Forage Intake in Two-Year Old Cows and Heifers Grazing Blue Grama Summer Range

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Abstract

Forage intake was estimated in 2-year-old cows and 2-year-old heifers grazing blue grama summer range by using the fecal output-indigestibility ratio technique. Heifers consumed only 67% as much forage as cows (1.4 vs 2.1 percent of body weight). Forage intake by cows was greater in earlier stages of lactation than in later stages (2.5% of body weight at 90 days postpartum vs 1.7% of body weight at 150 days postpartum). Considerable variation occurred in estimated levels of intake.

Voluntary forage intake is one of the most useful and important criteria in evaluating diets of grazing ruminants. Absolute forage intake by range livestock is difficult to determine since this requires measurement of fecal excretion. External marker techniques such as chromic oxide can be used to estimate fecal output and, with digestibility estimates, voluntary intake can be determined. Relative estimates of intake can be used for comparative purposes and serve as reference bases in animal nutrition and as guides for stocking rates.

The plains grasslands of North America have various communities partially dominated by blue grama (Bouteloua gracilis [H.B.K.] Lag.). Much of this rangeland is grazed by brood cows and replacement heifers, but quantitative data on forage intake by such cattle are limited. This study was conducted to examine levels of forage intake in 2-year-old cows and 2-year-old heifers grazing blue grama summer range.

Experimental Procedure

The study was conducted at the Fort Stanton Experimental Ranch in southern Lincoln County, N. Mex. Pastures were foothill ranges classified as plains grassland (Soil Conservation Service 1978) and dominated by blue grama. Other grasses were wolftail (Leymus phleoides H.B.K.), sand dropseed (Sporobolus cryptandrus [Torr.] Gray), red three awn (Aristida longiseta Stude.), and galleta (Hilaria jamesii [Torr.] Benth.). Major forbs were Carruth sageworth (Artemisia carruthii Carruth.) and summer cypress (Koelreuteria copallaria L. Roth.). Cholla cactus (Opuntia imbricata [Haw.] DC.) occurred infrequently. Range condition class was good to excellent and as summer rainfall was above average, herbage growth was excellent during the study. A thorough description of the Fort Stanton area has been given by Parker et al. (1974). Additional climatological data are contained in various reports (U.S. Dep. of Commerce).

Two 7-day intake trials were conducted the first weeks of June and August, 1976. Relative forage intake was estimated in eight esophageal-fistulated, 2-year-old Angus × Hereford females (four cows, \( x = 435 \text{ kg} \)) (four heifers, \( x = 475 \text{ kg} \)) which grazed the pastures throughout the summer. These cattle were used to estimate quantities of feces excreted and to collect representative forage for digestibility determinations. Daily intakes of forage organic matter were determined by dividing 24-hr output of fecal organic matter by indigestibility (100 — digestion coefficient) of forage organic matter. Fecal output was estimated using chromic oxide as an external marker:

Fecal output = \( \frac{\text{Amount of Cr}_2\text{O}_3 \text{ Given Daily}}{\text{Percentage Cr}_2\text{O}_3 \text{ in Feces}} \)

Chromic oxide concentration in feces was determined by the colorimetric procedure of Kimura and Miller (1957).

Chromic oxide was administered as impregnated paper (36% Cr2O3) encased in gelatin capsules which were dispensed via esophageal fistulae with a balling gun. Daily dosages of 12.9 g Cr2O3 (36 g impregnated paper) were given in equal portions twice daily (0700 hrs and 1700 hrs). Each portion consisted of two boluses with 9 g of shredded Cr2O3 paper per bolus. Marker administration began 5 days before the first sampling of feces and ended one day before last fecal sampling.

Rectal grab samples were taken concomitantly with morning bolusing. Fecal collection began 24 hours prior to the first fecal collection and ended 24 hours prior to the final fecal collection. Feces was collected during 30- to 45-minute periods at dawn during each collection. Feces and fecal samples were dried in a forced air oven at 50°C and ground through a 1-mm screen in a Wiley mill. Dry matter and ash were determined by AOAC (1965) procedures. In vitro digestibility (organic matter disappearance) of grazed forage was determined by Tilly and Terry (1963) procedures.

