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# FISH MEAL VS. SOLVENT SOYABEAN MEAL FOR LACTATING COWS FED ALFALFA SILAGE AS SOLE FORAGE[1]

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## EDITOR'S SUMMARY

The State of Wisconsin produces around 17% of the total U.S.A. milk production, with large high yielding dairy herds. The main forage is silage made from wilted alfalfa (lucerne). Like grass silage, alfalfa silage has little, if any, protein that escapes degradation in the rumen.

A source of such protein is believed to be required to supplement alfalfa silage for high yielding dairy cows.

To test the effect of feeding a supplementary protein with a high content of protein escaping degradation in the rumen, fish meal produced for ruminant use was compared with soyabean meal.

Yield of milk and fat corrected milk were increased significantly 37.1 v 36.0 kg and 35.9 v 34.6 kg per day respectively as a result of feeding fish meal (0.67kg per day). The concentration of fat in milk was increased, but the difference was small and non-significant.

Although the yield response comparing the feeding of fish meal versus soyabean meal was not large (around 1kg more milk per day), treatment diets were fed for a relatively short period (three weeks). Larger responses might be expected feeding fish meal for a longer period from calving or a few days earlier over the period when milk production is at its highest.

[1]From U.S. Dairy Forage Research Centre - 1988 Research Summaries, April 1989. (In press).

## INTRODUCTION

Most studies comparing protein supplements which are resistant to ruminal degradation have used corn silage as forage because its low crude protein (CP) content allows diets to be formulated with greater amounts of test protein. However, there is evidence that despite high CP levels, the protein in legume forages is poorly utilized by ruminants. This is particularly true for alfalfa silage, and resistant proteins should be tested as supplements for that forage. Cows fed alfalfa silage or hay as sole forage produced less milk protein and milk with lower protein content than cows fed corn silage-based diets supplemented with soybean meal to equalize dietary CP (Broderick, J. Dairy Sci. 69:2948, 1986).

Fish meal is known to be substantially resistant to ruminal degradation. The purpose of this study was to determine if the protein in fish meal (FM) would be used more efficiently than that in solvent soybean meal (SBM) in lactating dairy cows fed alfalfa silage-based diets.

## MATERIALS AND METHODS

Twenty Holstein cows, averaging 583kg liveweight and 2.3 lactations, 53 days (d) in milk yielding 39.7kg/d milk, were blocked into two groups according to production and stage of lactation. Supplements of abut 450 g CP/d from either FM or SBM were fed in a switch-back experiment. Fish meal was a gift from Zapata Haynie Co., Hammond, LA. Rate and extent of rumen in vitro degradation of protein in FM were 031/h and 40%, and in SBM were .096/h and 63%. Supplements were fed for periods of three weeks before switching; the complete switch-back cycle totalled six weeks. Data were analyzed from the last two weeks of each period. Diets were fed ad libitum as total mixed rations. Silage was second cutting alfalfa, chopped to a theoretical length of 1.0 cm and stored in a bunker silo. Alfalfa silage was 39% DM as-fed and provided 70% of diet DM (Table 1). Milk production was measured at each milking; milk samples were analyzed for fat, protein,lactose and urea. Cows were weighed on three consecutive d at the start of the trial and at the end of each period. Four hours after feeding on d 20 of each period, blood samples were taken from the tail vein of each cow. Blood plasma was prepared and analyzed for glucose and urea.

## RESULTS AND DISCUSSION

Compared to SBM, FM significantly ($\underline{P} < .05$ or smaller) increased weight gain, and production of milk, 3.5% FCM, protein and lactose, and protein concentration, and slightly reduced lactose concentration (Table 2). Also, there was a trend for increased fat production. Milk production improvement was small, but very consistent, indicating a modest protein deficiency on the basal diet. Highly significant increases in milk protein concentration and secretion are indicative of more efficient utilization of protein in FM relative to SBM. At 3% protein in milk, the .06kg protein/d increase corresponds to about 2kg/d of milk; this is greater than the 1.1 and 1.3 kg/d improvements in actual milk and FCM observed in the study. The nonsignificant difference of 0.3kg/d of DM intake cannot account for the 0.53kg/d greater weight gain with FM supplement. Increased intake would have provided only about 0.5 Mcal of the 2.71 Mcal NE[1] required for this extra gain.

Although blood glucose and urea were not influenced by protein, milk urea was higher with supplemental FM (Table 2). The very high urea concentrations in blood and milk reflect the high CP content of the diet (Table 1).

Findings from this study indicate that greater ruminal escape results in more efficient utilization of FM than SBM protein in lactating dairy cows fed alfalfa silage-based diets.

**TABLE 1**

**Diet composition**

| Component | Soybean meal | Fish Meal |
|---|---|---|
| | ----- (% of DM)----- | |
| Alfafla silage | 69.7 | 69.8 |
| High moisture corn | 25.1 | 25.1 |
| Ground shelled corn | ---- | 1.0 |
| Soybean meal | 4.3 | ---- |
| Fish meal | ---- | 2.9 |
| Trace mineral salt | 0.45 | 0.44 |
| Monosodium phosphate | 0.41 | 0.72 |
| Vitamin A,D&E con. | 0.11 | 0.11 |
| Crude protein | 20.3 | 20.1 |

**TABLE 2**

**Effect of supplemental protein from solvent soybean meal or fish meal on DM intake, weight gain, production of milk and milk components, plasma glucose and urea, and milk urea.**

| | Supplemental Protein | | |
|---|---|---|---|
| **Item** | **Solvent SBM** | **Fish Meal** | **Probability** |
| DM intake, kg/d | 22.9 | 23.2 | .296 |
| Weight gain, kg/d | 0.55 | 1.08 | .030 |
| Milk, kg/d | 36.0 | 37.1 | .002 |
| 3.5% FCM, kg/d | 34.6 | 35.9 | .014 |
| Fat, kg/d | 1.18 | 1.23 | .066 |
| Fat, % | 3.29 | 3.33 | .500 |
| Protein, kg/d | 1.02 | 1.08 | <.001 |
| Protein % | 2.83 | 2.92 | .010 |
| Lactose, kg/d | 1.88 | 1.92 | .041 |
| Lactose, % | 5.22 | 5.18 | .018 |
| Plasma glucose, mg/d1 | 59.1 | 59.9 | .812 |
| Plasma urea, mM | 7.52 | 7.58 | .861 |
| Milk urea, mM | 7.32 | 7.52 | .011 |