GRAZING EFFECTS ON THE STRUCTURES AND DYNAMICS OF GRASSLAND ECOSYSTEMS

Project No. 1786

Complementary Rotation Grazing System in Western North Dakota

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Introduction

Complementary grazing system used domesticated grass, legume, or annual crop pastures to add to or complement native range pastures. Rotation grazing moves livestock through a successive series of pastures in a preplanned sequence. Management of native range and domesticated grass pastures must be based on sound ecological principles that consider the growth and development of the dominant species and physiological needs, weaknesses and strengths of the plants to maintain productive stands. The nutritional needs of the livestock must be included in management considerations. Sound management recommendations can only be based on reliable scientific research.

Procedures

This project compares nongrazed, seasonlong grazing and rotation grazing on three native range sites to evaluate species composition, herbage production, and animal performance and the use of domesticated grass pastures in a complimentary rotation grazing system. The present complementary rotation grazing system has been in place at the ranch headquarters of the Dickinson Research Center since 1983. It consists of two crested wheatgrass (Agropyron desertorum) pastures of 13 acres for spring grazing from early May to 1 June and two altai wildrye (Elymus angustus) pastures of 30 acres for fall and early winter grazing from 15 October to 15 December. Native range has been grazed as two sets of three pastures during the summer from 1 June to 15 October and managed as a twice over rotation system. Two pastures were 80 acres and one pasture was 75 acres. Twenty-three cow-calf

pairs were used on each replication of the rotation grazing treatment. The seasonlong pasture treatments were established in 1986 and grazed from mid June to late October and consisted of 3 replicates of 80 acres of native range. Ten cow-calf pairs were used on each replication of the seasonlong grazing treatment. The two native range nongrazed treatments were established in 1987 and have not been grazed for more than 30 years.

The intended purpose of the trial is to maximize herbage and livestock production for a cow-calf operation, lengthen the grazing season in the spring and fall, improve range condition of native range, and reduce total acreage required to carry a cow and calf. The intention is to accomplish these goals with a low number of pastures with few rotation times and be flexible enough to be adapted by a wide range of livestock operations. This type of grazing system should improve operation efficiency, reduce costs and decrease labor per unit of production, and increase saleable production per acre.

Plant data collected on the treatments in this study were above ground herbage production, plant species composition, and leaf height measurements and phenological phases of eight major graminoid species. Animal weight performance for the commercial crossbred cattle used in this trial was collected only while livestock were on pasture at 15 or 30 day intervals.

Results and Discussion

The 1990 grazing season experienced drought conditions. A total of only 12.07 inches of precipitation fell for the entire year. The long term mean was 15.89 inches. Only 11.14 inches of precipitation occurred during the growing season, April to October.

The length of the grazing periods on the complementary rotation grazing system and seasonlong grazing treatments were reduced because of the drought conditions. The crested wheatgrass pastures were grazed from 21 May to 4 June for 14 days. Generally these pastures were grazed for 21 days. The native range was grazed from 4 June to 17 September for 105 days. The native range was previously grazed from 1 June to 15 October for 136 days. The altai wildrye pastures were grazed from 17 September to 17 October later for 30 days. Generally these pastures were grazed from 15 October to 15 December or later for 60 plus days. The native range seasonlong pastures were grazed from 20 June to 10 September for 82 days. Generally these pastures were grazed from mid June to late

October 129 days.

The total plant basal cover (Table 1) decreased on the nongrazed treatments on the sandy, shallow and silty range sites. The seasonlong grazed treatments on the sandy, shallow and silty range sites increased in basal cover compared to 1989 data. The rotation grazing treatments increased in total plant basal cover on the sandy, and shallow range sites but decreased slightly on the silty range sites. Generally the native range sites on the seasonlong and rotation grazing treatments showed a slight improvement in plant basal cover compared to 1989 data despite the prevailing drought conditions in 1990. The range sites on the nongrazed treatments did not show this improvement in plant basal cover.

The total above ground herbage production (Table 2) decreased on the rotation grazing treatments by 29%, 15%, and 14% on the sandy, shallow, and silty range sites, respectively, compared to 1989 data. The herbage production (Table 2) on the seasonlong grazing treatments decreased by 18% and 9% on the sandy and silty range sites and increased 9% on the shallow range sites. The herbage production (Table 2) on the nongrazed treatments increased by 33%, 49%, and 15% on the sandy, shallow, and silty range sites, respectively, compared to 1989 data.

The cow and calf average daily gain (Table 4) was decreased in 1990 compared to 1989 on the seasonlong treatments. The calf average daily gain (Table 4) was increased on the crested wheatgrass, native range, and decreased on the altai wildrye pastures of the complementary rotation treatments in 1990 compared to 1989. The cow average daily gain (Table 4) for the rotation was decreased on the crested wheatgrass, native range and altai wildrye pastures in 1990 compared to 1989. The cow and calf performance in 1990 was generally reduced compared to 1989 because of the continuation of drought conditions from August 1986.

