LIVESTOCK RESPONSE TO GRAZING SYSTEMS AND STOCKING RATE ON TALLGRASS PRAIRIE

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Story in Brief

Stocker cattle were grazed under continuous or rotation grazing systems on tallgrass prairie during 1989, 1990 and 1991. Cattle under both systems were grazed at a series of stocking rates ranging from 0.24 to 0.45 head per acre (4.1 to 2.2 acres per head). The grazing season ran from late April to late September. Cattle on the rotation grazing system gained 40 lb per head less than cattle grazed continuously, a reduction of 17%. This resulted in lower gain per acre for the rotation system at all stocking rates. Net economic returns per acre were also lower under rotation grazing and the gap in net returns increased as stocking rate was increased. Moderate stocking would essentially maximize net returns under both grazing systems.

(Key Words: Grazing Management, Cattle, Gain Per Acre, Net Returns.)

Introduction

Stocking rate is a fundamental management variable affecting vegetation, livestock, and economic responses on rangelands. Grazing system or the schedule of grazing and resting is also an important management variable. It is often assumed stocking rate and grazing system interact so that the stocking rate delivering optimum performance will differ between grazing systems. However, there is little controlled research to support this assumption. Statements that rotation grazing can greatly increase stocking rates over continuous grazing have generated considerable discussion over the last 15 years. The two systems have seldom been tested at more than one stocking rate. Studies have compared continuous grazing at one stocking rate with rotation grazing at a second, higher stocking rate. Such studies make comparisons difficult. The objective of this study was to measure vegetation, livestock, and economic response to continuous and rotation grazing over a series of stocking rates ranging from moderate to very heavy to determine

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which stocking rates gave optimum performance under each of the two grazing systems.

Material and Methods

Research Site

The study was conducted on the Oklahoma State University Research Range located about 10 miles south-southwest of Stillwater, OK. Average precipitation for the Research Range is 31 inches. Soils are mainly classified into loamy and shallow prairie range sites with some inclusions of eroded old fields and shallow savannahs. The vegetation is typical tallgrass prairie in good to excellent range condition. Dominant grasses included little bluestem, big bluestem, indiangrass, and tall dropseed.

Study Procedures

The experiment was conducted on 12 grazing units averaging 50 acres in area. Six units were allocated to each of the grazing systems, continuous and rotation. Within each grazing system, the six units were distributed evenly between moderate and very heavy stocking rates. The moderately grazed units had stocking rates of 0.24 head per acre (4.1 acres per head) while the most heavily grazed units had stocking rates of 0.45 head per acre (2.2 acres per head). The other four units were then assigned stocking rates between these two extremes. This resulted in 10-22 stocker cattle grazing the various units.

The rotation grazing units were sub-divided into 8 pastures. All cattle on a unit moved as a group from pasture to pasture. Each pasture was grazed for 2-7 days and rested 14-49 days. Grazing periods were shorter in the early growing season when forage growth was rapid and were lengthened as the growing season progressed. Grazing periods for individual pastures were adjusted for differences in pasture size and forage productivity. Each pasture was grazed 3-4 times each growing season.

The stocker cattle were typical crossbred steers and heifers obtained on a lease arrangement with local ranchers. The cattle averaged 485 lb when placed on the study pastures in late April. All cattle were gathered and reweighed in mid July and again in late September when they were removed from the study pastures.

Statistical Analysis

Weight gains were analyzed using regression procedures. Gain per head was the dependent variable and grazing system and stocking rate were the dependent variables. The qualitative variable of grazing system was coded as an indicator variable while the quantitative variable of stocking rate was expressed as head per acre. An interaction term for grazing system and stocking rate was also included in the regression model. Year effects were removed by adjusting all gains to the average gain for the three combined years. The analytical framework used by Hart et al. (1988) was then used to calculate gain per acre and net returns per acre. Economic analysis was based on returns to variable costs only and did not consider the cost of facilities development. Budgets were based on the average livestock price structure and input costs for 1989-91.

