Optimising sow performance through mineral supplementation

For many decades the focus for sow farmers has been on increasing the number of total weaned piglets per sow per year. This number has been steadily rising, with more and more farmers now reaching the impressive number of 35 piglets weaned per sow per year.

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However, society has become more concerned about animal welfare, increasing the pressure on farmers to house gestating sows in groups, reduce lameness in sows and improve the vitality of piglets.

Live weight of newborn piglets has been one of the main challenges with the increasing litter sizes and decreasing weaning age in many markets. Birthweight is seen as a very important indicator for performance in later life.

Optimising nutrition is generally accepted to be very important to meet these higher performance standards, while protecting the welfare of the sow. The approach can however be very different ranging from decreasing stress (from hunger) in gestating sows through ad libitum feeding, or stimulating fermentation in the lower gut (slow nutrient release over time), to stimulation of milk production with specific raw materials (branched chain amino acids, linoleic acid, highly digestible protein sources) or in general feed intake in lactating sows. These different approaches can be successful, but will need to be supported by optimal mineral supplementation for the best results.

Mineral supplementation

For development, growth and immunity, mineral supplementation is essential in all phases of life.
For highly prolific sows the most important body functions related to minerals are described here.

● Zinc
Zinc is essential to maintain healthy skin and claws. This is very important for sows, as lameness normally decreases feed intake, and therefore body condition and fertility. In addition, zinc is a critical element for many immunological processes to support general health. Finally, it is involved in carbohydrate metabolism and reproduction.

● Copper
Copper is involved in many processes in the body, with the main ones being the development of bone, connective tissue and collagen, the formation of haemoglobin, acting against free radicals in the body (anti-oxidant) and supporting immunity.

● Manganese
Manganese is important for the proper function of many proteins and carbohydrates, fertility, growth and development, as it is necessary for the formation of bone and joint cartilage, and neurological function. Together with zinc, fulfilling the sow's requirement for manganese is key to prevent lameness (supports both claws and skeleton).

● Iron
Iron in combination with proteins and copper forms haemoglobin, essential for oxygen supply. Iron is needed continuously to provide haemoglobin for newly produced red blood cells.

An additional challenge for the highly prolific sow is the changing mineral requirements depending on phase of production. The first phase is the development of the foetus, and replenishing the body reserves (body condition and bone mineralisation). The second phase is the growth of the foetus, followed by the parturition, and colostrum and milk production, followed by a dry period and insemination.

Successfully fulfilling the mineral requirements is important for both the reproductive success and performance of the offspring. However few studies have been performed to define the mineral requirements of highly prolific sows used today, which means that many sow feeds include high amounts of minerals to fulfill requirements.

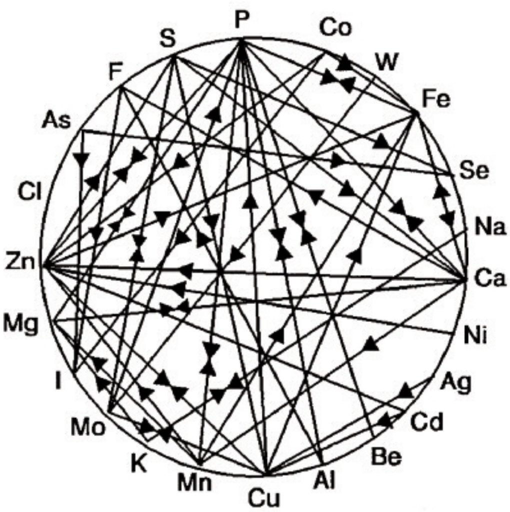

Fig. 1. Mineral wheel with interactions (based on publications of Watts et al., 1988-1994).

Optimising mineral supplementation

Absorption of minerals is limited because of antagonisms and inter-

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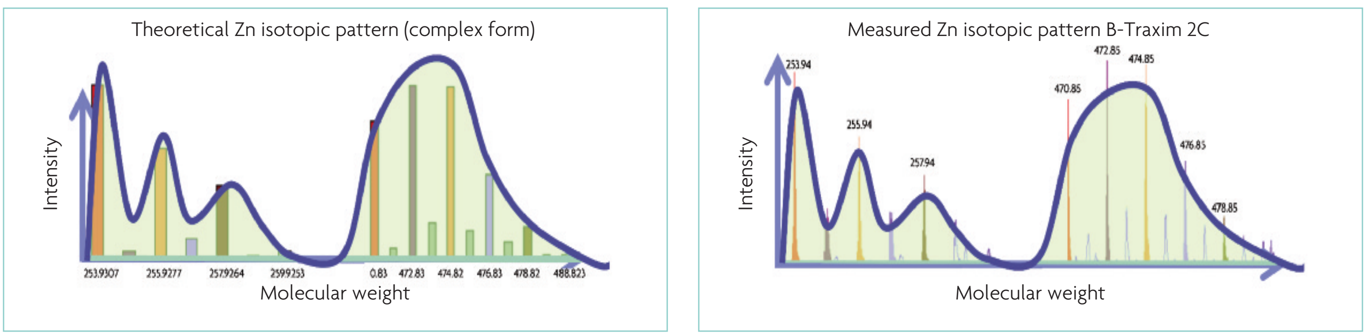
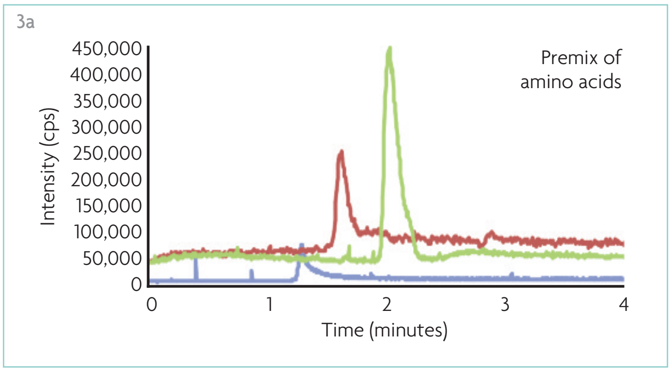
Fig. 2. The presence of zinc glycinate in water shown (using flight mass spectrometry), compared to the theoretical spectrum (Vacchina et al., 2010).





