IMPACT OF INCREASING AMOUNTS OF SUPPLEMENTAL HIGH-PROTEIN SOYBEAN MEAL ON PERFORMANCE OF RANGE BEEF COWS


Summary

One hundred and twenty spring-calving Hereford × Angus cows grazing low-quality, tallgrass-prairie forage were fed 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, or 6.0 lb soybean meal (SBM) per head daily. SBM as a source of supplemental degradable intake protein (DIP) can be effective in maintaining cow body weight and body condition during the winter grazing season. Performance as measured by changes in body weight and condition score was maximized when cows received approximately 3.5 to 3.8 lb/day. Below this level, cows lost about 48 lb (about .4 units of BCS) for every 1 lb decrease in the amount of supplemental SBM. The effect of amount of supplemental SBM on calf performance was minimal.

(Key Words: Range Cows, Forage, Soybean Meal.)

Introduction

Protein supplementation to beef cattle grazing low-quality, tallgrass-prairie forage has been a long-standing practice. However, in recent years, the mechanisms by which that protein is utilized have become more clear. We now classify the protein that is degraded by microbes in the rumen as degradable intake protein (DIP) and the protein that escapes ruminal degradation and passes through the rumen to the small intestine without being altered as undegradable intake protein (UIP).

Research at Kansas State University demonstrates that DIP is the first-limiting nutrient for optimal intake and utilization of low-quality forage. However, that research was conducted by supplementing DIP in a purified form (sodium caseinate). Applying that research under production conditions requires identification of potential protein supplements that are high in DIP. Soybean meal (SBM), in which 66% of the protein is DIP, is a good candidate.

The objectives of this study were to identify the level of SBM that elicits maximum performance response and to define the rate of performance decline below the maximum response.

Experimental Procedures

A performance study was conducted during winter 1996-97 to evaluate the impact of level of supplemental SBM on body weight, body condition, and pregnancy rate of spring-calving beef cows grazing low-quality, tallgrass-prairie forage. Forage samples clipped from the pastures contained 76% NDF and 2.7% CP, with 49% of the CP as DIP. DIP was estimated using a single-point enzyme assay. The SBM was 10.1% NDF and 53.9% CP, with 66% of the CP as DIP (1996 Beef NRC). One hundred and twenty Hereford × Angus cows (average initial body weight, 1141 lb; average initial body condition score, 5.3) were allotted randomly to one of three pastures. Within each pasture, cows were assigned to one of eight levels of supplemental SBM; 1.0, 1.5, 2.0, 2.5, 3.0, 4.0,
5.0, and 6.0 lb/head/day as-fed. Cattle in each
pasture were gathered daily, sorted into their
respective treatments, group-fed their supple-
ment, and then returned to pasture. The treat-
ment period began December 2, 1996 and was
terminated on February 10, 1997, which was the
first day of the calving season. After the calving
season began, all cows were fed 3.8 lb/head/day
until they calved. Following parturition, cows
were fed 10 lb/head/day of alfalfa until sufficient
new grass growth was available in the spring.
Body weight and condition were measured at
approximately 1-month intervals until the begin-
ing of the calving season. Thus, measurements
were obtained on December 2, January 6, and
February 10, with additional measures postcalving (within 48 h after calving), shortly
before the beginning of the breeding season
(May 8), and at weaning (October 1). Cows
were bred by natural service to Angus bulls.

Results and Discussion

Losses in cow body weight (BW) and body
condition score (BCS) through the
beginning of the calving season (Table 1) were
reduced (linear P<.01) by increasing the level of
supplemental soybean meal (SBM); however,
both BW and BCS showed a clear plateau
(quadratic P<.01). Maximal BW response to
supplemental SBM was achieved at approxi-
mately 3.5 lb/head/day, and BCS response was
maximized at approximately 3.8 lb/head/day.
Feeding SBM above these levels yielded no
further reduction in BW or BCS loss. Below
this point of maximal response (3.5 to 3.8 lb
SBM/head/day), each 1 lb decrease in SBM fed
daily resulted in a 48 lb reduction in BW and a .4
unit decrease in BCS.

