Cattle Diet
Digestibilities Determined from Components

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Highlight
In vitro digestibilities of diet mixtures and of individual forage species, adjusted for their relative proportions in the range cattle diet, were interchangeable.

Digestibility trials give better estimates of forage nutritive value than do chemical analyses (Cook et al., 1962). Whether the digestibilities of several individual forage species can be used to infer information about animal diet mixtures containing the same species has been questioned, however (Van Dyne and Heady, 1965). The investigator must assume identical digestibility for a species digested individually and in a mixture of other species. Dietz et al. (1962) found individual forage digestibilities were not additive in predicting total digestible nutrients in deer forage. Swift (1957) also found nonadditive effects when feeding concentrates with forages.

This note presents results from in vitro digestibility analyses of individual forage species in the cattle diet, and their relationship to digestibility of the cattle diet mixture.

Methods
Forage samples for in vitro analyses were collected from a ponderosa pine range grazing study area in northern Arizona (Pearson, 1964). These samples, collected at 6-week intervals during the summer consisted mainly of: Arizona fescue (Festuca arizonica Vasey), mountain muhly (Muhlenbergia montana (Nutt.) Hitchc.), bottlebrush squirreltail (Sitanion hystrich (Nutt.) J. G. Smith), sedge (Carex geophila Mackenzie), crested wheatgrass (Agropyron cristatum (L.) Gaertn.), intermediate wheatgrass (A. intermedium (Host) Beauv.), pine dropseed (Diphtheroneuron tricholepis (Torr.) Nash.), and mutton bluegrass (Poa fendleri (Steud.) Vasey). Forbs such as thistle (Cirsium spp.), lupine (Lupinus argenteus Pursh), groundsel (Senecio neomexicanus Gray), and others in the cattle diet were also collected.

Forty-five pairs of 9.6-ft² plots (one caged, one uncaged) were located in each of 7 experimental pastures for measuring cattle diets. Each forage species in the caged plots was clipped to match the stubble height in paired grazed uncaged plots. The 45 samples from each pasture were then combined, keeping each species separate. Nineteen of these combinations were used in this study. The clipped samples, assumed to be representative of the cattle diet, were used for in vitro digestibility determinations. An aliquot of each species sampled was kept separate for individual digestibility determinations. Species were also combined in proportion to amount (oven-dry weight) consumed from the paired plots. Digestibility of this mixture represented the digestibility of the diet of the grazing animal, and will hereafter be referred to as the “diet mixture” digestibility. Digestibilities of individual species were weighted in accordance to their diet proportions, and will be referred to as the “weighted average” digestibility. A sample diet computation is shown in Table 1, with a known “diet mixture” digestibility of 50.0%.

The in vitro dry matter digestion techniques used in these studies followed those of Tilley and Terry (1963) as modified by the filtration procedure described by Alexander and McGowan (1961). Each determination was in triplicate.

Results and Discussions
"Weighted average" and "diet mixture" digestibilities were highly correlated (r=0.975, df=17, Fig. 1). The relationship is expressed by the equation Y=1.017X, where Y is percent in vitro digestibility of the diet mixture and X is percent in vitro digestibility of the weighted average. Standard errors of triplicate digestibility determinations were within 4% of the means. Since the regression coefficient approaches 1, these digestion values are interchangeable: percent digestibility of separate forage species and their proportions in the diet can be used to calculate diet mixture digestibility. These findings are somewhat contradictory to in vivo studies where nutritive values of forage and supplemental concentrates were not additive (Swift, 1957). These differences are not surprising since rough-

