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Effects of Grazing System and Stocking Density on Performance of Summer Stocker Cattle Grazing Tallgrass Prairie

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Story in Brief

Two hundred and three stocker steers were grazed on tallgrass prairie at various stocking densities using rotational or continuous grazing during 1995, 1996 and 1997. Stocking densities were based on initial steer body weight and ranged from 120 lb of liveweight/acre to 227 lb of liveweight/acre. The grazing season began in late April and concluded in late September. Cattle managed with season-long continuous grazing gained more total pounds and had greater daily gains compared with rotationally grazed steers. Continuously grazed steers also had greater gains per acre than rotationally grazed cattle. Stocking steers at a moderate stocking density resulted in the greatest total gains and daily gains with reduced individual animal performance observed as stocking density increased. However, greater gains per acre occurred as stocking density increased. Managing stocker cattle with continuous grazing at heavy stocking density resulted in the optimal combination of individual animal performance and per acre gains on summer-grazed tallgrass prairie.

(Key Words: Stocking Density, Cattle Performance, Grazing Management.)

Introduction

Carrying capacity of land is limited by forage availability. Many factors can affect forage availability. The two factors in this study were stocking density and grazing system, both of which can be controlled by the livestock producer. Stocking density greatly affects animal performance, economic returns and range condition. Distribution of grazing can have a major impact on the utilization of forage. Rotational grazing is one method to control or influence distribution of grazing and has generated considerable producer interest in recent years. The objective of this study was to compare animal response to continuous and rotational grazing across various stocking densities ranging from moderate to very heavy. This study was intended to determine if decreased animal performance would occur from moving cattle less frequently. Previous studies (Gillen et al. 1992) on these pastures utilizing an eight-paddock rotation found reduced steer gains and lower net returns for rotational grazing compared with continuous grazing. In their rotational system, cattle were moved three to four times per week. This study utilized a four-paddock rotation with maximum rotation being no more than twice weekly, occurring during the early growing season.

Materials and Methods

Study Sites. The study was conducted at the Oklahoma State University Research Range (OSURR) located approximately 10 miles southwest of Stillwater, in Payne County, OK. Average precipitation for the Research Range is 33 inches with 65% falling from May-October. The average frost-free growing period is 204 d from April-October. Soils are mainly classified into loamy (25%) and shallow prairie (33%) range sites with some eroded old fields (22%) and shallow savannahs. The vegetation is typical tallgrass prairie in high seral state of good to excellent range condition. Dominant grass species consist of greater than 50% tallgrass species such as big and little bluestem, switchgrass and indiangrass with the remainder including tall dropseed, midgrasses, forbs, shortgrasses and annual grasses. Pastures were not burned during the 3 yr of the study or the year prior to the study but had previously been maintained on a 3-yr burn schedule. No fertilization or herbicide application was performed during the trial period.

Procedure. The experiment was conducted on 12 grazing units averaging 50 acres each. Six units (approx. 300 acres) were allotted to each grazing system. Within each grazing system, the six units were evenly distributed between moderate and very heavy stocking density. The moderately grazed units had stocking density of 120 lb of steer liveweight per acre (0.24 steers per acre; 4.2 acres per steer) while the most heavily grazed units had stocking density of 227 lb of steer liveweight per acre (0.45 steers per acre; 2.2 acres per steer). The other four units were assigned stocking densities between these two extremes. This resulted in 10 to 22 stocker cattle grazing the various units. Each unit assigned to rotational grazing was divided into four paddocks. Each paddock was grazed six to eight times per season for 3 to 7 d each time allowing 11 to 21 d of rest between grazing episodes. Grazing periods were shorter in the early growing season when forage growth was rapid and increased as growth slowed. Cattle were fed a 40% CP supplement from mid-July until trial end at the rate of 1 lb/(steer*day) prorated for three feedings weekly.

Cattle. Crossbred stocker cattle of mixed origin were obtained from private producers each year. All cattle received an implant of Synovex-S prior to arrival in Stillwater. Steers were received, processed and weighed at the OSURR. Weights were taken in late April at the initiation of grazing (503 lb), in mid July at the initiation of supplementation (634 lb) and again in late September at the completion of the grazing season (711 lb). All weights were obtained after a 14-h withdrawal from feed and water. Cattle had similar terrain and access to water across all pastures through all years of the trial.

