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EFFECTS OF EARLY SPRING GRAZING OF RANGELANDS USED IN WINTER GRAZING PROGRAMS IN THE NORTHERN GREAT BASIN[1]

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ABSTRACT

Effects of early spring grazing of rangeland utilized in a winter grazing program in the northern Great Basin were determined in the first year of a two-year study. In early to mid-March, five 30 X 50 m sites were selected in a 405 ha, native range pasture, and fenced off. Approximately 75 animal unit month's (AUM) of forage was removed by cow-calf pairs during the next 30 days. In early November, total forage production was estimated from samples clipped from 20 randomly selected m^2 plots on both the inside (ungrazed) and outside (grazed) of each site. Immediately following clipping, diet quality samples were obtained from five esophageally fistulated steers, grazing first inside, then outside each site. Total forage production estimates obtained from clipped samples were lower in grazed versus ungrazed sites ($P<.05$; 158.12 kg/ha vs. 77.42 kg/ha, respectively). An increase in CP concentration existed in previously grazed sites ($P<.05$), while NDF levels were similar ($P>.10$). In vitro OM digestibility (OMD) followed an opposite trend than CP, being higher in ungrazed sites ($P=.11$). A significant reduction in ADL content was present in ungrazed sites ($P<.05$); ADF concentrations in grazed and ungrazed sites were similar. Estimates of diet quality obtained from clipped samples found higher CP levels in grazed versus ungrazed sites ($P<.05$); however, concentrations of both NDF and ADL tended to be higher in ungrazed sites ($P=.16$ and $P=.15$, respectively). No difference in either IVDMD or ADF was apparent ($P>.10$). "Preconditioning" winter range forage by early spring grazing reduces the quantity of forage available for winter grazing programs, with little enhancement of diet quality. In addition, clipped samples may inaccurately estimate the quality of diet by failing to account for grazing selectivity.

(KEY WORDS: Rangelands, Diet Quality, Grazing.)

Introduction

Winter grazing is an alternative grazing management plan currently being investigated at the Eastern Oregon Agricultural Research Center. This program may be both economical (Bates et al., 1990) and beneficial to range condition and productivity (Barrett et al., 1985). Previous winter grazing research has centered on supplementation strategies to try and optimize animal performance and utilization of the range forage resource (DelCurto et al., 1991; Brandyberry et al., 1992). Important, potentially limiting factors in winter grazing programs include weather conditions, forage quality and the quantity of forage available for grazing (Brandyberry et al., 1992). While weather cannot be influenced, the potential may exist to improve range forage conditions. Traditionally, pastures utilized in winter grazing programs are not grazed during the rest of the year. Early spring grazing, or "preconditioning," of range designated for winter grazing may delay plant phenology, causing nutrients to be retained in foliage, rather than being translocated to roots. Spring clipping of bluebunch wheatgrass provided regrowth of higher forage quality than did nondefoliated plants (Pitt, 1986). Anderson and Scherzinger (1975) reported that spring grazing of bunchgrass range by cattle improved winter range for elk. This improvement was determined by the increase in elk numbers on the study site. However, spring grazing may impact forage availability, especially in periods of drought; these changes may have a greater impact on forage conditions than changes in diet quality. Therefore, the objectives of this study were to 1) determine effects of preconditioning on the quality of winter forage and 2) determine effects of preconditioning on the amount of forage available for winter grazing.

Materials and Methods

The study was conducted on the Northern Great Basin Experimental Range, 67 km west of Burns, Oregon, at an elevation of 1400 m. Average annual precipitation is 277 mm; approximately 60% of this occurs as snow during the fall and winter, with only 25% as rain during the growing season. In early to mid-March of 1992, five 30 X 50 m sites were selected in a 405 ha, native range pasture; these sites were excluded from grazing via electric fencing. Cow-calf pairs were turned onto the range at this time and allowed to graze until mid-April, removing approximately 75 animal unit month's (AUM) of forage. Following animal removal, no further grazing occurred in this pasture until plots were sampled in early November. Sampling was delayed until this time by mild temperatures; a hard freeze was needed to ensure that plants became dormant. At sampling time, total forage production was estimated by clipping 20 randomly selected m^2 plots on both the inside (ungrazed) and outside (grazed) of each site. Immediately following clipping, five esophageally fistulated steers (avg wt 575 kg) were used to obtain diet quality samples. Steers first grazed the inside, then the outside of each site. Species present in this pasture include Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*), bluebunch wheatgrass (*Agropyron spicatum*), sandberg bluegrass (*Poa sandbergii*), needle-and-thread (*Stipa comata*), cheatgrass (*Bromus tectorum*) and numerous forbs.

