Supplementation of Yearling Steers Grazing Fertilized and Unfertilized Northern Plains Rangeland

J.F. KARN AND R.J. LORENZ

Abstract

Supplementation studies were conducted with yearling steers on a silty range site in central North Dakota, where yearly precipitation averaged 380 to 410 mm. The studies were conducted for 3 summers on both fertilized (45 kg N/ha) and unfertilized native pastures. Animal performance was compared to seasonal changes in the chemical composition of pasture samples collected with esophageal-fistulated steers. Chemical composition differences between diet samples from the fertilized and unfertilized pastures were inconsistent, but generally protein was higher and acid detergent fiber lower on the fertilized pasture. Supplementation with barley in the early summer resulted in little benefit, but supplementation with barley in the late summer, especially when pasture digestibility (in vitro) dropped to 50 to 52%, was beneficial on both the fertilized and unfertilized pastures. However, the response was not consistent between years. Barley supplementation appeared to be economically viable, but the feasibility of this practice will vary from year to year, depending on the price of barley relative to the price of steers. The results of protein supplementation were more erratic, possibly because of differences in precipitation patterns and hence plant growth between years.

Native rangelands in the Northern Great Plains support good summer weight gains on yearling steers. Therefore, little consideration has been given to use of supplements which might produce still greater and more efficient gains. Rogler and Lorenz (1965) have shown that beef cattle carrying capacity of the Northern Great Plains mixed grass prairie can be approximately doubled with appropriate nitrogen fertilization. However, fertilization was shown to favor the growth of cool-season midgrasses, particularly western wheatgrass (Agropyron smithii), with an associated reduction in the stand of blue grama (Bouteloua gracilis), a warm-season shortgrass (Lorenz and Rogler 1972). This shift in species composition alters the seasonal growth pattern and may affect the nutritional value of the grazing animal's diet.

There is limited information available on the chemical composition of native forages in the Northern Great Plains, especially with respect to changes during the grazing season. Information available on the value of supplementing yearling steers grazing native forage is also limited. However, Railgh (1970) reported positive results from a supplementation scheme developed for use in eastern Oregon. Both crude protein (CP) and energy were supplemented as required to complement the diet of yearling steers grazing crested wheatgrass (Agropyron desertorum). A beneficial effect from energy supplementation of steers grazing spring native range in eastern Colorado has been reported by Denham (1977). These results suggested that CP and/or energy supplementation might also be beneficial to grazing steers in the Northern Plains.

Thus the objectives of this study were: (1) to determine the chemical composition of esophageal fistula diet collections taken from fertilized and unfertilized native range throughout the grazing season, and (2) to study the effect of CP and energy supplementation on the performance of yearling steers grazing these rangelands.

Materials and Methods

Summer supplementation studies were undertaken in 1977, 1978, and 1979 on a Northern Great Plains silty range site in the 380-410 mm rainfall area of central North Dakota. Predominant forage species were western wheatgrass (Agropyron smithii), prairie junegrass (Koeleria cristata), blue grama (Bouteloua gracilis), needleandthread (Stipa comata), green needlegrass (Stipa viridula), and upland sedges (Carex spp.). Big bluestem (Andropogon gerardii) was present in low areas and along intermittent waterways. The experimental site had been previously separated into 2 pastures. The smaller of these (14.2 hectares) had been fertilized annually for 20 years with 45 kg nitrogen per hectare (45-N). This practice was continued during these studies. The other pasture contained 28.4 hectares and had not been fertilized (0-N). The same number of steers were grazed on each pasture based on results of work by Rogler and Lorenz (1965), which demonstrated that a hectare of fertilized rangeland would support twice as many steers as a hectare of unfertilized rangeland.

Five esophageal-fistulated steers were used to collect weekly diet samples from each pasture in 1977 and 1978. The 1977 study was conducted from mid-May until mid-September and the 1978 study from mid-May until mid-October. In 1979 diet samples were collected every second week from mid-May to mid-October using 6 esophageal-fistulated steers. Diet samples were collected from both pastures the same day by using the same steers. To avoid a possible pasture bias, samples were collected one week from the 45-N pasture first and the next week from the 0-N pasture first. Obioha et al. (1970), reported slight but significant differences in nitrogen level between morning and evening forage samples collected via esophageal fistula. The difference was attributed to differences in grazing selectivity due to hunger. In our study samples were collected from pastures in the morning, with samples collected from the second pasture immediately following the first. Esophageal-fistulated steers were maintained on an adjacent 0-N native pasture and were not supplemented. They were kept off feed the night before sampling to facilitate diet collections.