Analysis. Treatments were analyzed as a replicated 2 x 3 factorial arrangement. Treatments were grazing system; continuous (CG) or rotational (RG), and one of three stocking densities. Stocking densities analyzed were moderate (M; 120 lb/A), heavy (H; 191 lb/A) and very heavy (VH; 227 lb/A). Cattle performance variables were analyzed using the GLM procedure of SAS (1992). Variables analyzed included total pounds of gain (GAIN) in the early season (ES; April-July), late season (LS; July-September) and season long (SL; April-September) grazing periods; rate of gain (ADG) for the same periods and gain per acre (G/A) for all three periods. The effects measured included system, stocking density, year, replication and the appropriate interactions.

Results and Discussion

Annual Variability. Precipitation was variable across the 3 yr of this study. In 1995 the precipitation year was near average. However, the spring and summer of 1996 were dry and summer gains were low due to the limited rainfall during the growing season. Cattle were removed from pastures in late August due to lack of forage. The fall was wet and rainfall was at near record levels for 1997. This led to abundant forage and near record gains by steers due to the amount and quality of forage. Across all of these varied year effects, the response to grazing system and stocking density was similar. The year effect was significant (P<.02) for all variables measured which was expected. There were no (P>.21) interactions by year for any variable. In addition, no interactions (P>.21) of stocking density by grazing system were noted.

Gain per Steer. Individual animal performance was greater as stocking density decreased. Stocking at M levels resulted in greater (P<.02) ES ADG for M vs H and M vs VH. No difference (P>.25) in ADG was found between H and VH stocking densities during the ES period. Also, SL ADG was greater (P<.01) for M stocking compared to VH. Season-long ADG was also greater (P<.10) for M vs H and H vs VH stocked cattle. Individual animal performance was greater for CG steers compared with RG cattle. Steers on CG vs RG had greater (P<.01) ADG during ES and SL, but not (P=.54) LS grazing periods. McCollum and Gillen (1998) found that steers on RG treatments at this site in an eight-paddock system had reduced intake and a lower diet quality than CG cattle. This resulted in less metabolizable energy and protein for RG cattle compared with CG steers. This agrees with our findings of lower animal performance for RG steers when compared with CG cattle. McCollum et al. (1994) found that at least four cycles of rotation per season were necessary to improve diet quality of RG steers. In this trial we doubled that number, but still saw decreased animal performance from RG cattle. Our results agree very closely with those of Gillen et al. (1992) in trials from 1989-1991 and 1989-1994 (Gillen, unpublished data) on these pastures using an eight-paddock rotation. They found RG cattle had reduced performance of 17% and lower net returns across all stocking densities compared with CG steers.

Gain per Acre. Total pounds of beef produced from a given land unit is an important economic indicator. While G/A is a function of stocking density and individual animal performance, acres are usually a fixed amount. Maximizing income from a fixed acreage often results in maximum income for an individual producer. Gain per acre during ES and SL was greater (P<.02) for CG than RG by 15 and 10%. Reduced (P<.01) G/A was realized by reducing stocking density from

VH to M and H to M during ES, LS and SL grazing periods. A trend (*P*<.15) for reduced G/A was noted by reducing stocking from VH to H in ES (*P*=.14) and SL (*P*=.10) periods but not (*P*>.45) during LS grazing.

Implications. As stocking density increased, G/A was greater while GAIN and ADG were reduced for cattle grazing both RG and CG. At similar stocking densities CG steers had greater GAIN, ADG and G/A vs RG steers. Decreasing the number of paddocks from eight to four did not improve animal performance of RG steers to a level similar to CG cattle. For optimal animal performance of stocker cattle grazed during the summer growing season on tallgrass prairie CG and moderate to heavy stocking densities should be considered. Many other individual factors may affect choice of grazing system, making RG a viable option for specific situations. However, to achieve maximum cattle performance, continuous grazing will result in greater weight gains, rate of gains and total pounds of beef gained per acre for summer stocker steers grazing tallgrass prairie.

Literature Cited

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Table 1. Animal performance by grazing system or stocking density.

