

Diets of Steers on a Shrub-Steppe Rangeland in South-Central Washington

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Highlight: Botanical composition of steers' diets on a shrub-steppe rangeland in south-central Washington was examined by inspection of finely ground fecal samples viewed through a microscope. Four species, Cusick bluegrass, Thurber needlegrass, hawksbeard and bluebunch wheatgrass, comprised 92% of the total diet. Grasses accounted for 73% of the diet and forbs and half shrubs contributed 26%. Botanical composition of the diets changed throughout the spring grazing season with changing availability and maturation of herbage. Preference indices in decreasing order were: Cusick bluegrass > Thurber needlegrass > hawksbeard > bluebunch wheatgrass, but bluebunch wheatgrass was the most abundant species in the pasture. The second most abundant grass, Sandberg bluegrass, was not selected by steers.

Information on cattle diets is needed for long-term productive use and management of rangelands. In the shrub-steppe region of south-central Washington, grazing is usually done during winter and spring months.

This study reports on the botanical composition of steer diets while grazing an *Artemisia tridentata*-*Agropyron spicatum* pasture. Forage selectivity as influenced by species and season was also analyzed.

Study Area and Methods

The study area is located on the Arid Lands Ecology (ALE) Reserve on the Energy Research and Development Administration's Hanford Reservation in Benton County, Wash. The site is situated on the gentle east-facing slopes of the Rattlesnake Hills at an elevation of 1,300 ft above mean

sea level. The precipitation averages 23 cm between October and May. The soil is a deep silt loam with very few stones in the

upper meter of its profile. The vegetation is representative of the *Artemisia tridentata*-*Agropyron spicatum* association (Rickard et al., 1975).

Two pastures, each 9 ha in area, were established within a homogenous plant community having a history of no livestock grazing since 1943 (Fig. 1). The pastures were enclosed with a four-strand barbed wire fence, having a common watering tank between them. During 1971, 15 yearling steers were grazed on both pastures for 58 days. Steers were moved from one pasture to the other at weekly intervals. The same



Fig. 1. Steers grazing on a moderately used *Artemisia tridentata*-*Agropyron spicatum* pasture in south-central Washington.

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Table 1. Average botanical composition of plants (% ± SE) on the shrub-steppe pasture during the spring grazing season of 1974.

| Plant taxa | April 9 | April 15 | May 8 | May 29 | Average |
|--|-------------------------|------------|------------|------------|---------|
| Grasses | | | | | |
| Bluebunch wheatgrass (<i>Agropyron spicatum</i>) | 50.0 ± 9.6 ¹ | 35.1 ± 4.9 | 39.8 ± 5.9 | 34.4 ± 5.3 | 39.8 |
| Cusick bluegrass (<i>Poa cusickii</i>) | 1.9 ± 0.8 | 2.0 ± 1.0 | 1.4 ± 0.7 | 2.2 ± 1.6 | 1.9 |
| Thurber needlegrass (<i>Stipa thurberiana</i>) | 1.1 ± 1.0 | 1.0 ± 0.6 | 1.1 ± 0.7 | 3.3 ± 2.5 | 1.6 |
| Sandberg bluegrass (<i>Poa sandbergii</i>) | 1.9 ± 0.1 | 9.0 ± 0.4 | 18.4 ± 1.8 | 17.6 ± 2.6 | 11.7 |
| Fescue (<i>Festuca</i> spp.) ² | 0.9 ± 0.8 | 3.0 ± 0.4 | 8.7 ± 1.8 | 5.4 ± 1.5 | 4.5 |
| Total | 55.8 | 50.1 | 69.4 | 62.9 | 59.5 |
| Forbs and half shrubs | | | | | |
| Hawksbeard (<i>Crepis atrabarba</i>) | 6.1 ± 1.6 | 13.9 ± 4.8 | 3.0 ± 1.3 | 8.0 ± 2.8 | 7.8 |
| Tansy mustard (<i>Descurainia pinnata</i>) | 2.8 ± 0.3 | 6.9 ± 0.9 | 4.4 ± 1.1 | 0.9 ± 0.5 | 3.8 |
| Lupine (<i>Lupinus laxiflorus</i>) | 0.7 ± 0.7 | 0 | 0.7 ± 0.7 | 0.2 ± 0.2 | 0.4 |
| Erigeron (<i>Erigeron filifolius</i>) | 4.0 ± 1.4 | 10.4 ± 2.8 | 6.2 ± 2.0 | 12.2 ± 6.4 | 8.2 |
| Phlox (<i>Phlox longifolia</i>) | 0.7 ± 0.7 | 0.5 ± 0.3 | 0.8 ± 0.8 | 1.5 ± 1.1 | 0.9 |
| Miscellaneous | 0.1 | 0.4 | 4.6 | 1.5 | 1.5 |
| Total | 14.4 | 32.1 | 24.3 | 22.6 | 22.5 |
| Shrubs | | | | | |
| Big sagebrush ³ (<i>Artemisia tridentata</i>) | 29.8 ± 6.9 | 17.8 ± 4.1 | 10.9 ± 2.5 | 13.3 ± 3.1 | 18.0 |

