Cattle Use of a Sprayed Aspen Parkland Range[1]

JAMES E. HILTON[2] AND ARTHUR W. BAILEY

Department of Plant Science,
University of Alberta,
Edmonton, Alberta, Canada.

Highlight

Aspen parkland range in central Alberta that had been treated with a herbicide two years prior to the study had greater grazing use of the sprayed forest vegetation than did the untreated forest. The grazing use was usually greater in sprayed versus unsprayed grasslands but the difference was not as great as in the forest. During 1968 and 1969 when precipitation was heavy, the grasslands were extensively used. However, when dry conditions occurred, a greater use of the forest vegetation was observed. A regression equation was developed relating grazing use to precipitation.

One of the prerequisites of using herbicides to control woody species on rangeland is that additional forage must not only be produced but that this forage must be utilized by grazing animals. It is known that herbicides can control aspen poplar (*Populus tremuloides*)[3] forests and subsequent forage production is greater (Friesen et al., 1965) but the grazing use of these sprayed forests has not been documented.

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[2] Present address: Centro Internacional de Agricultura Tropical, Apartado Aereo 58-13, Bogota, Colombia.

[3] Nomenclature of vascular plants follows Moss (1959).

Ranchers and administrators recognize that, in the parkland area of central Alberta, the grasslands are usually grazed in preference to the aspen poplar forest. However, what occurs in a sprayed forest and adjacent grassland is unknown. Bailey (1970) has demonstrated that the shrub silverberry (*Elaeagnus commutata*) acts as a barrier to grazing cattle when it occurs in the fescue (*Festuca scabrella*) grasslands. Tree density in the aspen poplar forests is frequently as great as the density of silverberry in the grasslands. The trees are likely to be a significant barrier to grazing animals.

The objective of the study was to determine the comparative use made by cattle of sprayed and unsprayed aspen poplar forest and adjacent sprayed and unsprayed rough fescue grassland.

The study area was located on the University of Alberta ranch, 95 miles southeast of Edmonton, Alberta. The vegetation is primarily rough fescue grasslands on the uplands and south-facing slopes and aspen poplar forests on north-facing slopes and in lower areas. Small ponds and sedge (*Carex* spp.)—dominated wet meadows occupy depressions. The precipitation averages 15 inches per year with 10 inches occurring during the May to September growing season. The study area is located in the Thin Black Soil zone but differences in microtopography and the presence or absence of forest vegetation result in a number of soil types being present. In general, gleysolic soils are found in the low lying areas, dark grey luvisolic and degraded chernozemic soils under the forest vegetation and black and dark brown chernozems under the grassland vegetation (Pettapiece, 1969).

Methods

A fixed-wing aircraft applied 1, 2, 3 and 4 lb./acre acid equivalent of mixed butyl esters of 2, 4-dichlorophenoxyacetic acid (2,4-D) in a diesel carrier in August, 1966 to

four 40-acre strips, each one mile long by 330-feet wide and spaced 150-feet apart. Applications were repeated in early July, 1968 with an added 8 oz/acre of 2, 4, 5-trichlorophenoxyacetic acid (2,4,5-T) to all but the 3 lb./acre treatment.

In the spring of 1968, a 136-acre enclosure was fenced including 59 acres of unaffected grassland and forest and 57 acres of sprayed grassland and forest. The remaining area was bare ground used as a fireguard in a separate study. The study area contained 29% sprayed forest, 22% unsprayed forest, 21% sprayed grassland and 28% unsprayed grassland.

The study area was grazed by cows, yearlings, and calves in 1968 from August 23 to September 12 accounting for 20 animal unit months of grazing. In 1969, grazing occurred from June 26 to August 13, accounting for 47 animal unit months of grazing.

In 1968 and 1969, the locations of all animals except calves were recorded on large scale aerial photographs during a two-hour period in the morning and another two-hour period in the evening. The animals were recorded as feeding or resting. In 1968, positions of feeding animals were recorded during 32 hours, accounting for 840 grazing observations. Locating the position of a grazing animal every one-half hour (in 1968) or every 15 minutes (in 1969) was considered a grazing observation (Hull et al., 1960). The short interval in 1969 was made possible by the placement of bells on a number of animals thereby enabling faster location. In 1969, positions of feeding animals were recorded during 82 hours, accounting for 3,970 grazing observations. Each week 600 to 700 grazing observations were recorded.

Precipitation was measured at a weather station on the ranch one mile east of the study area.

In early August, 1969, four randomly located samples were collected in sprayed areas for each major forage species. The four samples were composited and analyzed for moisture content, crude protein, crude fiber and phosphorus.

The arcsin transformation was applied to the grazing use data before correlation coefficients and regression equations were developed relating grazing use to environmental factors.

