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Effects of Fall Grazing on Grass-Leaf Height

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Introduction

Grazing beef cattle on native rangeland during the fall season is an optional management practice that has been followed in the Northern Plains. Fall occurs between the autumnal equinox (22 September) and the winter solstice (21 December) and includes October, November, and December. The practice of grazing during these months, frequently incorrectly referred to as "winter grazing", persists in part because of the common belief that grazing after frost in the fall does not harm perennial plants. A search of the pertinent scientific literature does not produce data to support the belief that native grasses are unaffected by late-season grazing. In fact, results of a study conducted from 1958 to 1962 at the Dickinson Research Extension Center indicated that fall grazing is detrimental to perennial grasses, greatly reducing leaf height of graminoid plants the following growing season.

Methods

Following World War II, the beef herd at the Dickinson Experiment Station was managed with a contemporary repeated spring, summer, and fall seasonal pasture grazing schedule. During the growing season, the 40-acre fall pasture was used as a native-grass study area on which basic plant growth data were collected for numerous range-related investigations. An exclosure (A) was constructed on the fall pasture during the spring of 1958, and a second exclosure (B) was constructed during late summer of 1961. From 1958 to 1962, Dr. Warren C. Whitman and Dr. Harold Goetz conducted a study designed to evaluate the effects fall grazing had on the height of grass leaves during the following growing season. Data from that study were reported by Goetz (1963).

Plant heights were determined by measuring leaves of an average of ten ungrazed lead tillers of each species to the nearest 1 cm during the growing seasons following fall treatments. Measurements were collected at approximately 7- to 10-day intervals from early April to mid September. Leaf heights were measured from the ground to the tips of extended leaves. Leaf-height measurements for needleleaf sedge (*Carex eleocharis*), needle and thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), and blue grama (*Bouteloua gracilis*) were collected in the fall-grazed pasture and in exclosures A and B, which were not grazed in the fall. A summary of these data and their interpretation is the primary subject of this report.

Growing-season conditions affect range plant growth (Manske 1998) and are a factor to be considered in the assessment of grass and sedge growth. The average monthly temperature and monthly precipitation data for 1958 to 1962 from the Dickinson Research Extension Center (Manske 2000) were used to characterize growing-season conditions as normal, drought, and wet.

Results

Goetz (1963) reported maximum leaf heights (table 1) of ungrazed lead tillers of needleleaf sedge, needle and thread, western wheatgrass, and blue grama measured from 1958 though 1962. Goetz (1963) stated that the data show that leaf heights for the four species of grasses and sedge were greater inside the exclosures than outside on the fall-grazed rangeland, irrespective of moisture conditions. Goetz (1963) concluded that the results of the study indicate a great reduction in maximum leaf height because of decreased vigor of the plants on rangeland subjected to fall grazing.

Maximum leaf heights of major graminoids on rangeland grazed during the fall were reduced 23.0%, 17.3%, 30.4%, and 43.0% for needleleaf sedge, needle and thread, western wheatgrass, and blue grama, respectively, compared to maximum leaf heights on treatments not fall grazed (table 2). Fall grazing reduced maximum leaf height of major graminoids 28.4% during the succeeding growing season.

Maximum leaf heights of the major graminoid species were affected by growing-season weather conditions in addition to the fall grazing treatments. The weather conditions of the growing seasons from 1958 to 1962 are summarized in table 3. The growing-season conditions of 1959 and 1961 were normal, the growing seasons of 1958 and 1960 had drought conditions with average precipitation levels 8.8% below normal, and the growing-season conditions of 1962 were wet, with precipitation levels 21% above the long-term mean.

Maximum leaf heights were shorter under drought growing-season conditions than under normal growing-season conditions for major graminoids on the treatments not fall grazed (table 4). During growing seasons with drought conditions, maximum leaf heights decreased 25.8%, 14.0%, and 11.8% for needleleaf sedge, needle and thread, and blue grama, respectively, from maximum leaf heights during growing seasons with normal conditions. During the study conducted by Whitman and Goetz, maximum leaf height of western wheatgrass was 8.0% greater during growing seasons with drought conditions than during growing seasons with normal conditions (table 4). This inconsistency can be explained by the precipitation patterns of the drought and normal growing seasons of 1958 to 1961 (table 3). Western wheatgrass completes most of its growth during May and June. Precipitation levels for June were greater than three inches in each of the two years with drought-condition growing seasons, 1958 and 1960. During the two years in which growing-season conditions

were normal, 1959 and 1961, precipitation levels were greater than three inches during June only in 1959. These differences between the precipitation patterns of the drought and normal growing seasons can cause the observed differences in leaf heights of western wheatgrass. Precipitation occurring during important growth periods can greatly benefit single grass species even during growing seasons with generally stressful conditions. Maximum leaf height of major graminoids was reduced 11% in growing seasons with drought conditions.

