

# Trace Mineral Feeding and Assessment

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## KEYWORDS

- Trace minerals or elements • Dairy nutrition • Liver biopsy • Nutrient requirements

## KEY POINTS

- Trace minerals are an essential component of a feeding program for dairy herds. Deficiencies are unlikely when the cows are fed amounts to meet National Research Council (NRC) requirements.
- The need for additional trace elements to support high milk production is supported by the increased dry matter intake associated with lactation.
- Dietary analysis is needed to identify the relative concentrations of the antagonists and potentially the antagonists may be removed rather than increasing supplementation.
- Organic and alternate forms of trace elements have received wide acceptance throughout across multiple food animal production systems.
- Blood and liver analysis can be effectively used to confirm diagnoses or monitor the efficacy of the feeding program.

## INTRODUCTION

Practitioners may be asked to evaluate the trace mineral status of dairy herds or offer opinions on the mineral supplementation program. Many times this request comes based on reduced reproductive success, udder health problems, or nonspecific increases in morbidity or mortality. As McClure<sup>1</sup> noted, deficiencies of almost all nutrients have been thought to cause infertility, yet few have been proven to do so in cattle. Trace minerals fit in a somewhat unique position because either deficient or excessive amounts can lead to disorders.

Before an investigation on trace mineral inadequacy or excess, the author recommends an approach suggested by Clark and Ellison in the article aptly titled “Mineral testing—the approach depends on what you want to find out.”<sup>2</sup> The strategy of who and what to test depends on the question at hand.

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Disclosure: W.S. Swecker has received funding from Zinpro Corporation (<\$10k) in 2004 for evaluation of trace mineral content of ovaries. Results presented at 2006 ADSA meeting.

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Vet Clin Food Anim ■ (2014) ■–■

<http://dx.doi.org/10.1016/j.cvfa.2014.07.008>

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1. Is the poor performance owing to a mineral deficiency?
2. Are animals on this farm ever likely to suffer from a mineral deficiency?
3. Are animals going into a period where demand is increasing or availability is decreasing? If so, do they have adequate reserves to prevent a deficiency?
4. Is the supplementation program on this farm adequate?

The author suggests the addition of a potential fifth category based on herds that recycle manure on farm.

5. Does the supplementation program pose an environmental risk?

The goal is to provide trace minerals at a concentration that provides for the needs of the cattle without incurring an economic or toxicologic expense.

The objectives of this article are to:

1. Provide a brief overview of the essential trace elements for dairy cows;
2. Provide a description of the determination of the requirements of essential trace elements for dairy cows;
3. Describe the relative contribution of common feeds to meeting the trace element needs of dairy cows;
4. Describe common classes of trace element supplements; and
5. Describe sampling both feeds and animals to determine trace mineral adequacy.

#### WHICH TRACE ELEMENTS ARE REQUIRED BY DAIRY COWS?

Dairy cattle, like other animals, have a requirement for essential trace minerals. Currently, cobalt (Co), copper (Cu), iodine (I), iron (Fe), manganese (Mn), selenium (Se), and zinc (Zn) are deemed essential and thus must be supplied in the diet.<sup>3</sup> A critical aspect of essentiality is that a biologic function has been established for that mineral and that dysfunction or disease can be identified when the element is not present at adequate amounts in the ration. To that end, both chromium and molybdenum (Mo) may have biologic functions within cattle, but the deficiency state has not been established thus they are currently not considered essential trace elements [Table 1](#).

#### *Requirements for the Trace Elements for Dairy Cows*

The maintenance requirement of these minerals is the amount needed to prevent the deficient state or development of classic lesions associated with deficiency. Many of these elements are involved in immune and reproductive function and the amount needed for optimal immune or reproductive function may be at a higher level than the amount required to prevent deficiency; however, data are limited to affirm those amounts. Although trace mineral supplementation is a relatively low-cost portion of a cow's ration, a sensible approach is needed to provide adequate amounts in the ration.

Likewise, some elements like Cu, Se, and I, when fed at higher levels, may be associated with toxicoses. The potential for trace mineral accumulation should be considered when manure and urine are recycled on crop fields. Manure and urine represented 90% or more of the output of Cu, Mn, and Zn on Swedish dairy farms.<sup>7</sup> Sheppard and Sanipelli<sup>8</sup> proposed that Cu and Zn could accumulate in soils that are managed to prevent accumulation of phosphorus, because most harvested crops would take up less Cu and Zn, relative to phosphorus. Currently, there are proposals to add trace mineral balance to nutrient management plans.<sup>9</sup> Therefore, the goal of a dairy ration is provide essential amounts to support productivity without leading to toxicoses or soil accumulation.

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