Feed Additives

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Feed additives are feed ingredients that produce a desirable animal response in a non-nutrient role (a nutrient role would be providing protein or mineral requirements). Additives can lead to the following responses:

- Increased milk yield (peak milk and/or milk persistency)
- Increase in milk components (protein and/or fat)
- Increased dry matter intake
- Maintain a desirable rumen pH
- Stimulate rumen microbial synthesis of protein and/or volatile fatty acid (VFA) production
- Increased rate of passage or flow of nutrients out of the rumen
- Improved fiber digestion in the rumen
- Stabilize rumen environment
- Improve growth (gain and/or feed efficiency conversion)
- Minimize weight loss
- Reduce heat stress effects
- Improve health (such as less ketosis, reduced acidosis, or improved response)

Economics or profitability is a key factor when deciding if an additive should be used. If milk improvement is the observed response, Table 1 can be used to determine breakeven point. For example, if an additive costs six cents a day and milk is priced at $10 per cwt, every cow must increase milk yield .6 pound per cow to cover the additive cost. An additive should return two dollars for every one invested to cover non responding cows and variable responses under field conditions.

Research is essential to critically determine if a measured reponses can be repeated in the field. Studies must be conducted under controlled and unbiased conditions, be statistically analyzed, and completed under conditions that are similar to field situations.

Results obtained on individual farms are the economic payoff for dairy managers. When selecting an additive, decide which measurements can be used to evaluate success (peak milk, milk persistency, milk component changes, reproduction shifts, somatic cell count changes, dry matter intake, heifer growth charts, body condition score, or herd health profiles).

Feed additives are not a must for high milk production and economic success. Table 2 compares the use of common feed additives in high producing herds in 1983 and 1992. Interest in feed additives will continue and will be influenced by new research results, advertising, and profit margins. Table 3 outlines feed additives in six categories that will allow dairy managers, consultants, feed company personnel, and veterinarians to decide if an additive should be used. Current status is classified as recommended (include as needed), experimental (additional research is needed), evaluative (monitor under specific situations), or not recommended (lacks economic response to currently use).

Table 1: Required increase in milk yield to recover various additive costs with different milk prices.

Additive Cost ($/cow/day)	Milk Price ($/cwt) 10	12	14
	—— lbs milk/cow/day ——		
.02	.2	.2	.1
.06	.6	.5	.4
.10	1.0	.8	.7
.30	3.0	2.5	2.1

Table 2: Feed additives used in diets fed to high producing herds in 1992 compared to 1983.

Additive	1992 % used	1983 % used
Sodium bicarbonate	75	70
Magnesium oxide	66	NA
Yeast/Yeast culture 51	17	
Niacin	38	16
Zinc methionine	48	NA

Table 3: Current status of common feed additives for dairy cattle.

ANHYDROUS AMMONIA

1. Function: Sources of non-protein nitrogen, extend fermentation in silage, reduce mold growth, improve bunk life at feeding time, and increase fiber digestibility.
2. Level: Corn silage = 8 lb per wet ton
   Legume/grass = 1% D.M.
   Straw/low quality forage = 2 to 3% D.M.
3. Cost: Depends on level.
4. Benefit to Cost Ratio: Not available.
5. Feeding Strategy: Apply to silage prior to ensiling, during the baling of hay, or under plastic cover to treat straw.
6. Status: Recommended.

ANIONIC SALTS

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: 100g ammonium chloride 100g magnesium sulfate.
3. Cost: 20¢ to 25¢ per day.
4. Benefit to Cost Ratio: 10:1.
5. Feeding strategy: Feed to dry cows two to three weeks before calving. Adjust dietary calcium levels up to 100 to 150g per day.
6. Status: Recommended.

ASPERGILLUS ORYZAE (Amaferm brand name)

1. Function: Stimulate fiber digesting bacteria, and stabilize rumen pH, and reduce heat stress.
2. Level: 3g per day.
3. Cost: 5¢ per day.
4. Cost to Benefit Ratio: Not available.
5. Feeding Strategy: High grain diets, low rumen pH conditions, and under heat stress.
6. Status: Experimental.

BETA-CAROTENE

1. Function: Improve reproductive performance, immune response, and mastitis control.
2. Level: 200 to 300 mg per day.
3. Cost: 30¢ 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.

CHOLINE

1. Function: A methyl donor used to minimize fatty liver formation and to improve neuotransmission.
2. Level: 30g per day.
3. Cost: 10¢ per cow.
4. Benefit to Cost Ratio: Not available.
5. Feeding Strategy: Feed dry cows two weeks prepartum and to cows experiencing ketosis and weight loss.
6. Status: Not recommended until rumen protected.

DECOQUINATE (Deccox brand name)

1. Function: Prevent and control coccidiosis in calves.
2. Level: .5 mg/2.2 lb (kg) of B.W.
3. Cost: 2¢ per day.
4. Benefit to Cost Ratio: Favorable.
5. Feeding Strategy: Add to liquid diet and/or calf starter.
6. Status: Recommended.

LASALOCID (Bovatec brand name)

1. Function: An ionophore for calves and heifers only which shifts rumen volatile fatty acid patterns, lower methane, production, improves feed efficiency, and prevents coccidiosis in calves.
2. Level: 60 to 200 mg per heifer.
3. Cost: 1¢ to 2¢ per heifer per day.
4. Benefit to Cost Ratio: 8:1.
5. Feeding Strategy: To young calves (coccidiosis prevention) and growing heifers (growth and feed use improvement).
6. Status: Recommended.