Results and Discussion

Annual Variability

Precipitation was generally favorable for the three study years (Table 1). Rainfall was especially high in the 1989 growing season. Standing crop of forage remaining in the study pastures in September reflected growing season precipitation (Table 1). However, stocker gains were not closely related to precipitation or forage availability. Excessive May-June precipitation may be partly responsible for lower gains in 1989. Pastures were burned in the spring of 1990 which contributed to the higher gain in that year. Hot, dry July-August conditions in 1991 reduced gains.

Table 1. Annual variation in study conditions.

Year	Annual precipitation (inches)	Growing season precipitation (inches)	Standing forage in September (lb/A)	Average livestock gain (lb/head)
1989	43.0[a]	24.0	3990	216
1990	36.2	11.1	1760	280
1991	30.0	13.5	2820	196

[a] Average annual and growing season precipitation is 30.7 and 14.0 inches.

Gain per Head

The regression model accounted for 72% of the observed variation in gain per head. Increasing stocking rate had a negative linear effect on gain per head (Fig. 1). This effect was the same for both grazing systems. However, the intercept of the lines was significantly different ($P=0.05$). Cattle under rotation grazing averaged 40 lb less gain per head at all stocking rates. This translates to a 17% gain reduction due to rotation grazing.

Gain per Acre

Gain per acre was also reduced under rotation grazing (Fig. 2). The size of the reduction was dependent on stocking rate and was more severe as stocking rate increased. This was a direct result of the gain per head responses. Since the gain per head curves did not cross for the two systems, the gain per acre curves also did not cross and we could not compensate for lower per head gains by increasing stocking rate.

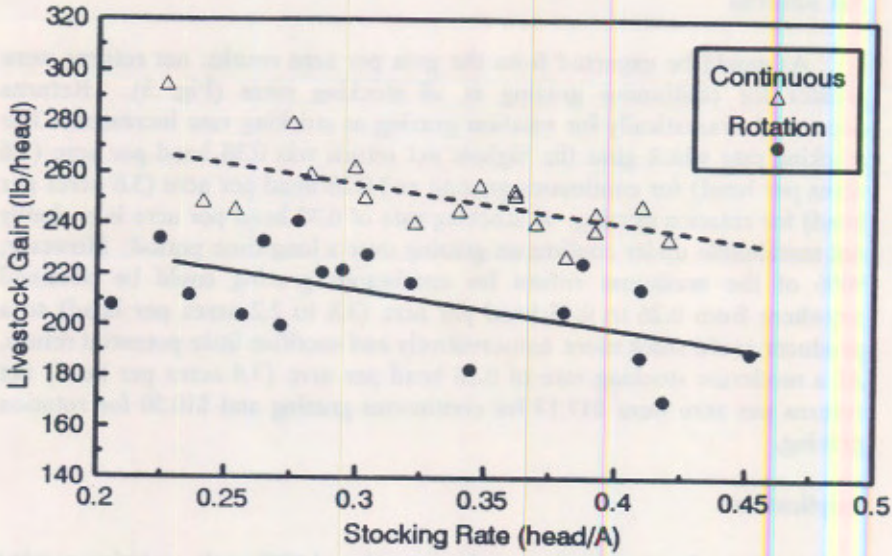

Figure 1. Livestock gain per head under continuous and rotation grazing for stocker cattle grazing tallgrass prairie, 1989-91.