Weather data were recorded daily at a station approximately 1.5 km from the study pasture. Precipitation

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Table 1. Forage production and chemical composition[a] of winter forage following deferred or spring grazing on northern Great Basin rangelands.

	Clipped samples				Esophageal samples			
Item	Ungrazed[b]	Grazed	SE	P-value	Ungrazed	Grazed	SE	P-value
Total Forage production (kg/ha)	158.12	77.42	17.06	.03				
CP	7.48	9.48	.54	.05	7.64	8.43	.20	.001
NDF	70.77	67.64	1.30	.16	70.75	70.14	.38	.26
ADF	54.36	51.34	1.53	.24	55.54	55.06	.38	.37
ADL	5.74	5.38	.14	.15	6.03	6.96	.26	.01
OMD					66.65	65.08	.68	.11
IVDMD	48.62	51.90	2.30	.37				

[a]Chemical composition expressed on a percent OM basis.
[b]Ungrazed = grazing deferred until winter. Grazed = spring grazing.

received from September through the following August is reported as growing season precipitation. All samples were dried at 55° C in a forced-air oven for 48 h, then ground to pass a 1-mm screen in a Wiley mill. Clipped samples were composited within treatment and sampling site; all samples were analyzed in duplicate for DM, ash, Kjeldahl N (AOAC, 1980) and ADF, NDF and ADL as described by Goering and Van Soest (1970). All samples were analyzed for in vitro digestibility as described by Tilley and Terry (1963). Rumen fluid was obtained from two steers consuming long-stem meadow hay.

Data were analyzed as a randomized complete block design, with treatment and block as the only terms in the model. If treatment differences were detected, means were separated using a Student's *t*-test (Steel and Torrie, 1980). All data were analyzed using the GLM procedure of SAS (1985).

Results

Growing season precipitation totalled 23.06 cm for 1991-92; this is approximately 90% of the long-term average. Below-average amounts of precipitation have occurred each of the past seven years on the Northern Great Basin Experimental Range. Temperatures in late winter-early spring were somewhat mild; these favorable temperatures caused forage to initiate spring growth earlier than normal. Precipitation levels at this time were low, however, causing the plants to become dormant relatively early in the season (mid-May). Mean values for total forage production and all diet quality components are presented in Table 1.

Estimates of total forage production obtained from clipped samples showed that early spring grazing resulted in a 51% reduction in winter forage availability (P<.05). When compared to grazing deferral, early spring grazing elevated CP levels in clipped samples by 21% (P<.05). There was a tendency for NDF to be higher in ungrazed sites (P=.16), and early spring grazing also tended to reduce ADL content (P=.15). Concentrations of both IVDMD and ADF from clipped samples were similar (P>.10).

Esophageal sampling found both ADF and NDF content to be similar in ungrazed and grazed sites (P>.10). Preconditioning increased CP concentrations in selected diets by 10% (P<.01); however, ADL was 13% higher in grazed vs. ungrazed sites (P<.05). In vitro OM digestibility (IVOMD) estimates obtained from esophageal samples tended to be higher in sites excluded from grazing (P=.11).

Discussion

Availability of forage for winter grazing was reduced by grazing in early spring. However, the magnitude of reduction in forage production following grazing could have been affected by changes in plant phenology. Mild late winter temperatures initiated plant growth earlier than normal, while dry growing conditions caused plants to revert to dormancy by mid-May. Wilson et al. (1966) reported that bluebunch wheatgrass is most susceptible to clipping during the boot stage, which is usually in early to mid-May. At this stage, root carbohydrate reserves are low, and little chance for regrowth occurs. The combination of mild late winter temperatures and low levels of spring precipitation occurring in the current study may have accelerated plant development, causing plants to go into the boot stage much earlier, making them susceptible to grazing at a time when grazing is not usually a problem. Likewise, plants may have simply shut down following spring grazing, due to low levels of soil moisture. In addition, any removal of standing dead material from the crown area of bunchgrasses may decrease carbon dioxide absorption, due to greater air movement and subsequent increased plant water stress, causing a reduction in plant production (Sauer, 1978). Van Soest (1982) stated that water stress will reduce dry matter yields, although digestibility is somewhat increased. Thus, the reduced volume of forage should be of higher quality.

