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Plant and Animal Responses to Grazing Systems in the Nebraska Sandhills

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Summary

Short duration grazing (SDG) and deferred rotation (DR) were compared in a 10-year study conducted on upland native pastures in the northern Nebraska Sandhills. Herbage production of cool-season grasses and sedges was less on the SDG pastures, although total herbage production (including warm and cool season herbage) did not differ consistently between the two grazing systems. The decline in diet quality (CP and IVOMD) through the 5-month grazing season did not differ consistently between the two systems, and ADG of spayed heifers was similar. The lack of increased forage production and animal performance responses to SDG indicate that the higher input costs associated with SDG are not justified in the Nebraska Sandhills.

Introduction

Two common grazing systems used in the Nebraska Sandhills are short duration grazing (SDG) and deferred rotation (DR). Claims have been made that SDG systems can enhance range condition and livestock diet quality, distribution, and performance compared to less intensive forms of grazing systems. A DR system is less intensive and was developed to enhance range condition through increased plant vigor and reproduction by deferring grazing in one pasture of a multiple-pasture system until the dormant season. The objective of this study was to compare herbage standing crop, diet quality, and weight gain of grazing cattle in these two systems in order to determine if the implementation of a more intensive grazing system is beneficial to producers in the region.

Procedure

The study was conducted on upland range at the University of Nebraska Barta Brothers Ranch in the northeastern Nebraska Sandhills near Ainsworth, Neb. The study was initiated in 1999 with establishment of 2 replications of an 8-pasture SDG system and a 4-pasture DR system. Each system was grazed annually (1999 through 2008) by cow-calf pairs from 15 May to 15 October. Average pasture size was 115 acres. Stocking rates were adjusted each year based on precipitation and herbage availability, but stocking rate remained similar throughout the study on all systems at about 0.73 AUM/acre. The SDG systems were grazed in 3 cycles with 2-day occupations in the first cycle and 6- to 11-day occupations in the second and third cycles. Each pasture in the DR system was grazed only once during the growing season, and the pasture grazed last in the grazing sequence was deferred until September 1. Grazing periods lasted for 30 to 45 days. Timing of grazing changed annually for each pasture in the two grazing systems. A pasture was grazed one or two grazing periods earlier with each successive year, except for a pasture in the first grazing period that was moved to the last grazing period in the next year.

Standing crop was estimated by clipping in 240 grazing exclosures (16 ft^2) distributed through six pastures of each treatment. The exclosures were moved to a new location in May of each year. All standing vegetation was clipped to ground level in a 2.8 ft^2 quadrat placed in each of the exclosures in mid-June and mid-August of each year. The mid-June and mid-August harvests represent peak standing crop of cool-season grasses and sedges and warm-season grasses, respectively.

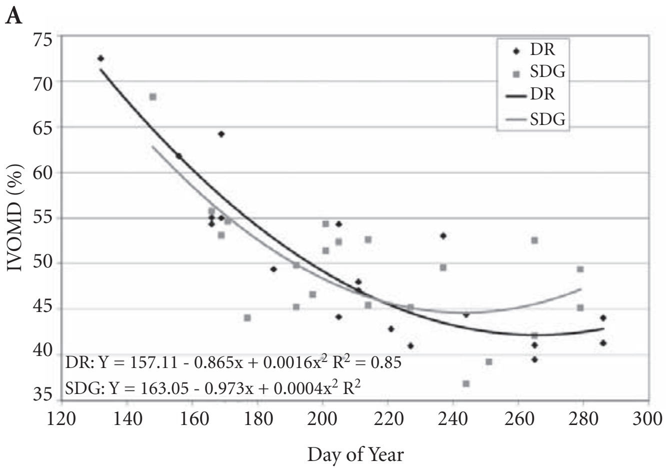
Esophageally fistulated cows were used to collect diet samples throughout the grazing seasons of 2005 and 2006. Collection sites of about 5 acres were selected in each of the 14 pastures that were sampled. All DR pastures were sampled and three pastures in each SDG replication were sampled each year. Diet samples were collected at the mid-point of each grazing period in each DR pasture. Samples were collected 1 to 2 days before and after each grazing period in the second and third cycle of each designated SDG pasture. Diet samples were frozen immediately following collection, freeze-dried, and ground through a Wiley Mill using a 1 mm screen. Samples were composited by pasture and analyzed for NDF, CP, and *in vitro* organic matter digestibility (IVOMD).

