Effect of Continuous or Rotational Grazing on Growing Steer Performance and Land Production

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Summary with Implications

Individual animal performance and animal production per acre were evaluated for steers grazing smooth bromegrass over 2 consecutive years. Treatments consisted of steers continuously grazing smooth bromegrass and initially stocked at either 4.0 animal unit months (AUM)/ac (HI) or 2.8 AUM/ac (LO) or steers rotationally grazing smooth bromegrass and initially stocked at 4.0 AUM/ac (ROT). Average calculated stocking rate for the LO, HI, and ROT treatments was greater than initial stocking rates due to the use of put and take animals. In vitro organic matter digestibility and crude protein of rotationally grazed pastures was relatively constant as the grazing season progressed, whereas continuous grazing showed a decrease in digestibility. However, there were no differences in gain between treatments. Treatment pastures grazed at a higher intensity, regardless of grazing method, had greater calculated stocking rate than pastures grazed at a lower intensity. Gain per acre, however, did not differ among treatments. Overall, although there was an increase in diet sample quality associated with rotational grazing compared to continuously grazed pastures, greater emphasis should likely be placed on managing an appropriate grazing intensity, rather than grazing method.

Introduction

During the period from 2006–2011, large amounts of grazing land in the Western Corn Belt were converted to crop land. This in turn caused an increase in pasture rental rates for the remaining available grazing land. Therefore, with decreased availability of grasslands for grazing and increased rent associated with grazing, optimizing use of land both in terms of animal performance and production per fixed unit of land is important to offset increased costs associated with grazing. A commonly discussed method for optimizing use of land is through the use of rotational grazing. Rotational grazing is a stocking method that has been reported to increase stocking rates while maintaining similar individual animal gain by dividing a pasture into separate paddocks that undergo short periods of grazing followed by longer periods of rest. Positive responses to rotational grazing have been reported to be more likely on cool-season forages compared to native range and improved warm-season forages. The objective of this study was to evaluate the effects of rotational grazing compared to continuous grazing, at stocking rates equal to or lesser than the rotational grazing stocking rate, on forage nutritive value, individual animal performance, and animal production per unit of land.

Procedure

Yearling steers grazed smooth bromegrass pastures over the course of 2 grazing seasons in 2015 and 2016. Three treatments were applied consisting of cattle continuously grazing bromegrass pastures at an initial stocking rate of 2.8 animal unit months (AUM)/ac (LO), 4.0 AUM/ac (HI), or cattle rotationally grazing smooth bromegrass at an initial stocking rate of 4.0 AUM/ac (ROT).

Pasture and Animal Management

Each year, 71 crossbred steer calves (689 lb, SD = 13) were assigned to 1 of 3 treatments with 3 replications per treatment. Prior to the start of the 2 years, treatments were allocated randomly to 1 of 9 pasture areas. For the rotationally grazed pastures each pasture area was divided into 6 paddocks. Paddocks were rotationally grazed for an average of 156 days each year from April to September. The grazing period was divided into 5 cycles with cycle 1 lasting 24 days and cycles 2, 3, and 4 lasting 36 days. Cycle 5 lasted between 24 and 36 d depending on forage availability. Cattle assigned to the ROT treatment rotated paddocks every 4 d during cycle 1 and 5 and every 6 d during cycles 2, 3, and 4. In all pastures, urea was surface applied as the N source at a rate of 80 lb N/ac in late March or early April, prior to the initiation of grazing. Cattle were implanted with 40 mg trenbalone acetate and 8 mg estradiol on d 1 of the trial each year (Revalor-G; Merck Animal Health).

Seven to 9 tester animals were maintained on each pasture, depending on size and treatment grazing intensity, at all times for performance measurements. A variable stocking rate was used in order to maintain a similar grazing pressure across all 3 treatments by utilizing put and take animals that were added or removed equally across treatments depending on forage production, which was assessed weekly. In the first year of the experiment, one put animal was added to each treatment pasture on April 29th, June 10th, and June 17th. In the second year, two puts were added to each pasture on April 21st, May 24th, and June 6th. On June 20th, two puts were removed from each pasture. Determination of forage yield was conducted visually to maintain approximately 7 in of standing forage at the conclusion of grazing. By utilizing put and take animals and varying stocking rate, the effects of treatment on animal performance and animal production per acre of land were measured while maintaining similar grazing pressure across treatments. Put and take animals were not used to calculate individual performance but were used to calculate total number of head days. Pastures were initially stocked each spring at a rate described above for each treatment. To calculate AUM/ac, total head days for each

Table 1. Nutritive value of diet samples by treatment and sampling date.