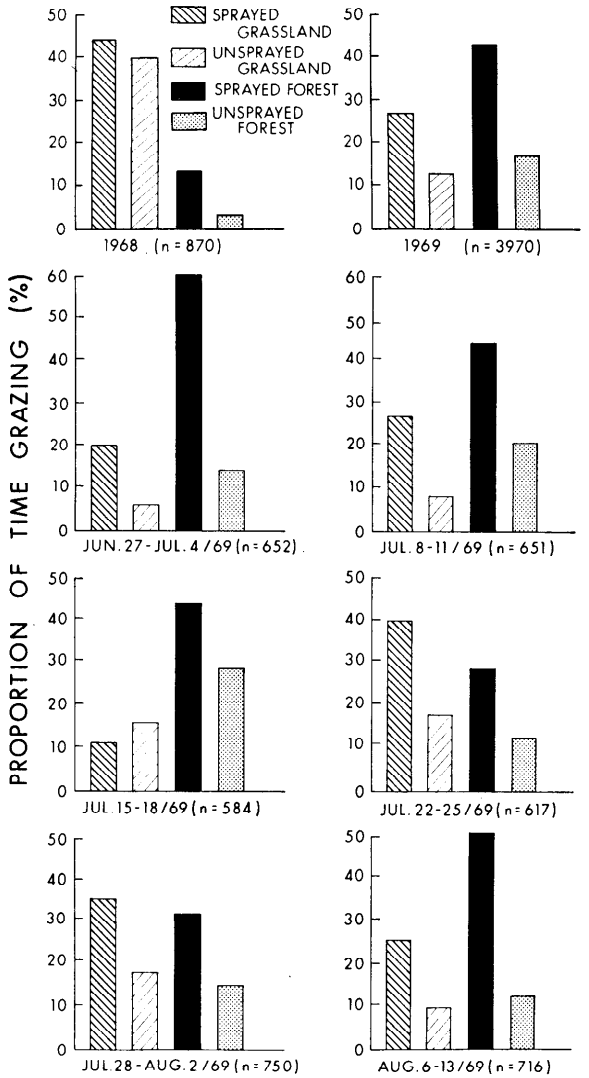

FIG. 1. Proportion of time spent grazing in sprayed and unsprayed grassland and forest by time interval adjusted to equal-sized areas.

Results

The cattle showed a distinct preference for the grassland rather than the forest during the 21-day grazing period in 1968 (Fig. 1). The grasslands provided 84% of the grazing. In the forest, grazing use of sprayed areas was four times greater than that of unsprayed forests. There was little difference in the use of sprayed versus unsprayed grassland.

In 1969, there was greater grazing use of the forest than the grassland (61% vs. 39%). As in the previous year, grazing use in the sprayed forest was greater than that of the unsprayed forest (43% vs. 18%). The sprayed grasslands were preferentially grazed over the untreated grassland (27% vs. 12%). The treated forest was preferred over the adjacent treated grassland.

Grazing use of the forested area was highest (74%) the first week (June 27 to July 4) of the grazing season (Fig. 1). For most of the season, the treated forest was more preferred than the adjacent treated grassland. From late June until mid-July, two to three times more observations were made of cattle grazing in the forest than in the grassland. The preference displayed by cattle for the forested vegetation occurred at the end of a month long drought. Precipitation in June, 1969 was 15% of the long term monthly average (Canada Department of Transport, Meteorology Division, 1969). About one week after a heavy rain in July, use of the grassland increased while grazing in the forest decreased. When less rain fell in late July and early August, grazing use of the forest vegetation again increased (Fig. 2).

The 1969 grazing study can be divided into three dry periods and three wet periods. During the dry periods, a greater proportion of the grazing time was spent in the forests with the sprayed forest being more preferred (Table 1). In wet periods, grazing use of sprayed grasslands nearly doubled.

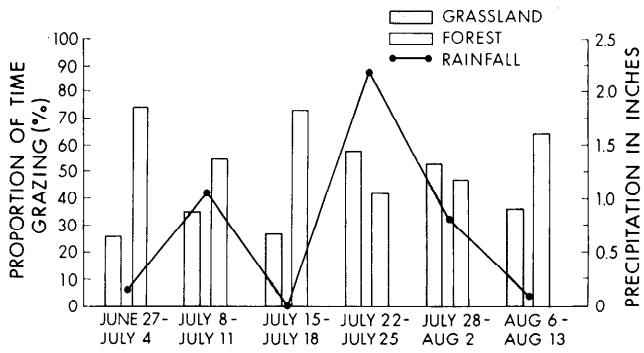

FIG. 2. Proportion of time grazing in grassland versus forest as adjusted to equal-sized areas and compared to rainfall during the previous week.

