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KeyShure®

Precision Release Minerals

Balchem Research Summary

Effects of an organic source of copper,
manganese and zinc on dairy cattle
productive performance, health status
and fertility

A summary of a study conducted by Andrea Formigoni, et al. "Effects of an organic source of copper, manganese and zinc on dairy cattle productive performance, health status and fertility." *Animal Feed Science and Technology*. 164.3 (2011): 191-198. Print.

Background

Providing adequate amounts of essential minerals is critical to maintain health and maximize productivity of dairy cows (NRC, 2001). Organic minerals can be described as nutritionally essential minerals attached to a carbon–hydrogen based molecule which acts as a ligand. Ligands that are used most frequently include amino acids, peptides and proteins. In particular, complexes where a mineral is bonded to amino acids with at least two bonds from each amino acid are referred to as chelated minerals or mineral chelates. Chelates are less likely to be bound by antagonists in the rumen and are characterized by higher bioavailability and retention by the animal than inorganic minerals.

Several beneficial effects were reported when organic trace minerals were fed to dairy cows, including improved fertility, prevention of mastitis and foot lesions, and improved productive performances. In most of the cited studies, organic trace minerals were used at levels considerably higher than NRC (2001) guidelines. The objective of this study was to determine effects of partially replacing Zn, Cu and Mn provided in sulfate form with organic trace minerals during the dry period and lactation on dairy cow productive performance, fertility and health status. Zn and Cu will be supplied to meet NRC (2001) guidelines for lactating Holstein dairy cows in mid-lactation, and Mn above NRC (2001) guidelines.

Materials and Methods

The experiment was conducted on a commercial dairy farm in Italy. Over the course of the experiment, 296 cows were assigned to one of two treatments, with 147 cows in the control and 149 in the KeyShure® group. Cows were fed their respective treatments from 60 days pre-calving to 240 days post-calving. Diets formulated using CPM Dairy version 3 software to meet Dairy NRC (2001) guidelines for Holstein lactating cows in mid-lactation. Ingredient composition of the diet remained the same throughout the trial. During the dry period, cows were fed a diet where Cu, Mn, and Zn were supplied as sulfates (control) or a diet in which 500 g/kg of Cu, Mn, and Zn was supplied as sulfates and 500 g/kg as OTM (KeyShure; Balchem, New Hampton, NY, USA). During lactation, cows were fed a diet for 240 d where Cu, Mn and Zn were supplied as sulfates (control) or a diet in which 750 g/kg of Cu, Mn, and Zn was supplied as sulfates and 250 g/kg as OTM (KeyShure). KeyShure Cu, Mn and Zn are individual products that each contains 150 g/kg of the respective metal which is bound with amino acids and partially hydrolyzed protein to form a metal proteinate.

Colostrum production was recorded over the first two milkings. Milk production was recorded daily and samples were collected every four weeks for analyses of fat, protein, and Somatic Cell Count. Reproductive performance was assessed by recording days to first estrus, days to first service, number of services per conception, and days open. Cows were scored for body condition every 4 weeks (based on a scale of 1 = emaciated to 5 = obese). Animal health status was monitored daily and all disorders recorded. Disorders monitored included: retained placenta, metritis, ketosis, mastitis, displaced abomasum, and calf mortality. Hoof health was examined at the start of the dry period and at 0, 150, and 240 days of lactation and hoof abnormalities were recorded under the headings: sole ulcers, digital dermatitis, foot rot, abscess (both wall and toe), and white line disease.

Results and Discussion

Throughout the study, average daily DM intake was 12.0 and 23.8 kg/cow during the dry and lactation phases, respectively. **Colostrum from cows fed OTM contained more immunoglobulins ($P < 0.01$)** and tended ($P = 0.08$) to contain more Ca and Mg (not shown), whereas OTM supplementation had no effect on concentrations of trace minerals in colostrum (Figure 1).

During the first 150 d of lactation, **OTM supplementation increased milk fat content ($P < 0.05$)** while milk yield, CP content and SCC were not affected (Figure 2). Body condition score of cows was not influenced by treatment and averaged 2.83 between 0 and 150 days and 3.02 between 151 and 240 days.

Feeding dairy cows with OTM had no effect on days to first estrus, days to first service, and proportion of cows pregnant by 150 d in milk. Because more cows from the OTM group became pregnant between 150 and 240 d, the number of services per conception was increased in cows fed OTM (data from cows that did not get pregnant were not included in the analysis). Cows fed OTM had a higher ($P < 0.01$) number of services per conception (2.01 versus 2.61 for control and OTM, respectively).

Calf mortality at calving was lower ($P < 0.05$) in multiparous cows fed OTM (15.6 versus 5.6/100 calves for control and OTM, respectively); but there were no differences with regard to other pathologic events. Incidence of claw disorders was not influenced by OTM supplementation.