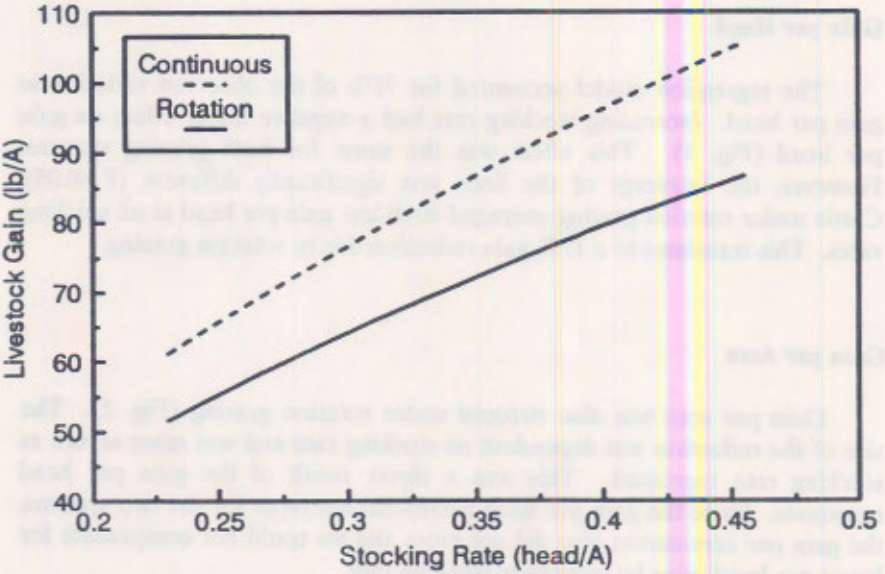

Figure 2. Livestock gain per acre under continuous and rotation grazing for stocker cattle grazing tallgrass prairie, 1989-91.

Net Returns

As would be expected from the gain per acre results, net returns were greater for continuous grazing at all stocking rates (Fig. 3). Returns decreased dramatically for rotation grazing as stocking rate increased. The stocking rate which gave the highest net return was 0.38 head per acre (2.6 acres per head) for continuous grazing and 0.28 head per acre (3.6 acres per head) for rotation grazing. A stocking rate of 0.38 head per acre is probably not sustainable under continuous grazing over a long time period. However, 90% of the maximum return for continuous grazing could be obtained anywhere from 0.26 to 0.45 head per acre (3.8 to 2.2 acres per head) so a producer could stock more conservatively and sacrifice little potential return. At a moderate stocking rate of 0.26 head per acre (3.8 acres per head) net returns per acre were $17.17 for continuous grazing and $10.20 for rotation grazing.

Implications

Gain per head of stocker cattle was reduced 17% under rotation grazing compared to continuous grazing at all stocking rates studied. This translated

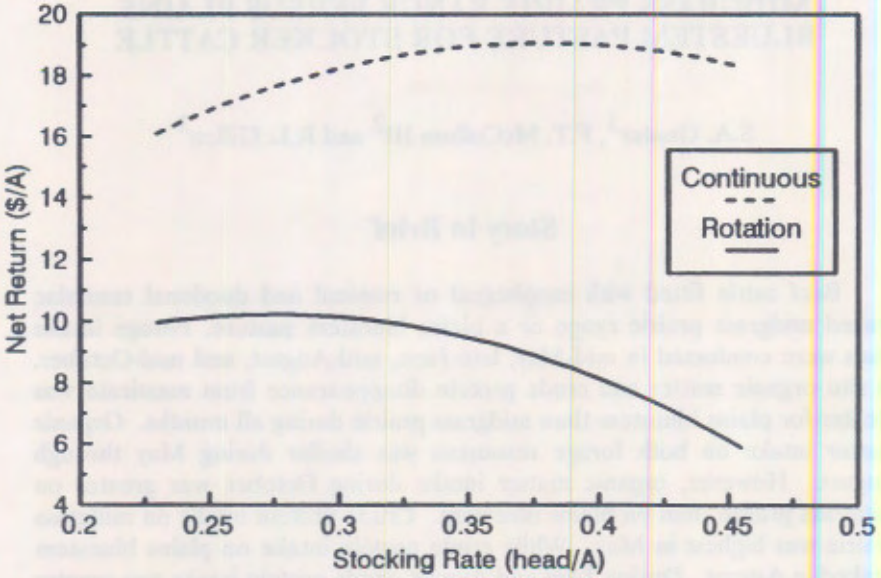

Figure 3. Net returns per acre under continuous and rotation grazing for stocker cattle grazing tallgrass prairie, 1989-91.

directly into lower gains per acre and lower net returns per acre under rotation grazing. Increasing stocking rate did not compensate for these reductions. The stocking rate which gave maximum net returns was actually lower for rotation grazing than for continuous grazing. The curve relating net returns to stocking rate was broad for continuous grazing. Stocking to maintain a vigorous mixture of the desirable tallgrasses will essentially maximize net income, especially if a supplementary vegetation management practice such as prescribed burning is used.

Literature Cited

Hart, R. H., et al. 1988. Cattle, vegetation, and economic responses to grazing systems and grazing presssure. J. Range Manage. 41:282-286.