The grazing use of grassland was related to precipitation and temperature using correlation and simple and multiple regression analyses. Positive correlation coefficients were found for precipitation that occurred one, two, three and four weeks prior to grazing and for maximum daily temperature. The only significant one ($P < 0.05$) however, was precipitation that occurred one week prior to grazing ($r = 0.817$). Most of the variation as given by the coefficient of determination was accounted for by precipitation that occurred one and two weeks prior to grazing. Using a stepwise regression analysis program of Smillie (1969), the following regression equation was developed:

$$Y = 28.66 + 9.42X_1 + 4.84X_2$$

where Y = proportion (%) of grazing time in grassland, X_1 = precipitation one week prior to grazing, and X_2 = precipitation the second week prior to grazing. This accounted for 91% of the total variation and the multiple correlation coefficient ($R = 0.954$) was significant ($P < 0.05$). Precipitation one week prior to grazing (X_1) accounted for 67% of the variation and the t-test on b ($t = 5.33$ with 4df) was significant ($P < 0.05$). Precipitation the second week prior to grazing (X_2) accounted for 24% of the variation and the t-test on b ($t = 2.85$ with 4df) was also significant ($P < 0.05$).

In August, when grazing use of the grassland was 36% and there was 64% use in the forest, the moisture content of major grassland species was about one-half that of forest forages (Table 2). The crude protein and phosphorus content of grassland and forest forages was about the same. The crude fiber content was somewhat higher in forest forages.

Table 2. Chemical composition (%) of major grassland and forest forages in August, 1969.

Species	Moisture	Crude protein	Crude fiber	Phosphorus
Grassland species:				
Slender wheatgrass (*Agropyron trachycaulum*)	31	7.8	38	0.17
Western porcupine grass (*Stipa spartea* var. *curtiseta*)	26	8.6	36	0.16
Rough fescue (*Festuca scabrella*)	21	7.5	43	0.20
Sedge (*Carex obtusata* and others)	24	11.5	30	0.19
Mean of grassland species	26	8.9	37	0.18
Forest species:				
Bearded wheatgrass (*Agropyron subsecundum*)	46	8.5	46	0.21
Northern reedgrass (*Calamagrostis inexpansa*)	42	6.7	47	0.16
Fringed brome (*Bromus ciliatus*)	51	7.1	46	0.19
Sedge (*Carex prairea* and others)	43	10.2	33	0.21
Mean of forest species	46	8.1	43	0.19

Discussion

Administrators and ranchers in the parkland area of central Alberta recognize that overgrazing of the grasslands can be expected before much forage is consumed in unsprayed aspen clones when these occur interspersed with grassland. Similarly, in Colorado, Ellison and Houston (1958) and Paulsen (1969) indicated that cattle did not graze as much in the aspen forest as in the grassland. Their observations, however, apply only to an untreated forest. Hilton (1970) has demonstrated that much larger quantities of forage are available in the sprayed forest than in untreated areas.

Grazing use of the grasslands was quite variable and the study was not long enough to fully under-

Table 1. Proportion of the time (%) spent grazing in grassland and forest in dry and wet periods, 1969.

Period	Grassland			Forest			No. of observations
	Sprayed	Unsprayed	Total	Sprayed	Unsprayed	Total	
Dry	19	11	30	51	19	70	1952
Wet	35	14	49	35	16	51	2018

stand all of the causes. However, certain comparisons can be made with previous animal behavior studies. Dwyer (1961) in Oklahoma and McDaniel and Roark (1956) in Louisiana observed that high daytime temperatures influenced the grazing habits of beef cattle. The relationship found in the present study in 1969 between grazing use of the grasslands and maximum daily temperature yielded a correlation coefficient that was positive but not significant ($r = 0.436$). Dwyer (1961) considered that temperatures above 85F caused the grazing animals to modify their behavioral patterns. Similarly, in Louisiana, cows having natural shade in their pasture made greater gains than those with no shade (McDaniel and Roark, 1956); however, the mean maximum temperature ranged from 87 to 91F. In 1969 during our study the mean maximum temperature was 75F and ranged from 70 to 80F during the six observation periods. Apparently the maximum daily temperatures obtained were not high enough to encourage cattle to graze more heavily in the shady, unsprayed forest since the correlation coefficient between grazing use of the unsprayed forest and mean maximum temperature by grazing period was $r = -0.482$, a nonsignificant value.

We have found the amount of precipitation one and two weeks prior to grazing to be strongly related to grazing preference in 1969. We have also observed that for one period, August 6–13, when the forest accounted for 2/3 of the grazing use, the only major difference in chemical composition amongst the analyses made between grassland and forest ranges was in moisture content. The moisture content of the forage was apparently one important factor influencing animal preference in the relatively dry year of 1969.

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