old world bluestems declines rapidly with increasing maturity. In order to achieve optimal performance of growing livestock, forage must be kept in a vegetative and actively growing condition (Dewald et al., 1985).

One method of maintaining this actively growing condition may be manipulation of stocking rate. However, increasing stocking rates may have negative effects on forage nutritive quality and quantity as well as weight gain of cattle. Identification of optimal stocking rates for maximizing stocker cattle weight gain per acre would aid in making decisions regarding management of old world bluestem pastures. Furthermore, monitoring the effects of stocking rate on forage diet quality, intake, and residual standing crop may aid in making management decisions.

The objectives of this study were to determine the effects of stocking rate on forage diet quality, intake, and residual standing crop. Additionally, we collected grazing time data from the heavy steers in all stocking rates. Results of steer performance are reported in a companion paper in this research report.

Materials and Methods

Study Site. The study site was located at the Bluestem Research Range 7 miles southwest of Stillwater, OK. Cattle were allowed to graze Plains old world bluestem (*Bothriochloa ischaemum* var. Plains: OWB) from May 29, 1997 through August 5, 1997. One hundred lb of N/acre and an herbicide treatment was applied to OWB pastures early in the growing season.

Cattle and Stocking Rate. Two-hundred fourteen mixed breed light weight steers (average initial wt: 311 ± 37 lb: LHT) and 115 mixed breed heavier weight steers (average initial weight: 584 ± 37 lb: HWT) were used in this study. Steers were weaned and vaccinated prior to their arrival in Stillwater. All steers received a Synovex-Câ implant prior to initiation of the trial. Stocking rates were: light stocking; 1.5 (LS), moderate stocking; 1.1 (MS), and heavy stocking; .7 (HS) acres/500 lb of initial steer live weight. When expressed as lb/live weight/acre, calculated stocking rates would have been 333, 455, and 714 lb/live weight/acre for LS, MS, and HS, respectively. However, due to variance in steer live weight, actual stocking rates were approximately 350, 450, and 750 lb/live weight/acre for LS, MS, and HS, respectively. All stocking rate by cattle type combinations were replicated twice resulting in a total of 12 pastures. Cattle were weighed May 28, 1997 and August 8, 1997. In an attempt to equalize fill across treatments, all cattle were placed in the same tallgrass prairie pasture 3 to 4 d prior to both weigh dates. Approximately 12 to 16 h prior to weighing, cattle were moved to a small holding area devoid of grass, and water was withheld until weighing.

Forage. Forage OM intake was estimated once in August using intraruminal (Captec) controlled release chromium boluses (Adams et al., 1991). Four steers in each cattle type x stocking rate combination were given a Captec bolus to provide an internal marker. Fecal samples were collected once daily for 4 d following a 6-d adaptation period. Chromium content of feces was used to estimate fecal output, and IVOMD and fecal output were used to estimate forage OM intake.

Diet samples were collected monthly in June, July, and August. Eight ruminally cannulated steers (average body weight: 534 $\pm$ 25 lb) were placed on OWB pastures approximately 7 d prior to each collection period. Two ruminally cannulated animals were assigned to each pasture, thus, four pastures were sampled per day for 3 d. Diet quality samples were collected by removing ruminal contents, allowing animals to graze for 1.0 to 1.5 h, then removing the masticate from the rumen and replacing ruminal contents (Lesperance et al., 1960). Diet quality samples were analyzed for DM, ash, Kjeldahl N, NDF, ADF, and IVOMD. Forage standing crop was estimated in August using clipped weights from all 12 pastures. Five .1 m^2 quadrats were clipped to approximately 1 inch of height in each pasture. Grazing time for heavy steers was estimated using vibracorders in a method similar to Adams et al. (1986). Vibracorders were placed on two HWT steers in each of the stocking rates and grazing time was recorded over 7 d.

Statistical Analysis. Steer performance, forage OM intake, standing crop, and grazing time data were analyzed using the GLM procedure of SAS (1992). Treatment means were separated using Fishers protected LSD. Diet quality data were analyzed as a repeated measures within a 2 x 3 factorial using MIXED of SAS (1992). When a significant ($P < .05$) interaction was detected, the SLICE command was used to analyze simple effects.

Results and Discussion

Analysis of diet quality variables (Table 1) indicated some changes in forage quality between months. Diet quality factors were analyzed as simple effects because of a significant ($P<.05$) stocking rate x month interaction. Although some statistical differences ($P<.05$) were found, most diet quality variables did not differ to a great extent between months at any stocking rate. One exception is IVOMD, which increased ($P<.05$) in all pastures from the low 60% to the low 70% range from June to August. An increase in IVOMD would seem unlikely in a normal summer season. However, the summer of 1997 was wet throughout and late season rains were probably the major contributing factor to the increase in digestibility as the summer progressed. The lack of major numerical changes in the other diet quality variables may also have been due to this type of summer season. Additional diet quality samples were collected in September and CP (9.6%) and IVOMD (69.5%) were starting to decline. Diet quality of forage selected by the steers was not different ($P>.10$) among stocking rates or size of steer.

