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Protein Supplementation for Finishing Cattle
Fed All-Concentrate or Low Roughage (Alfalfa) Diets

(Preliminary Report on Experiment In Progress)

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Age, body weight, sex, weight gain and composition of the weight gain are animal factors involved in the total protein requirement for growing and finishing feedlot cattle. Protein requirements can be expected to vary as the animal grows and fattens and with the rate of growth and fattening. Therefore, protein requirements cannot be determined accurately for animals of various weights and rates of production in growing and finishing experiments. However, feeding trials are commonly used to determine animal response to various amounts or percentages of protein in supplements or the total diet. While not a precise measure of requirements at specific weights and rates of production, the method is of practical value in determining appropriate levels of supplementation under various conditions as to animals and diets.

The experiment reported here was conducted to determine the need for supplemental protein in all-concentrate diets composed largely of corn grain and in diets with low levels of roughage (4 lb. of alfalfa haylage). Cattle fed supplements with soybean meal or urea were compared to those fed similar diets without supplemental protein to the corn or corn and alfalfa haylage.

Procedures

The 144 steers (72 Hereford x Angus and 72 Hereford) used in the experiment were from a previous one where they were fed corn silage and protein supplement with soybean meal or urea as the major supplemental protein. They were adjusted to a high-concentrate diet of reconstituted high-moisture corn grain with 4 lb. of alfalfa haylage over a period of about 10 days. The corn was gradually increased to a full feed from an initial level of 5 lb. daily. Haylage was gradually decreased to the 4 lb. level from an initial daily rate of 18 pounds. No supplements were fed with the corn and haylage during a preliminary period of 42 days prior to the finishing experiment.

Dietary treatments for the finishing experiment consisted of a corn supplement, a soybean meal supplement and a urea supplement each fed at 2 lb. per head daily with the all-concentrate diet and the diet with 4 lb. of alfalfa haylage. Four pens of six cattle each (3 Hereford x Angus and 3 Hereford) were fed one of the six diets (24 pens).

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The cattle had previously received one of four implant treatments--36 mg zeranol, 36 mg diethylstilbestrol (DES), Synovex-S or served as nonimplanted controls. They were reimplanted with the same product and dosage level 105 days following the initial implanting (about 1 month before the finishing experiment). The cattle were reallocated within the four implant groups into 6 pens of 6 cattle, one of which received each of the six dietary treatments.

Corn grain was purchased about 1 month before the experiment and stored in a 17 ft. x 50 ft. oxygen-limiting silo. It was blown into the silo using a silo blower with water added to an auger ahead of the blower. Considerable cracking of the grain occurred and no further processing was used. Other animals were fed from the silo and it was refilled in the same manner in early August. Samples of corn are being collected at time of feeding for chemical analysis. Average protein content on a moisture-free basis is approximately 10.4%.

The haylage was first cutting alfalfa harvested in early June. It was stored in an upright concrete stave silo. Average moisture content as stored averaged about 42% and the protein content on a moisture-free basis was approximately 21%.

A corn-based supplement was used to provide diets with no supplemental protein to corn or corn and haylage. Soybean meal or urea was used in the other two supplements to give a protein content of about 32%. Ingredient composition of the supplements is shown in table 1.

Table 1. Ingredient Composition of Supplements

| Ingredient | Corn suppl. % | SBOM suppl. % | Urea suppl. % |
|---|---------------------|---------------------|---------------------|
| Ground corn grain, fine | 81.08 | 16.58 | 71.18 |
| Soybean meal (44%) | -- | 69.00 | -- |
| Urea (46% N) | -- | -- | 8.7 |
| Trace mineral salt, regular | 3.00 | 3.00 | 3.00 |
| Trace mineral premix | 0.20 | -- | 0.20 |
| Dical + Monocal (Cyphos) | 2.50 | 2.00 | 2.60 |
| Limestone | 7.00 | 6.00 | 5.60 |
| Calcium sulfate | -- | -- | 2.40 |
| Potassium chloride | 5.80 | 3.00 | 5.90 |
| Vitamin A (30,000 IU/g) (10,000 IU/lb.) | 0.70 | 0.70 | 0.70 |
| Vitamin E (100,000 IU/lb.) (200 IU/lb. suppl.) | 0.9 gm | 0.9 gm | 0.9 gm |
| Aureomycin-10 (35 mg CTC/lb. suppl.) | 0.35 | 0.35 | 0.35 |
| Percent composition (Calculated) | | | |
| Protein | 8.11 | 32.02 | 32.09 |
| Ca | 3.18 | 2.93 | 3.18 |
| P | 0.70 | 0.67 | 0.69 |
| K | 3.13 | 3.07 | 3.16 |

The cattle were fed once daily in outside, paved pens without shade or shelter.

