AgriLIFE EXTENSION
Texas A&M System

L-5390
12/00

Managing Milk Composition:

Feed Additivies and Production Enhancers

Sandra R. Stokes, Dan N. Waldner, Ellen R. Jordan, and Michael L. Looper*

Feed additives and management tools such as bST (bovine somatotropin) play an essential role in enhancing production and yield of milk and milk components. The need for a particular feed additive and its effectiveness depend upon a variety of factors. Producers are encouraged to critically evaluate the cost-to-benefit ratio of each feed additive in their management systems.

Feeding strategies that optimize rumen function result in maximum milk production and milk component percentages and yield. Additionally, producers who use records such as those provided by DHIA (Dairy Herd Improvement Association) can critically evaluate their nutrition and feeding management programs.

Feed Additives

Supplemental Fat: Adding supplemental fat to rations for high producing dairy cows has become a common practice. It is necessary to follow certain guidelines when feeding fat to cattle to avoid a depression of 0.1 to 0.2 units in the milk protein level. When used properly, added fat usually maintains or slightly increases milk fat percent, makes relatively little change in milk protein percent and increases milk production. The net result is increased production of milk protein and nonfat solids. Too much fat in the ration can interfere with fiber digestion, reducing milk fat levels.

Limit total fat to 7.5 percent of the ration dry matter. A good rule of thumb is to provide the same amount of fat in the ration as pounds of milk fat produced. *For example: 100 pounds of milk per day x 4.0 percent milk fat = 4 pounds of milk fat or 4 pounds total fat in the ration.* Provide one-third of fat in the ration from normal ration ingredients, one-third from oilseeds or natural fats and one-third from rumen inert fat. Recommended guidelines for feeding fat are provided in Table 1.

Table 1. Fat Feeding Guidelines

Recommended Source	Maximum Inclusion
Basal diet	3.0 %
Natural fats	2.0 % - 4.0 %
Whole oilseeds	1.0 lb.
Tallow	1.0 lb.
Protected fats	2.0 % (1.0 lb.)
Total	6.0 - 7.0 %

Note: When feeding supplemental fats, calcium and magnesium should be provided at 1.0 and 0.35 percent of the ration dry matter, respectively, because these fats can bind with calcium and magnesium and reduce their availability.

Sulfur: Sulfur is necessary for the synthesis of essential amino acids by rumen microbes. Sulfur supplementation is important in rations that contain high levels of nonprotein nitrogen (i.e., urea). Low sulfur intake can induce protein deficiency. The likelihood of this problem occurring increases with rations containing corn silage or poor quality grass silage. The recommended level of sulfur is 0.22 to 0.25 percent of the total ration dry matter.

Buffers: Buffers added to the diet help reduce the acid load placed on the rumen when high levels of grain are fed or when hay and grain are fed separately. Sodium

* Respectively, Extension Dairy Specialist, The Texas A&M University System; Extension Dairy Specialist, Oklahoma State University; Extension Dairy Specialist, The Texas A&M University System; and Extension Dairy Specialist, New Mexico State University.

bicarbonate, magnesium oxide or a combination are the primary buffers recommended for feeding lactating dairy cows. Supplements of sodium bicarbonate should be 0.6 to 0.8 percent of the total diet dry matter or 1.2 to 1.6 percent of the concentrate mixture. Magnesium oxide should be added as 0.2 to 0.4 percent of the total diet dry matter or 0.4 to 0.6 percent of the concentrate mixture.

When feeding a combination of sodium bicarbonate and magnesium oxide, two to three parts sodium bicarbonate should be mixed with one part magnesium oxide and fed as a supplement at 0.8 to 1.2 percent of the total diet dry matter or 1.6 to 2.2 percent of the concentrate mix. Force-feeding larger amounts of these buffers may depress feed intake. Providing additional sodium bicarbonate free choice, beyond that which is already provided in the base ration, may prove beneficial in some herds when feeding for specific milk component changes. Estimated cost is 6 cents per head per day. The benefit-to-cost ratio is 4-to-1.