Maximum leaf heights were greater under wet growing-season conditions than under normal growing-season conditions for major graminoids on the treatments not fall grazed (table 4). During the growing season with wet conditions, maximum leaf heights were 22.5%, 46.6%, 69.7%, and 65.4% greater for needleleaf sedge, needle and thread, western wheatgrass, and blue grama, respectively, than maximum leaf heights attained during growing seasons with normal conditions. Maximum leaf height of major graminoids increased 51% in the growing season with wet conditions.

In 1959 and 1961, when the growing season conditions were normal, leaf heights (table 5) of the major species on the treatments not fall grazed were greater than leaf heights of the plants on the treatments grazed the previous fall. Fall grazing reduced maximum leaf height of major graminoids 20.8% during the growing seasons with normal conditions.

In 1958 and 1960, when the growing seasons had drought conditions, leaf heights (table 5) of the major species on the treatments not fall grazed were not much greater than leaf heights of the plants on the treatments grazed the previous fall. Leaf heights of needleleaf sedge and needle and thread on treatments not grazed in the fall did not differ from leaf heights on the fall-grazed treatments (table 5). Fall grazing reduced maximum leaf height of major graminoids 9.4% during the growing seasons with drought conditions.

In 1962, when the growing season conditions were wet, leaf heights (table 5) of all the major species on the treatments not fall grazed were considerably greater than leaf heights of the plants on the treatments grazed the previous fall. Leaf height of blue grama on exclosure A was more than twice the leaf height of the fall-grazed plants (table 5). Fall grazing reduced maximum leaf height of major graminoids 31.2% during the growing season with wet conditions.

Upland sedges attained an average maximum leaf height of 12.0 cm (4.7 in) in early to mid June during growing seasons with normal conditions. Leaf height of upland sedges was reduced 26% under drought conditions and increased 23% under wet conditions. Fall grazing reduced maximum leaf height of upland sedges 23%.

Needle and thread attained an average maximum leaf height of 19.3 cm (7.6 in) in late June to early July during growing seasons with normal conditions. Drought conditions reduced leaf height 14% from leaf height during normal conditions, and wet conditions increased leaf height 47% over leaf height during normal conditions. Fall grazing reduced maximum leaf height of needle and thread 17%.

Western wheatgrass attained an average maximum leaf height of 23.8 cm (9.4 in) by mid July during growing seasons with normal conditions. Wet conditions increased leaf height 70%. In growing seasons with drought conditions but with greater than three inches of precipitation in June, leaf height for western wheatgrass was not reduced. Drought conditions with below-normal precipitation in June would

cause a reduction in maximum leaf height for western wheatgrass. Fall grazing reduced maximum leaf height of western wheatgrass 30%.

Blue grama attained an average maximum leaf height of 12.7 cm (5.0 in) in early to mid July during growing seasons with normal conditions. Under drought conditions, leaf height decreased 12%, and under wet conditions leaf height increased 65%. Fall grazing reduced maximum leaf height of blue grama 43%.

Growth in height of the major graminoid species of the mixed prairie in the Northern Plains was affected by grazing during the fall as well as by precipitation patterns and moisture conditions during the growing season. Fall grazing damaged perennial grasses and reduced grass growth in leaf height during normal, drought, and wet growing-season conditions.

Discussion

Data collected by Whitman and Goetz during their study clearly show that fall grazing on native rangeland damages range plants and reduces leaf height by diminishing the vigor of the plants. The range condition of pastures that have a history of being grazed during the fall season can be improved if the fall grazing location is changed from the native range pasture to pastures of an alternative forage type like a variety of perennial wildrye (Altai, Russian, basin) or to a spring-seeded winter cereal pasture. The data from Goetz (1963) can be used to help predict the levels of improvement in the major species after the fall grazing practice has been changed. The average maximum leaf height of the major native range graminoids could be expected to increase 17.2% during the first year if the growing season had normal conditions and 33.3% if the first growing season had wet conditions. An increase of 42.5% in leaf height could be expected within four years of a change from grazing native rangelands in the fall.

Conclusion

The scientific results from the five-year research project Dr. Whitman and Dr. Goetz conducted at the Dickinson Research Extension Center provide evidence that fall grazing of native rangeland causes biological damage to the major rangeland species. Leaf heights of the major graminoids of the mixed grass prairie are affected by the grazing management practices used during the previous fall season and by the precipitation pattern and moisture conditions of the growing season. Not the benign practice it is commonly believed to be, fall grazing of rangeland causes a decrease in plant vigor and a great reduction in leaf height (28%) of the major graminoids during the succeeding growing season, regardless of the growing-season moisture conditions.

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Table 1. Maximum leaf height [centimeters (cm) and inches (in)] of ungrazed lead tillers measured during growing seasons following treatments fall grazed or not fall grazed (1958-1962), data from Goetz (1963).

