

Using Fish Meal in Dairy Rations

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By-pass protein is an important part of the diet of lactating cattle. The National Research Council recommends that bypass protein make up 34 to 36 percent of the total crude protein consumed by lactating cattle.

Fish meal is high in crude protein (65 to 70 percent) and is a source of bypass protein (also called ruminally undegradable protein or RUP). It can be used in dairy rations to help meet the bypass protein requirement.

The addition of fish meal, which is high in lysine, also would be an advantage in corn- and corn silage-based diets with a low lysine content (Table 1).

Other animal bypass protein sources include meat meal, feather meal, meat and bone meal, and blood meal. Grain sources include corn distillers grains and corn gluten meal. Decide which sources to use based on cost, amino acid profile, and availability.

How much fish meal should be used?

Use just enough fish meal to satisfy the bypass protein requirements. The amount of fish meal needed depends on the crude protein content of the diet. The average amount of fish meal added to a ration should range from 1 to 3.5 percent of the total

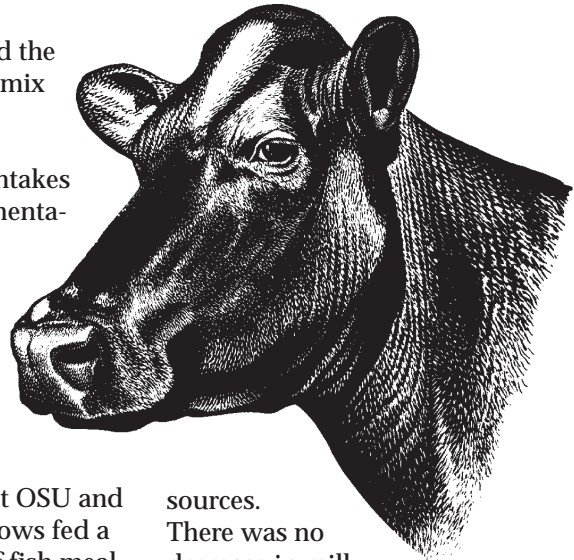
ration dry matter. Blend the fish meal into the total mix ration.

Some users report decreased dry matter intakes with fish meal supplementation. However, these results usually are associated with either top-dressing the fish meal or feeding excessive levels (more than 6 percent of the ration dry matter).

Studies performed at OSU and elsewhere found that cows fed a more moderate level of fish meal (3 to 4 percent) blended into a total mixed ration had similar dry matter intakes compared with cows fed diets without fish meal.

Feeding more than 5.3 oz of fish oil per head per day has been associated with milk fat depression. Therefore, the maximum amount of fish meal you can use will be dictated by the oil content of the fish meal. The level of oil in fish meal varies with the type of fish and the process used to remove the oil (Table 1).

During an OSU study, we supplied 13 percent of the ration dry matter with whole cottonseed (20 percent oil) and 3.5 percent with fish meal (6 to 8 percent oil). At maximum dry matter intake, the cows were receiving 2.8 oz of fish oil and 2.5 oz of cottonseed oil for a total of 5.3 oz of unsaturated fatty acids from these two



sources.

There was no decrease in milk fat percentage. These results indicate that the unsaturated oil did not reduce fiber digestion.

Results of fish meal supplementation

Milk production

Results of adding fish meal to dairy rations vary with the level of fish meal supplemented, production of the cow, and composition of the basal ration. In general, fish meal supplementation seems to have a greater effect during the first several weeks of lactation before peak milk is reached.

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In some research, the addition of fish meal to the diet stimulated milk production during the first 4 to 6 weeks of lactation; there were no effects after peak milk. In a trial at OSU, cows supplemented with 3.5 percent fish meal averaged 6.5 lb more milk per day than cows fed a soybean meal diet during the first 6 weeks of lactation. There was no difference after peak milk was reached.

Cows in the Midwest fed alfalfa silage as the sole forage source responded to menhaden fish meal (Sea-Lac) with a 2.6 lb per day increase in milk yield over the first 17 weeks of lactation. However, supplementing fish meal to cows in early lactation has not always improved production when compared with supplementing soybean meal.

Milk protein production

Some studies show an increase in milk protein yield with fish meal supplementation. However, not all studies have shown an increase in milk protein yield with

supplementation of fish meal compared with soybean meal.

Results of fish meal supplements on milk protein yield vary depending on the basal ration and crude protein level fed. During a study at OSU, cows supplemented with 3.5 percent fish meal increased milk protein yield by 0.13 lb per day compared with cows fed a diet supplemented with soybean meal. Increases in milk protein with fish meal supplementation also occurred in three trials conducted in Wisconsin.

