Effects of Trace Mineral Source on Preweaned Calf Performance
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Trace minerals are required for normal metabolic processes, growth, and immune function in calves and other domestic animals. Most typically, calf diets (milk replacer, calf starter) contain trace minerals that are bound to inorganic molecules. Trace minerals bound to organic molecules have been shown to have greater bioavailability and/or tissue retention versus inorganic forms. Greater trace mineral bioavailability may support improved immune function during times of stress as well as faster growth. The objective of this article is to summarize recent research that demonstrated organic trace mineral supplementation improved growth of calves fed an intensified plane of nutrition.

Functions of Trace Minerals in Young Calves

Organic trace minerals commonly used in calf milk replacers are zinc (Zn), manganese (Mn), iron (Fe), copper (Cu), and selenium (Se). Organic selenium is commonly included in milk replacers due to its importance for immune and antioxidant function, as well as its relatively low cost. The impact of organic Zn, Mn, Fe, and Cu has been the focus of recent research. The biological functions and common supplemental forms of these minerals are detailed in Table 1 below.

Table 1. Functions and common supplemental forms of zinc, manganese, iron, and copper for young calves

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Functions</th>
<th>Common Inorganic Form</th>
<th>Common Organic Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc</td>
<td>Disease resistance, muscle development, appetite, skin and claw health, hair coat</td>
<td>Zinc sulfate</td>
<td>Zinc methionine complex¹</td>
</tr>
<tr>
<td>Manganese</td>
<td>Disease resistance, bone development, skin and claw health</td>
<td>Manganese sulfate</td>
<td>Manganese methionine complex¹</td>
</tr>
<tr>
<td>Iron</td>
<td>Disease resistance, oxygen transport</td>
<td>Ferrous sulfate</td>
<td>Iron amino acid complex¹</td>
</tr>
<tr>
<td>Copper</td>
<td>Disease resistance, bone development, appetite, skin and claw health, nervous system, hair coat, oxygen transport</td>
<td>Copper sulfate</td>
<td>Copper lysine complex¹</td>
</tr>
</tbody>
</table>

¹Zinpro Performance Minerals®, Eden Prairie, MN

Research Support – Organic Trace Mineral Supplementation of Preweaned Calves

Golombeski et al. (2008) conducted research at University of Minnesota Southern Research and Outreach Center (Waseca, MN) with Holstein heifer calves sourced from three commercial dairies. Treatments were: 1) 20-20 all-milk milk replacer (MR) with 100% inorganic trace minerals (control), 2) 20-20 all-milk MR with 100% organic Zn, Mn, Fe, and Cu (Org TM), and 3) 20-20 all-milk MR with 100% Zn, Mn, Fe, Cu, and Se (Org TM + Org Se). Calves were fed MR powder at a rate of 1.25 lbs/day from day 1-35, then 0.625 lbs/day from d 36-42 then weaned. Calves were fed an 18% CP texturized starter, and were housed in individual pens from d 1-56. In conventionally fed calves, organic trace mineral supplementation did not affect average daily gain (ADG), feed efficiency, or health parameters. Calves on the Org TM treatment had significantly greater hip height gains from day 1 to 56 compared with the control treatment (4.32 vs. 3.80 inches, respectively). The calves used in this study were fed colostrum, well-managed, raised in a facility with low pathogen load, and fed a conventional nutrition program; therefore, results may have been affected by the degree of immune stress and plane of nutrition.
A study (Osorio et al., 2008) conducted at the University of Illinois with transported Holstein bull calves tested the effects of plane of nutrition (conventional vs. accelerated) and trace mineral form (inorganic vs. organic). Organic trace minerals were sourced from Zinpro Performance Minerals® (ZPM). The four treatments were conventional nutrition + inorganic trace minerals (CI), conventional nutrition + organic trace minerals (CZPM), accelerated nutrition + inorganic trace minerals (AI), and accelerated nutrition + organic trace minerals (AZPM). Conventionally fed calves were fed a 22-20 MR at 1.25 lbs/day, had free-choice access to an 18% CP starter, and were weaned at 6 weeks of age. The accelerated program employed a 28-20 MR fed at 1.25 lbs/day for week 1, 1.78 lbs/day for week 2, 2.50 lbs/day for week 3-6, and 1.25 lbs/day for week 7 (weaning), plus a 22% CP starter. For the CZPM and AZPM treatments, both the MR and the calf starter contained organic sources of Zn, Mn, Fe, and Cu.

Results indicated that there was an interaction of trace mineral source and plane of nutrition, meaning that organic trace minerals improved growth of calves on the accelerated plane of nutrition but had no effect on conventionally fed calves. Figure 1 shows that AZPM calves had greater ADG from week 1 to 9 compared with the other treatments (plane of nutrition × trace mineral source interaction, $P \leq 0.05$).

Similarly, a plane of nutrition × trace mineral source interaction existed for frame growth where AZPM calves had greater hip height at week 5 ($P < 0.05$), week 8 ($P < 0.05$), and week 12 ($P = 0.08$); data is shown in Figure 2.

Data shown here indicates that organic trace minerals can support greater gain and frame growth when provided as part of an accelerated, or intensive, growth program. Intensive feeding programs are designed to allow calves to achieve superior frame and lean tissue growth compared with conventional programs. While trace mineral concentration is important, data presented here illustrates that trace mineral bioavailability is integral in allowing the intensively fed calf to achieve her growth potential.

New and Improved — Hubbard Mother’s Pride Milk Replacer

Hubbard Feeds has reformulated Mother’s Pride milk replacer to contain organic trace minerals at the levels utilized in the study detailed above. Product features and benefits include:

- 28% crude protein from all-milk sources to support intensive growth
- 18% fat to support energy requirements for frame growth in concert with protein requirements
- 100% of Zn (50 ppm), Mn (50 ppm), Fe (100 ppm), and Cu (10 ppm) from organic sources (Zinpro Performance Minerals®, Eden Prairie, MN)
- Contains essential fatty acid technology (NeoTec4™, Provimi North America, Brookville, OH)

References