Diet samples collected by individual steers were dried to a constant weight at 50°C in shallow pans in a forced draft oven then ground through a 1-mm screen in a Wiley mill. Chemical analysis included Kjeldahl nitrogen, in vitro digestible organic matter (Tilley and Terry 1963, Moore and Mott 1974), neutral detergent fiber (Van Soest and Wine 1967), acid detergent fiber (ADF) and lignin (Van Soest and Wine 1966). In 1978 and 1979 diet samples from individual steers were processed the same as in 1977. Kjeldahl nitrogen was measured on each sample, but the other chemical analyses were performed on a composite sample for each pasture.
and 179 gm CP). Steers offered brewers grains consumed this
began.

greatest benefit to supplementation in 1978 appeared to be in the
steers on each pasture were then randomly assigned to one of the
was weighed and subtracted from the amount offered. The experi-
dings each, 24 hours apart. Intermediate weights were taken approx-
weighing procedures were the same as in 1977. In the early summer
implanted with 30 mg diethylstilbestrol and individually supple-
results. The ES period was terminated after 45 days and the late
received supplement were individually fed. Refused supplement
the steers from the pasture. All steers had continual access to a
ralled each morning before 1000 hours CDT and those that
changed to .45 kg soybean meal and .23 kg rolled barley (2.
Drought and consequent lack of forage, which forced removal of
received a mixture of salt and dicalcium phosphate.

Initial and final steer weights represented an average of 2 weigh-
ings each, 24 hours apart. Intermediate weights were taken approx-
early every 2 weeks. All weights were taken following an
overnight stand without feed or water.

1977 Study
Twenty yearling Hereford steers weighing approximately 265 kg
were randomly assigned to either the 45-N or 0-N pasture. Five
steers on each pasture were then randomly assigned to one of the
following treatments: (1) no supplement, or (2) .9 kg dry rolled
barley containing 2.7 Mcal DE and 119 gm CP. Steers were cor-
rallled each morning before 1000 hours CDT and those that
received supplement were individually fed. Refused supplement
was weighed and subtracted from the amount offered. The experi-
ment was started June 1 and terminated July 22 because of a severe
drought and consequent lack of forage, which forced removal of
the steers from the pasture. All steers had continual access to a

1978 Study
This study was initiated June 2 and continued a full 152-day
grazing season, but was divided into two periods. Feeding and
weighing procedures were the same as in 1977. In the early summer
(ES) period 30 yearling Hereford steers weighing 267 kg were
randomly assigned to either the 45-N or 0-N pasture, then 5 steers
on each pasture were randomly assigned to each of the following
treatments: (1) no supplement, (2).68 kg dry rolled barley (2.0
Mcal DE and 87 gm CP) or (3).68 kg brewers grains (1.8 Mcal DE
and 179 gm CP). Steers offered brewers grains consumed this
supplement very poorly, thus their data were not included in the ES
results. The ES period was terminated after 45 days and the late
summer (LS) period continued the last 107 days of the grazing
season. Treatments 1 and 2 were continued, but treatment 3 was
changed to .45 kg soybean meal and .23 kg rolled barley (2.1 Mcal
DE and 247 gm CP). Steers averaged 322 kg when the LS period
began.

1979 Study
Thirty yearling Hereford steers, weighing 308 kg, were
implanted with 30 mg diethylstilbestrol and individually supple-
mented as in 1977 and 1978. Supplementation treatments were: (1)
no supplement, (2).68 kg dry rolled barley (2.0 Mcal DE and 87 gm
CP), and (3).68 kg brewers grains containing 1.8 Mcal DE and 179
gm CP. The study was not initiated until July 19 because the
greatest benefit to supplementation in 1978 appeared to be in the
LS and fall period. Steers were removed from the 45-N pasture
September 21 and from the 0-N pasture October 19.

Poor acceptance of the feeding procedure by steers had been a
problem in 1977 and 1978. Thus, during the early part of the
summer of 1979, steers were trained to use the individual feeding
equipment to facilitate supplementation when the study was
initiated.

Weight gains for each pasture, each period, and each year were
analyzed separately, then the two years of ES data and the two
years of LS data were analyzed as randomized complete blocks.
Treatments differences were determined by Duncan's multiple
range test and were considered statistically significant at the 5% level
of probability.