	Julian Day										*P*–value[1]				
Treatment[2]	120	134	153	157	195	218	230	259	260	SEM	Trt	Day	T*D	D*D	T*D*D
CP, % DM										1.1	0.03	0.10	< 0.01	< 0.01	0.02
LO	21.0[b]	15.3	14.4[b]	15.4	15.6[b]	16.8[ab]	16.0[b]	23.2[a]	17.7[b]						
HI	19.9[b]	17.4	15.3[ab]	16.6	21.6[a]	19.3[a]	17.9[ab]	19.2[b]	18.5[b]						
ROT	26.7[a]	16.3	17.9[a]	15.2	22.9[a]	15.0[b]	20.0[a]	23.9[a]	22.5[a]						
NDF, % DM										3.0	0.45	< 0.01	0.77	0.01	0.07
LO	65.1	62.7	70.5[a]	78.2	75.0[a]	71.5[b]	61.3	56.9	75.1[a]						
HI	68.8	71.3	66.4[b]	73.1	61.2[b]	70.4[b]	63.5	61.4	68.4[ab]						
ROT	64.0	66.7	68.5[ab]	71.0	67.0[ab]	79.5[a]	59.6	58.2	63.2[b]						
IVOMD, %										2.8	0.03	< 0.01	< 0.01	0.12	0.74
LO	74.0	66.7	69.1	66.3	55.9[b]	56.7[ab]	61.1[b]	68.5[ab]	43.5[c]						
HI	70.7	66.3	71.4	65.8	65.0[a]	50.7[b]	62.1[b]	60.8[b]	53.8[b]						
ROT	71.1	66.5	72.1	62.0	64.4[a]	62.3[a]	72.4[a]	73.2[a]	64.6[a]						

[abc] Means within Julian day and nutritive measurement with differing superscripts are different ($P < 0.07$).

[1] T*D = treatment × sampling date interaction, D*D = quadratic effect of day, T*D*D = treatment × quadratic effect of day interaction

[2] Treatments consisted of continuously grazed pastures initially stocked at 2.8 AUM/ac (LO), continuously grazed pastures initially stocked at 4.0 AUM/ac (HI), rotationally grazed pastures initially stocked at 4.0 AUM/ac (ROT).

pasture was converted to total months, multiplied by average BW of the tester animals, expressed as animal units (1000 lb), and then divided by the pasture area (ac).

Beginning and ending BW measurements were collected on 3 consecutive days and averaged following 5 days of being limit fed a diet of 50% alfalfa hay and 50% Sweet Bran at approximately 2% of BW to equalize gut fill.

Forage Measurements

Diet samples were collected once during each grazing cycle on a paddock rotation day from the paddock cattle were being moved to, prior to ROT cattle being rotated. Two ruminally cannulated steers were used to sample a pasture from each treatment (6 steers total). Diet samples were analyzed for OM, NDF, CP, and in vitro organic matter digestibility (IVOMD).

Estimates of forage mass were taken at the beginning and end of the grazing season each year to determine if appropriate grazing pressure was applied.

Statistical Analysis

Data were analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, NC) as a generalized randomized block design. Model effects included year, treatment, block, and the year × treatment interaction for performance. Diet sample values were regressed across Julian date with treatment and Julian date as fixed effects, and year as a random effect. Significance was declared at $P < 0.05$ and tendencies are discussed at $P < 0.10$. One replication of the HI treatment was removed from the analysis in each year due to poor performance of the treatment pasture, unrelated to the experiment.