Figure 1. Colostrum and IgG yield and Zinc, Copper, and Manganese concentration for control vs. OTM treatment groups.

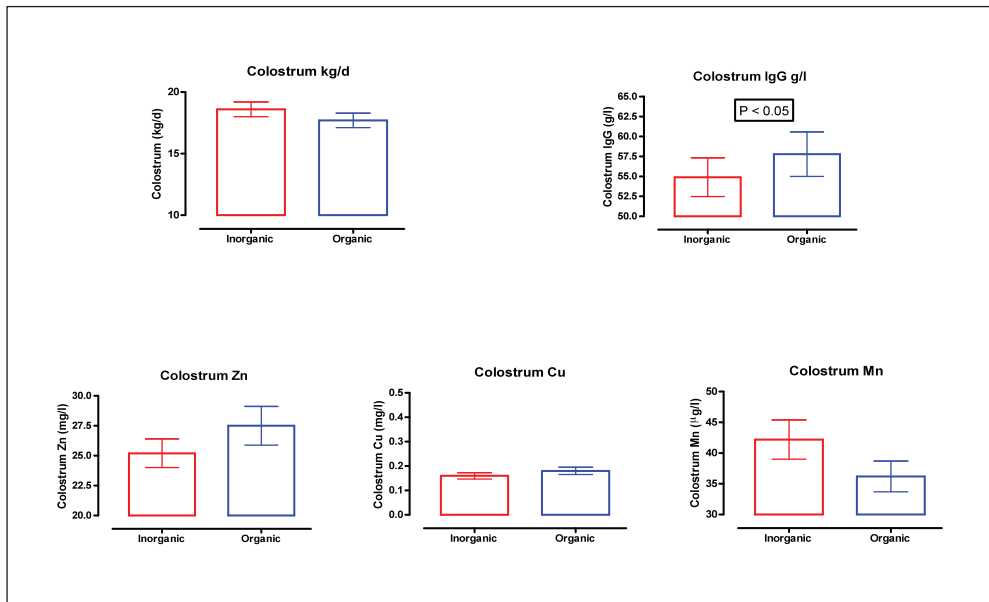
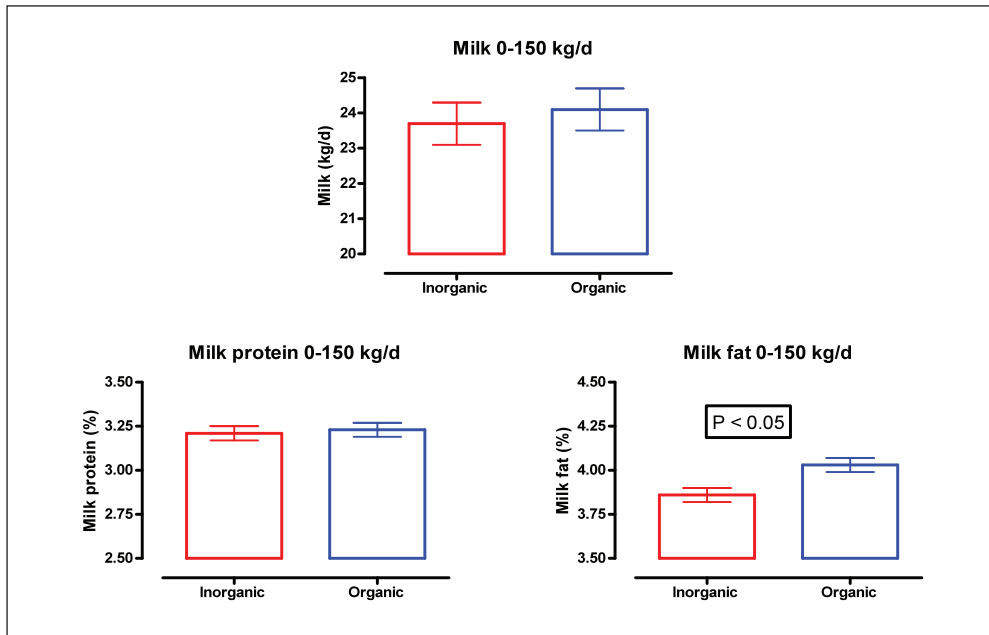


Figure 2. Milk yield and milk protein and fat % for 0-150 days in milk for Inorganic vs. Organic TM Treatment groups.



Summary

Partial substitution of Zn, Cu and Mn sulfates with OTM during the dry period and lactation resulted in higher colostrum immunoglobulin levels and lower calf mortality at calving. In this study, productive and reproductive performance, as well as incidences of pathologic events and claw disorders, were not influenced by feeding organic trace minerals in partial replacement for the minerals in a sulfate form.

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