Milk flavor

Neither an oxidized off-flavor nor other off-flavors were detected by the OSU Dairy Products Judging Team in milk produced by cows supplemented with corn gluten meal or fish meal. Other research agrees with these results.

Fertility

The addition of fish meals to the diet has either improved fertility or helped maintain it.

In studies performed in Ireland and Israel, cows with fish meal added to their diet showed improvement in some measurements of reproductive performance.

In an OSU study, cows fed fish meal maintained body weight and body condition score and had a similar high level of reproductive performance compared with cows fed the soybean meal control diet.

Work in Wisconsin has shown an increase in body weight with supplementation of fish meal, which may indicate a faster return to positive energy balance. Cows with enhanced nutritional status and weight gain early in lactation are associated with improved reproductive performance.

When does it pay to add fish meal?

In a study at OSU, it was profitable to feed cows a 3.5 percent fish meal diet from weeks 1 to 10 postpartum at \$10.00/cwt milk. If cows were fed through

Table 1.—Chemical composition of corn gluten and fish meals.^a

| Measurement | Corn Gluten Meal | Sea-Lac ¹ | Arctic Alaska ² | Ocean Proteins ³ |
|--|---------------------|----------------------|-------------------------------|--------------------------------|
| Dry Matter, % | 90 | 90 | 96 | 93 |
| —————Dry Matter Basis————— | | | | |
| Crude Protein, % | 74 | 68 | 69 | 68 |
| Bypass protein, % of crude protein | 68 | 68 | 47 | 46 |
| Lysine, % of crude protein | 1.3 | 5.2 | 5.2 | 4.3 |
| Methionine, % of crude protein | 1.5 | 1.8 | 2.1 | 1.7 |
| Ether Extract, % (estimate of oil content) | 1.4 | 6.5 | 8.4 | 8.1 |
| Ash, % | 1.4 | 22 | 21 | 22 |
| Calcium, % | 0.1 | 7 | 5 | 6 |
| Phosphorus, % | 0.4 | 3.8 | 3.0 | 3.5 |

¹Sea-Lac, ruminant grade fish meal, Zapata-Haynie, LA.

²Arctic Alaska, Newport, OR.

³Ocean Proteins, Charleston, OR.

^aCarroll, D.J., S.A. Allen, and M.R. Keller. 1994. Evaluation of Oregon-produced fish meal. Professional Animal Scientist, Volume 10(4).

the first 18 weeks of lactation, \$13.50/cwt of milk was needed before the production would yield a profit.

The addition of fish meal to a ration should be evaluated for changes in milk, milk protein, and milk fat yield. You also should monitor other aspects of performance, including changes in body condition score and reproductive performance.

Storing fish meal

Purchase small amounts of fish meal at a time. Do not store fish meal more than 6 months. Some processors add antioxidants to avoid fat oxidation, but others do not.

Check with your source for storage recommendations. In general, avoid storing bagged or bulk fish meal in moist areas. Processing of fish meal involves an extensive drying process that should kill bacteria. However, improper handling and storage can lead to contamination with salmonella bacteria. Protect bulk fish meal from cats, rodents, and birds.

Table 2.—Comparison of fish meal used in OSU experiments.

| Item | Sea-Lac Zapata-Haynie, LA | Arctic Alaska Newport, OR | Ocean Proteins Charleston, OR |
|-----------------------------------|------------------------------|------------------------------|----------------------------------|
| Type of fish | Menhaden | Whitefish | Bottom fish ¹ |
| Parts of fish | Whole fish | Waste from surimi plant | Waste and whole fish |
| Processing water with solubles | Removed | Added back | Not separated |

¹Bottom fish included sole, true cod, channel rock, sablefish, and others depending on season.

Variations in fish meal

Fish meals range from 40 to 70 percent bypass protein. In an OSU study, two Oregon-produced fish meals were lower in bypass protein compared with a ruminant grade menhaden (Table 1).

Variations in bypass protein levels are caused by the length of storage before processing, dryer types, species of fish, addition of preservatives, and proportion of fish solubles added back into the meal during processing (Table 2). Be sure to consider these differences in bypass protein levels when balancing rations.

We have evaluated only one load of fish meal from each

Oregon producer and therefore cannot report whether there are variations within the fish meal from the same processor. It is very likely that fish meal will vary with change of season and catch. Always have new loads of fish meal tested for dry matter, crude protein, and ether extract (an estimate of oil content).

Cost

In 1993, fish meal cost an average of \$500/ton in the Pacific Northwest. It can vary in price from \$200 to \$700/ton depending on the source and transportation costs. Comparisons of prices are important, but do not compromise quality for cost.

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