Continuous vs Rotational Stocking of Warm-Season Grasses at Three Stocking Rates

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Continuous vs Rotational Stocking of Warm-Season Grasses at Three Stocking Rates

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Continuous stocking changes species composition of grass stands and may affect long-term productivity. Rotational stocking lengthens the grazing season but may not increase total gains.

Summary

Pastures containing big and little bluestem, indiangrass, sideoats grama, and switchgrass were stocked with 2.1, 2.7, and 3.3 yearling steers/acre from June to August. Continuous stocking and six-paddock rotations were used. Grazing terminated early on most continuously stocked pastures due to low herbage mass. As stocking rate increased, ADG declined; continuous stocking produced highest (1.6 lbs) and lowest (.69 lbs) ADG. Gain/acre was unaffected by stocking rate using rotational stocking (224 lbs/acre) but declined from 250 to 133 lbs/acre as stocking rate increased using continuous stocking. Continuous stocking caused big bluestem to replace little bluestem and indiangrass and caused a slight decrease in stands.

Introduction

Many studies have shown that grazing systems including warm-season grass pastures are more productive than grazing only cool-season grasses. In addition, numerous reports extol the benefits of rotational stocking, but research comparisons rarely have found large differences in animal gains between continuous and rotational stocking. Stocking rate is the most important controllable factor influencing animal and pasture performance, regardless of the grass grazed. Despite their importance, few studies have evaluated either stocking rate or grazing methods of warm-season grasses.

Stocking rate and grazing methods influence animal and pasture performance several ways. Gain per animal remains constant at stocking rates below a critical level and decrease above that level. Gain per acre increases with stocking rate until gain per animal becomes so low that gain per acre declines rapidly with further increases in stocking rate. Plant species differ in their response to grazing so botanical composition may change under various stocking rates and combinations of grazing and rest.

This study examined botanical changes in mixed stands of warm-season grasses and measured yearling cattle gains as influenced by continuous or rotational stocking at three stocking rates.

Procedure

Eighteen seeded pastures containing a mixture of big bluestem (*Andropogon gerardii*), indiangrass (*Sorghastrum nutans*), sideoats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), and switchgrass (*Panicum virgatum*) were grazed at the Agricultural Research and Development Center near Ithaca, NE during 1993-1995.

Pastures contained about 3.3 acres and were grazed as a 3 x 3 factorial with 2.1, 2.7, and 3.3 yearling steers per acre. Continuous stocking and six-paddock rotations with either fixed (5-day graze, 25-day rest) or variable graze/rest periods were the grazing methods. Variable graze/rest periods were

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adjusted to match rotation and plant growth rates; animals generally were moved to the next paddock when one-half of the herbage mass in the medium stocking rate paddocks had disappeared according to visual estimates. A split-plot arrangement was used, with stocking rate as whole plots and grazing method as sub-plots. Whole plots were allocated in a completely randomized design with two replications. Pastures were fertilized annually in late May or early June with 80 lbs N/acre.

Yearling beef steers (620 lb) grazed corn stalks during winter and smooth bromegrass for 20 to 40 days during spring before starting the trials. Steers were blocked according to size and performance during winter grazing before starting to graze warm-season grasses in early June. Grazing was terminated early each year on most continuously stocked pastures when herbage mass dropped below 500 lbs/acre. Initial and final weights were the average of two weights taken on consecutive days following a 6-to 10-day feeding of a 50 percent alfalfa hay and 50 percent corn silage diet (DM basis), with intake limited to 2 percent of body weight. Data were analyzed as a split-plot in time with year as the sub-plot. In 1995 (year 3), after grazing warm-season grasses for 30 days, cattle from all pastures were moved back to smooth bromegrass pastures for 14 days and then returned to warm-season grasses for the remainder of the summer grazing season. This modification permitted longer rest periods for the warm-season grasses and used smooth bromegrass residue and regrowth that would have had poor feed value if left unused until after summer warm-season grazing was complete. Average daily gain data for 1995 include this bromegrass grazing.

Before grazing each year, basal plant cover and relative species composition were determined in each pasture using a modified single step-point method with over 400 points per pasture.

Results

Gain/acre was not affected by stocking rate when rotationally stocked (ave. 224 lbs/acre). However, it declined from 250 to 133 lbs/acre as stocking rate increased from 2.1 to 3.3 steers/acre using continuous stocking (Table 1). The ADG declined linearly across all grazing methods as stocking rate increased. The decline was greatest with continuous stocking, which produced both the highest (1.6 lbs) and lowest (.69 lbs) ADG among all treatments. Reported gains of steers continuously stocked at 2.7 or 3.3 head/acre probably were underestimated due to severe shortages of forage mass available late in the grazing season. Intermediate full weights (data not shown) taken periodically during years one and two suggest that steers on these pastures lost almost one lb/day during the last 20 days of grazing.

