Grazing Systems for the Mixed Grass Prairie of North Dakota

Don Kirby[1], William Barker[2], Paul Nyren[3]

[1]Presented at the Fifth International Rangeland Congress (Salt Lake City, Utah, July 23-25, 1995).
[2]Range Scientists, Animal and Range Science Department, North Dakota State University, Fargo, ND 58105.
[3]Superintendent, Central Grasslands Research Center, Streeter, ND 58483.

Abstract

Herbage production and disappearance were similar among repeated seasonlong (1.85 AUM/ha), twice-over rotation (2.67 AUM/ha) and short duration (2.67 AUM/ha) grazing treatments between 1982 and 1992. Plant species composition and live basal cover on selected range sites remained similar on grazing treatments except during an extended drought when live basal cover decreased. Livestock performance was similar across grazing treatments, while production was greater on rotation treatments due to the increased stocking rates (40%) that were maintained.

Introduction

The mixed grass prairie comprising approximately 30 percent of the land area of North Dakota is dominated by cool- and warm-season midgrasses, short-grasses and sedges. The principal effects of repeated and unrestricted heavy grazing in the mixed grass prairie are a marked decrease of midgrasses and an increased coverage of short-grasses and sedges, with a subsequent decrease in total herbage yield. Considered to be below their potential for herbage hence livestock production, North Dakota's rangelands warrant research into more efficient management systems such as intensive rotation grazing systems.

The aim of this paper is to summarize the long-term results of TOR and SD grazing research in the mixed grass prairie of North Dakota. Specific purposes are to report effects of the rotation grazing on plant community species composition, herbage production and disappearance, livestock performance and production, and rangeland stocking rate.

Study Area and Methods

The study was conducted between 1982 and 1992 on the Central Grasslands Research Center (46°70'N Lat., 99°40' W Long.) in south-central North Dakota. Average annual precipitation is 45 cm with over 70% occurring between May and September. This region experiences approximately 120 frost-free days per year. The Center is located within the Wheatgrass-Needlegrass Vegetative Type of the northern Great Plains mixed grass prairie (Barker and Whitman 1988).

A repeated seasonlong (RSL) grazing treatment (130 ha) was compared to TOR (4-32.5 ha paddocks) and SD (8-16.25 ha paddocks) grazing systems. Allocated cow/calf pairs

averaged 45, 65 and 65 for the RSL (1.85 AUM/ha), TOR (2.67 AUM/ha) and SD (2.67 AUM/ha) grazing treatments respectively. Livestock were rotated every 20 days through paddocks of the TOR system. Three to four rotations were made seasonally through SD grazed paddocks averaging 3 to 5 days during herbage growth periods and 7 to 10 days when herbage was dormant. Annual grazing seasons averaged 160 days from late May to early November.

Long-term plant species composition changes were evaluated from points analysis from permanently established transects on silty and overflow range sites in each grazing treatment. Herbage production and disappearance was estimated by clipping "paired" grazed and ungrazed (caged) quadrats on both range sites in each grazing treatment. Livestock were annual weighed at the initiation and termination of grazing seasons on each grazing treatment.

Statistical differences in annual herbage production and disappearance, and cow and calf performance among treatments were determined with t-tests. Species composition changes were evaluated using relative basal cover data of the major plant species (>3%). Basal cover changes between similar range sites across treatments, and among years were determined using principal components analysis. Multiresponse permutation procedures (Biondini et al. 1988) and the Bonferroni multiple comparisons procedure were performed to determine differences in principal components.

Results and Discussion

Eleven-year average herbage production and disappearance was not different ($P \geq O.l$) between grazing treatments despite a 45% greater stocking rate on the rotation grazing systems (Table 1). The explanation for this is not obvious but likely related to improved harvest efficiency of forage under rotation grazing. Stuth et al. (1981) and Allison et al. (1982) reported harvest efficiency of grazed forage by livestock improved as stocking pressure increased.

Average daily gain of cows and calves and average gain of cows per ha were similar ($P \geq O.l$) between grazing treatments (Table 1). Average gain per ha for calves was greater ($P \geq O.1$) on rotation grazing systems reflecting the greater stocking rate on these treatments. Presumably individual livestock performance was maintained through monitoring of grazing pressure to prevent overuse of vegetation which has been strongly correlated to decreased livestock performance (Hart et al. 1988).

Relatively little species composition or basal cover changes occurred during the study period (Table 2). On the silty range site a significant increase in Poa spp. and decreases in Stipa spp. and Bouteloua spp. occurred by 1992 on the RSL and TOR grazing treatments. For the overflow range site, all grazing treatments had a significant increase in Poa spp. and decrease in warm- season grasses.

Literature Cited

Allison, C.D., M.M. Kothmann and L.R. Rittenhouse. 1982. Efficiency of forage harvest by grazing cattle. J. Range Manage. 35:351-354.

Barker, W.T. and W.C. Whitman. 1988. Vegetation of the Northern Great Plains. Rangelands 10:266-272.

Biondini, M.E., P.W. Mielke and K.J. Berry. 1988. Data-dependent permutation techniques for the analysis of ecological data. Vegetatio 75:161-168.

Hart, R.A., M.J. Samuel, P.S. Test and M.A. Smith. 1988. Cattle, vegetation, and economic responses to grazing systems and grazing pressure. J. Range Manage. 41:282-286.

Stuth, J.W., D.R. Kirby and R.E. Chmielewski. 1981. Effect of herbage allowance on the efficiency of defoliation by the grazing animal. Grass and Forage Sci. 36:1-7.