Understanding the cross functional role of trace minerals

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Increased animal production pressures, including higher feed ingredient costs and stricter standards and regulations, have created many challenges for the industry and for the animals themselves.

Nutritionists are being asked to keep it all in balance – health and welfare of the animal and, at the same time, maintaining production efficiency and creating the highest quality end product possible.

Key nutrition requirements are well established and known, but with the challenges and evolving regulations facing the industry, many are taking another look at the role micronutrients play in building metabolic balance, efficiency and peak performance in animals.

Key benefits

Improved growth performance, immune development, structural integrity of tissues, bone development and strength, protection against oxidation and enzymatic activity are all benefits that can be seen with the right trace mineral nutrition management.

Specifically, zinc, copper and manganese perform important roles in helping poultry operations reach their potential, but when needs are met, it is clearly evident in the animal. When animals are zinc deficient, the result is poor growth, delayed sexual maturity, abnormalities in foetuses, diarrhoea, skin lesions and compromised immunity.

- Zinc's cross functional role is critical in animal development. When required levels are fed, it builds skin integrity, improves immunity, helps with normal growth and development and serves as an essential component for multiple enzymatic activities. The core absorption site for zinc is the duodenum, and about 60% accumulates in the muscle and 30% accumulates in the animal's bones. Zinc also modulates enzymatic activity and assists with enzymatic structural stability in the 300 known zinc-dependent enzymes.

- Copper deficiency is identified with poor growth rates, low fertility rates, disorders in bone and connective tissue, weak vascular tissue and impaired egg shell formation in poultry. Often, copper is used as a growth promoter to improve appetite, as well as increase antibiotic activity and feed efficiency. Like zinc, the major site of absorption is the duodenum. Copper concentration occurs with 45% accumulating in the bone and 25% accumulating in the skeletal muscle. Copper is critical to immune function and is also a cofactor for several enzymes.
- When manganese is not fed to requirements, the result is poor conception rates, structural abnormalities and lameness, congenital defects and abnormal metabolic activity. Manganese focuses on growth and reproduction, wound healing and shell matrix formation in poultry. Manganese concentration is located in the mitochondria where it generates energy in all the tissues of the body.

All three of these organic trace minerals – zinc, copper and manganese – function to improve growth performance, enzymatic activity, tissue and structural health, immune function and protect against oxidative stress. Another key function is to support structural integrity in the animal, which includes bone, tendon, hoof, skin and egg shell.

These minerals allow for collagen and keratin synthesis and cross linking and elastin crosslinking, while bone development and strength rely on collagen and cartilage synthesis followed by ossification.

In poultry, egg shell formation relies heavily on zinc, copper and manganese because the calcification of the collagen matrix is dependent on the enzymatic cofactors. Their role also includes reducing oxidative stress, which reduces the risk and susceptibility of disease and builds a stronger immune system.

There is no single solution to increasing performance in animal production, therefore a holistic approach is best utilised to address the myriad of challenges in animal production.

From a nutrition standpoint, zinc, copper and manganese play a critical role in helping to keep metabolic and biological processes in balance and can help improve performance, efficiency and profitability.

Maximising nutrition

Inorganic trace minerals like sulphates or oxide salts, have traditionally been the choice to supply animals with minerals, and they have been added to the diet at levels that exceed those recommended by scientific bodies like the National Research Council.

Uncertainty over the bioavailability of mineral elements from inorganic sources has caused producers to feed more inorganic minerals than recommended to ensure an adequate supply is delivered to the tissue of the animal.

However, identifying minerals as either organic or inorganic does not differentiate them enough. Further categorisation of organic trace minerals includes true chelates and non-chelates.

Non-chelated structures often lack a defined structure, meaning the bonding ligand may not be consistent. This lack of consistency makes it impossible to determine and guarantee the number of bonds, bond strength, or size and number of ligands present in the non-chelated organic trace mineral.

Therefore, it is questionable what the non-chelate's consistency is and what amount of mineral is truly bound to the ligand.

Important production outcome measures can be directly improved by including adequate supplementation levels of chelated organic trace minerals. The outcome measures can include feed conversion, weight gain, reduced mortality, piglet birth weight, meat quality, carcase quality, chick quality, immune response, footpad scores, laying rate and many others.

In contrast, ineffective sources and levels of trace minerals can limit animal performance. It is critical to be aware of the source of trace minerals in order to improve uptake and maximise performance.

A diet which includes Mintrex chelated trace minerals can result in improved bioavailability, which increases profitability by decreasing mortality, improving feed efficiency and improving vaccine response when compared to other mineral sources.

Mintrex provides a unique 2:1 chelation structure that optimises key production measures and maximises potential uptake levels well beyond those achievable by other mineral sources, which directly increases customer profitability.

The results are most obvious when animal diets deficient of chelated trace minerals are then fed at required levels to high performance animals.

Mintrex, a highly bioavailable mineral source, allows for a decrease of inclusion rates while meeting nutritional requirements and maximising animal performance. Including it in the diet also offers a direct benefit through reduced mineral content excreted into the environment.

Mintrex optimises trace mineral nutrition, resulting in maximised animal performance and increased producer profitability. ■