Table 1. Gain/acre and average daily gains of steers grazing mixed stands of warm-season grasses for three years in eastern Nebraska.

Grazing method	Steers/acre 2.1	2.7	3.3
	------- Gain/acre (lb) --------		
Continuous stocking	250[w]	173[y]	133[z]
Fixed rotation	217[x]	221[x]	227[x]
Variable rotation	237[wx]	219[x]	226[x]
	---- Average daily gain (lb) ----		
Continuous stocking	1.60[a]	1.03[d]	0.69[e]
Fixed rotation	1.35[bc]	1.10[cd]	1.02[d]
Variable rotation	1.47[ab]	1.10[cd]	0.98[de]

[a,b,c,d,e,w,x,y,z]Values with different superscripts are different ($P<.05$).

Table 2. Change in basal cover of a mixed stand of warm-season grasses following two seasons of grazing in eastern Nebraska.

Grazing method	Steers/acre 2.1	2.7	3.3
	------ Percentage units ------		
Continuous stocking	-4.8[a]	-2.2[b]	-3.5[ab]
Fixed rotation	-4.7[a]	0.1[c]	0.2[c]
Variable rotation	-2.2[b]	1.1[c]	-0.3[c]

Initial basal cover prior to 1993 grazing averaged 7.3%; basal density prior to 1995 averaged 5.6%.
[a,b,c]Values with different superscripts are different ($P<.05$).

Stand basal cover declined after two years of continuous stocking and at the lower stocking rate (Table 2). Rotational stocking at higher stocking rates caused no significant changes in overall basal cover. Lower stand cover at low stocking rates may have occurred because some plants were grazed repeatedly. This repeated grazing combined with competition from adjacent ungrazed plants probably killed some of the grazed plants.

Relative species composition was affected by stocking rate and grazing method (Table 3). Big bluestem increased compared to other grasses at all stocking rates and also with continuous and fixed rotational stocking. Change in species composition of pastures was least when variable rotational stocking was used and at the medium stocking rate. If lower stand basal cover and less species diversity cause poorer animal performance, long-term declines in productivity may occur with continuous stocking.

Big bluestem and indiangrass changed in relative species composition with each other and with little bluestem and switchgrass, respectively (Table 4). At heavier stocking rates under the variable stocking method, relative species composition of indiangrass increased as big bluestem decreased (Table 3). However, continuous stocking at the medium and higher stocking rates caused big bluestem to replace the other grass species.

The relatively short grazing season (about 70 days) used with these warm-season grasses may have limited the usefulness of rotational stocking to increase animal production. Also, small paddocks used in research prevent factors such as distance from water, topography, and shade from influencing grazing distribution.

Nonetheless, rotational stocking extended the grazing season when stock-

Table 3. Change in relative species composition of five warm-season grass species following two seasons of grazing in eastern Nebraska.

Grazing	Big bluestem	Switchgrass	Indiangrass	Sideoats grama	Little bluestem
	------ Percentage Units ------				
Steers/acre					
2.1	+14.98[a]	+0.96[b]	-10.40[c]	-2.63[b]	-2.91[b]
2.7	+ 7.08[a]	-0.64[b]	-1.84[b]	-0.72[b]	-3.88[b]
3.3	+15.52[a]	-2.05[bc]	-6.01[c]	-0.63[b]	-6.83[c]
Grazing method					
Continuous	+20.14[a]	+1.30[b]	-14.70[d]	-2.14[bc]	-4.58[c]
Rotation					
Fixed	+18.05[a]	+0.02[b]	-7.40[c]	-2.62[b]	-8.04[c]
Variable	-0.61[ab]	-3.05[b]	+ 3.86[a]	+0.80[ab]	-1.00[ab]

[a,b,c,d]Values within a row with different superscripts are different (P<.05).

Table 4. Partial correlation coefficients relating relative species composition of five warm-season grass species following two seasons of grazing in eastern Nebraska.

	Big bluestem	Indiangrass	Little bluestem	Sideoats grama
Switchgrass	0.05	-0.47*	0.22	-0.01
Big bluestem		-0.80**	-0.59**	-0.02
Indiangrass			0.21	-0.24
Little bluestem				-0.31

*, ** Significant at 0.05 and 0.01, respectively.

ing rate was relatively high and it maintained comparatively higher ADG and gain/acre than continuous stocking as stocking rate increased. In addition, continuous stocking caused greater changes in botanical composition, which may affect long-term production. Grazing will continue at least two more years to try and document the importance of these changes.

Rest periods in this study were too short (< 30 days) for warm-season grasses to recover from grazing, even when growing rapidly. Observations suggest that 40 to 45 days are needed. As this study continues during the next two years, a brief mid-summer grazing (14 to 21 days) of smooth bromegrass will be used to provide more recovery time for grazed plants and to utilize smooth bromegrass more effectively in the grazing system.

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