# ALFALFA LEAF MEAL IN WINTERING BEEF COW DIETS

C.M. Zehnder, J. M. Hall[a], D. B. Brown, and A. DiCostanzo
Department of Animal Science
North Central Experiment Station
University of Minnesota
[a]Virginia Tech University

## Summary

One hundred dry pregnant cows (1389 lb) and twenty-four pregnant heifers (1034 lb) were assigned by calving date and body condition to one of four dietary treatments for a wintering period during their late gestation. Dietary treatments consisted of supplementing crude protein (CP) at 100 % or 120 % of the recommended intake (NRC, 1996) using either soybean meal or alfalfa leaf meal (ALM) as the supplemental protein source. Cows were group fed (two replicate pens/treatment) while heifers were individually fed for the duration of the study. The study lasted 70 (early) or 85 (late) days for cows and ended when the first cow in each replicate calved. For heifers, the study lasted for 100 days and ended accordingly when each heifer calved. Heifers fed ALM had consumed less ($P < .05$) hay and corn dry matter (DM). Overall diet DM intakes were unaffected ($P > .05$) by protein source. Feeding 120 % of recommended protein (2.38 vs 2.07 lb/day) to heifers increased ($P < .05$) their rate of gain by almost .5 lb/head/day. Cows fed ALM had faster ($P < .05$) rates of gain when gain was measured 22 days before calving. Once cows calved, weight change was similar ($P > .05$) for each protein source. However, cows fed alfalfa leaf meal consumed more ($P = .054$) total dry matter (DM). Calving traits were not affected by protein source or intake. Wintering heifers or cows on ALM-based supplements had no detrimental effect on performance of heifers or cows or their calves at birth. Additional protein may be required by heifers to ensure that they continue gaining weight during late gestation.

## Introduction

Alfalfa leaf meal is a byproduct of processing alfalfa hay to separate stems for power generation. The leaves are high in protein, calcium and other minerals. In addition, the energy content of leaves should approximate that of high quality hays or small grain silages. Because of its relatively high fiber content, ALM may not impact rumen function negatively as some starch-based supplements do. These characteristics make ALM an alternative source of protein, energy and minerals for the diets of beef cows. Therefore, the objectives of this study were twofold:

a) to determine the feeding value of ALM in the diets of wintering pregnant cows or heifers, and

b) to determine whether additional protein in the diets of wintering pregnant cows or heifers has a positive effect on weight gains or calving traits.

## DISCLAIMER

## Materials and Methods

One hundred dry pregnant cows (1389 lb) and twenty-four pregnant heifers (1034 lb) were assigned by calving date and body condition to one of four dietary treatments for a wintering period during their late gestation. Dietary treatments consisted of supplementing crude protein (CP) at 100% or 112.5% of the recommended intake (NRC, 1996) using either soybean meal or ALM as the supplemental protein source. Cows were group fed in a pole shed barn that housed two replicate pens assigned to each treatment while heifers were individually fed in stanchions for the duration of the study. Heifers were allowed access to feed between 2 pm and 7 am of the following day and were allowed access to water and an exercise area between 7 am and 2 pm every day. The study lasted 70 (early) or 85 (late) days for cows and ended when the first cow in each replicate calved. For heifers, the study lasted for 100 days and ended accordingly as each heifer calved.

Diets consisted of poor quality grass hay, corn and a protein supplement to provide 2.3 or 2.7 lb CP/head/day (cows), or 2.2 or 2.6 lb CP/head/day (heifers), 60% TDN, .75% Ca and .27% P. Composition of feeds used is provided in Table 1. Diets were balanced for mineral and vitamin content. Nutrient analysis of feedstuffs and composition of supplements are provided in Table 1 and 2 .

Table 1. Nutrient composition of feeds.

| | | DM basis, % | | |
|---|---|---|---|---|
| Feed | DM, % | CP | NDF | ADF |
| HEIFERS | | | | |
| Whole corn | 89.9 | 9.42 | 9.95 | 1.60 |
| Hay | 82.1 | 7.42 | 67.62 | 35.21 |
| Supplements[a] | | | | |
| ALM100-Hi | 92.2 | 19.00 | 31.24 | 19.37 |
| ALM00-Hi | 90.2 | 21.83 | 14.92 | 4.22 |
| ALM100-NRC | 92.3 | 14.00 | 22.55 | 11.18 |
| ALM00-NRC | 90.4 | 15.50 | 15.81 | 4.12 |
| COWS | | | | |
| Whole corn | 89.8 | 9.60 | 9.95 | 1.6 |
| Hay | 78.4 | 6.10 | 68.24 | 36.62 |
| Supplements[a] | | | | |
| ALM100-Hi | 93.9 | 19.10 | 31.24 | 19.37 |
| ALM00-Hi | 90.4 | 22.35 | 14.92 | 4.22 |
| ALM100-NRC | 92.5 | 14.05 | 22.55 | 11.18 |
| ALM00-NRC | 90.3 | 15.85 | 15.81 | 4.12 |
| Alfalfa leaf meal | 95.3 | 22.05 | 33.83 | 20.68 |

[a] ALM100: alfalfa leaf meal-based supplement; Hi: formulated to provide 112.5% of NRC recommendation; ALM00: soybean meal-based supplement; NRC: formulated to provide 100% of NRC recommendations.