Steers grazing light and moderate stocked pastures gained ($P<.10$; Table 2) more weight (2.57 and 2.49 lb/day, respectively) than steers in HS pastures (2.27 lb/day). Diet quality was not different among stocking rates, thus, higher rates of gain for steers in lighter stocking rate groups may be related to changes in forage availability, intake, and(or) time spent grazing. Additionally, alteration of animal behavior due to increasing stocking rate may have played a role.

August forage OM intake was not different ($P>.10$) among steers in any of stocking rates (3.0, 2.7, and 2.8% of BW for LS, MS, and HS steers, respectively: Table 2). However, LHT steers consumed (P<.05) more forage as a percentage of BW than did HWT steers (3.2 vs 2.5% of BW for LHT and HWT, respectively: Table 3). Light weight steers consumed more forage as a percentage of BW but had lower ADG than HWT steers (Table 3), implying that these steers were somehow less efficient. One possible explanation for this disparity could be type of cattle. The LHT steers were of Mexican origin and were of mixed ages and quality, while the HWT steers originated in Mississippi and may have had more potential to gain than the LHT steers.

Time spent grazing may influence energy expenditure and harvesting efficiency. Steers grazing HS pastures spent (P<.05) more time grazing (10.2 h/d: Table 2) than steers in the LS pastures (8.7 h/d) while steers MS pastures grazed 9.6 h/d which was similar (P>.10) to both HS and LS steers.

Forage standing crop (DM: Table 2) was lowest (P<.05: 4065 lb/acre) for the HS pastures, while LS and MS pastures were similar (P>.70: 7811 and 7364 lb/acre for LS and MS, respectively). There was no difference (P=.12) in standing crop between cattle types. Heavy stocking resulted in decreased forage quantity, however, quality of diets selected by steers was not different among stocking rates, no matter the amount of standing crop.

Forage OM intake was not different among stocking rates, thus, steers in HS pastures spent more time grazing, but consumed similar quantities of forage as steers in LS or MS pastures. Increased grazing time for steers in HS pastures may have been due to decreased standing crop. Therefore, the decline in ADG as stocking rate increased may have been due to increased grazing time rather than differences in diet quality or OM intake.

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Table 1. Chemical composition of old world bluestem masticate samples in June, July, and August.

Item	Stocking rate[a]	June	July	August	SE[b]
DM, %	Light	92.1^{e}	89.8^{d}	91.8^{e}	.50
	Moderate	93.2^{f}	89.4^{d}	90.5^{e}	.50
	Heavy	92.3^{e}	89.6^{d}	91.9^{d}	.50
			% of OM		
Ash[c]	N/A	11.6	10.2	10.0	.54
CP[c]	N/A	14.7^{e}	10.7^{d}	11.2^{d}	.25
NDF	Light	82.8^{e}	81.7^{de}	80.4^{d}	.87
	Moderate	81.3^{e}	79.0^{d}	81.4^{e}	.87
	Heavy	84.6^{f}	81.7^{e}	79.5^{d}	.87
ADF	Light	39.9^{d}	42.6^{e}	42.2^{e}	.90
	Moderate	41.1	41.4	43.0	.90
	Heavy	42.6^{e}	44.0^{e}	41.2^{d}	.90

IVOMD	Light	64.2[d]	73.8[e]	73.2[e]	.62
	Moderate	63.7[d]	72.7[e]	71.9[e]	.62
	Heavy	61.3[d]	71.7[e]	73.1[e]	.62

[a]Stocking rates: light (350 lb BW/acre), moderate (450 lb BW/acre), and heavy (750 lb BW/acre).
[b]Standard error of the means.
[c] No significant interaction (P>.05), main effects were compared.
[d,e,f] Means within a row without common superscripts differ (P<.01).

Table 2. Initial stocking rates, forage standing crop (lb DM/acre), OM intake (% BW), grazing time (hours/day), and average daily gain of steers during August.

	Stocking rate			
	Light	Moderate	Heavy	SE
Stocking rate, acres/steer[a]	1.5	1.1	.7	--
Stocking rate, lb LW/acre[b]	350	450	750	--
Forage, lb DM/acre	7811[e]	7364[e]	4065[d]	1021.8
Forage OM Intake, % BW	3.0	2.7	2.8	.15
Grazing Time, h/d[c]	8.7[d]	9.6[de]	10.2[e]	.31
ADG, lb	2.57[e]	2.49[e]	2.27[d]	.073

[a] Acres per 500 lb of initial steer live weight.
[b] Actual stocking rates.
[c] Heavy cattle only.
[d,e] Means within a row without common superscripts differ (P<.10).

Table 3. Gain and OM intake of light vs heavy steers.

	Cattle type		
	Light	Heavy	SE
ADG	2.22[a]	2.67[b]	.060
Forage OM Intake, % BW	3.2[b]	2.5[a]	.11

[a,b] Means within a row without common superscripts differ (P<.05).