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Effect of Stocking Rate and Grazing Method on Forage-On-Offer, Forage Intake, and Animal Weight Changes on Cool-Season Pastures

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Summary

In a 98-day winter wheat grazing study, the effects of stocking rate and grazing method (continuous versus rotational grazing) were investigated. Each grazing method was stocked at the rate of 1, 1.5, and 2 steers/A with two replications. Variables measured were forage-on-offer, bite rate, bite size, and animal weight changes. Forage-on-offer decreased linearly with a decrease in forage height. Bite rate remained constant across the stocking rates, but as forage height decreased from 12.5 inches on day 1 to 8.5 inches on day 7, bite rate decreased from 40 to 35 bites per minute and bite size decreased from .63 to .43 g/bite, respectively. There were no significant differences in average daily gains attributed to grazing methods. However there were increases with decreased stocking rates.

Introduction

It is a common practice to raise young animals on small grain pasture in many parts of the United States during the winter months. Research has demonstrated the cold tolerant small grain varieties to have a high potential for animal gains. Wheat in Texas has been used to extend the grazing season in the winter and early spring. However, there is still need for research with different kinds of beef animals on the best combinations of grazing methods and stocking rates that will allow for effective utilization of the forage while at the same time maximizing beef production and reducing the dependency on the expensive supplements such as energy and protein supplements.

Procedure

The study was conducted at Texas A&M University farm, approximately 8 miles west of College Station during the 1985-86 season. The experiment was laid out as a completely randomized design with two replications of continuous and rotational grazing methods each stocked at 1-1.5 and 2.0 steers/A. Twelve pastures of winter wheat were established in late September under conventional agronomic practices including land preparation, weed control, and nitrogen fertilizer (150 lb N/A using in-spirt applications). Irrigation of the pasture was provided as required during the experimental period. During the middle of December, each of the six pastures to be rotationally grazed was subdivided into four sections (paddocks) in order to implement a 7-day grazing and 21-day resting cycle. In each of the six continuously grazed pastures the entire area was available to the grazing steers at all times.

On December 16, 1985 three hand-clipped samples along with their corresponding heights were collected from each pasture to determine how much forage was available prior to the initiation of the grazing study. On the following day, 36 1-year-old cross-bred Angus steers with an average weight of 357 lb were randomly put into 12 groups of three animals each. Each group was randomly assigned to each of the 12 pastures on December 17, 1985. Each group was allowed 28 days of adjustment to the wheat pasture, after which the animals were re-weighed. Thereafter the animals were weighed every 28 days until the trial concluded after 98 days.

To monitor the amount of forage-on-offer, from each pasture, three forage height measurements were recorded from three randomly placed 1 ft^2 quadrate on days 1, 4, and 7 of grazing throughout the 98-day experimental period. Forage from each quadrate was handclipped 5 cm from the ground level, ovendried at 70° for 48 hours and then re-weighed. On the same sampling days, 30 additional height measurements were taken in a zig-zag pattern along the length of each pasture. The average of these 30-height measurements was then put into the regression equation derived from the height and weight relationship to predict the amount of forage-on-offer on days 1, 4, and 7. Portions of overdried samples were ground to pass through a 2 m screen for the determination of in vitro dry matter digestibility (IVDMD).

Measurements of bite rate (bites/minute) and bite size (grams o.m./bite) were taken on days 1, 4, and 7 to estimate forage intake on rotationally grazed pasture only. Three hundred bites were recorded on each steer. Bite rate was determined by dividing the 300 bites by the time actually spent by the animal taking the bites. On day 1 of grazing the animals were allowed to graze for 30 minutes before bite rate was measured. This 30-minute period was necessary to obtain a normal grazing pattern; bite rate during the first 30 minutes is faster than normal because the animals are moving from low to high forage availability. However on days 4 to 7 no such 30-minute adjustment period was necessary.

Bite size was estimated from esophageal samples collected from fistulated steers. At the beginning of each sampling period, the esophagus of the fistulated steer was temporarily plugged off with a sponge and a collection bag put around the fistula. The collected esophageal samples were then ovendried at 70° for 72 hours. Bite size was calculated as the total amount of dry matter divided by the total number of bites.

All data was analyzed by proc GLM as analysis of variance and/or co-variance. Further testing with multiple and orthogonal comparisons were performed when necessary.