Table 2. Composition of supplements[a,b].

| Ingredient | ALM100-Hi | ALM00-Hi | ALM100-NRC | ALM00-NRC |
|---|---|---|---|---|
| Corn | 6.31 | 53.53 | 45.67 | 68.67 |
| Alfalfa leaf meal | 83.29 | 0 | 41.14 | 0 |
| Soybean meal | 0 | 33.43 | 0 | 16.57 |
| Molasses | 6.54 | 6.54 | 8.04 | 8.04 |
| Limestone | .71 | 3.36 | 3.57 | 3.57 |
| TM salt | 1.86 | 1.86 | 1.86 | 1.86 |
| Dicalcium phosphate | .71 | .71 | .71 | .71 |
| Vit-A, D, E premix | .57 | .57 | .57 | .57 |

[a] Supplements were fed at the rate of 7 lb/head/day.

[b] ALM100: alfalfa leaf meal-based supplement; Hi: formulated to provide 112.5% of NRC recommendation; ALM00: soybean meal-based supplement; NRC: formulated to provide 100% of NRC recommendations.

Weights and body condition scores (a subjective measure of fat cover on a scale of 1, emaciated, to 9, obese) were obtained at the initiation, 14 to 28 days before calving (cows only) and at calving. Feed offered and refusals were measured daily to calculate daily intake. Heifers and cows were observed for signs of parturition beginning two weeks before the scheduled due date. As cows or heifers calved, their calves were weighed, the calving process scored (calving ease of 1, no assistance required, to 5, breech birth), and the calf's vigor assessed by a subjective score (1, alert, stands and nurses quickly, to 4, stillborn).

Data on weights, average daily gain, body condition scores, body condition score change, DM intake, and calving traits were analyzed for a randomized block design using the general linear model of SAS. Effects tested were protein source, protein intake, protein source by protein intake interaction, and block. When the model was found to be significant ($P < .05$), mean differences were separated by the least square procedure.

**Results and Discussion**

Because no significant interaction between protein source and intake was detected ($P > .05$), heifer performance and calving traits are listed for protein source or protein intake in Table 3. Heifers fed ALM consumed less ($P < .05$) hay and corn dry matter (DM) intakes although overall diet DM intakes were unchanged ($P > .05$). Actual CP intakes between protein intake groups were 2.4 or 2.1 lb/day. Feeding 15% higher protein (2.38 vs 2.07 lb/day) to heifers increased ($P < .05$) their rate of gain by almost .5 lb/head/day while reducing corn, hay and total DM intakes ($P < .05$). Calving traits were not affected by protein source or intake.

No significant interaction between protein source and intake was detected (P >.05); therefore, cow performance and calving traits are listed for protein source or protein intake in Table 4. Cows fed alfalfa leaf meal had faster (P < .05) rates of gain when gain was measured 22 days before calving. Once cows calved, weight change was similar (P > .05) for each protein source. However, cows fed ALM consumed more (P = .054) total dry matter (DM). Actual CP intakes between CP intake groups were 3 and 2.4 lb/head/day. However, feeding higher than recommended CP to mature cows tended (P=.10) to increase DM intake, but had no effect on gain. Calving traits were not affected by protein source or intake.

Wintering heifers or cows on ALM supplements had no detrimental effect on performance or cow or calves at birth. Additional protein may be required by heifers to ensure that they continue gaining weight during late gestation.