	Grazing system			***Stocking density***			
	CG	***RG***	***SE***	***M***	***H***	***VH***	***SE***
GAIN, ES[1]	141^{a}	121^{b}	4.1	147^{a}	128^{b}	119^{b}	5.1
GAIN, LS[2]	80	76	4.5	80	79	74	5.5
GAIN, SL[3]	220^{a}	196^{b}	5.0	225^{ac}	208^{abd}	192^{be}	6.1
ADG, ES	1.57^{a}	1.35^{b}	.05	1.64^{a}	1.42^{b}	1.33^{b}	.06
ADG, LS	1.51	1.46	.09	1.54	1.54	1.37	.11
ADG, SL	1.52^{a}	1.37^{b}	.04	1.57^{ac}	1.45^{abd}	1.33^{be}	.05
G/A, ES	50^{a}	43^{b}	1.6	36^{a}	49^{b}	54^{b}	2.1
G/A, LS	29	27	1.7	20^{a}	31^{b}	33^{b}	2.1
G/A, SL	78^{a}	70^{b}	2.0	56^{ac}	80^{bd}	86^{be}	2.5

[1,2,3] ES=early season, LS=late season, SL=season-long.
[a,b] Means within row without common superscripts differ (*P*<.05).
[c,d,e] Means within row without common superscripts differ (*P*<.10).

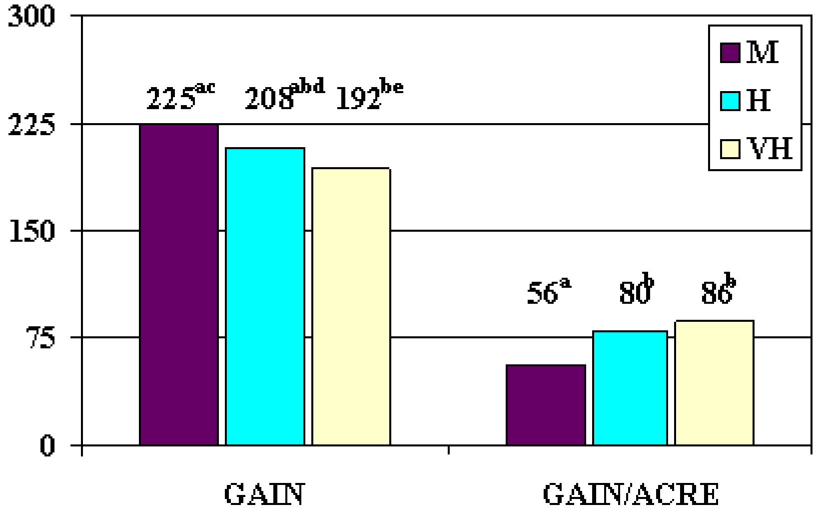

Figure 1: Season-long gains for steers at three stocking rates*.

[*] M=moderate (4.2 A/steer); H=heavy (2.63 A/steer); VH=very heavy (2.2 A/steer).
[a,b] Means without common superscripts differ (*P*<.05).
[c,d,e] Means without common superscripts differ (*P*<.10).

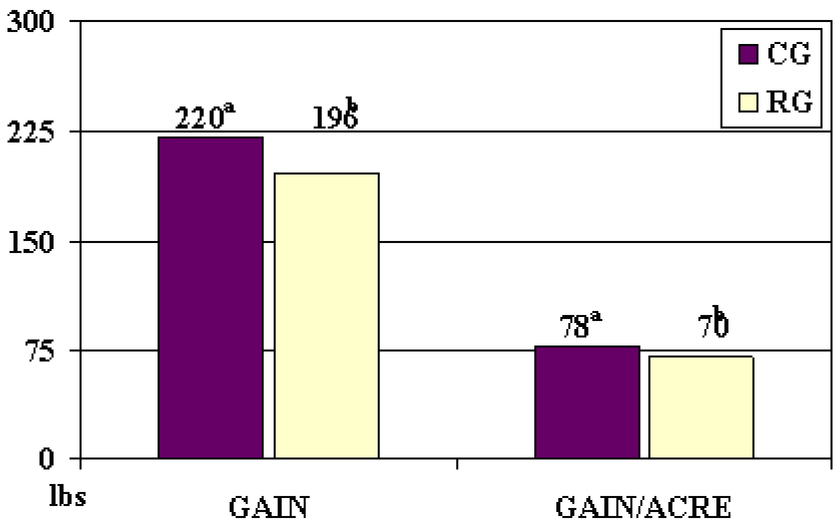

Figure 2: Season-long gains[1] for steers on CG and RG[2].

[1] GAIN=total pounds of gain; GAIN/ACRE=total pounds gained per acre.
[2] CG=continuous grazing; RG=rotational grazing.
[a,b] Means within group without common superscripts differ (*P*<.05).