One of the principles outlined by Anderson and Scherzinger (1975) involving spring grazing for improved winter forage is proper grazing pressure. Enough pressure must be applied to "top-off" the pastures, yet leave an adequate volume of forage in order to allow for diet selection.

Reductions in forage quantity can reduce diet quality by forcing animals to consume plants or plant parts that normally would not be selected, such as sagebrush twigs (Brandyberry et al., 1992). Therefore, if forage quantity is reduced, forage quality must be increased in order to compensate and make the practice of preconditioning a practical alternative. Diet quality components exhibited inconsistent responses to either grazing deferral or spring grazing. While CP levels were increased by preconditioning, exclusion of grazing elevated IVOMD and reduced ADL concentrations. Other variables (NDF and ADF) were not affected by grazing treatment. Thus, preconditioning did not enhance the quality of diet selected. Diet quality usually declines as forage matures, primarily due to increased amounts of fiber and decreased concentrations of dietary protein (Ball et al., 1978). Increased lignification and reductions in leaf:stem ratio also contribute to declines in forage quality with increasing maturity (Van Soest, 1982). Pitt (1986) reported that clipping bluebunch wheatgrass during spring growth delayed phenological development until later in the season. Regrowth following clipping was higher in CP and lower in ADF than nondefoliated plants. According to Van Soest (1982), water stress tends to retard plant development and maturity. The plant remains in a more vegetative state and digestibility is somewhat increased. Anderson and Scherzinger (1975) made the following suppositions, based on the ideas of Salisbury and Ross (1969):

1) Termination of growth at an immature stage due to heat or drought stops or greatly reduces translocation, thereby fixing the nutritional quality of green foliage in the mature forage.
2) Termination of growth due to heat or drought increases the palatability of foliage through the conversion of starch to sugars.
3) Young-tissue regrowth following grazing may grow a bit longer into the hot dry season, thereby increasing the volume of nutritious forage.
4) Autumn production of green forage, when it occurs, may be more reliable and longer lasting in plants that acquired drought hardiness - therefore, frost hardiness - through a reduced water supply while in an immature stage of growth.

Thus, the grazed sites would be expected to be of higher quality, since grazing would delay plant phenology, causing plants to remain in a vegetative state until summer heat and dry conditions terminated growth. However, adapted perennial plants in desert regions may revert to dormancy in a dry year, pulling reserves into the roots and leaving an aerial part of lower nutritive value (Van Soest, 1982). Very low levels of moisture due to several successive dry years may have terminated growth following spring grazing. Another potential factor contributing to diet quality in this study may have been forage quantity. Since twice as much forage was available on ungrazed sites, a greater opportunity may have existed for animals to select a high-quality diet.

The forage quality of the standing crop (determined via clipped samples) appeared to be improved by early spring grazing (Table 1); these results are similar to those of Pitt (1986) and follow the hypotheses of Anderson and Scherzinger (1975). However, the chemical composition of forage obtained by clipping is seldom the same as forage selected by the grazing animal, due to the ability of the animal to selectively graze (Hardison et al., 1954). Use of esophageally fistulated animals has been shown to be an accurate and effective method of estimating forage quality (Torell, 1954; Bath et al., 1956). More recently, Olson (1991) concluded that the ruminal evacuation technique provided satisfactory estimates of diet quality. Increased amounts of available forage on ungrazed sites may have provided animals with more opportunities to selectively graze. If forage quantities (and therefore selection opportunities) were similar under both grazing procedures, preconditioning should improve diet quality, due to the enhancement of quality in the standing crop. However, in order to accurately reflect the animal's ability to selectively graze, either esophageal or ruminal collection techniques should be used for determining diet quality.

Implications

Preconditioning forage for winter grazing appeared to improve the nutritive quality of the available forage. However, the quality of diet selected was not enhanced with preconditioning. In addition, early spring grazing reduced the quantity of forage available for winter use. Environmental factors, such as mild late-winter temperatures and low levels of available moisture may have affected forage conditions by halting plant growth earlier than expected. During dry years, preconditioning may not be a viable management plan for winter range. In addition, clipped samples may inaccurately estimate the quality of diet by failing to account for grazing selectivity.

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