## USDA-ARS

## Importance of Including Alfalfa in Dairy Cow Diets

Hannah Wilson, Kenneth Kalscheur, U.S. Dairy Forage Research Center ey considerations for successfully feeding alfalfa to dairy cows include determining nutrients required based on the cow's production state, selecting best ingredients to fully meet or exceed requirements economically, and utilizing an appropriate management and feeding system to best fit your operation. The main goal of high milk production is to formulate rations allowing a cow to produce to her genetic capability while minimizing input costs. High-quality alfalfa can be utilized in successful operations because of its nutritional density and the versatility it offers farmers.



June alfalfa harvest at USDFRC, Prairie Du Sac, WI. Photo: Scott Serwe.

**Forages in dairy diets.** Forages are required in dairy cow diets to maintain optimal fermentation and rumen health. Increased forage consumption has been directly related to improved health, including a lower incidence of acidosis and foot rot leading to lower culling rates and increased longevity. Increasing forages in total mixed rations (TMR) can be an economical way to reduce feed costs by utilizing more homegrown forages. However, dry matter intake (DMI) of the lactating dairy cow may be limited based on forage quality. Utilizing high-quality forages like alfalfa can be beneficial for overall cow efficiency, production, and economical value.

Based on current NRC (2001) recommendations, when the predominant grain source is dry ground corn, the minimum for feeding forage is to provide 25% of the dietary DM as neutral detergent fiber (NDF). Also, 19% of dietary DM must be NDF provided solely from forage and not from other ingredients containing NDF, which are typically more digestible. Recommendations provide no adjustments for physical effectiveness of fiber, interactions among fiber sources and nonfiber carbohydrates, or animal characteristics influencing ration formulation. However, based on studies cited by the NRC, cows fed alfalfa-based diets and corn grain as the primary starch source had similar milk production and similar milk composition when fed diets with 25% total NDF compared to diets with higher NDF concentrations. These recommendations do not factor in cost of feed ingredients, which is important when determining the best forage options. This suggests, as long as other nutrient requirements are being met (i.e., energy and protein), it is possible that increasing forage in the diet can be an economical way to feed cows.

**Nutritional characteristics of alfalfa.** Alfalfa has a number of beneficial nutritional characteristics making it a high-quality feedstuff for dairy cows. Despite the increase in price, alfalfa remains one of the top forages utilized by most U.S. operations due to its nutritional importance. It provides nutritional benefits that often get overlooked by contemporary diet formulations. Key chemical components are structural fiber (hemicellulose and cellulose), protein, pectin, starch, sugar, fat, and minerals. It should also be valued for its rapidly digestible pectin which has a high cation exchange capacity (responsible for stimulating rumination, chewing, and salivation), as well as for its high levels of nutritionally important minerals and specific amino acids (namely lysine). However, care should be taken when feeding alfalfa to dry cows due to its high calcium content.

Some evidence suggests legumes yield a higher proportion of metabolizable energy from net energy compared to grass forages of similar quality due to reduced heat increment losses. Corn silage, a mixture of corn grain and grass forage, is known for its high starch content (71% DM basis) and high fermentable carbohydrate value, but would be expected to have greater heat increment losses in lactating dairy cows.

Grasses typically have higher NDF content (60% DM basis) compared to alfalfa (40-50% NDF) and corn silages (40-45% NDF). In addition to lower NDF content, researchers continue to investigate ways to increase alfalfa NDF digestibility. Improvements in alfalfa silage NDF digestibility increase DMI and milk production. Increasing forage nutrient availability increases economic value. Highly digestible forages can be consumed in greater amounts compared to lower-quality forages due to greater digestion and rumen passage rates. Consequently, a TMR formulated with highly digestible forages more easily meets nutrient requirements of the high-producing dairy cow compared to diets formulated with poorly digestible forages.

Another consideration is the protein content alfalfa offers compared to other popular forages like corn silage. Alfalfa silage is high in crude protein (CP) and rumen degradable protein (RDP), but low in rumen undegradable protein (RUP). In contrast, corn silage CP is much lower (7-9% CP DM basis) compared to alfalfa silage (19-24% CP depending on quality). Increasing inclusion of high-quality alfalfa in the TMR can be challenging when CP and RDP concentrations exceed cow needs. The fate of excess dietary nitrogen is that it is excreted as urea in urine. Since alfalfa protein is high in RDP, it may be necessary to provide a source of RUP to meet the metabolizable protein requirement of the cow.

**Harvesting, storage, and quality**. Fiber digestibility of alfalfa declines more slowly as plants mature compared to typical warm-season grasses. This allows flexibility when harvesting alfalfa. Compared to corn silage, harvested once a year, alfalfa can be managed to be cut 3, 4, or even 5 times a year in the Midwest. Harvesting alfalfa at an early immature growth stage (early bloom, late bud stage) will produce a higher energy, high-protein, low-fiber forage but with relatively lower yields. However, the most important quality component of alfalfa compared to grass is its lower fiber content, since this allows for greater feed intake resulting in greater milk production.

Additional considerations for feeding alfalfa in dairy cow diets includes storage and management of the crop. Alfalfa may be fed directly as green chop, cut and baled as dry hay, or chopped and ensiled in a bunker, pile, silage bag, or tower silo. Harvesting and additional processing methods, like finer chop lengths or maceration before ensiling, can affect availability and digestibility of CP and other nutrients in alfalfa. It is important to have each individual forage tested to know specific nutritional quality of your alfalfa.

**How much alfalfa should you feed?** There is always a challenge to balance nutrients between forages and concentrates to meet nutrient requirements of lactating dairy cows. Many typical Midwest dairy producers feed anywhere from 50-70% of the diet DM as forages. Although alfalfa could be used as the sole source of forage in the dairy cow diet, it is more often used in combination with other types of forages. When feeding high volumes of forages, achieving sufficient energy intake becomes the challenge. High-quality alfalfa comes closer to meeting all the above considerations in successful feeding of dairy cows than any other feed.