MAGNESIUM OXIDE

1. Function: Alkalizer (raises rumen pH) and increases uptake of blood metabolites by the mammary gland raising fat test.
2. Level: .1 to .15 pound per day.
3. Cost: 2¢ per day.
4. Benefit to Cost Ratio: Favorable.

5. Feeding Strategy: With buffers.
6. Status: Recommended.

METHIONINE HYDROXY ANALOGUE

1. Function: Minimize fatty liver formation, control ketosis, and improve milk fat test.
2. Level: 30 g.
3. Cost: 10¢.
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. Recommendation: Not recommended.

MONENSIN (Rumensin brand name)

1. Function: An ionophore for calves and heifers only which shifts rumen fermentation increasing feed efficiency and prevents coccidiosis.
2. Level: 50 to 200 mg per heifer.
3. Cost: 1¢ to 2¢ per heifer per day.
4. Benefit to Cost Ratio: 8:1.
5. Feeding Strategy: To growing heifers (over 400 lb) and prevent coccidiosis.
6. Status: Recommended.

NIACIN (B3, nicotinic acid, and nicotinamide)

1. Function: Coenzyme system in biological reactions, improve energy balance in early lactation cows, minimize ketosis, and stimulate rumen protozoa.
2. Level: 6g per cow (preventive) 12g per cow (treatment).
3. Cost: 6¢ to 12¢ per day.
4. Benefit to Cost Ratio: 6:1.
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 (10-12 weeks postpartum).
6. Status: Recommended.

PROBIOTICS (Bacterial direct-fed microbes)

1. Function: Produce metabolic compounds that destroy undesirable organism, provide enzymes improving nutrient availability, or detoxify harmful metabolites.
2. Level: Not clearly defined.
3. Cost: 3¢ to 18¢ per day
4. Benefit to Cost Ratio: Not available.
5. Feeding Strategy: To cows at calving to balance host animal's digestive tract during stressful or disease conditions and to calves on liquid diet to stimulate calf starter intake.
6. Status: Experimental.

PROPIONIC ACID

1. Function: Mold inhibitor and preservative for high moisture corn, wet hay, and haylage.
2. Level: .5 to 1.5 percent (depends on moisture level).
3. Cost: 50-60¢ per pound.
4. Benefit to Cost Ratio: Favorable.
5. Feeding Strategy: Apply to forage or grain prior to storage or ensiling.
6. Status: Recommended.

SILAGE BACTERIAL INNOCULANTS

1. Function: To stimulate silage fermentation reducing dry matter loss, decreasing ensiling temperature, and increasing VFA production.
2. Level: 100,000 organisms per gram of wet silage or 90 billion per ton (common bacteria inoculants include Lactobacillus plantarum, Lactobacillus acidilacti, Pediococcus cereviseae, Pediococcus pentacoccus, and Steptococcus faecium).
3. Cost: $.50 to $2 per pound.
4. Benefit to Cost Ratio: 8:1.
5. Feeding Strategy: Apply to wet silages (over 60% moisture), first and last cutting (due to natural low bacteria levels), and poor fermentation environment.
6. Status: Evaluative.

SILAGE ENZYMATIC INNOCULANTS

1. Function: To digest plant cell walls which can be used by lactic-acid bacteria lowering silage pH and to improve the rate or extent of forage digestibility.
2. Level: Not clearly defined.
3. Cost: Variable.
4. Benefit to Cost Ratio: Not available.
5. Feeding Strategy: Ensile innoculants (celluloses, pectinases, hemicellulases, xylanases, and amylases) at storage. Protease enzymes are questionable. Wetter silages may benefit more.
6. Status: Experimental.

SODIUM BENTONITE

1. Function: A clay mineral used as a binder, shifts VFA patterns, slows rate of passage, and exchanges mineral ions.
2. Level: 1 to 1 1/2 pound per day (rumen effect).
3. Cost: 4¢ to 6¢.
4. Benefit to Cost Ratio: Not available.
5. Feeding Strategy: With high grain diets, loose stool conditions, low fat test, and dirt eating.
6. Status: Evaluative.

SODIUM BICARBONATE/SODIUM SESQUICARBONATE (BUFFER)

1. Function: Increase dry matter intake and maintain rumen pH.
2. Level: .75% of total ration dry matter intake.
3. Cost: 5¢ to 6¢ per day.
4. Benefit to Cost Ratio: 4:1.
5. Feeding Strategy: Feed 120 days postpartum and with diets high in corn silage (over 50%), wet rations (over 45% moisture), lower fiber rations (<19% ADF), little hay <5 lb), finely chopped forage, pelleted grain, slug feeding, and heat stress conditions.
6. Status: Recommended.

UREA

1. Function: Source of non-protein nitrogen, extend corn silage fermentation, and improve bunk life at feeding .
2. Level: 10 pounds per ton of wet corn silage.
3. Cost: 13¢ per pound.
4. Benefit to Cost Ratio: 3:1.
5. Feeding strategy: Apply at ensiling.
6. Status: Recommended.

YEAST CULTURE

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

ZINC METHIONINE (Zinpro brand name)

1. Function: Improve immune response, harden hooves, and lower somatic cell counts.
2. Level: 4.5g per day (Zinpro 40 product).
3. Cost: 2¢ per cow.
4. Benefit to Cost Ratio: 14:1.
5. Feeding Strategy: To cows experiencing foot disorders.
6. Status: Recommended.

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