Year	Upland sedge		Needle and thread		Western wheatgrass		Blue grama	
Treatment	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)
1958								
Initial	9.0	3.5	16.7	6.6	23.0	9.1	9.7	3.8
1959								
Exclosure A (1 yr)	10.7	4.2	20.0	7.9	22.3	8.8	12.0	4.7
Fall Grazed	9.0	3.5	19.0	7.5	20.0	7.9	9.0	3.5
1960								
Exclosure A (2 yr)	8.7	3.4	16.5	6.5	28.3	11.1	12.7	5.0
Fall Grazed	9.0	3.5	17.0	6.7	19.0	7.5	8.0	3.1
1961								
Exclosure A (3 yr)	13.3	5.2	18.6	7.3	25.3	10.0	13.3	5.2
Fall Grazed	9.0	3.5	16.0	6.3	22.0	8.7	7.0	2.8
1962								
Exclosure A (4 yr)	16.3	6.4	29.5	11.6	41.7	16.4	25.0	9.8
Exclosure B (1 yr)	13.0	5.1	27.0	10.6	39.0	15.4	17.0	6.7
Fall Grazed	11.0	4.3	23.0	9.1	26.0	10.2	11.5	4.5

Table 2. Average maximum leaf height [centimeters (cm) and inches (in)] of ungrazed lead tillers measured during growing seasons following treatments fall grazed or not fall grazed (mean of 1958-1962), summary of data from Goetz (1963).

Treatments		Exclosure	Fall grazed	Percent difference from treatments not fall grazed (%)
Upland sedge	(cm)	12.6	9.7	-23.0
	(in)	5.0	3.8	
Needle and thread	(cm)	23.1	19.1	-17.3
	(in)	9.1	7.5	
Western wheatgrass	(cm)	32.6	22.7	-30.4
	(in)	12.8	8.9	
Blue grama	(cm)	16.5	9.4	-43.0
	(in)	6.5	3.7	

Table 3. Summary of weather conditions during study of fall grazing effects on leaf height (1958-1962).

Year		1958	1959	1960	1961	1962
Growing-season precipitation	(in)	9.42	11.56	8.54	12.65	16.41
Percent of long-term mean precipitation	(%)	69.44	85.21	62.95	93.25	120.96
Months with water stress		May, Aug, Sep	Apr, Jul, Aug	Apr, Jul, Sep, Oct	Jul, Aug, Oct	Sep, Oct
Percent growing-season months with water stress	(%)	50	42	50	42	25
Months with > 3" precip.		Jun, Jul	Jun, Sep	Jun	Sep	May, Jul
Spring conditions		Dry	Dry	Dry	Normal	Wet
Fall conditions		Dry	Wet	Dry	Normal	Dry
Growing-season conditions		Drought	Normal	Drought	Normal	Wet

Data from Manske 2000

Table 4. Average maximum leaf height [centimeters (cm) and inches (in)] of ungrazed lead tillers measured during three growing-season conditions on treatments not fall grazed (1958-1962), summary of data from Goetz (1963).

Growing-season conditions		Normal	Drought		Wet	
Treatments		Exclosure	Exclosure	% Difference from Normal (%)	Exclosure	% Difference from Normal (%)
Upland sedge	(cm)	12.0	8.9	-25.8	14.7	+22.5
	(in)	4.7	3.5		5.8	
Needle and thread	(cm)	19.3	16.6	-14.0	28.3	+46.6
	(in)	7.6	6.5		11.1	
Western wheatgrass	(cm)	23.8	25.7	+8.0	40.4	+69.7
	(in)	9.4	10.1		15.9	
Blue grama	(cm)	12.7	11.2	-11.8	21.0	+65.4
	(in)	5.0	4.4		8.3	

Table 5. Maximum leaf height [centimeters (cm) and inches (in)] of ungrazed lead tillers measured during three growing-season conditions following treatments fall grazed or not fall grazed (1958-1962), summary of data from Goetz (1963).

Growing-season conditions		Normal		Drought		Wet		
Years		1959 & 1961		1958 & 1960		1962		
Treatments		Exclosure A	Fall grazed	Exclosure A	Fall grazed	Exclosure A	Exclosure B	Fall Grazed
Upland sedge	(cm)	12.0	9.0	8.9	9.0	16.3	13.0	11.0
	(in)	4.7	3.5	3.5	3.5	6.4	5.1	4.3
Needle and thread	(cm)	19.3	17.5	16.6	16.8	29.5	27.0	23.0
	(in)	7.6	6.9	6.5	6.6	11.6	10.6	9.1
Western wheatgrass	(cm)	23.8	21.0	25.7	21.0	41.7	39.0	26.0
	(in)	9.4	8.3	10.1	8.3	16.4	15.4	10.2
Blue grama	(cm)	12.7	8.0	11.2	8.8	25.0	17.0	11.5

	(in)	5.0	3.1	4.4	3.5	9.8	6.7	4.5

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