1977 Study
Forage Chemical Composition
Steer differences in diet selection on the 45-N pasture were
reflected by standard errors in the CP content of weekly diet
sample means, which ranged from .17.±.93 to .11.±.13. Standard
errors were comparable on the 0-N pasture. Crude protein and in
vitro digestible organic matter (IVDOM) were higher (P<.05) and
neutral detergent fiber (NDF), ADF, and lignin lower (P<.05) for
the 45-N compared to the 0-N pasture (Table 1). Although NDF
was lower (P<.05) on the 45-N pasture, monthly averages shown in
Table 1 indicate that differences were primarily in the May
samples. There was a difference (P<.05) in CP and IVDOM values
between periods, with a general decline through August followed
by an increase in September. Neutral detergent fiber and ADF values
were also different (P<.05) between periods, showing a
gradual seasonal increase followed by a decrease in NDF in August
and ADF in September. Lignin was not different (P>.05) between
sampling periods. The greatest decline in CP and IVDOM occurred
during May and June when the paucity of forage pre-
ceded grazing. The increase in CP and IVDOM in late summer
was a reflection of unusually heavy rainfall (Table 2), resulting in
new forage growth which was selected by the fistulated steers. The
September decline in NDF, ADF, and lignin in 45-N pasture diet
samples was also indicative of higher forage quality. However,
NDF, ADF, and lignin in diet samples from the 0-N pasture
changed little in September.

Animal Performance
Results of the supplementation study (Table 3) show that steers

Table 1. Chemical composition of forage samples collected via esophagel fistulated steers during the summer grazing season from native range receiving
45-N and 0-N (1977).1,2

<table>
<thead>
<tr>
<th>Month</th>
<th>IVDOM % of D.M.</th>
<th>CP % of D.M.</th>
<th>NDF % of D.M.</th>
<th>ADF % of D.M.</th>
<th>Lignin % of D.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-N</td>
<td>0-N</td>
<td>Mean</td>
<td>45-N</td>
<td>0-N</td>
<td>Mean</td>
</tr>
<tr>
<td>May1</td>
<td>66.2</td>
<td>62.4</td>
<td>64.3</td>
<td>19.1</td>
<td>12.8</td>
</tr>
<tr>
<td>June</td>
<td>59.7</td>
<td>74.9</td>
<td>58.6</td>
<td>13.4</td>
<td>10.5</td>
</tr>
<tr>
<td>July</td>
<td>56.6</td>
<td>33.6</td>
<td>55.1</td>
<td>12.7</td>
<td>8.8</td>
</tr>
<tr>
<td>August</td>
<td>58.2</td>
<td>35.5</td>
<td>55.4</td>
<td>12.7</td>
<td>7.9</td>
</tr>
<tr>
<td>September</td>
<td>58.0</td>
<td>55.9</td>
<td>58.1</td>
<td>16.2</td>
<td>12.6</td>
</tr>
<tr>
<td>mean</td>
<td>60.2±4</td>
<td>56.4±4</td>
<td>58.3±4</td>
<td>14.7±4</td>
<td>10.5±4</td>
</tr>
</tbody>
</table>

1Each value is an average of 20 samples (4 dates by 5 steers) except September, which contains only 3 sampling dates and May which contains 19 samples for the 45-N pasture and 18 for the 0-N pasture.
2Contains June 2 sampling date.

Table 2. Growing season precipitation (mm).

<table>
<thead>
<tr>
<th>Month</th>
<th>1977</th>
<th>1978</th>
<th>1979</th>
<th>Mean 1975-1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>37</td>
<td>107</td>
<td>19</td>
<td>55</td>
</tr>
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<td>June</td>
<td>57</td>
<td>72</td>
<td>59</td>
<td>64</td>
</tr>
<tr>
<td>July</td>
<td>42</td>
<td>44</td>
<td>167</td>
<td>60</td>
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<tr>
<td>August</td>
<td>47</td>
<td>13</td>
<td>41</td>
<td>38</td>
</tr>
<tr>
<td>September</td>
<td>244</td>
<td>53</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>32</td>
<td>9</td>
<td>4</td>
<td>22</td>
</tr>
</tbody>
</table>
fed barley on the 45-N pasture tended to gain better (1.08 kg/da) than unsupplemented steers (.89 kg/da), but the difference was not statistically significant. Steers supplemented with barley on the 0-N pasture did, however, gain more (P<.05) than controls (1.32 vs 1.11 kg/da). The response of steers to supplemental energy in this experiment may have been due to a shortage of forage, rather than to a decline in forage quality. The experimental design called for both energy and CP supplementation during the late summer and and fall, but drought induced lack of forage caused the study to be terminated following the early summer period.