Biometrical evaluation followed that outlined by Steel and Torrie (1960) for split plot analysis of variance with sampling periods as main unit treatments and reproduct status as subunit treatments. The least significant difference procedure was used in comparing paired values following preliminary F tests by analysis of variance.

Results and Discussion

Estimated voluntary forage intakes (organic matter basis) of 2-year-old heifers and 2-year-old primiparous cows grazing blue grama summer range (Table 1) averaged 1.4% of body weight.

Table 1. Estimated voluntary intake of forage from blue grama range-lan during summer grazing by 2-year-old primiparous cows and 2-year-old heifers.

<table>
<thead>
<tr>
<th>Date</th>
<th>Reproductive-lactational status</th>
<th>Intake</th>
<th>% of body weight</th>
<th>Coefficient of variation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kg/day</td>
<td>G/W</td>
<td>KG</td>
<td></td>
</tr>
<tr>
<td>June 5–11</td>
<td>Heifers</td>
<td>7.1b</td>
<td>70b</td>
<td>1.5b</td>
</tr>
<tr>
<td></td>
<td>Cows (90 days postpartum)</td>
<td>11.0c</td>
<td>110c</td>
<td>2.3c</td>
</tr>
<tr>
<td>August 6–13</td>
<td>Heifers</td>
<td>6.0b</td>
<td>59b</td>
<td>1.2b</td>
</tr>
<tr>
<td></td>
<td>Cows (150 days post-partum)</td>
<td>1.3a</td>
<td>77a</td>
<td>1.7a</td>
</tr>
</tbody>
</table>

*CR2O3 indicator
**Means within columns with different superscripts differ (P< .05).
weight (64 g/Wkg\(^{75}\)) and 2.1% of body weight (96 g/Wkg\(^{75}\)), respectively. When expressed relative to body weight or metabolic size, heifer intake was 67% of the amount consumed by lactating cows. This difference (P < .01) agrees with findings of other investigators. Jordan et al. (1973) found that dry matter intake of silage by Shorthorn cows increased rapidly after calving but did not specify the magnitude of increase. Hutton (1963) indicated that a lactating dairy cow consumed 47% more forage than her nonlactating monozygotic twin. Marsh et al. (1971) reported a 20-30% increase in voluntary forage intake of dairy cows 6 weeks postpartum compared to the first week postpartum. Similar results were reported for ewes by Arnold and Dudzinski (1967) and Arnold (1975) who measured 30% increases in digestible organic matter intake for ewes during early lactation compared to dry ewes. Kartchner (1975) found no net influence of lactation on forage intake; during seasonal grazing trials, spring-calving cows consumed only 10% more forage than fall-calving cows that were still nursing their calves.

Although comparisons of forage intake by lactating and nonlactating ruminants are limited, the above studies substantiate the 40% and 23% increases in voluntary forage intake by 2-year-old lactating beef cows 90 and 150 days postpartum. Moreover, cow intakes at 90 days were greater (P < .05) than intakes at 150 days (116 g/Wkg\(^{75}\) vs 77 g/Wkg\(^{75}\), respectively), which reflects higher nutrient requirements in earlier stages of lactation. The decreased intake at 150 compared to 90 days postpartum was not due to lower digestibility of diets selected by cows later in the summer. Organic matter digestibility of diets selected 90 days postpartum was 75%, while that selected at 150 days was 78% (Table 2). Nutrient requirements for lactating beef cows (N.R.C. 1976) only are given for 3 to 4 months postpartum, implying that milk production thereafter is less and thus fewer nutrients are required than in earlier lactation. Increased intake during lactation may result from increased reticulorumenal volume (Tulloh and Hughes 1965) caused by hormonal changes (Campling 1970). Conversely, intake may decline in advanced pregnancy due to rumen compression by the gravid uterus (Forbes 1969). Actual measurement of roughage intake under dry lot conditions (Rosiere 1978) indicated that pregnant cows ate essentially the same amount as nonpregnant heifers when voluntary consumption was expressed as a percent of body weight.

