Precision mineral feeding for the efficient supply of trace elements

Last November, Animine organised its scientific academy, a unique meeting point between the feed industry and academy. This cross-cutting event, organised every two years, offers neutral and non-promotional topics with the aim of presenting the latest advances in mineral nutrition to the public.

by Valérie Kromm,
Product Manager, Animine.
www.animine.eu

This year, in a format 100% digital, more than 20 renowned experts from all over the world covered subjects of various aspects: nutrition, intestinal health, microbiota, environmental sciences and analytical sciences.

For the first time, one session was dedicated to mineral nutrition of ruminants.

New NASEM requirements

Following the 8th revised edition of the Nutrient Requirement of Dairy Cattle (NASEM 2021), Professor Bill Weiss (Ohio State University) who actively participated to this update, was invited to review the main changes concerning trace element recommendations.

Manganese

Compared to the previous edition (2001 NRC guidelines), the major changes were observed for manganese (Mn) (Table 1).

Indeed, following a study where clinical deficiencies in newborn calves occurred despite an adequate level of Mn in the diet, Mn requirement was evaluated closely.

It resulted in an increase in the Mn level for maintenance (+30%) and a decrease in the coefficient of absorption (0.75 to 0.4%). As a consequence, the recommendations more than doubled (40ppm vs 19ppm for dry cows and 30ppm vs 13ppm for lactating cows) compared to 2001 data.

Zinc and copper

Some significant changes also occurred for zinc (Zn) and copper (Cu). For both elements maintenance increased. As coefficient of absorption also increased, little change is observed in requirements in these two elements for average lactating cows.

However, for dry cows, requirements increased 10% for Zn and 40% for Cu, while for high producing cows, requirements increased 15% for Zn and decreased 45% for Cu.

Limitations

With the most recent information on dairy cattle mineral nutrition, NRC guidelines are becoming more and more accurate in defining dietary requirements. Still, some limitations in the system do exist.

Professor Bill Weiss highlighted those requirements systems do not take into account rumen effect, 'non absorbed' effects but also antagonistic effect. That is why adjustments need to be done by the user despite the high precision of the new NASEM requirements.

Copper: from essential to toxic

Because of the small margin between Cu deficiency and Cu toxicity and because of the high susceptibility of Cu to bind antagonists in the rumen, Cu is a good example of an element to adjust closely in ruminants. This was the topic Dr Andrea Clarkson, (University of Nottingham), whose main field of research is Cu in livestock nutrition, addressed to the audience.

Oversupply in dairy cattle

When talking about the risk of Cu toxicity in ruminants, the first thought that comes to mind is Cu toxicity in sheep. However, a study carried out at the University of Nottingham, showed that most sheep (60%) have normal liver Cu and are more likely to be deficient.

The same study showed that 70% of dairy cattle in the UK have high Cu status (Fig. 1) with 60% of the farms feeding animals with Cu levels above 20mg/kg DM and 8% above the legal limit.

The main reasons reported were misinformation of farmers and the fear of deficiency. In addition, the multichannel supply of trace elements and the variability in level of Cu antagonists (S, Mo, Fe) in forages make it difficult to monitor Cu supplementation.

Chronic copper toxicity

Dr Andrea Clarkson also explained that prolonged Cu intake, above requirements, can lead to chronic toxicity which is the result of the slow accumulation of Cu in the liver during a long period of time. At the opposite of acute toxicity, chronic toxicity can remain 'silent' for months or years, before the toxicity is apparent. A haemolytic crisis can then appear and lead to death in a few days in most of the cases.

A growing number of lethal cases reported by veterinarians in the UK showed that such silent intoxication is spreading in dairy herds, which urges the development of strategies to monitor herd Cu status and amplify the awareness of farmers for Cu toxicity.

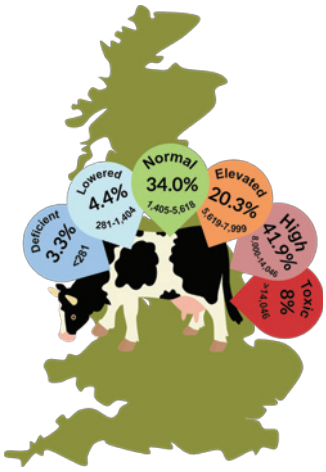

Fig. 1. Liver copper status of dairy cows in the UK (µmol/kg DM) (University of Nottingham) (image courtesy of Dr Clarkson).

Conclusion

These topics, addressed during the ruminant session of the Animine e-academy, highlight the importance of precision mineral feeding in order to guarantee an efficient supply of trace elements, safe for the animal and for the environment.

In that objective, well characterised Animine sources, with high stability in the rumen and a high bioavailability, mitigate the risk of compromised supply of trace minerals. ■

Table 1. Changes from NRC 2001 for trace minerals (image courtesy of Pr. Weiss).

	Heifer	Dry cow	Lactating cow
Co	↑	↑	↑
Cu	↑↑	↑↑	↔↓
Fe	↔	↔	↔
Mn	↑↑	↑↑↑	↑↑↑
Se	↔	↔	↔
Zn	↔	↑	↑