1978 Study

Forage Chemical Composition

Chemical composition of diet samples from the 45-N and O-N pastures are shown in Table 4. Crude protein and NDF were higher (P<.05) for the 45-N pasture while lignin was higher (P<.05) for the 0-N pasture. The presence of mature western wheatgrass beginning in late June probably accounted for the high NDF for the 45-N pasture. Acid detergent fiber and IVDOM tended to be higher for the 0-N pasture, but differences were not significant.

Crude protein and IVDOM decreased (P<.05) throughout the season while NDF, ADF, and lignin increased (P<.05) as the season progressed. The greatest change in NDF and IVDOM, however, had occurred by June and July, respectively. Crude protein and ADF changed more gradually throughout the season, however, had occurred by June and July, respectively. Crude protein and ADF changed more gradually throughout the season. Although lignin differed (P<.05) between sampling times, there was not a consistent seasonal trend for the 45-N pasture.

Animal Performance

Steers supplemented with barley during the ES period gained little better (P>0.5) than unsupplemented steers on either pasture (Table 3). However, in the LS period, steers that received either barley or a CP supplement on the 45-N pasture had greater (P<.05) weight gains than unsupplemented steers (Table 3). The efficiency of supplement utilization was calculated by dividing the amount of supplement consumed by the difference in gain between supplemented and unsupplemented steers. Efficiencies were 5.9 and 4.4 kg feed/kg gain, respectively, for the barley and CP supplemented steers. Steers fed either barley or the CP supplement on the 0-N pasture tended to gain more than unsupplemented steers, but differences were not significant.

Average cumulative weight gains of steers on the 45-N and 0-N pastures for both the ES and LS periods were combined by weighing period and plotted with combined diet CP and IVDOM values (Fig. 1). Diet CP dropped below the NRC requirement (National Research Council 1976) for 350 kg steers to gain .9 kg per day by August 3. There was little response to supplemental CP at this time, but animal gains were only about .3 kg/day regardless of treatment. Protein supplementation appeared beneficial beginning

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### Table 3. Effect of supplementation on daily gains (kg) of yearling steers during early and late summer periods.1

<table>
<thead>
<tr>
<th></th>
<th>Early Summer</th>
<th>Late Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1977</td>
<td>1978</td>
</tr>
<tr>
<td></td>
<td>Mean ES</td>
<td>Mean LS</td>
</tr>
<tr>
<td></td>
<td>45-N 0-N</td>
<td>45-N 0-N</td>
</tr>
<tr>
<td>No Supp.</td>
<td>.89 1.11 1.14</td>
<td>.09 .47 .44</td>
</tr>
<tr>
<td>Barley1</td>
<td>1.08 1.32 1.19</td>
<td>.20 .54 .44</td>
</tr>
<tr>
<td>CP Supp.4</td>
<td>—</td>
<td>.31 .72 .70</td>
</tr>
</tbody>
</table>


2Means in a column with the same superscript are not different (P>0.5).

31977, 2.76 Mcal DE and 104 gm CP; 1978 and 1979, 1.95 Mcal DE and 87 gm CP, values based on actual consumption.

41978 LS (soy-barley), 2.06 Mcal DE and 242 gm CP; 1979 (brewers grains), 1.69 Mcal DE and 186 gm CP, values based on actual consumption.

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### Table 4. Chemical composition of forage samples collected via esophageal fistulated steers during the summer grazing season from native range receiving 45-N and 0-N (1978).1