Intakes of range forage were not determined absolutely, yet the relative differences which occurred in intakes between cows and heifers of the same age and weight indicate that productive status should be considered when allocating animal units to range pastures. If 430-450 kg cows with 1-3 month old calves are regarded as 1.25 animal units, as suggested by Vallentine (1965), then heifers of that weight which consumed only 67% as much forage would be .84 animal units, slightly lower than standards given by Vallentine (1965) and Kothmann et al. (1974). On public ranges where cows and small calves are regarded as one animal unit, replacement heifers would be equivalent to two-thirds of an animal unit. This same relationship probably exists between older lactating and nonlactating cows, suggesting that about 30% more dry cows or replacement heifers can graze a range at the same grazing intensity as when grazed by lactating cows. It could also be inferred that a range would carry dry cows longer than the same number of lactating cows. The actual duration would be dependent on forage decomposition, extent of trampling, stage of lactation, etc., and management factors. An application of this concept could be the early weaning of calves during drought to extend the grazing period by brood cows. Most of this gain would come from lowered intakes commensurate with cessation of lactation, although some forage savings could be attributed to removal of calves.

Forage intake by calves was not measured in this study. Calves may graze and even regurgitate food at a few weeks of age (Preston 1971), yet relative mature size of stomach compartiments does not occur until 5-6 months of age (Church 1969). Thus, young calves may consume only limited amounts of forage. Kartchner (1975) found that four-month-old calves consumed less than 1 kg forage daily. Since milk production by beef cows declines 3 to 4 months following calving and as forage intake by calves increases with decreasing milk consumption (Baker et al. 1976), it appears that forage intake by calves during June trials (90 days postpartum) was probably slight but may have been substantial by the August trials (150 days postpartum). Even though forage consumption by calves was undoubtedly greater at 5 months of age, cow intakes had declined 33%. Therefore, there appears no need to assess the cow and 5-month-old calf greater than 1.25 animal units.

While comparative levels of forage intake between heifers and cows appear reasonable, estimated values for daily intake may be slightly low. Kartchner (1975), as expressed by Cordova (1977), reported intakes in grazing Hereford cows ranging from 75 to 145 g dry matter/unit metabolic body size. Suctester et al. (1974) estimated forage intake (dry matter) from native mountain meadows by Brown Swiss, Charolais x Angus, and Hereford lactating cows to be 145, 141, and 125 g/Wkg\(^{75}\) (3.1, 3.2, and 2.8% of body weight), respectively. The latter authors felt that these values were "slightly high." Cordova (1977) estimated voluntary intakes (total fecal collection technique) of forage organic matter in yearling steers grazing blue grama ranges on the Fort Stanton Experimental Ranch. He reported a mean value of 2.0% of body weight over all seasons, while summer intakes were 2.3% of body weight. It seems logical that intakes of 2-year-old heifers which were estimated at 1.4% of body weight should, in reality, have approached the 2.0% reported for steers with cow intakes 25-30% greater (2.6% of body weight). Conversion of these values to a dry matter basis indicated that cow and heifer intakes were 3% and 2.3% of body weight, respectively.

Average coefficients of variability of forage intakes of cows and heifers was 35.8 and 31.4%, respectively (Table 1). Daily fluctuation in levels of voluntary intake was documented by Rosiire (1978) under dry lot conditions where intake

Table 2. In vitro organic matter digestibility of forage* selected from blue grama summer range by 2-year-old primiparous cows and 2-year-old heifers.

<table>
<thead>
<tr>
<th>Collection day</th>
<th>June 5-11</th>
<th>August 1-15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cows (90 Days postpartum)</td>
<td>Cows (150 Days postpartum)</td>
</tr>
<tr>
<td>1</td>
<td>72</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>72</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>77</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>78</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>77</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>78</td>
<td>76</td>
</tr>
<tr>
<td>x±S.D.</td>
<td>76±3</td>
<td>75±4</td>
</tr>
<tr>
<td>C.V.</td>
<td>3.8%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

* Collected via esophageal fistula from the same cante used to estimate fecal production.
coefficients of variation for cottonseed hulls varied from 4 to 12%. Similarly, Van Dyne and Meyer (1964) measured daily variations from mean intake as large as 14%. Under range situations when forage is limited, where cows and their calves may become periodically separated, with rough topography and stormy weather as well as influences such as estrus, intake levels may vary considerably more. It is proposed that day to day variation in forage intakes of 20 to 25% are natural occurrences under such conditions and may reflect variations in fecal output shown in Table 3. Thus, some but certainly not all of the extreme variability observed in intakes can be regarded as error in technique.

**Literature Cited**


