Economics of Feed Additives

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Feed additives are a group of feed ingredients that can cause a desired animal response in a non-nutrient role such as pH shift, growth, or metabolic modifier. Several feed additives contain nutrients, such as sodium in sodium bicarbonate or protein in yeast culture.

EVALUATING FEED ADDITIVES
Four factors can be considered to determine if a feed additive should be used: anticipated response, economic return, available research, and field responses.

Response refers to performance changes the user could expect when a feed additive is included.

- Higher milk yield (peak milk and/or milk persistency)
- Increase in milk components (protein and/or fat)
- Greater dry matter intake
- Stimulate rumen microbial synthesis of protein and/or volatile fatty acid (VFA) production
- Increase digestion in the digestive tract
- Stabilize rumen environment and pH
- Improve growth (gain and/or feed efficiency)

- Minimize weight loss
- Reduce heat stress effects
- Improved health (such as less ketosis, reduce acidosis, or improve immune response)

Returns reflect the profitability of using a selected additive. If milk improvement is the measurable response, a breakeven point can be calculated. For example, a consultant recommends an additive that raises feed costs 10¢ per day. If milk is valued at 12¢ per pound, every cow must produce 0.8 pound more milk to cover the added cost associated with adding a buffer. Another consideration is if all cows receive the additive, but only cows fresh less than 100 days respond. These responding cows must cover the additive costs for all cows (responsive and nonresponsive cows). One guideline is an additive should return two dollars or more for each dollar invested in an additive to cover nonresponsive cows and field conditions which could minimize the anticipated response.

Research is essential to determine if experimentally measured responses can be expected in the field. Studies should be conducted under controlled and unbiased conditions, have statistically analyzed results (determines if the differences are repeatable), and have been conducted under experimental designs that would be similar to field situations.

Results obtained on individual farms are the economic payoff. Dairy managers and nutritionists must have a database to compare and measure responses. Several tools to measure results include DHI milk records (peak milk, persistency, milk components, and milk curves), reproduction summaries, somatic cell count data, dry matter intake, heifer growth charts, body condition graphs, and herd health profiles which will allow critical evaluation of a selected additive.

ECONOMICS OF FEED ADDITIVES
Feed additives are not a requirement or guarantee for high productivity or profitability. Table 1 outlines additives using six categories that can be used in deciding if an additive should be included.

1. Function of an additive is how the product should impact the animal.
2. Level is the recommended amount needed to result in a response based on research results.
3. Cost is the typical price in the fall of 2002 (will vary due to location and production points).
4. Benefit to cost ratio is the research-based milk response divided by the cost of the additive.
5. Feeding strategy is when the additive should be used.
6. Status is a classification based on research and economic responses in the following four categories:
   - Recommended: Include the additive as needed

- Experimental: Additional research and study are needed before recommending
- Evaluative: Monitor under specific situation; research results are variable
- Not recommended: Lacks economic responses to recommend

Table 1. Feed additive guidelines for dairy cows.

Anionic salts and products

1. Function: Cause the diet to be more acidic increasing blood calcium levels by stimulating bone mobilization of calcium and calcium absorption from the small intestine
2. Level: Reduce DCAD to –50 meq/kg using chloride sources (calcium chloride, ammonium chloride, Bio Chlor, Animate, Soy Chlor 44, Soy Chlor 16, Nutro Chlor, and hydrochloric acid treated feeds)
3. Cost: 40 to 75 cents per dry cow per day, depending on product used
4. Benefit to Cost Ratio: 10:1
5. Feeding Strategy: Feed to dry cows two to three weeks before calving. Adjust dietary calcium levels to 150 g per day (50 g inorganic). Raise dietary magnesium levels to 0.4 percent.
6. Status: Recommended

Aspergillus oryzae

1. Function: Stimulate fiber-digesting bacteria, stabilize rumen pH, and reduce heat stress
2. Level: 3 g per day
3. Cost: 3 cents per cow per day
4. Benefit to Cost Ratio: 6:1
5. Feeding Strategy: High grain diets, low rumen pH conditions, and under heat stress (cows) and calves receiving a liquid diet
6. Status: Evaluative