Rumen-protected amino acids: Responses to feeding individual amino acids to dairy cattle have not been consistent. Response differences probably occur based on the quantity and proportion of amino acids in the microbial and dietary protein digested and absorbed from the small intestine. Responses are often greater when mixtures of amino acids, rather than individual amino acids, are taken in beyond the rumen. Combinations of rumen-protected methionine and lysine have been shown to increase milk protein yield and concentration in diets low in rumen-degradable protein. Further, supplementing diets that contain added fat with rumen-protected methionine and lysine alleviates the milk protein depression effect of feeding added fat.

Yeast culture/fermentation products: Yeast culture and their fermentation products stabilize the rumen environment and improve fiber digestion. They maintain or increase dry matter intake and milk fat percent. Most benefits are seen in high producing cows or cows in early lactation. Feeding rate is 10 to 120 grams depending on yeast culture concentration. The cost is approximately 4 to 6 cents per cow per day. The estimated benefit-to-cost ratio is 4-to-1.

Niacin: Niacin, a water-soluble vitamin, was assumed to be produced in sufficient quantities by rumen microbes to meet the needs of the host animal. However, bacterial synthesis of niacin may not be adequate for high producing cows. Milk yield and composition responses to niacin feeding are variable, at best. However, in some situations, niacin fed at 6 to 12 grams per day improves the milk protein depression caused by feeding high levels of fat. The estimated benefit-to-cost ratio is 6-to-1 for the 6-gram feeding level. The approximate cost is 1 cent per gram.

Bovine Somatotropin (bST)

The gross composition of milk (fat, protein and lactose) is not affected by treatment with bST. The factors that affect fat and protein content of milk of non-bST-treated cows have the same effects on milk composition of bST-treated cows. For example, certain breeds have a higher milk fat content, and an increase in milk fat typically occurs in late lactation for all breeds. Treatment with bST does not alter these relationships. Likewise, the increase in milk fat content that occurs when the cow is using more energy than it is consuming and the decrease in milk protein content that occurs when the cow has an inadequate protein intake are also observed in bST-treated cows.

Milk from bST-treated cows also does not differ in vitamin content or in concentrations of nutritionally important mineral elements. In addition, proportions of total milk proteins represented by whey proteins and the different casein fractions are not changed substantially. Thus, the manufacturing characteristics are not altered by the use of bST to enhance milk yield in lactating cows.

Milk yield, milk components, dry matter intake, growth, health and weight can be impacted when a feed additive is included in the diets of dairy cattle.

Evaluating Cost Effectiveness

Consider the following factors in determining if a feed additive should be used:

- anticipated response
- economic return
- available research
- field response.

Anticipated response refers to performance changes such as increased milk yield, increased milk components, improved dry matter intake, improved growth, improved health, and/or minimized weight loss that could be expected when a feed additive is included.

If improvement in milk volume is the measurable response, a breakeven point can be calculated. For example, an additive that raises feed costs 10 cents per day is used. If milk is valued at 12 cents per pound, every cow must produce 0.84 pounds more milk to cover the extra cost associated with the additive. Another consideration is if all the cows receive the additive, but only cows fresh for less than 100 days respond. These responding cows must cover the costs for all cows (responsive and nonresponsive). One guideline is that an additive should return $2 or more for each dollar invested to cover nonresponsive cows and field conditions that could minimize the anticipated response.

Remember, it is difficult to assess management practices that acutely alter milk production. Research is essential to determine if experimentally measured responses can be expected in the field. Rely on research studies conducted under controlled and unbiased conditions that use an experimental protocol similar to field conditions and that have statistically analyzed results.

Results obtained on individual farms are the economic payoff. Managers and consultants must use a database to accurately compare and measure responses. Several tools to measure results include DHIA milk production records, reproduction summaries, somatic cell count data, dry matter intake, heifer growth charts, body condition scores and herd health profiles. These tools will enable managers and consultants to critically evaluate the effectiveness of selected additives.

Produced by AgriLife Communications and Marketing, The Texas A&M University System
Texas AgriLife Extension publications can be found on the Web at: http://AgriLifebookstore.org

---

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Chester P. Fehlis, Deputy Director, Texas Agricultural Extension Service, The Texas A&M University System.

250, New