<table>
<thead>
<tr>
<th>Month</th>
<th>45-N % Pasture</th>
<th>0-N % D.M.</th>
<th>Mean</th>
<th>0-N % Mean</th>
<th>0-N % Pasture</th>
<th>Mean</th>
<th>45-N % Pasture</th>
<th>0-N % D.M.</th>
<th>Mean</th>
<th>0-N % Mean</th>
<th>0-N % Pasture</th>
<th>Mean</th>
<th>45-N % Pasture</th>
<th>0-N % D.M.</th>
<th>Mean</th>
<th>0-N % Mean</th>
<th>0-N % Pasture</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>71.1</td>
<td>70.5</td>
<td>70.8</td>
<td>16.4</td>
<td>14.1</td>
<td>15.2</td>
<td>50.4</td>
<td>59.1</td>
<td>54.8</td>
<td>33.7</td>
<td>36.9</td>
<td>35.3</td>
<td>8.0</td>
<td>6.7</td>
<td>7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>60.6</td>
<td>58.0</td>
<td>59.3</td>
<td>10.9</td>
<td>8.9</td>
<td>9.9</td>
<td>70.8</td>
<td>66.5</td>
<td>68.6</td>
<td>42.0</td>
<td>41.5</td>
<td>41.8</td>
<td>7.0</td>
<td>6.7</td>
<td>6.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>47.3</td>
<td>53.8</td>
<td>50.6</td>
<td>10.2</td>
<td>10.0</td>
<td>10.1</td>
<td>70.9</td>
<td>67.2</td>
<td>69.0</td>
<td>44.2</td>
<td>45.7</td>
<td>45.0</td>
<td>8.2</td>
<td>9.2</td>
<td>9.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>50.0</td>
<td>50.3</td>
<td>50.2</td>
<td>9.4</td>
<td>8.7</td>
<td>9.0</td>
<td>70.4</td>
<td>66.0</td>
<td>68.2</td>
<td>45.9</td>
<td>47.1</td>
<td>46.5</td>
<td>8.4</td>
<td>10.0</td>
<td>9.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>48.1</td>
<td>47.3</td>
<td>47.7</td>
<td>6.9</td>
<td>7.2</td>
<td>7.0</td>
<td>73.7</td>
<td>64.7</td>
<td>69.2</td>
<td>48.8</td>
<td>48.6</td>
<td>48.7</td>
<td>8.0</td>
<td>10.8</td>
<td>9.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>45.7</td>
<td>48.7</td>
<td>47.2</td>
<td>7.8</td>
<td>5.5</td>
<td>6.6</td>
<td>73.1</td>
<td>70.7</td>
<td>71.9</td>
<td>50.3</td>
<td>51.6</td>
<td>51.0</td>
<td>9.2</td>
<td>9.3</td>
<td>9.2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>53.81</td>
<td>54.81</td>
<td>54.3</td>
<td>10.3a</td>
<td>9.1a</td>
<td>9.7</td>
<td>68.22</td>
<td>67.0</td>
<td>44.21</td>
<td>45.2e</td>
<td>44.73</td>
<td>8.1a</td>
<td>8.8a</td>
<td>8.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Pasture means with the same heading and different superscripts are different (P<.05).

2Values represent an average of 4 composite samples for all months except May which had only 3.

3Values represent an average of 20 individual samples (4 dates and 5 steers) except for May which contained only 3 sampling dates and July when the 45-N pasture contained only 19 samples.

4For convenience, a June 1 date was included in the May average, an August 31 date was included in the September average, and a September 28 date was included in the October average.
Animal performance supplementation was effective in the fall when forage IVDOM was about August 23 when CP in the forage dropped below the NRC maintenance requirement (8.5%). The response to both CP and barley supplementation was increasingly evident through mid-October.

Forage IVDOM declined quickly from almost 73% in mid-May to 50% by mid-July. During mid-summer, animal performance appeared to be related to forage IVDOM, but in the fall animal performance increased while IVDOM continued to decline. Barley supplementation was effective in the fall when forage IVDOM was low.

1979 Study
Forage Chemical Composition
Crude protein and IVDOM were higher (P<0.05) and ADF and lignin lower (P<0.05) for the 45-N pasture compared to the 0-N pasture (Table 5). However, there was not a significant difference in NDF between the pastures. Crude protein and IVDOM decreased (P<0.05) and ADF increased (P<0.05) as the season progressed. Lignin and NDF tended to increase as the season advanced, but seasonal differences were not significant.

Animal Performance
In the 1979 study (Table 3), which was shortened because of drought induced lack of forage, weight gains show that steers supplemented with either barley or the CP supplement on the 45-N pasture tended to gain more than unsupplemented steers, but differences were not significant. However, weight gains of steers that received either barley or the CP supplement on the 0-N pasture were greater (P<0.05) than gains of unsupplemented steers. The efficiency of gain for the additional weight on the 0-N pasture attributable to supplementation was 4.1 and 5.3 kg/ld/kg gain, respectively, for the barley and CP supplemented steers.

Weight gain of steers grazing the 45-N and 0-N pastures were plotted with diet CP and IVDOM in Figures 2 and 3, respectively.

Weight gain for the entire grazing season is shown for comparison with forage chemical composition, even though the supplementation study involved only the last part of the season.

Crude protein for the 45-N pasture did not drop below the NRC requirement for .9 kg/day gain until about the time this portion of the study was terminated, which explains why a significant response to CP supplementation was not obtained. Weight gain increased at a near linear rate while IVDOM declined from 66% to less than 52% by August 29. Little change in IVDOM was measured during the remainder of the season.

