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Preferences of mule deer for 16 grasses found on Intermountain winter ranges

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Abstract

In rangeland revegetation, selection of forages palatable to the primary grazer is crucial. Five tame mule deer were used in the spring and fall to determine forage preferences for 16 grasses commonly found on seeded foothill rangelands. Trials were conducted within a planted enclosure. Cheatgrass (*Bromus tectorum* L.) was the most preferred species in spring, and also preferred in fall. Other preferred species included 'Paiute' orchardgrass (*Dactylis glomerata* L.), 'Luna' pubescent wheatgrass (*Agropyron trichophorum* link.), and fairway wheatgrass (*Agropyron cristatum* [L.] Gaertn). The least preferred grasses were three species of wildrye, 'Vinall' and 'Boisoisky' Russian wildrye (*Psathyrostachys juncea* Fisch.) and 'Magnar' basin wildrye (*Elymus cinereus* Scrib. and Merr.). Results showed a wide range of preferences for grasses.

Key Words: mule deer, seeding, grasses, diet, forage preferences, winter range

The grass component in the year-long diet of mule deer is generally small compared to the amount of forbs and browse consumed (Kufeld et al. 1973). Consumption of grasses is primarily limited to early spring, before ample forbs become available, and fall if late summer precipitation stimulates regrowth (Austin and Urness 1983, Willms and McLean 1978). Availability of nutritious new growth in the fall improves body condition, delays utilization of fat and reduces subsequent winter mortality (Urness et al. 1983, Wallmo et al. 1977). The timing of spring green-up is important to ending overwinter mortality and rapid physical recovery, particularly for lactating does (Moen 1978).

The values of improving depleted or burned big game winter ranges through revegetation are evident, and the selection of species used in planting is critical to success in terms of plant establishment and persistence, erosion control, and increased forage availability and quality (Plummer et al. 1968). The objective of this study was to determine preferences of mule deer for various grasses used for revegetation of big game winter ranges.

Materials and Methods

A combination of species and accessions of grasses (n=16) were selected for evaluation. Grass selections are listed in Table 1. Four replicated macroplots were established in a linear rectangular design with 2 m between macroplots. Each macroplot contained 16 randomly assigned microplots, one for each selection, arranged in a 4 x 4 square. Microplots were separated by 2 m. Within each microplot 16 plants of a selection were established also in a 4 x 4 square on 1 m centers. The only exception was cheatgrass (*Bromus tectorum* L.) which was direct seeded throughout the microplot in fall 1990. All other selections were established as transplants in spring 1990.

The center of each microplot was marked with an identifying color-coded and numbered wooden stake. Plants were watered and weeds were removed during the initial summer (1990) of establishment. Weeds were removed the following spring prior to sampling with deer and again in fall. To investigate differences between deer preferences for irrigated and non-irrigated plants in fall, 2 of the 4 replications were irrigated.

To determine production and nutritive values of selections, before sampling for dietary preferences, 2 plants, ocularly estimated as the mean in size within each microplot, were selected. One-half of each plant was clipped. For cheatgrass, 2 samples were selected to each represent 1/32 of the available biomass on each replication. Thus 1/16 of all plant biomass was removed from each accession. Samples were air-dried, weighed, and subjected to near infrared reflectance spectroscopy (NRI) for nutritional analyses at the Utah State University Soils, Plant and Water Analysis Laboratory.

Sampling for dietary preferences using 5 tame mule deer was completed during spring (5 April to 11 May) and fall (12 to 25 September), 1991. During both periods, deer were transported to a holding pen and maintained for 3 days before the first sampling trial. Samples of all grasses were available within the holding pen to facilitate acclimatization to the selections.

Diets were determined by bite counts (Neff 1974) with individual deer used as replications in the diet analyses. Total bite counts for all trials were converted to dry-weight consumption using air-dry weight of 25 simulated bites for each species. Simulated bites were collected mid-way through the sampling periods. During each trial, morning or evening, all deer were released into the research pasture. A pre-determined sampling schedule for deer was followed with a primary and a secondary deer designated for observation. That is, when the primary deer was feeding, it was observed and bites were counted; observations shifted to the secondary deer when the primary deer was not feeding. When neither the primary nor secondary deer were feeding, observations were shifted to a third deer selected at random. Bites were recorded with hand-held tally registers, and number of bites recorded when the observed deer changed grass selection. A rejection was recorded when the observed deer walked through a selection and failed to take a bite, but began foraging on the next selection encoun -

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Table 1. Production, estimated use, and mule deer diet preferences and nutritional parameters for selected grasses in central Utah during spring and fall, 1991.