Biotin

1. Function: Improve hooves by reducing heel warts, claw lesions, white line separations, sand cracks, and sole ulcers and increase milk yield through a metabolic route
2. Level: 10 to 20 milligrams per cow per day for 6 months to one year
3. Cost: 8 to 10 cents per cow per day
4. Benefit to Cost Ratio: 3:1
5 Feeding Strategy: Herds with chronic foot problems, may require supplementation for 6 months before evaluation, and company recommends beginning supplementation at 15 months of age
6 Status: Recommended

Beta-carotene

1. Function: Improve reproductive performance, immune response, and mastitis control
2. Level: 200 to 300 mg per day
3. Cost: 30 cents per cow per day
4. Benefit to Cost Ratio: Not available
5. Feeding Strategy: In early lactation and during mastitis-prone time periods
6. Status: Not recommended

Calcium propionate

1. Function: Increase blood glucose and calcium levels
2. Level: 120 to 225 grams
3. Cost: 80 cents per pound
4. Benefit to Cost Ratio: Not available
5. Feeding Strategy: Feed 7 days prepartum to 7 days postpartum or until appetite responds; unpalatable.
6. Status: Recommended

Protected choline

1. Function: A methyl donor used to minimize fatty liver formation and to improve fat mobilization
2. Level: 15 to 30 g per day
3. Cost: Not available
4. Benefit to Cost Ratio: 2:1 (when protected)
5. Feeding Strategy: Feed two weeks prepartum to eight weeks postpartum to cows experiencing ketosis, weight loss, and high milk yield.
6. Status: Experimental (rumen protected)

Enzymes (fibrolytic)

1. Function: Increase fiber digestibility by reducing fiber (cellulase and xylanase enzymes) and DM intake
2. Level: Not clearly defined (enzymatic units per unit of feed dry matter)
3. Cost: 15 to 25 cents per cow per day
4. Benefit to Cost Ratio: 2 to 3:1 (Canadian data)
5. Feeding Strategy: Increase fiber digestibility, treated 12 hours before feeding, spray on product more effective when applied to dry diets, and may be diet specific
6. Status: Experimental

Magnesium oxide

1. Function: Alkalinizer (raises rumen pH) and increases uptake of blood metabolites by the mammary gland, raising fat test
2. Level: 45 to 90 g per day
3. Cost: 21 cents per pound
4. Benefit to Cost Ratio: Not available
5. Feeding Strategy: With sodium-based buffers (ratio of 2 to 3 parts sodium bicarbonate to 1 part magnesium oxide)
6. Status: Recommended

Methionine hydroxy analog

1. Function: Minimize fatty liver formation, control ketosis, and improve milk fat test
2. Level: 30 g
3. Cost: 10 cents per cow per day $1.60 per pound)
4. Benefit to Cost Ratio: 2:1
5. Feeding Strategy: Feed to cows in early lactation receiving high levels of concentrate and limited dietary protein.
6. Status: Evaluative (unless protected)

Niacin (B_3, nicotinic acid, and nicotinamide)

1. Function: Coenzyme systems in biological reactions, improve energy balance in early lactation cows, control ketosis, and stimulate rumen protozoa
2. Level: 6 g per cow (preventive and prepartum) and 12 g per cow (treatment and postpartum)
3. Cost: One cent per gram (6 to 12 cents per cow per day)
4. Benefit to Cost Ratio: 6:1 (6 gram level)
5. Feeding Strategy: High producing cows in negative energy balance, heavy dry cows, and ketotic-prone cows fed two weeks prepartum to peak dry matter intake (10 to 12 weeks postpartum)
6. Status: Evaluative

Probiotics (Bacterial direct-fed microbes)

1. Function: Produce metabolic compounds that destroy undesirable organisms, provide enzymes improving nutrient availability, or detoxify harmful metabolites
2. Level: Not clearly defined
3. Cost: 5 to 15 cents per cow per day
4. Benefit to Cost Ratio: Not available
5. Feeding Strategy: Feed to calves on liquid diet, transition cows, and during stress conditions
6. Status: Experimental for cows; recommended for milk-fed calves

