Diet may reduce mastitis risk

A dairy cow’s diet — especially essential trace minerals — plays a role in minimizing mastitis.

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The National Mastitis Council (NMC) estimates that around $184 per cow per year is lost due to mastitis, a disease that results in reduced milk production, discarding milk that already had been produced and increased treatment costs for both drugs and veterinary services.

Considering that there are more than 9 million cows in the U.S., mastitis costs U.S. farmers around $1.65 billion each year. On top of this, the cost of mastitis is passed along through the chain of production to the processors and vendors of cheese and other dairy products. These products face lower yields, shorter shelf lives and reduced consumer acceptance.

The majority of modern mastitis prevention efforts have primarily focused on management practices. Among these efforts is the five-point plan developed in the U.K. in the 1960s and, more recently, an attempt to address the housing of cattle — which, in the U.S., is considered largely substandard by NMC — through the use of inorganic bedding material.

Careful management is the best way to prevent contagious and environmental mastitis. According to NMC, the best situation for reducing teat exposure to environmental pathogens is to either pasture graze herds or design housing to mimic the conditions of a well-groomed pasture.

Traditional management methods are only effective at preventing parts of the causes of mastitis, and as a result, there are still gaps to fill that can be quite costly.

Diet also plays an important role when it comes to optimizing the animals’ natural defense system, especially essential trace minerals. Feeding essential trace minerals in organic form can provide the animal with the best opportunity to optimize its natural defenses and aid in the prevention of costly pathogenetic exposure that leads to an increase in somatic cell count (SCC).

A 2007 study using a mixture of organic manganese, zinc and copper highlighted the efficacy of multiple mineral supplementation on SCC in the milk of 90 dairy cows.

After being divided into three groups, the control group received zinc, copper and manganese as inorganic sulfates. In the experimental groups, 50% or 100% of the daily need for those elements was covered by organic proteinates. Supplementation with 100% of the daily need being met by organic mineral sources appeared to be the most effective, with cows having the lowest SCC and highest milk yield.

When provided on its own, zinc supplementation has been shown to have major beneficial effects on SCC and, thus, the quality and shelf life of milk produced (Smith and Hogan, 2001).

In a test comparing two organic zinc sources and inorganic zinc oxide, all at 500 mg daily doses in 10 Danish herds of dairy cattle, SCCs were reduced by 20-24% within the first 100 days of lactation. Looking further, over 250 days of lactation on average, one of the commercially available organic zinc sources reduced SCC by 8% and the other, on average, by 13%. In this test, inorganic zinc oxide showed no effect on SCC.

In a separate trial on three herds of Danish cattle, a daily dose of 2.5 g of zinc proteinate reduced the average SCC steadily during the two months following its addition to the herds’ diets.

Organic copper supplementation, while not affecting SCC during trials, has been shown to provide protective effects in the instance that a cow does become infected with mastitis-causing pathogens.

In a trial published in 2012 (Scaletti and Harmon, 2012), purposeful infection of one mammary quarter of Holstein heifers with *Escherichia coli* strain 727 was used to test the effects of copper supplementation in organic and inorganic form on a mastitis infection under controlled conditions. These animals were fed a basal diet in the control group (no copper supplementation) or a diet supplemented with 10 mg/kg of copper in the form of either inorganic copper sulfate or organic copper proteinate.

In all subjects, bacterial counts increased sharply from six to 12 hours post-infusion, peaking at the same level at 12 hours. Copper proteinate-supplemented animals showed consistently lower bacterial counts after...
24, 72 and 96 hours than those either supplemented with inorganic copper sulfate or in the control group.

Furthermore, this lower bacterial count was associated with lower clinical scores in infected heifers, indicating a less damaging, less stressful and less lengthy period of sickness for the subjects receiving copper supplementation. Copper proteinate-supplemented cows also had greater milk production compared to the control and copper sulfate-fed cows.

Selenium-deficient feedstuffs are a common problem globally. This is due to selenium-deficient soil, which, in turn, produces plants deficient in selenium. This has a direct effect on animals; therefore, supplementation is needed for adequate animal performance.

It is well known that insufficient dietary selenium is associated with a number of dairy production and reproductive health problems in affected cattle. These include elevated SCC, increased outbreaks of clinical mastitis, retained placentas and the potential for cystic ovaries.

Selenium plays a significant role in optimizing an animal’s natural defense system; therefore, selenium deficiency can be directly correlated with the reduced ability of neutrophils to kill phagocytized pathogens or the dairy cow’s ability to fight infection.

In a 2008 trial of selenium supplementation (Ibeagha et al., 2009) in the form of both inorganic sodium selenite and organic selenized yeast, no significant difference in neutrophil phagocytosis was observed. However, and more importantly, higher respiratory burst activity was shown from neutrophils in selenium-supplemented cows, leading to higher levels of intracellular kill, with the highest levels being reported in cows supplemented with an organic form of selenium at 0.5 mg/kg.

So, while all cows had neutrophils capable of capturing infectious pathogens, selenium-supplemented cows had a significantly increased ability to actually kill these captured pathogens.

In addition, selenium-supplemented cows showed two trends in neutrophil apoptosis — programmed cell death — indicating the longevity of the normally short-lived immune cells. In the case of inorganic sodium selenite, apoptosis was increased threefold over the unsupplemented control to around 15%. When looking at organic, selenized yeast supplementation, neutrophil apoptosis was numerically lower than the control cows at 5%. This indicates that selenium supplementation is best done through an organic form, which has the strongest positive effect on intracellular kills and little impact on cell apoptosis.

It is common sense that any animal needs proper nutrition for good health and well-being. While all-around good nutrition, in addition to appropriate housing, is ideal for raising cattle, different mineral supplementation strategies can be used to solve different problems associated with deficiencies in the cows’ diets.

Manganese and zinc have been shown to help herds maintain a low SCC and bacterial count (Kinal et al., 2007). Copper supplementation is effective for reducing the severity of an already commenced infection and returning the animal to normal more quickly. Organic selenium acts on a cellular level to increase the killing efficiency of immune cells even in non-immunocompromised animals, positively affecting ongoing infections and helping to prevent new ones.

References