Grass accessions	Spring Production $\bar{x}$	SE	Estimated Use[2]	Spring Diet Consumption	$\bar{x}$	SE	$\bar{x}$	SE
	g/plant[1]			(%)	(Bites/deer)		Rejections/deer	
Cheatgrass *Bromus tectorum L.*	12.3^{bef}	6.0	H	49.6^{a}	3,386	909	0.2^{a}	0.4
Paiute Orchardgrass *Dactylis glomerata L.*	14.0^{bc}	5.9	H	17.3^{b}	1,124	489	2.0^{abc}	1.6
Luna Pubescent Wheatgrass *Agropyron trichophorum* (Link.)	14.7^{bcd}	9.5	H	13.2^{b}	820	603	1.4^{ab}	1.3
Kentucky Bluegrass *Poa pratensis* L.	4.9^{hi}	2.3	H	5.2^{c}	823	776	0.8^{a}	1.1
Fairway Wheatgrass *Agropyron cristatum* (L.) Gaertn.	15.8^{abc}	4.5	M	3.4^{c}	277	103	2.8^{ad}	2.7
Crested Wheatgrass *Agropyron desertorum* (Fisch.) Schult	16.8^{ab}	5.7	M	2.5^{c}	248	84	5.0^{df}	5.3
Crested Wheatgrass (wideleaf) *Agropyron desertorum* (Fisch.) Schult	9.2^{egi}	3.3	M	1.5^{c}	174	75	2.4^{ad}	1.7
Mountain Rye *Secale montanum* Guss.	14.9^{bc}	3.2	M	1.5^{c}	177	93	4.6^{cde}	3.4
Hycrest Crested Wheatgrass *Agropyron cristatum* (L.) Gaertn.*A. desertorum* (Fisch.) Schult	20.8^{a}	4.7	L	1.4^{c}	152	37	6.2^{efh}	3.1
Regar Meadow Brome *Bromus erectus* Hudson	10.4^{ceg}	3.7	M	1.1^{c}	190	179	4.0^{bde}	2.1
Smooth Brome *Bromu inermis* Leyss	17.1^{ab}	10.3	L	1.0^{c}	148	80	7.6^{fh}	4.9
Ephraim Fairway Wheatgrass *Agropyron cristatum* (L.) Gaerth	9.5^{degh}	5.0	M	0.9^{c}	153	71	8.2^{hi}	3.1
Vinall Goldar Western Wheatgrass[3] *Agropyron spicatum* (Push) Schibn. and Smith	6.8^{gi}	2.4	M	0.9^{c}	174	146	4.2^{bde}	2.8
Russian Wildrye *Psathyrostachys juncea* (Fisch.)	10.4^{ceg}	3.8	L	0.3^{c}	41	46	11.4^{j}	3.6
Boisoisky Russian Wildrye *Psathyrostachys juncea* (Fisch.)	8.3^{fgi}	6.5	L	0.1^{c}	11	13	11.6^{j}	4.0
Magnar Basin Wildrye[3] *Elymus cinereus* (Scrib. and Merr.)	3.7^{i}	2.7	L	0.1^{c}	12	6	10.8^{ij}	1.9