Summary

The management of this complementary rotation grazing system has been based on ecological principles that consider the physiological needs, weaknesses, and strengths of the dominant plant species. Consideration of the nutritional needs of the livestock have been incorporated. Season of use of each pasture type was limited to periods of grazing when the detrimental effects of grazing were minimized and the potential for improvement in animal weight performance was maximized near potential. Effort has been made to limit the number of pastures and rotation times

to be the minimum. One pasture of crested wheatgrass was used for spring grazing. A second pasture may be necessary to move the starting date earlier. The native range was managed with three pastures, each grazed two times during the grazing season. One pasture of altai wildrye was used in this system for fall and early winter grazing. The grazing season has been lengthened from the traditional 6 months to 7.1 months. This system has the potential to lengthen the grazing season to 8.0 months with additional research. The acreage required to carry a cow and calf was reduced from 24.4 acres for 6 months to 11.6 acres for 7.1 months.

By using a complementary rotation grazing system similar to the one at the Dickinson Research Center, livestock producers have the potential to: lengthen the grazing season, reduce the acreage required to feed a cow and calf, and increase the amount of saleable beef produced from each livestock unit.

Table 1. Mean percent basal cover for native range treatments, Dickinson Research Center, July, 1990.

Range Site Treatment	Grass	Sedge	Forb	Shrub	Other plant	Total plant	Litter	Soil
Sandy								
Ungrazed								
Nongrazed	12.2	6.3	1.7	0.3	0.0	20.5	78.9	0.7
Seasonlong	—	---	---	—	—	—	—	—
Rotation	11.5	6.3	5.6	0.6	0.0	23.9	74.2	2.0
Grazed								
Seasonlong	13.0	13.8	8.8	0.5	0.0	36.0	61.0	3.0
Rotation	10.0	8.7	5.5	0.4	0.0	24.6	72.5	2.9
Shallow								
Ungrazed								
Nongrazed	6.8	9.4	3.8	0.0	0.0	19.9	76.8	3.3
Seasonlong	---	---	---	---	---	---	---	---
Rotation	12.4	7.9	4.5	0.5	0.4	25.6	70.9	3.5

Grazed								
Seasonlong	13.3	11.5	6.0	0.1	0.1	31.0	60.4	8.5
Rotation	13.2	7.2	3.3	0.3	0.1	24.1	68.7	7.3
Silty								
Ungrazed								
Nongrazed	9.1	5.2	4.3	2.0	0.1	20.7	79.3	0.1
Seasonlong	16.8	5.8	11.0	0.0	0.3	33.8	65.0	1.2
Rotation	14.3	5.7	6.1	0.0	0.1	26.3	71.1	2.7
Grazed								
Seasonlong	18.5	4.3	9.9	0.0	0.0	32.6	64.9	2.4
Rotation	13.8	4.2	4.5	0.0	0.0	22.5	72.6	5.0

Table 2. Mean herbage in pounds per acre, Dickinson Research Center, July, 1990.

Range site Treatment	Cool season	Warm season	Sedge	Forb	Shrub	Total live	Standing dead	Total above ground herbage	Litter
Sandy									
Ungrazed									
Nongrazed	269	785	234	16	0	1305	832	2137	4275
Seasonlong	253	232	458	241	0	1184	179	1363	2730
Rotation	218	194	304	143	0	858	143	1001	1588
Grazed									
Seasonlong	60	212	371	108	0	750	104	854	2475

Rotation	93	116	287	95	0	591	45	636	1292
Shallow									
Ungrazed									
Nongrazed	210	38	623	102	0	974	325	1299	2640
Seasonlong	163	114	337	170	0	783	96	879	1217
Rotation	240	118	236	107	0	701	105	806	543
Grazed									
Seasonlong	110	89	376	85	0	660	37	697	1737
Rotation	86	123	200	59	0	468	32	500	680
Silty									
Ungrazed									
Nongrazed	241	247	478	182	0	1147	356	1503	2439
Seasonlong	396	289	108	307	0	1100	207	1307	2324
Rotation	339	222	200	174	0	934	157	1091	887
Grazed									
Seasonlong	139	214	133	82	0	567	72	639	1845
Rotation	148	201	100	82	0	531	67	598	898

Table 3. Mean cow and calf periodic weight in pounds, Dickinson Research Center, 1990.

Treatment	1 May		15 May		1 Jun		15 Jun		1 Jul		15 Jul		1 Aug		15 Aug
Seasonlong								Native							
Rotation		Altai		Crested							Native				

Cow															
Seasonlong								1335					1356		
Rotation		1190		1203		1232		1264		1271		1286		1297	
Calf															
Seasonlong								285					372		
Rotation		200		235		266		307		335		378		435	

Table 3. Mean cow and calf periodic weight in pounds, Dickinson Research Center, 1990 cont'd.

Treatment	1 Sep		15 Sep		1 Oct		15 Oct		30 Oct		15 Dec
Seasonlong	Native										
Rotation			Altai								
Cow											
Seasonlong		1331									
Rotation	1258		1246				1156				
Calf											
Seasonlong		494									
Rotation	484		539				568				

Table 4. Mean cow and calf average daily gain and gain per acre in pounds, Dickinson Research Center, 1990.

	Crested wheatgrass	Native range	Altai wildrye	Total system
Average Daily Gain (ADG)				
Cow				
Seasonlong	—	-0.25	---	-0.25
Rotation	2.18	0.14	-2.09	-0.21
Calf				
Seasonlong	---	2.54	---	2.54
Rotation	2.30	2.60	0.96	2.26
Gain/Acre (G/A)				
Cow				
Seasonlong	---	-0.42	---	-0.42
Rotation	54.00	1.45	-59.22	-2.78
Calf				
Seasonlong	---	25.42	---	25.42
Rotation	57.00	26.72	47.50	30.44