

**Table 5** Feed additive guidelines for dairy cows

Function	Level	Cost	Benefit to cost ratio	Feeding Strategy	Feeding Strategy	
<b>Anionic salts and products</b> Cause the diet to be more acidic increasing blood calcium levels by stimulating bone mobilization of calcium and calcium absorption from the small intestine	Reduce DCAD to zero to -50 meq/kg or 5 meq/100 grams using chloride sources (calcium chloride, ammonium chloride, Bio Chlor, Animate, Soy Chlor, and hydrochloric acid treated feeds)	40 to 75 cents per dry cow per day depending on product used	10:1	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	Recommended	
<b>Aspergillus oryzae</b>	Stimulate fiber-digesting bacteria, stabilize rumen pH, and reduce heat stress	3 g per day	3 cents per cow per day	6:1	High grain diets, low rumen pH conditions, and under heat stress (cows) and calves receiving a liquid diet	Evaluative
<b>Biotin</b>	Improve hooves by reducing heel warts, claw lesions, white line separations, sand cracks, and sole ulcers and increase milk yield through a metabolic routes	10 to 20 milligrams per cow per day for 6 months to one year	8 to 10 cents per cow per day	4:1	Herds with chronic foot problems, may require supplementation for 6 months before evaluation, and company recommends beginning supplementation at 15 months of age	Recommended
<b>Beta-carotene</b>	Improve reproductive performance with higher ovarian levels, increase fiber digestion by rumen microbes, immune response, and mastitis control	300 mg per day (blood levels 1.5 to 3.5 micrograms/ml); 500 mg per day (blood levels < 1.5 micrograms per ml)	30 cents to 50 cents per cow per day	Not available	In early lactation and during mastitis-prone time periods	Experimental
<b>Calcium propionate</b>	Increase blood glucose and calcium levels	20 to 225 grams	80 cents per pound	Not available	Feed 7 days prepartum to 7 days postpartum or until appetite responds; unpalatable	Recommended as a drench agent
<b>Choline (rumen protected)</b>	A methyl donor used to minimize fatty liver formation and to improve fat mobilization leading to improved milk yield and reproductive performance	15 to 30 g per day	30 cents per cow per day	3:1 (when protected)	Feed two weeks prepartum to eight weeks postpartum to cows experiencing ketosis, weight loss, and higher milk yield	Experimental
<b>Chromium propionate</b>	Enhance insulin sensitivity, maintain blood glucose levels, stimulate dry matter intake, increase milk yield, reduce heat stress, and improve immunity	500 parts per billion (controlled by FDA)	8 to 10 cents per cow per	6:1	Feed to transition cows (close up dry cows through 30 to 60 days after calving or when the risk of ketosis decline	Recommended
<b>Enzymes (fibrolytic)</b>	Increase fiber digestibility by reducing fiber (cellulase and xylanase enzymes) and DM intake	Not clearly defined (enzymatic units per unit of feed dry matter), amylase (300 KNU)	15 to 30 cents per cow per day	2 to 3:1 (Canadian data)	Increase fiber digestibility, treated 12 hours before feeding, spray on product more effective when applied to dry diets, and may be diet specific	Experimental
<b>Enzymes (starch-amylase)</b>	Amylase based enzymes can improve total tract starch digestibility and improve milk yield and feed efficiency	300 kNU per kg dry matter intake. 1 kNU = approx 6 "Ceralpha Units" using the Megazyme International amylase assay	15 cents per day	3:1 (U Wis study)	Improve starch utilization reducing corn levels and replacing with lower cost rumen fermentable carbohydrate sources	Experimental
<b>Essential oil compounds (cinnamon oil, clove oil, and/or garlic oil)</b>	Improve rumen fermentation by reducing protein deamination, increase propionate production, increase feed efficiency, and/or improve hydrogen status	0.5 to 1.5 grams per cow per day (higher levels may have a negative impact	Varies, six cents per cow per day	7:1 (Wisconsin data)	Increase propionate production in the rumen and feed efficiency	Experimental
<b>Immune stimulation (OmniGen AF—brand name)</b>	Impacting immune function as measured by changes in neutrophil activity including migration via L-selectin, phagocytosis, oxidative burst reactions leading to lower SCC and high milk yield related to immunity improvement. May be used to reduce HBS or bloody gut losses	56 grams per day	13 cents per day	7:1 early lactation; 3:1 for entire lactation	Dry off to 60 days postpartum	Experimental
<b>Magnesium oxide</b>	Alkalinizer (raises rumen pH) and increases uptake of blood metabolites by the mammary gland raising fat test	45 to 90 g per day	21 cents per pound	Not available	With sodium-based buffers (ratio of 2 to 3 parts sodium bicarbonate to 1 part magnesium oxide)	Recommended as a source of magnesium and buffer pack with bicarb
<b>Monensin</b>	Improve feed efficiency for lactating cows, reduce ketosis and displaced abomasums in transition cows by shifting rumen fermentation and microbial selection. Milk yield may increase 2.2 pounds per day. Control cocci in calves and heifers.	11 g to 22 g per ton of total ration dry matter consumed (250 to 400 mg / cow / day); lower levels in calves and heifers	1 cent per 100 mg per day	5 to 1	Feed to dry cows (reduce metabolic disorders) and lactating cow (feed efficiency) while monitoring milk components to evaluate optimal levels of monensin.	Recommended