Fall Production			Diet					Nutritional Parameters Protein		Digestible Dry Matter	
		Estimated Use									
x	SE		Consumption	$\bar{x}$	SE	$\bar{x}$	SE	Spring	Fall	Spring	Fall
(g/plant)			(%)	(Bites/deer)		Rejections/deer		----- (%) -----			
26.7^{f}	16.4	H	15.4^{a}	587	120	3.2^{bc}	1.0	21.2	9.0	72.2	55.4
63.9^{bde}	47.0	H	15.6^{a}	762	434	0.6^{a}	0.5	24.3	12.3	69.8	59.2
28.7^{ef}	11.8	H	16.8^{a}	627	162	3.8^{c}	1.3	27.4	11.1	71.7	56.6
27.7^{ef}	9.3	M	4.3^{bc}	233	206	4.2^{c}	1.9	24.5	14.3	71.4	62.3
59.4^{bf}	49.0	H	8.7^{b}	521	305	0.4^{a}	0.5	28.4	15.3	72.0	60.3
66.2^{bd}	48.4	H	7.0^{bc}	364	203	0.8^{a}	1.1	28.3	14.2	72.8	59.6
41.4^{cdf}	28.7	H	6.2^{bc}	289	208	0.0^{a}	—	27.6	13.5	73.2	58.7
114.9^{a}	111.6	H	6.4^{bc}	308	109	0.6^{a}	0.5	25.0	16.6	70.6	63.6
58.5^{bf}	45.1	H	6.4^{bc}	294	168	1.8^{ab}	1.5	27.1	18.3	71.3	63.9
70.4^{bc}	65.4	M	3.2^{c}	152	279	3.6^{bc}	2.6	27.2	16.8	70.8	61.0
112.6^{a}	86.4	M	2.5^{c}	131	169	3.0^{bc}	1.9	27.5	19.8	72.0	63.6
36.5^{cdf}	26.9	H	5.0^{bc}	389	217	1.8^{ab}	1.3	29.0	16.9	71.3	60.7
50.7^{bf}	40.0	H	1.8^{c}	99	51	6.6^{d}	1.5	26.0	13.6	72.3	59.9

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Table 1. Continued

Fall											
Production			Diet					Nutritional Parameters			
		Estimated Use						Protein		Digestible Dry Matter	
x	SE		Consumption	$\bar{x}$	SE	$\bar{x}$	SE	Spring	Fall	Spring	Fall
(g/plant)			(%)	(Bites/deer)		Rejections/deer		----- (%) -----			
85.9[ab]	77.4	L	0.4[c]	19	28	7.2[de]	2.8	30.1	20.5	73.2	63.6
56.2[bf]	58.7	L	0.5[c]	34	44	7.8[de]	2.0	29.0	18.8	72.3	62.3
57.8[bf]	38.1	L	0.1[c]	8	14	9.0[e]	1.7	28.7	9.4	71.1	55.5

[1]Within columns, means with the same letter are not significantly different P>.0.05.
[2]Categories of use by %: Light 0-5, Moderate 6-25, Heavy 26+.
[3]Native species.

tered.

Twenty trials were completed in spring, with deer having simultaneous access to all 4 replications. Sixteen trials were completed in fall, with 6 trials on non-irrigated and 10 on irrigated replications. Irrigated and non-irrigated replications were separated by a temporary fence. Trials lasted 2 to 3 hours, and ended when all deer finished foraging.

At the end of spring and fall trials, percent utilization of grass biomass was ocularly estimated for each selection in each replication, by 4 independent observers. Plant use was categorically placed into 3 levels of utilization using the means from the observers: light 0-5%, moderate 6-25%, heavy 26+%.

Data sets from spring and fall were analyzed separately. In spring, because of the extremely high variability between trials in total bites and in dietary choice of bites/deer/selection, all 20 trials were combined. In fall, because diets were not different between irrigated and non-irrigated macroplots ($P > 0.75$), all 16 trials were also combined. To determine differences in dietary preferences and rejections among selections, and the variability among deer, 2-way analyses of variance using the repeated measures design (Neter and Wasserman, 1974, Sokal and Rohlf 1981) were used. That is, grass selections were considered treatments (N=16) and deer were replications (N=5). Contrast comparisons were used to separate differences between treatments. Because conclusions from the statistical analyses for both spring and fall diets were the same for bite count and bite counts converted to consumption, only the statistics using the consumptive values are presented.

To determine differences in biomass production between selections for both spring and fall a repeated measures, 2-way analysis of variance was used. Selections were considered treatments (N=16) and clipped plants were replications (N=8). To relate dietary consumption with selection production and nutritional parameters, coefficients of determination (r^2) were obtained.

Results

Analyses revealed dietary differences among grasses were significant for both spring and fall ($P < 0.001$). A total of 39,557 bites was recorded during spring dietary preference trials and 24,089 in fall.

In spring, cheatgrass was the most preferred selection comprising 49.6% of the diet (Table 1). Paiute orchardgrass (*Dactylis glomerata* L.) and Luna pubescent wheatgrass (*Agropyron trichophorum* Link.) were also preferred. These 3 preferred species comprised 80% of the diet. The 3 selections of wildrye (*Elymus cinereus* Scrib. and Merr. and *Psathyrostachys juncea* Fisch.) received the lowest use and comprised less than 1% of the diet. Variability among deer was not significant ($P > 0.25$).