Propylene glycol

1. Function: Source of blood glucose, stimulates an insulin response, and reduces fat mobilization
2. Level: 8 to 16 ounces per cow per day
3. Cost: $1.25 per pint or pound
4. Benefit to Cost Ratio: Not available
5. Feeding Strategy: Drench cow starting at one week prepartum (preventative role) or after calving when signs of ketosis are observed (treatment role). Feeding not as effective as drenching.
6. Status: Recommended

Silage bacterial inoculants

1. Function: To stimulate silage fermentation, reduce dry matter loss, decrease ensiling temperature, increase feed digestibility, improve forage surface stability, and increase VFA (lactate) production
2. Level: 100,000 colony forming units (CFU) per gram of wet silage. Recommended bacteria include Lactobacillus plantarum, Lactobacillus buchneri, Lactobacillus acidilacti, Pediococcus cereviseai, Pediococcus pentacoccus, and/or Streptococcus faecium.
3. Cost: $0.60 to $2.00 per treated ton of silage
4. Benefit to Cost Ratio: 3:1 (feed recovery) to 7:1 (milk improvement)
5. Feeding Strategy: Apply to wet silage (over 60 percent moisture); corn silage, haylage, and high moisture corn; low natural bacteria counts (first and last legume/grass silage and frost damaged corn silage); and under poor fermentation situations
6. Status: Recommended

Sodium bentonite

1. Function: A clay mineral used as a binder, shifts VFA patterns, slows rate of passage, and exchanges mineral ions. Field claims to tie up mycotoxins have been reported.
2. Level: 450 to 700 g per day (rumen effect), 110 grams for mycotoxin effect
3. Cost: 15 cents per pound
4. Benefit to Cost Ratio: Not available
5. Feeding Strategy: With high grain diets, loose stool conditions, presence of mold, low fat test, and dirt eating
6. Status: Evaluative

Sodium bicarbonate/sodium sesquicarbonate (buffer)

1. Function: Increase dry matter intake and stabilize rumen pH
2. Level: 0.75 percent of total ration dry matter intake
3. Cost: 6¢ per cow per day (bicarb = $0.19/lb; S Carb = $0.18/lb)
4. Benefit to Cost Ratio: 4:1 to 12:1
5. Feeding Strategy: Feed 120 days postpartum with diets that are high in corn silage (over 50%), wet rations (over 55% moisture), lower fiber ration (<19% ADF), little hay (<5 lb), finely chopped forage, pelleted grain, slug feeding, and heat stress conditions.
6. Status: Recommended

Yeast culture and yeast

1. Function: Stimulate fiber-digesting bacteria, stabilize rumen environment, and utilize lactic acid
2. Level: 10 to 120 g depending on yeast culture concentration
3. Cost: 4 to 6 cents per cow per day
4. Benefit to Cost Ratio: 4:1
5. Feeding Strategy: Two weeks prepartum to ten weeks postpartum and during off-feed conditions and stress
6. Status: Recommended

Yucca extract

1. Function: Decrease urea nitrogen in plasma and milk by binding ammonia to the glycofraction extract of Yucca shidigera plant improving nitrogen efficiency in ruminant animals.
2. Level: 800 milligrams to 9 grams per day (depending on source)
3. Cost: 2 to 4 cents per cow per day ($1.28/ lb for Micro Aid 1X)
4. Benefit to Cost Ratio: Not available
5. Feeding strategy: To cows with high BUN and MUN levels
6. Status: Evaluative

Zinc methionine

1. Function: Improve immune response, harden hooves, and lower somatic cell counts
2. Level: 9 g per day (Zinpro 40 trademark product)
3. Cost: 2 to 3 cents per cow per day
4. Benefit to Cost Ratio: 14:1
5. Feeding Strategy: To cows experiencing foot disorders, high somatic cell counts, and wet environment
6. Status: Recommended