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<b>Niacin (B3, nicotinic acid, and nicotinamide)</b>	Coenzyme systems in biological reactions, improve energy balance in early lactation cows, control ketosis, and stimulate rumen protozoa. Can also reduce heat stress negative effects.	6 g unprotected per cow (prepartum), 12 g unprotected per cow (postpartum), or 3 grams of rumen protected (one gram of rumen protected replaces 8 grams of unprotected niacin) and 3 grams of unprotected for rumen function	One cent per gram unprotected; ten cents rumen protected	3:1 (12 grams level)	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)	Evaluative
<b>Prebiotics (Non-viable probiotics)</b>	Function: Stimulate bacterial growth or reduce bacteria growth that can reduce animal performance. Examples include inulin (stores carbohydrates), oligofructose, yeast cell wall products, MOS products, butyrate (0.16 g/liter of milk), lactoferrin (2 mg/ml of colostrums)	Varies by product and brand	4 to 15 cents per day	Not available	Feed to calves and animal exposed to undesirable bacteria in the digestive tract	Experimental
<b>Probiotics (Bacterial direct-fed microbes)</b>	Produce metabolic compounds that destroy undesirable organism, provide enzymes improving nutrient availability, or detoxify harmful metabolites	Not clearly defined	5 to 15 cents per cow per day	Not available	Feed to calves on liquid diet, transition cows, high levels of rumen fermentable starch/carbohydrates, and during stress conditions	Evaluative for cows; recommended for milk fed calves
<b>Propylene glycol</b>	Source of blood glucose, stimulate an insulin response, and reducing fat mobilization	8 to 16 ounces per cow per day	\$1.25 per pint or pound	Not available	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.	Recommended
<b>Silage bacterial inoculants</b>	To stimulate silage fermentation, reduce dry matter loss, decrease ensiling temperature, increase feed digestibility, improve forage surface stability, and increase VFA (lactate) production	100,000 colony forming units (CFU) per gram of wet silage. Recommended bacteria include Lactobacillus plantarium, Lactobacillus buchneri, Lactobacillus acidilacti, Pediococcus cereviseai, Pediococcus pentacoccus, and/or Streptococcus faecium.	\$0.60 to \$2.00 per treated ton of silage	3:1 (feed recovery) to 7:1 (milk improvement)	Apply to wet silage (over 60 percent moisture); corn silage, haylage, and high moisture corn; field conditions with low natural bacteria counts (first and last legume/grass silage and frost damaged corn silage); and under poor fermentation situations	Recommended
<b>Sodium bentonite</b>	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 (not legal claim via FDA)	450 to 700 g per day (rumen effect), 110 grams for mycotoxin effect	15 cents per pound	Not available	With high grain diets, loose stool conditions, presence of mold, low fat test, and dirt eating	Evaluative
<b>Sodium bicarbonate/sodium sesquicarbonate (buffer)</b>	Increase dry matter intake and stabilize rumen pH.	.75 percent of total ration dry matter intake	6¢ per cow per day (bicarb = \$0.19/lb; S Carb = \$0.18/lb)	4:1 to 12:1	Diets that are high in corn silage (over 60% of total forage intake), wet rations (over 55% moisture), lower fiber ration (<19% ADF), limited hay intake (<5 lb), finely chopped forage (over 50% in the bottom Penn State Particle Box, pelleted grain mixtures, slug feeding of concentrates, and under heat stress conditions.	Recommended
<b>Yeast culture and yeast</b>	Stimulate fiber-digesting bacteria, stabilize rumen environment, and utilize lactic acid.	10 to 120 g depending on yeast culture concentration	4 to 6 cents per cow per day	4:1	Two weeks prepartum to ten weeks postpartum, calf starter feeds, and during off-feed conditions and stress periods	Recommended
<b>Yucca extract</b>	Decrease urea nitrogen in plasma and milk by binding ammonia to the glycofraction extract of Yucca shidigera plant improving nitrogen efficiency in ruminant animals.	800 milligrams to 9 grams per day (depending on source)	2 to 4 cents per cow per day (\$1.28/ lb for Micro Aid 1X)	Not available	To cows with high BUN and MUN levels	Evaluative
<b>Zinc methionine</b>	Improve immune response, harden hooves, and lower SCC.	9 g per day or 25% of added zinc supplemented	2 to 3 cents per cow per day	14:1	To herds experiencing foot disorders, high somatic cell counts, and wet environment	Recommended