Dietary choice of selections was similar in fall. The same 3 preferred selections comprised 48% of the diet, and the 3 least preferred selections comprised only 1%. Fairway wheatgrass (*Agropyron cristatum* [L.] Gaertn.) was also selected in preference to several selections (Table 1). Variability among deer was significant ($P < 0.02$).

Analyses also showed rejection differences among grasses were significant for both spring and fall ($P < 0.001$). A total of 416 and 272 rejections of grass selections were recorded in spring and fall, respectively. The number of rejections were inversely related to selection preferences. In spring and fall combined, the 3 selections of wildrye each contributed about 14% of all rejections. 'Regar' meadow brome (*Bromus erectus* Hudson), 'Hycrest' crested wheatgrass (*Agropyron cristatum* X *desertorum* [Fisch.] Schult), 'Ephraim' fairway wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis* Leyss), and 'Goldar' western wheatgrass (*Agropyron spicatum* [Push] Scribn. and Smith) each comprised 5-8% of all rejections. The 8 other selections, including the 3 preferred, each contributed less than 5%.

Differences in dry-weight production among grass selections (Table 1) were significant in both spring and fall ($P < 0.001$). Differences among replications were not significant in spring ($P > 0.50$), but were significant in fall ($P < 0.001$) probably due to differences between irrigated and non-irrigated treatments. In spring, mean production ranged from 3.7 to 17.1 g/plant and in fall from 26.7 to 114.9 g/plant. The coefficients of determination relating percent consumption and plant production showed no significant ($P > 0.50$) relationships ($r^2 = 0.01, 0.16$) for spring or fall.

Utilization estimates mirrored dietary consumption. Use was heavy for the 3 preferred selections, mostly moderate to heavy for the 10 intermediate selections, and light for the 3 wildryes. The highest levels of use occurred on Kentucky bluegrass (*Poa pratensis* L.) at 47% in spring, and 64% for Paiute orchardgrass in fall.

Nutritional parameters among grass selections showed mostly low variability (Table 1) for both spring production and fall regrowth. Except for percent neutral detergent fiber in fall the coefficients of determination (r^2) relating dietary consumption and nutritional parameters were all zero or negative. Most correlations were low ($r^2 < 0.30$). The highest negative correlations between consumption and nutritional parameters were percent protein ($r^2 = -0.59$) and percent total digestible nutrients ($r^2 = -0.50$), both in spring.

Discussion and Conclusions

Deer showed large differential preferences for the available forages. Dietary preferences were confirmed directly by post-trial estimates of forage utilization, and inversely by observations of forage

rejections. Results suggest choice of grasses used in revegetation of mule deer winter range may have considerable influence on the degree of grass utilization by deer. Furthermore, in consideration of alternative foraging areas, the choice of seeded selections may influence movement patterns as well as deer numbers. Consequently, revegetation using selections of wildrye might displace deer. Thus, private landowners or highway departments may choose grasses of lower deer preference rankings where perceived competition with livestock for forage or where incidents of deer-vehicle collisions are high. Conversely, managers of wildlife management areas favoring deer should choose grasses preferred by deer.

Even though plant production varied greatly among selections, differences in biomass were not related to deer choices for forages. This was probably due to all forages being adequately abundant, and completion of foraging trials before availability became limiting on any selection.

The nutritional levels of all 16 grass selections in spring and fall were high. Most grasses exceeded 16% protein (dry matter basis), generally regarded as the level where maximum needs of deer are met (Verme and Ullrey 1972, Urness 1973). Digestible dry matter estimates exceeded 60% in most grasses, and all other parameters were high in comparison with other deer forages (Dietz et al. 1962, Tueller 1979), and exceeded nutritive requirements where known (Short 1981). Consequently, even though deer in this study preferred grasses with comparatively lower nutritional level was relatively high.

For seeding rangelands with grasses where use by mule deer in spring or fall is desirable, plantings of Paiute orchardgrass, Luna pubescent wheatgrass, and fairway wheatgrass would be preferred. These grasses would complement seeded browse species, native forbs and ubiquitous cheatgrass. For seeding rangelands with grasses where use by mule deer is not desired, Russian or basin wildrye may decrease use.

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