

The results in Table 4 show a significant difference in DM intake, milk yield and fat-corrected milk (FCM) between the two lower NDF values and 36% NDF. This is in contrast with studies by Staples et al. (1992) where 35% NDF diets performed equally as well as 31% NDF diets except in the sorghum silage diets. The differences are probably due to forage type since forages vary considerably in NDF content. In most forage type rations, NDF values from 31% to 36% appear to be acceptable for high producing cows. In contrast, lactating cows appear to perform better on lower NDF rations when alfalfa hay and similar legumes are the major forage types.

Formulating rations based on NDF values requires a good understanding of forage types and by-product feedstuffs. To effectively use NDF values in formulating rations containing large amounts of by-products, discount values (Mertens, 1992) should be applied to certain by-product feedstuffs such as distillers' grains, hominy feed and soybean hulls. The reason is because the values given in the NRC publication on nutrient requirements of dairy cattle (1989) are higher for these feedstuffs than for alfalfa hay.

The physical form of a feed has a great impact on the effectiveness of the fiber in the diet. Chewing time is a good indication of that effectiveness for certain feedstuffs. For example, Sudweeks et al. (1981) showed that long alfalfa hay containing 40% acid detergent fiber (ADF) was chewed at the rate of 28.2 min/lb of DM; ground and pelleted alfalfa hay was chewed at the rate of 16.8 min/lb of DM. This demonstrated that long alfalfa hay was a more effective source of fiber than pelleted alfalfa. In contrast, both citrus pulp and cottonseed hulls stimulated chewing time at 14 min/lb of DM which indicated they had equal effective fiber values. In reality, citrus pulp is low in effective fiber (12%) and cottonseed hulls are high in effective fiber (43%).

By-product feedstuffs are used extensively in dairy cattle diets throughout the country. Frequently, these by-product feedstuffs are used as major sources of fiber or as fiber extenders in dairy cattle diets. While performance may remain good, the NDF content of the diet is sometimes higher than suggested in the 1989 NRC publication for high-producing cows. Attempting to lower the NDF content in the diet results in milk fat depressions, looseness in bowel and acidosis type conditions. The problem can frequently be avoided by adjusting or discounting the NDF content of the by-product feedstuffs being used in the

diets. Table 5 contains a list of selected feedstuffs with NRC values taken from the 1989 NRC publication, discount values (DV), and adjusted NDF (ANDF) values. Similar adjusted NDF values have been suggested and developed by Mertens (1992).

The key to a successful feeding program for high-producing dairy cows is a balance between the needs for ruminally available protein and carbohydrates that will optimize microbial growth and metabolism in the rumen. As these needs are met, fine-tuning the ration with sources of bypass protein and fats may be advantageous. While the level of NSC needed in the ration will vary with forage type and use of by-products feedstuffs, a suggested range is 35% to 45% NSC. The lower range is recommended when rations contain good quality hay and/or silage with natural grains such as corn and limited amounts of ingredients such as citrus pulp and soybean hulls. Using adjusted NDF and NSC values for by-product feedstuffs will help minimize the formulating problems encountered when attempting to use higher levels of by-product feedstuffs in the diet.

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