Trace minerals for dairy cows and heifers: strategy for improved profitability

With current economic trends in the dairy industry, producers need to ensure efficiency in all aspects of milk production. Reproductive performance dictates daily milk production, number of replacements available and selective culling opportunities within the herd.

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Many factors influence reproductive performance and choice of trace mineral supplementation is one of them.

Trace mineral form and function

The form of minerals supplied in feed has been the focus of much research. Opportunities to improve animal production have led to the development of minerals chelated with an organic ligand, commonly called organic trace minerals.

This makes them similar to the forms found in plants and allows for improved absorption and utilisation when supplied in feed compared to inorganic mineral sources. Examples of inorganic minerals are oxides, sulfates and chlorides.

Mineral proteinates have been developed as a source of organic zinc, copper, manganese and cobalt. Proteinated minerals, such as Bioplex, blend single amino acid chelates and short-chain peptide chelates.

Certain minerals cannot be naturally chelated due to their electrochemical properties.

One such example is selenium. In order to produce an organic form of selenium, it is necessary to supply it as a substrate for yeast fermentation. The mineral is metabolised into seleno-amino acids within the yeast (Sel-Plex).

Different forms of minerals fit into the category 'organic minerals', but it is important to remember that all forms are not created or perform equally in the diet.

Dairy cow reproduction

There are many parameters in the category of reproduction that can improve efficiency on a dairy. Until heifers calve and start their lactations, they are generally a cost burden to the dairy compared to generating income with the onset of lactation.

Age at calving can vary widely from dairy to dairy and can have a large impact on the total cost of raising heifers.

Once a lactation begins for either a heifer or cow, they need to get pregnant again within a reasonable timeframe to start the entire calving cycle all over again in 12-14 months.

Days open has been associated with costs of $3-6 per day for each day open over 100 days. Days to return to oestrus and pregnancy rate are two crucial performance measures to reduce days open.

Research at Penn State University fed heifer calves with either organic or inorganic trace minerals (sulphate /selenite) during the heifer development period and into their first lactation. Heifers fed organic trace minerals tended to calve 22 days earlier (P<0.07) (Table 1) than those supplemented with sulfates/selenite.

Additionally, average milk yield in early lactation was greater (P<0.05) (Fig. 1) in heifers supplemented with organic trace minerals, with an average increase of 3.7 pounds per day over the first 100 days of lactation.

Another benefit demonstrated in heifers by Pino and Heinrich (2016) from only supplementing with organic forms of trace minerals were reductions in total manure produced (P<0.01) and urine excretion (P<0.01) compared to heifers supplemented

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Fig. 1. Effect of feeding organic trace mineral (OTM) vs. inorganic trace mineral (ITM) during growth and lactation on average production per day (100 DIM) during the first lactation.

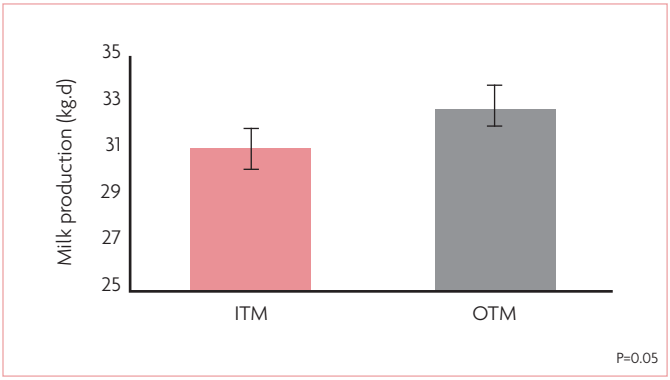
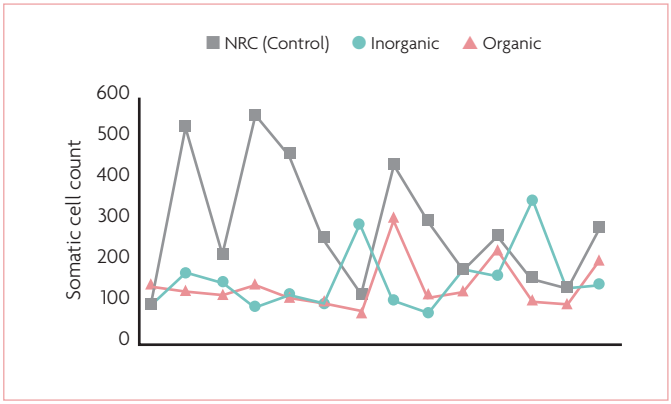


Fig. 2. Somatic cell content over time from dairy cows fed three diets differing in level of source of minerals.



Treatment[1]	Age at calving[2] (months)	SE	P-value
IH	24.8	0.30	0.07
OH	24.0	-	-
IC	24.6	0.35	0.05
OC	23.7	-	-
IH-IC	24.7	0.54	0.51
IH-OC	24.3	-	-
OH-IC	24.9	-	-
OH-OC	23.3	-	-

[1]I = inorganic TM (ITM), O = organic TM (OTM); H = heifer (from birth to calving), C = cow (dry period). Interactions: IH-IC = ITM in heifer, ITM in cow; IH-OC = ITM in heifer, OTM in cow; OH-IC = OTM in heifer, ITM in cow; OH-OC = OTM in heifer, OTM in cow. [2]n = 29 for OTM and n = 28 for ITM.

Table 1. Effect of trace mineral (TM) source fed during the cow dry period and from birth to calving of progeny (heifers) and their interaction

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with inorganic trace minerals. A recent publication from France showed the effect of trace mineral source and amount on reproduction in lactating dairy cows. All groups were fed the same basal diet, with the only difference being the composition of the trace mineral component.

The three treatment groups were industry-standard levels of inorganic trace minerals (Zn, Mn, Cu, Se), reduced levels using organic trace minerals as Bioplex/Sel-Plex and reduced levels using inorganic sources.

Though not statistically different (P=0.13), 71% of cows supplemented with organic minerals were pregnant after 10 weeks compared to 53% of cows supplemented with the reduced inorganic levels and 47% of cows supplemented with the industry inorganic levels.

Additionally, there were differences in other measures of economic importance for the dairy.

Parameter[2]	CON (100% inorganic)	INORG (reduced inorganic)	SD	P-value
Feed intake (kg/d DM)[3]	23.0	23.2	23.3	-
Milk yield (kg/d)	32.0[a]	31.3[b]	32.6[b]	2.39
Energy-corrected milk (kg/d)	31.0[a]	30.7[a]	31.5[b]	2.59

[1]Means with different superscripts differ significantly (P>0.05). [2]DM = dry matter. [3]Group data, so not statistically analysed.

Table 2. Effect of feeding industry (CON) levels of inorganic minerals vs. lower levels of inorganic (INORG) or organic (ORG) minerals for 10 weeks on feeding, lactation and milk quality in dairy cows.

Energy-corrected milk yield was greater (P<0.005) (Table 2) for the organic mineral cows compared to the other two groups (69.4 pounds vs. 67.7 pounds and 68.3 pounds, respectively). The organic mineral group tended (P=0.05) (Fig. 2) to have lower somatic cell counts (SCC) overall compared to the other two groups.

Conclusion

Trace minerals are essential for many economically important functions in dairy cows and heifers. Focusing on the form of trace minerals in diets and using organic minerals like Bioplex and Sel-Plex can have positive benefits on many parameters like reproduction.

These improvements can increase the lifetime performance of cows and overall profitability of dairy farms. ■

References are available from the author on request