Results

The experiment is in progress and preliminary results after 98 days are shown in table 2. Rate of gain up to this time is slightly greater for soybean meal and slightly less for urea in comparison to the group without supplemental protein with the all-concentrate diet and the diet with 4 lb. of alfalfa haylage. Feed consumption has been about the same for steers fed the corn supplement or soybean meal. Urea appears to have reduced feed intake either with or without haylage. Steers fed supplemental protein have lower feed requirements than those fed the corn supplement.

Table 2. Level and Source of Protein for Finishing Cattle Fed Diets With and Without Roughage

| Alfalfa haylage | Corn | | SBOM | | Urea | |
|------------------------|-------|-------|-------|-------|-------|-------|
| | 0 | 4 lb. | 0 | 4 lb. | 0 | 4 lb. |
| No. of animals | 24 | 24 | 23 | 24 | 24 | 24 |
| Init. filled wt., lb. | 779 | 777 | 776 | 775 | 777 | 779 |
| Final filled wt., lb. | 1041 | 1086 | 1050 | 1100 | 1031 | 1081 |
| Avg. daily gain, lb. | 2.68 | 3.15 | 2.80 | 3.32 | 2.59 | 3.08 |
| Avg. daily feed, lb. | | | | | | |
| HM corn grain | 19.34 | 20.37 | 19.24 | 20.35 | 18.08 | 18.99 |
| Haylage | 0.14 | 3.96 | 0.14 | 3.96 | 0.14 | 3.96 |
| Suppl. | 2.00 | 1.98 | 1.98 | 1.98 | 1.98 | 1.98 |
| Total | 21.48 | 26.31 | 21.36 | 26.29 | 20.20 | 24.83 |
| Feed/100 lb. gain, lb. | | | | | | |
| HM corn grain | 728 | 663 | 697 | 615 | 700 | 616 |
| Haylage | 6 | 131 | 5 | 120 | 6 | 131 |
| Suppl. | 75 | 66 | 73 | 60 | 77 | 66 |
| Total | 809 | 860 | 775 | 795 | 783 | 813 |

The 4 lb. of alfalfa haylage have resulted in a considerable improvement (about 18%) in weight gain with all supplements. The response appears to be similar for each supplement. Haylage-fed steers consumed slightly more corn than those fed all-concentrate diets. While total feed requirements are higher with haylage, there is a lower requirement for concentrates (corn plus supplement). In all comparisons between all-concentrate and haylage diets, 100 lb. of haylage as fed reduced concentrate requirements per 100 lb. of gain by 73 pounds. This saving in concentrates along with a shorter feeding period (about 18% faster gain) for a given amount of gain would result in a rather high value for the haylage for equal cost of gains in comparison to all-concentrate diets.

Protein requirements of growing and finishing feedlot cattle decrease as a percentage of the diet with increasing weight and fatness. It would, therefore,

be of interest to compare performance between supplements at periodic intervals during the experiment. Accumulative average gains with the percentage of the corn supplement at each weigh period are shown in table 3.

Table 3. Accumulative Average Gain by Weigh Periods as Affected by Protein Supplementation and Type of Diet