¹Calculated by clipped (live + dead) herbage values (n = 16).²Annual species.³Values calculated on one harvest date.

stocking rate and system of grazing were maintained for only 41 days in 1972. One pasture was selected for continued grazing and seven and five steers were introduced during 1973 and 1974, respectively. The steers were removed when it was visually estimated that about 50% of the new growth of bluebunch wheatgrass had been consumed, which was prior to the boot stage of floral development.

Sampling for plant biomass in the pasture consisted of hand clipping 16 one-half-square meter circular plots at 3-week intervals throughout the spring growing season (Rickard et al., 1975).

Ten samples of feces were collected over a 2-day period biweekly during the 1974 grazing season. These were oven-dried for 48 hours at 65°C and passed through a Wiley mill fitted with a 1-mm screen. The sample was thoroughly mixed and five microscope slides were made from each sample. Twenty microscope fields were examined on each slide. The identification of plant fragments was based on cellular characteristics, primarily the epidermal

tissues (Sparks and Malechek, 1968; Rogers and Uresk, 1974).

Forage preference indices were calculated as outlined by Krueger (1972):

$$\text{Preference} = \frac{\% \text{ Diet Frequency} \times \% \text{ Diet Composition}}{\% \text{ Range Frequency} \times \% \text{ Range Composition}}$$

This preference index takes into account the distribution and species composition of plants both in the field and in the diets.

Results and Discussion

The plant species composition of the shrub-steppe pasture was comprised of relatively few species (Table 1). Clearly, the abundant grass was bluebunch wheatgrass. Sandberg bluegrass was the second most abundant grass, and small amounts of Cusick bluegrass and Thurber needlegrass also occurred mixed with annual fescues.

The most abundant forbs in the pasture were hawksbeard and tansy mustard; the most abundant half-shrub was erigeron. Big sagebrush was also very common on the pasture.

Bluebunch wheatgrass comprised between 34 and 50% of the total vegetation at various times during the spring grazing season, and the botanical composition of Sandberg bluegrass varied between 2 and 18%. Hawksbeard contributed between 3 and 14% of the herbaceous forage. Big sagebrush ranged from 11 to 30%.