The relationship between weight gain, diet CP, and IVDOM for the 0-N pasture (Fig. 3) shows that a response to both CP and energy supplementation began about mid-August when CP was just over 9% but rapidly declining. Weight gain increased at a near linear rate until October 4, while IVDOM quickly declined to near 52% by July 31. Supplementation of either energy or CP appeared to be beneficial on both the 45-N and 0-N pasture when IVDOM declined to about 52% but the response began much earlier in the season and resulted in a much greater difference on the 0-N pasture. It cannot be determined from these data whether the beneficial effect of supplementation was caused by CP, energy, or by a combination of the two.

Discussion
In 1977, NDF was higher for the 0-N pasture, and in 1978, it was higher for the 45-N pasture. Crude protein was higher and lignin lower for the 45-N pasture in all 3 years. In 1977 and 1979, IVDOM was higher and ADF lower (P<0.05) for the 45-N pasture. Differences between the 45-N and 0-N pastures in 1977 and 1979 were caused in part by the dilution effect of old plant growth in the 0-N pasture.

Rainfall pattern during the growing season was found to be the

![Fig. 2. Cumulative weight gains, forage CP and IVDOM on the 45-N pasture, 1979.](image1)

![Fig. 3. Cumulative weight gains, forage CP and IVDOM on the 0-N pasture, 1979.](image2)

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**Table 5. Chemical composition of forage samples collected via esophageal fistulated steers during the summer grazing season from native range receiving 45-N and 0-N (1979).**

<table>
<thead>
<tr>
<th>Month</th>
<th>45-N Pasture</th>
<th>0-N Pasture</th>
<th>Mean</th>
<th>45-N Pasture</th>
<th>0-N Pasture</th>
<th>Mean</th>
<th>45-N Pasture</th>
<th>0-N Pasture</th>
<th>Mean</th>
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<th>0-N Pasture</th>
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<th>45-N Pasture</th>
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</thead>
<tbody>
<tr>
<td>May</td>
<td>62.1</td>
<td>60.1</td>
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1 Pasture means with the same heading and different superscripts are different (P<0.05).
2 Values represent an average of 12 individual samples (2 dates and 6 steers). May, June, July, and August values represent an average of 6, 18, and 11 samples, respectively.
major factor influencing chemical composition of 6 native grasses of the High Plains of Texas (Willard and Schuster 1973). Erratic precipitation patterns are a major factor in determining whether a forage species remains actively growing vegetatively, goes into dormancy, or matures reproductively. Precipitation in the Northern Great Plains is also often erratic, as indicated by the precipitation data presented in Table 2.

There was a seasonal decline (P<.05) in IVDOM all 3 years; however, in 1978, most of the decline had occurred by July; in the other 2 years the change was more gradual. Crude protein decreased and ADF increased (P<.05) with advance in season in 1979 suggesting that mid-summer steer gains may have been more closely related to environmental conditions than pasture quality.

The erratic results with CP supplementation indicate that steers were not consistently selecting a diet deficient in CP during the late summer-early fall period as might be expected. The data indicate that supplementation with barley would be beneficial more often than with a supplement higher in CP. However, either barley or a CP supplement must be used to complement dietary forage, and the data demonstrate that dietary forage quality does not necessarily follow a classic plant maturity curve. Year differences in animal response to supplementation are the result of differences in the quality of forage available to the grazing animal as influenced by precipitation amount and pattern.

When 1977 and 1978 ES steer gains were analyzed together (Table 3), no significant benefit was obtained from early summer supplementation. However, Denham (1977) did obtain increased gains over a 32-day spring supplementation period with .45 kg concentrate. When the 1978 and 1979 LS data were analyzed together, a response (P<.05) was obtained from either barley or CP supplementation for both the 45-N and 0-N pastures, respectively. The economics of barley supplementation is illustrated by the following example. If barley were priced at 13.3e per kg ($2.90 per bu), the daily cost of supplemental barley per steer would be 9e (13.3e × .68 kg barley). Average daily weight gain per steer attributed to barley over the 2 years was .11 kg (Table 3). If yearling steers were selling for $1.32 per kg (60¢ lb), the value of the gain would be 14.5e ($1.32/kg × .11 kg); thus supplemental barley would have a net value of 5.5e (14.5e - 9.0e) per steer per day or $4.95 per steer over a 90-day grazing period. The market value of barley and steers will of course determine whether barley supplementation is a viable alternative to the producer.

Literature Cited