Results

Forage Analysis

Monthly rainfall over the summers of 2015 and 2016 was 2–6 in more rain than average. There was no year × treatment interaction for measures of forage nutritive value ($P > 0.15$). There was a tendency for a quadratic day × treatment interaction on NDF level of forage ($P = 0.07$; Table 1). Neutral detergent fiber tended to be higher for the LO treatment in mid-July compared to the HI and ROT treatments. In early-August, NDF tended to be higher for the ROT treatment compared to the LO and HI treatments. Likewise, there was a significant quadratic day × treatment interaction for CP ($P < 0.02$). At the beginning and end of the grazing season, all treatments had similar CP levels. However, during the period from early July to mid-August, when temperatures are highest and growth of cool-season grasses is lowest, the HI and ROT diet samples tended to have higher CP levels than LO diet samples. For IVOMD, there was a linear day × treatment interaction ($P < 0.01$). As time of the grazing season progressed, ROT forage maintained a relatively constant IVOMD, whereas the HI and LO diet samples decreased in a linear fashion. Time of season appears to have a greater effect on forage nutritive value than stocking method. In general, for all three treatments, measures of nutritive value were higher at the beginning and end of the grazing season in May and September, and lower in the middle of the season in July.

Cattle Performance

There were no treatment × year interactions for any performance measures ($P > 0.40$). Ending BW and ADG did not differ among treatments ($P \geq 0.85$; Table 2).

Stocking rate was greater for HI and ROT treatments compared to LO ($P < 0.01$). Calculated stocking rate for HI and ROT pastures was 4.83 and 4.88 AUM/ac, respectively, while LO was 4.37 AUM/ac. All treatments had greater actual stocking rates over the course of the grazing season than what pastures were initially stocked at due to above average rainfall in 2015 and 2016 and increased forage production. However, even though there was an increase in stocking rate associated with HI and ROT treatments, gain per acre did not differ among treatments ($P = 0.35$) due to small differences in actual AUM/ha between the LO and HI and ROT treatments. Small stocking rate

Table 2. Effect of grazing strategy on performance of yearling steers grazing smooth bromegrass pastures.

	Treatments[1]				
	LO	HI	ROT	SEM	*P*-Value
Initial BW, lb	687	689	689	1.5	0.36
Ending BW, lb	890	883	890	11.4	0.87
ADG, lb	1.30	1.23	1.28	0.07	0.85
AUM/ac[2]	4.37[b]	4.83[a]	4.88[a]	0.02	< 0.01
Gain/acre, lb	213	228	237	14.0	0.35

[a,b,c] From the *P*-values, means within a row with differing superscripts are different ($P < 0.05$).
[1] Treatments consisted of continuously grazed pastures initially stocked at 2.8 AUM/ac (LO), continuously grazed pastures initially stocked at 4.0 AUM/ac (HI), rotationally grazed pastures initially stocked at 4.0 AUM/ac (ROT).
[2] Actual stocking rate.

differences combined with no differences in ADG led to a numerical increase in gain per acre for the HI and ROT treatments compared to the LO, but due to a large standard error, was not statistically significant.

There was no year × treatment interaction for estimated available forage ($P > 0.40$). At the beginning of the grazing season, LO pastures tended to have greater forage mass (2275 lb/ac) than HI pastures (1887 lb/ac; $P = 0.07$), with ROT pastures being intermediate (1969 lb/ac). At the conclusion of the grazing season, there were no differences ($P = 0.38$) in estimated available forage mass between treatments with LO, HI, and ROT pastures having estimates of 1095, 1000, and 851 lb/ac, respectively. Similar estimates of forage mass at the conclusion of the grazing season would indicate that treatment pastures were managed appropriately in relation to one another to achieve a similar ending residue level at the end of the grazing season.

Conclusions

The results of this study indicate that individual animal gains are not affected by grazing method. Additionally, gain/acre was also similar between treatments even though the HI and ROT treatments had slightly increased stocking rate in comparison to the LO treatment. The advantage of rotational grazing is that it keeps forage in a vegetative state which affects forage quality. The increase in forage quality was observed during the summer slump period but did not translate into increased ADG or gain/ac. Although there may be benefits to rotationally grazing cool season pastures, the greatest emphasis should be focused on grazing intensity rather than grazing method.

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