The botanical composition of the fecal material is shown in Table 2 as determined by microscopic examination of plant fragments in the feces. These data indicate that Cusick bluegrass and hawksbeard were the most abundant plants grazed in the early part of the grazing season. Both of these declined in importance as the season

Table 2. Botanical composition (% ± SE) of steer diets during 1974.

| Plant taxa | April 9 | April 15 | May 8 | May 29 | Average |
|------------------------------|-------------------------|-------------|------------|------------|---------|
| Grasses | | | | | |
| Bluebunch wheatgrass | 11.3 ± 0.8 ¹ | 27.1 ± 10.0 | 33.7 ± 1.0 | 55.7 ± 4.6 | 31.9 |
| Cusick bluegrass | 48.2 ± 1.3 | 23.7 ± 1.4 | 17.1 ± 0.9 | 11.7 ± 0.4 | 25.1 |
| Thurber needlegrass | 11.9 ± 2.2 | 9.0 ± 1.6 | 17.4 ± 3.1 | 9.4 ± 0.8 | 11.9 |
| Sandberg bluegrass | 1.0 ± 1.0 | 0.1 ± 0.1 | 0.2 ± 0.2 | 0 | 0.3 |
| Fescue species ² | 3.4 ± 0.3 | 0.9 ± 0.9 | 6.1 ± 1.3 | 5.8 ± 1.4 | 4.1 |
| Total | 75.8 | 60.8 | 74.5 | 82.6 | 73.3 |
| Forbs and half shrubs | | | | | |
| Hawksbeard | 23.9 ± 0.7 | 33.7 ± 4.2 | 19.6 ± 5.7 | 12.0 ± 3.0 | 22.3 |
| Tansy mustard | 0.7 ± 0.3 | 0.2 ± 0.2 | 3.0 ± 0.9 | 1.4 ± 0.6 | 1.3 |
| Lupine | 0.3 ± 0.3 | 0 | 0 | 0 | 0.1 |
| Erigeron | 0 | 0.7 ± 0.2 | 0.1 ± 0.1 | 0.9 ± 0.9 | 0.5 |
| Phlox | 0 | 1.4 ± 1.2 | 1.6 ± 1.1 | 1.8 ± 1.8 | 1.2 |
| Miscellaneous | 0.5 ± 0.5 | 0.4 ± 0.2 | 1.3 ± 0.1 | 1.4 ± 0.3 | 0.9 |
| Total | 25.4 | 36.4 | 25.6 | 17.5 | 26.3 |

¹Calculated by relative density values (n = 2).²Annual species.

Table 3. Relative steer preference indices of important forage plants in the shrub-steppe pasture at four times during the spring grazing season.

| Species | April 9 | April 15 | May 8 | June 6 |
|------------------------------|---------|----------|-------|--------|
| Grasses | | | | |
| Cusick bluegrass | 39.24 | 16.97 | 11.69 | 6.56 |
| Thurber needlegrass | 24.20 | 8.79 | 22.93 | 2.92 |
| Sandberg bluegrass | 0.02 | * | * | 0 |
| Bluebunch wheatgrass | 0.03 | 0.19 | 0.23 | 0.62 |
| Fescue species | 0.02 | 0.01 | 0.06 | 0.10 |
| Forbs and half shrubs | | | | |
| Hawksbeard | 1.40 | 0.91 | 1.70 | 0.31 |
| Lupine | * | 0 | 0 | 0 |
| Tansy mustard | * | * | 0.01 | 0.10 |
| Phlox | 0 | 0.48 | * | 0.34 |
| Erigeron | 0 | * | * | * |

* <0.01.

progressed because they became less available. However, bluebunch wheatgrass comprised more of the diet as the season progressed. Although Sandberg bluegrass was relatively abundant, it was only sparsely represented in the fecal material. Tansy mustard and erigeron were relatively abundant plants on the pasture, but comprised little of the cattle dietary consumption.

Botanical composition of steer diets shows that grasses were the major food items followed by forbs and half-shrubs.

Indices of the relative preferences of the important herbaceous species growing in the shrub-steppe pasture are shown in Table 3. Clearly, Cusick bluegrass and Thurber needlegrass were the highly preferred grass species.

The steers showed no preference for Sandberg bluegrass. Hawksbeard was the preferred forb species.

These data obtained by microscopic examination of plant species in cattle fecal droppings correlate very well with general field observations as to species preferences of cattle under moderate spring grazing in these same pastures (Rickard et al., 1975).

Literature Cited

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