Results and Discussion

Forage-On-Offer

Data on forage-on-offer from rotationally grazed pasture are presented in Table 1.

There was a significant ($P<0.0001$) linear relationship between forage height and forage-on-offer. The model used to explain this relationship, based on data collected over a 98-day period was $Y = 1003.7 + 194 \times (R^2 = .52)$. According to this mode, for every inch increase in forage height, the amount of forage-on-offer increased by 194

KEYWORDS: Winter wheat/grazing/stocking rate/animal gains.

TABLE 1. EFFECT OF STOCKING RATE AND DAY OF GRAZING ON FORAGE-ON-OFFER

Variable	Day	Stocking Rate			
		Heavy	Medium	Light	Mean
Forage height (inches)	1	9.1	12.0	16.3	12.5
	4	6.3	9.4	15.2	10.3
	7	4.3	7.5	13.8	8.5
Mean		6.6	9.6	15.1	
Forage-on-offer (lb/A)	1	2,768	3,334	4,161	3,421
	4	2,119	2,820	3,942	2,960
	7	1,834	2,200	3,683	2,572
		2,240	2,785	3,928	

TABLE 2. EFFECT OF STOCKING RATE AND DAY OF GRAZING ON BITE RATE AND BITE SIZE

	Day	Stocking Rate			
		Heavy	Medium	Light	Mean
Bite rate (bites/min.)	1	43.5	38.5	39.3	40.4
	4	38.7	36.5	36.5	37.2
	7	35.8	35.8	34	35.2
Mean		39.3	36.9	36.6	
Bite size (g/bite)	1	.58	.59	.72	.63
	4	.57	.55	.66	.59
	7	.36	.32	.60	.43
Mean		.50	.49	.66	

lb/A. When averaged, forage height of 6.6 inches had the lowest forage-on-offer (2,240 lb/A) while that of the light stocked pasture (15.1 inches) had the highest (3,930 lb/A). Forage-on-offer decreased from 3,420 lb/A on day 1 to 2,570 lb/A on day 7. Since the amount of forage-on-offer on day 7 was above 2,000 lb/A it is assumed that the steers had sufficient forage throughout the 7-day grazing periods irrespective of stocking rate.

Bite Rate and Bite Size

Results of the effects of stocking rate on bite rate and bite size are presented in Table 2. There was insufficient evidence at this stage of the study to indicate that bite rate was significantly affected by stocking rate. However, when averaged across the stocking rates, bite rate decreased significantly ($P<0.05$) from 40.4 bites per minute on day 1 to 35.2 bites per minute on day 7. Further testing using orthogonal contrast revealed that this decrease was significantly ($P<0.01$) linear with days. There was no significant stocking rate by day interaction effect on bite rate.

Results of the effects of stocking rate on bite size are presented in Table 2. Bite size with the heavy stocking rate (0.50 g/bite) was significantly ($P<0.01$) lower than that in the light stocking rate (0.66 g/bite). Further testing with orthogonal contrast revealed that this effect of stocking rate on bite size was significantly quadratic ($P<0.01$). There was also a significant ($P<0.05$) decrease in bite size as grazing advanced from day 1 (.63 g/bite) to day 7 (0.43 g/bite). Further testing showed that this decrease was quadratic ($P<0.10$). All interactions were not significant. Although both bite rate and bite size decreased by days and by stocking rate (bite size only) it is assumed that the steers had sufficient forage to graze throughout the 98-day study period as reflected by the high bite size.

There were no significant differences in the weight changes of steers (Table 3) between the continuous and rotational grazing methods. However in both grazing methods there was a significantly ($P<0.05$) linear decrease in total weight gain as the level of stocking increased from 1 hd/A in the light stocking rate to 2 hd/A in the heavy stocking rate. It is interesting to point out that average daily gain was above 1.8 lb/animal/day regardless of the stocking rate or grazing method. This is further evidence of sufficient grazable forage in all the treatments throughout the 98-day period. Visual observations in the continuous pastures suggested that the light stocking rate was the best in terms of providing the highest steer gains. However, most forage was wasted through trampling and there was loss of lower leaves. In the rotationally grazed pasture the medium stocking rate had less forage wastage and gave higher animal gains than the heavy stocking rate. A grazing method by stocking rate interaction (Fig. 1) suggests that average daily gain of steers will be maximized at a stocking rate of 1.68 hd/A.