Twenty spayed heifers replaced 10 pairs in each of the four herds in 2006, 2007, and 2008. Individual body weights of the spayed heifers were recorded at the beginning and end of each grazing season.

Experimental unit was the individual grazing system. For diet quality data (IVOMD, CP, NDF), the PROC REG procedure of SAS was used to evaluate linear and quadratic relationships between quality characteristics and collection dates. This analysis was conducted within year and grazing system. The PROC MIXED and PROC REG procedures of SAS were then used to test year and grazing system effects on regression coefficients, and to test for year and grazing system effects for grazing period.

Results

Standing crop of cool-season grasses and sedges was 12 to 19% lower on SDG pastures than DR pastures in mid-June and mid-August (Table 1). Yields of the other live portions of the standing crop did not differ between the two grazing systems. In mid-June,



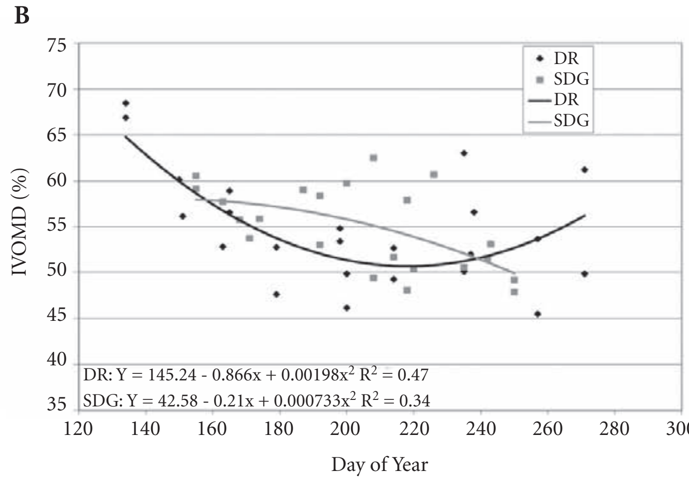


Figure 1. IVOMD of diet samples from DR (deferred rotation) and SDG (short duration grazing) pastures in 2005 (A) and 2006 (B).

Table 1. Mean herbage yields (lb/acre; SE) in June and August from 2000-2008.

Grazing System	Warm-Season Grasses	Cool-Season Graminoids	Forbs	Shrubs	Cactus	Litter and Standing Dead	Total Live
June							
DR[1]	286 (13)	590 (36)[a]	126 (15)	129 (15)	22 (8)	613 (42)	1154 (39)[a]
SDG[2]	284 (8)	517 (23)[b]	112 (10)	123 (10)	24 (5)	612 (28)	1061 (26)[b]
August							
DR	629 (31)	619 (39)[a]	240 (24)	152 (20)	22 (5)	474 (32)[b]	1664 (63)
SDG	642 (21)	503 (26)[b]	238 (16)	162 (12)	22 (4)	551 (21)[a]	1570 (41)

[a,b]Herbage means within column and month with a different superscript differ ($P < 0.1$).
[1]DR = deferred rotation.
[2]SDG = short duration grazing.

total live standing crop of SDG pastures was 8% lower than that of DR, but there was no difference in mid-August. All SDG pastures were grazed in the first cycle during the last half of May of each year, while only one of the four DR pastures was grazed in late May and early June. The annual grazing of SDG pastures in May might have been the cause of the relatively low yields of cool-season graminoids.

Crude protein content of diets declined through the growing season of both years but did not differ between SDG and DR. The IVOMD of diets declined at similar rates for the two systems in 2005, but rate of decline was greater for DR in 2006 (Figure 1). Weight gain of spayed heifers did not differ between the two treatments. Average daily gain (ADG) over treatments and years was 1.88 lb/head/day. The ADG varied by year ($P < 0.1$), with the highest average ADG (2.04 lb/head/day) in 2007.

When compared to DR, SDG has been hypothesized to provide a more consistent supply of high quality forage through the growing season, resulting in greater animal performance. The assumption has been that the increased stocking density and multiple rotations through the pastures associated with SDG will result in more even use of forage and will maintain the pasture forage in a more palatable and productive state. Short duration grazing can require more fencing and livestock water development and can be more labor and management intensive. Overall, the lack of increased forage production and animal performance responses to SDG in this study indicate that the higher input costs associated with SDG are not justified in the Nebraska Sandhills.

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