Table 3. Performance of heifers fed diets supplemented with soybean meal or alfalfa leaf meal at 100% or 112.5% of NRC recommended CP intake.

| | Alfalfa leaf meal, % of supplemental protein | | Protein level | | |
|---|---|---|---|---|---|
| Item | 0 | 100 | Low | High | SE |
| Initial BW, lb | 1025 | 1044 | 1044 | 1025 | 19.78 |
| Final BW, lb | 1039 | 1041 | 1027 | 1053 | 21.84 |
| ADG, lb | .11 | -.08 | -.23[e] | .25[f] | .10 |
| Initial BCS[a] | 4.8 | 4.8 | 4.8 | 4.8 | .15 |
| Final BCS[a] | 5.0 | 5.0 | 4.9 | 5.1 | .25 |
| BCS change[a] | .2 | .2 | .1 | .3 | .21 |
| DMI, lb/day | | | | | |
| Hay | 14.5[e] | 12.54[f] | 14.15 | 12.90 | .57 |
| Corn | 4.23[e] | 3.92[f] | 4.61[e] | 3.53[f] | .06 |
| Supplement[b] | 2.40[e] | 4.63[f] | 2.70[e] | 4.32[f] | .03 |
| Total | 21.13 | 21.09 | 21.46 | 20.76 | .63 |
| CP intake, lb/day | 2.27 | 2.18 | 2.07[e] | 2.38[f] | .04 |
| Calving traits | | | | | |
| Calving ease[c] | 1.42 | 1.92 | 1.92 | 1.42 | .32 |
| Calf birth wt, lb | 67.83 | 73.92 | 71.33 | 70.42 | 4.15 |
| Calf vigor[d] | 1.25 | 1.42 | 1.42 | 1.25 | .17 |

[a] Body condition score (1 = emaciated; 9 = obese).
[b] Corn grain included and added to corn grain total.
[c] Scale of 1 = unassisted to 5 = breech birth.
[d] Scale of 1 = stands and nurses quickly to 4 = stillborn.
[e,f]Means differ (P < .05).

Table 4. Performance of cows fed diets supplemented with soybean meal or alfalfa leaf meal at 100% or 112.5% of NRC recommended CP intake.

| | Alfalfa leaf meal, % supplemental protein | | | | Protein level | | | |
|---|---|---|---|---|---|---|---|---|
| Item | 0 | SE | 100 | SE | 100% NRC | SE | 112.5% NRC | SE |
| Initial BW, lb | 1381 | 26.00 | 1398 | 29.92 | 1383 | 23.79 | 1397 | 33.18 |
| Pregnant BW[a], lb | 1437 | 26.43 | 1501 | 30.34 | 1450 | 24.20 | 1489 | 33.60 |
| Final BW, lb | 1326 | 28.71 | 1328 | 33.22 | 1326 | 26.38 | 1329 | 36.23 |
| Pregnant ADG[a], lb | .74[f] | .09 | 1.17[g] | .10 | .85 | .08 | 1.05 | .11 |
| Final ADG, lb | -.72 | .14 | -.77 | .16 | -.78 | .13 | -.70 | .17 |
| Initial BCS[b] | 5.1 | .19 | 4.8 | .22 | 5.0 | .17 | 4.9 | .24 |
| Pregnant BCS[a,b] | 5.4 | .12 | 5.4 | .14 | 5.3 | .11 | 5.5 | .16 |
| Final BCS[b] | 4.8 | .17 | 4.6 | .20 | 4.9 | .16 | 4.6 | .22 |
| Pregnant BCS[a,b] change | .3 | .13 | .6 | .15 | .3 | .12 | .6 | .17 |
| Final BCS[b] change | -.3 | .17 | -.2 | .19 | -.2 | .15 | -.3 | .21 |
| DMI, lb/day | | | | | | | | |
| Hay | 22.60 | .43 | 21.25 | .43 | 21.80 | .43 | 22.05 | .43 |
| Corn | 4.58 | .09 | 5.77 | .09 | 5.32 | .09 | 5.03 | .09 |
| Supplement[c] | 2.45 | .01 | 4.83 | .01 | 2.77 | .01 | 4.51 | .01 |
| Total | 29.62 | .51 | 31.86 | .51 | 29.89 | .51 | 31.59 | .51 |
| Alfalfa leaf meal, lb/day | | | | | | | | |
| CP intake, lb/day | 2.65 | .38 | 2.77 | .38 | 2.45 | .38 | 2.97 | .38 |
| Calving traits | | | | | | | | |
| Calving ease[d] | 1.11 | .04 | 1.07 | .05 | 1.08 | .04 | 1.10 | .05 |
| Calf birth wt, lb | 86.01 | 1.92 | 83.92 | 2.23 | 85.97 | 1.78 | 83.96 | 2.44 |
| Calf vigor[e] | 1.47 | .14 | 1.35 | .16 | 1.37 | .13 | 1.45 | .18 |

[a] Measured 14 to 28 days before calving.
[b] Body condition score (1 = emaciated; 9 = obese).
[c] Corn grain included and added to corn grain total.
[d] Scale of 1 = unassisted to 5 = breech birth.
[e] Scale of 1 = stands and nurses quickly to 4 = stillborn.
[f,g]Means differ ($P < .05$).