<table>
<thead>
<tr>
<th>Species in diet</th>
<th>Weighted diet proportions</th>
<th>In vitro digestibility (Percent)</th>
<th>Weighted digestibility (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona fescue</td>
<td>0.203</td>
<td>48.0</td>
<td>9.74</td>
</tr>
<tr>
<td>Mountain muhly</td>
<td>0.402</td>
<td>46.5</td>
<td>18.69</td>
</tr>
<tr>
<td>Bottlebrush squirreltail</td>
<td>0.300</td>
<td>51.8</td>
<td>15.54</td>
</tr>
<tr>
<td>Sedge</td>
<td>0.040</td>
<td>58.7</td>
<td>2.35</td>
</tr>
<tr>
<td>Pine dropseed</td>
<td>0.018</td>
<td>50.8</td>
<td>0.91</td>
</tr>
<tr>
<td>Mutton bluegrass</td>
<td>0.023</td>
<td>67.2</td>
<td>1.55</td>
</tr>
<tr>
<td>Thistle</td>
<td>0.010</td>
<td>52.1</td>
<td>0.52</td>
</tr>
<tr>
<td>Lupine</td>
<td>0.004</td>
<td>76.3</td>
<td>0.31</td>
</tr>
<tr>
<td>Sum</td>
<td>1.000</td>
<td>49.61</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. “Weighted average” diet digestibility versus the “diet mixture” digestibility.
management of northern New Mexico rangelands. It appears forage well ahead of native ranges in early spring, at which time it is most needed by cows and ewes to maintain the flow of milk for their young.

Highlight

Seeded crested wheatgrass (Agropyron desertorum (Fisch.) Schult.) has been an exciting and noteworthy development in northern New Mexico. Private ranchers and land-managing agencies have enthusiastically adopted the practice, and for good reasons. Crested wheatgrass is productive and relatively easy to establish on northern New Mexico rangelands. It appears to be long-lived, despite being at the southern limits of its range of adaptability. It regrows with summer rains, and reproduces well from seed. Its big selling point, however, is its ability to furnish succulent, nutritious forage well ahead of native ranges in early spring, at the very time it is most needed by cows and ewes to maintain a flow of milk for their young.

More than 100,000 acres of brush-infested range, mostly big sagebrush (Artemisia tridentata Nutt.), have been cleared and seeded to crested wheatgrass in northern New Mexico. An additional 225,000 acres are judged suitable for seedling. These acreages of seeded and seedling sites are being given a chance to improve and become more productive.

Technological Notes

Crested Wheatgrass for Spring Grazing in Northern New Mexico

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LITERATURE CITED


MANAGEMENT NOTES

Crested Wheatgrass for Cattle

To determine how intensively to graze crested wheatgrass range in the spring, cattle were grazed at different intensities for a month long spring season for 7 years at one site and for 4 years at another site. Cows and calves utilized the grass an average of 41, 55, and 69% at the first site, and yearlings 34, 56, and 77% at the other site. Cows and calves used the grass an average of 30, 50, and 60% at the first site, and yearlings 40, 60, and 70% at the other site.

The advantages of crested wheatgrass for spring cattle grazing are shown by comparing daily weight gains from crested wheatgrass with those from native range. Average daily gains (in pounds) for the test periods were as follows:

<table>
<thead>
<tr>
<th></th>
<th>Cows</th>
<th>Calves</th>
<th>Yearlings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native range</td>
<td>1.21</td>
<td>1.16</td>
<td>1.50</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>3.23</td>
<td>2.18</td>
<td>1.98</td>
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</table>

Of most significance are the extra gains put on the calves, which usually are the marketable product in northern New Mexico. In any year, the daily gain per head for calves was similar at all grazing intensities. Yearlings too made good gains. No real differences in daily gains of yearlings were found between grazing intensities, but the results were considered inconclusive.

Daily gains of cows were inversely related to intensity of grazing. On the average of the 7 years, the cows gained 55% more per day during the spring grazing period under the lightest grazing than under the heaviest. In a cow-calf operation, the condition of the cow is important. However, the least gain on the cows on the most heavily grazed pasture during 7 years of study was an average daily gain of 1.85 lb. This seems adequate for breeding animals.

1 Forest Service, U.S.D.A., central headquarters maintained at Fort Collins, in cooperation with Colorado State University; research reported here conducted in cooperation with New Mexico State University, Albuquerque.