| | Type of supplement | | |
|---|--------------------|------|------|
| | Corn | SBOM | Urea |
| <u>All-concentrate diets</u> | | | |
| <u>28 days</u> | | | |
| Avg. gain to date | 74 | 95 | 88 |
| % of corn | | 129 | 118 |
| <u>56 days</u> | | | |
| Avg. gain to date | 167 | 172 | 169 |
| % of corn | | 103 | 101 |
| <u>84 days</u> | | | |
| Avg. gain to date | 239 | 248 | 226 |
| % of corn | | 104 | 95 |
| <u>98 days</u> | | | |
| Avg. gain to date | 263 | 274 | 254 |
| % of corn | | 104 | 97 |
| <u>Diets with 4 lb. alfalfa haylage</u> | | | |
| <u>28 days</u> | | | |
| Avg. gain to date | 95 | 106 | 97 |
| % of corn | | 112 | 103 |
| <u>56 days</u> | | | |
| Avg. gain to date | 185 | 198 | 175 |
| % of corn | | 107 | 94 |
| <u>84 days</u> | | | |
| Avg. gain to date | 277 | 291 | 249 |
| % of corn | | 105 | 90 |
| <u>98 days</u> | | | |
| Avg. gain to date | 309 | 325 | 302 |
| % of corn | | 105 | 98 |

There was an improvement in weight gain from protein supplementation during the first 4 weeks of the experiment. The improvement was greater for soybean meal than for urea and greater with the all-concentrate diet than with 4 lb. of alfalfa haylage. After this time there was no advantage for protein supplementation on basis of weight gain for either the all-concentrate or haylage diets. After the first month, steers fed the urea supplement gained slightly less than those fed the corn supplement except during the last 2 weeks of the experiment. This is probably a reflection of the slightly lower feed consumption by the urea group. The small advantage after 98 days in feed efficiency for steers fed the protein supplements resulted from an improvement during the first month when weight gains

were higher. After this time there was no advantage of protein supplementation on basis of feed efficiency for either the all-concentrate or haylage diets.

A comparison between the all-concentrate diets and those with alfalfa haylage by weight periods is shown in table 4. In general, the response to haylage was similar during the course of the experiment with each supplement. This would appear to be an effect from the haylage other than its protein contribution since the response was similar with and without supplemental protein.

Table 4. Accumulative Average Gain by Weigh Periods as Affected by Amount of Roughage and Protein Supplementation

| | All concentrate (Avg. gain to date) | 4 lb. haylage | Percent all concentrate |
|-------------|---|------------------|-------------------------------|
| <u>Corn</u> | | | |
| 28 days | 74 | 95 | 128 |
| 56 | 167 | 185 | 111 |
| 84 | 239 | 277 | 116 |
| 98 | 263 | 309 | 117 |
| <u>SBOM</u> | | | |
| 28 days | 95 | 106 | 112 |
| 56 | 172 | 198 | 115 |
| 84 | 248 | 291 | 117 |
| 98 | 274 | 325 | 119 |
| <u>Urea</u> | | | |
| 28 days | 88 | 97 | 110 |
| 56 | 169 | 175 | 104 |
| 84 | 226 | 249 | 110 |
| 98 | 254 | 302 | 119 |

Summary

One hundred forty-four steers averaging about 775 lb. (filled weight basis) were fed an all-concentrate diet or one with 4 lb. of alfalfa haylage. Reconstituted high-moisture corn was the grain source. Each diet was fed with 2 lb. per head daily of a corn supplement, a 32% protein supplement with soybean meal or a 32% protein supplement with urea. Protein content of the corn grain on a moisture-free basis was about 10.4%. The experiment is in progress, but results have been summarized after 98 days.

Both sources of supplemental protein resulted in an improvement in weight gain during the first 4 weeks of the experiment. There was more improvement from soybean meal than from urea and more with all-concentrate diets than with those which contained 4 lb. of alfalfa haylage. After the initial 4 weeks and

cattle weights averaging about 850 lb., there was no advantage of protein supplementation with either diet. Those fed urea generally gained at a slightly lower rate than those fed no supplemental protein after the first 4 weeks.

Steers fed diets with 4 lb. of alfalfa haylage gained about 18% faster than those fed all-concentrate diets. The response to haylage was similar for all supplements and at various times during the experiment. Corn consumption was slightly higher with haylage. While total feed requirements per 100 lb. of gain were higher with haylage, there was a reduction in requirements for concentrates (corn plus supplement). On the basis as fed, 100 lb. of the haylage reduced concentrates required per 100 lb. of gain by 77 pounds. The effect of alfalfa haylage appeared to result from factors other than the additional protein contributed since the response was similar for diets with and without supplemental protein.

Protein content of the dry diets without alfalfa haylage (about 10.4%) is lower than recommended (11.1%, National Research Council) for cattle of the weights in this experiment.