The level of SBM fed from the beginning of
the winter grazing season until the beginning of
the calving season had no affect on calf birth
date (Table 2; P>.52) or calf average daily gain
(P>.43). However, there was a trend for level of
supplemental SBM to affect calf birth weight
(linear P=.14; quadratic P=.16) and weaning
weight (quadratic P=.12). Pregnancy rate not
influenced significantly (P=.51).

Knowledge of the amount of supplemental
SBM at which performance is maximized and
the rate of decline below that maximum can be
used as a rough guideline for determining the
amount of supplemental SBM necessary to
achieve a specified level of BW or BCS change
in spring-calving beef cows grazing winter
range.
Table 1. Effects of Increasing Amounts of Supplemental Soybean Meal (SBM) on Cumulative and Period Body Weight (BW) and Condition Score (BCS) Change, Pregnancy Rate, and Calf Performance of Beef Cows Grazing Dormant, Tallgrass-Prairie Forage

<table>
<thead>
<tr>
<th>Supplemental SBM, lb</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
<th>6.0</th>
<th>SEM</th>
<th>Contrasts^b</th>
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<tr>
<td>No. of cows</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Initial BW, lb</td>
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<td>1152</td>
<td>1136</td>
<td>1153</td>
<td>1125</td>
<td>1137</td>
<td>1132</td>
<td>1160</td>
<td>27.6</td>
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<tr>
<td>Period BW change, lb</td>
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</tr>
<tr>
<td>2 Dec - 6 Jan</td>
<td>-60</td>
<td>-43</td>
<td>-31</td>
<td>-21</td>
<td>-8</td>
<td>-2</td>
<td>4</td>
<td>8</td>
<td>8.5</td>
<td>L, Q</td>
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<tr>
<td>7 Jan - 10 Feb^c</td>
<td>-49</td>
<td>-16</td>
<td>-15</td>
<td>-13</td>
<td>11</td>
<td>15</td>
<td>17</td>
<td>30</td>
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<td>-166</td>
<td>-184</td>
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<td>-226</td>
<td>-244</td>
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<td>238</td>
<td>261</td>
<td>192</td>
<td>198</td>
<td>216</td>
<td>213</td>
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<td>-201</td>
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<td>-209</td>
<td>-223</td>
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<td>Initial BCS</td>
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<tr>
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<td>-.75</td>
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<td>-.15</td>
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<td>.07</td>
<td>.25</td>
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<td>11 Feb - 8 May</td>
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<td>-.43</td>
<td>-.43</td>
<td>-.38</td>
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<td>8 May - 1 Oct</td>
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<td>1.15</td>
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<td>.63</td>
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<td>.78</td>
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<td>-.05</td>
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<td>-.10</td>
<td>-.13</td>
<td>-.03</td>
<td>-.22</td>
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<td>NS</td>
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<tr>
<td>% Pregnant^f rate, %</td>
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<td>93</td>
<td>93</td>
<td>100</td>
<td>87</td>
<td>93</td>
<td>87</td>
<td>-</td>
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<tr>
<td>Birth wt, lb</td>
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<td>83.1</td>
<td>83.2</td>
<td>89.3</td>
<td>88.3</td>
<td>85.3</td>
<td>93.6</td>
<td>84.3</td>
<td>.1</td>
<td>NS</td>
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<tr>
<td>Weaning wt, lb</td>
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<td>489</td>
<td>512</td>
<td>537</td>
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<td>527</td>
<td>515</td>
<td>503</td>
<td>17.8</td>
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<tr>
<td>Calf ADG^g, lb</td>
<td>2.1</td>
<td>2.0</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.0</td>
<td>.1</td>
<td>NS</td>
</tr>
</tbody>
</table>

^aBody condition scale: 1=extremely emaciated; 9=extremely obese.
^bL=linear P<.05; Q=quadratic P<.05; NS=Not significant.
^c10 February=calving.
^d8 May=breeding.
^e1 October=weaning.
^fChi-square P=.51.
^gADG=average daily gain; calculated as (weaning weight-birth weight)/age at weaning.

Cattlemen's Day 1998