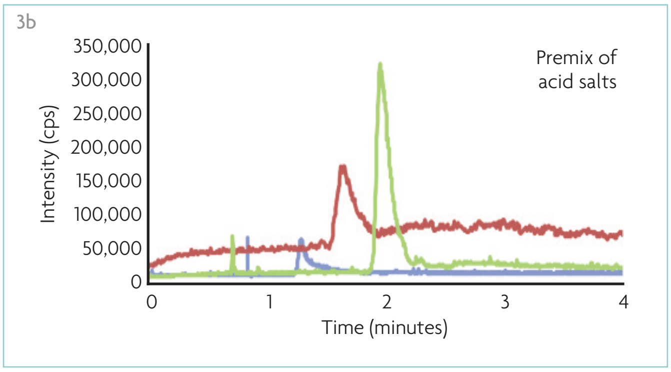


Fig. 3a and 3b. The recovery of B-TRAXIM 2C products (Mn, Zn and Cu) as glycinates in different premixes.

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actions with feed components. Formation of insoluble, or too big to be absorbed, complexes with other components in the feed, limit availability of minerals for the animal. In addition, some minerals compete for the same transporters and metabolic processes for absorption, which limits the availability of these minerals or vitamins for the animal. Interactions between minerals are always present and still new interactions are found, which indicates the complexity of meeting mineral requirements (Fig. 1).

It is certain however, that simply increasing the supplementation levels is often not the solution to meet mineral requirements.

Organic trace minerals

The negative effects of interaction with feed components and competition for absorption on bioavailability can be reduced by combining the mineral with an organic ligand.

Inorganic mineral forms (sulphates) are very weakly bound and are therefore free to interact. Organically bound minerals are not reactive, which will prevent complex formation. Moreover, competition for absorption can be avoided partly by absorption using the pathway(s) of the ligand.

Stability of the organic bond is essential to prevent interactions and competition, demonstrating the added value of an organic trace mineral (OTM).

In different trials, the superior stability of a specific glycinate (minerals bound to the amino acid glycine), B-TRAXIM 2C, has been shown in water (Fig. 2), at different pH, in premix (Fig. 3), in pelleted feed and even in the presence of known antagonists and in acidic liquid feed (Fig. 4).

B-TRAXIM 2C products are produced using a unique spouted bed technology, which is optimised to create superior handling and homogeneity of the products.

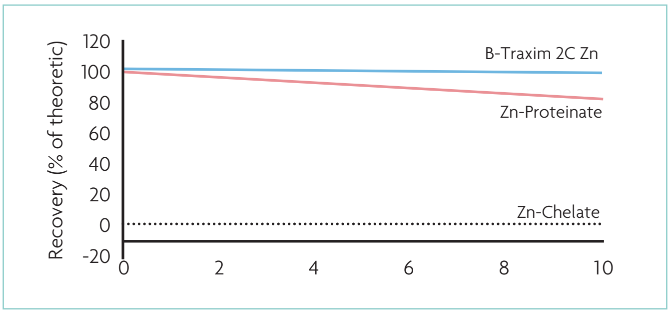
A fine granulate without dust is the result (Fig. 5), perfectly free-flowing, with a low risk for caking, due to its reduced surface area compared to finer products, and improved distribution in premix and feed, due to its small and uniform particle size. As the ingredients are solubilised before spraying, the final products are perfectly water soluble (Fig. 6).

Glycine as ligand

Glycine is the smallest amino acid (Fig. 7), with good chelating properties (forming glycinates). It is also colourless, odourless and sweet-tasting, giving these properties also to the glycinates. It is used as an additive in pet food and animal feed as a taste enhancer. Because glycine has the lowest molecular weight of any amino acid, glycinates are very concentrated in mineral content and are more easily absorbed by the animal compared to larger mineral complexes.

Unlike some other producers of organic trace minerals, the chemical structure and the stability of B-TRAXIM 2C in different environments have been clearly established. Oguey et al. (2008) established the chemical structure of the different crystalline complexes which give this range part of its name, '2C' (Fig. 8).

Fig. 4. Stability of the organic bound mineral in acidic liquid feed.



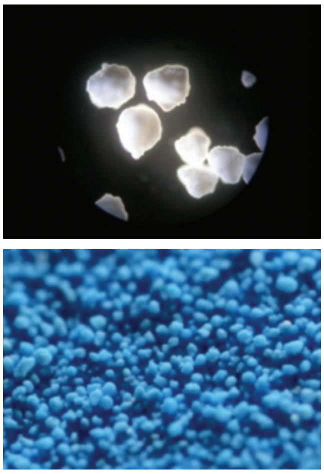


Fig. 5. Top, B-TRAXIM 2C Zn particles (microscopic), and bottom, B-TRAXIM 2C Cu (close up).

All in one particle

Homogenous distribution in premix and feed are essential in mineral supplementation. Low dosages per tonne of feed, make it challenging to provide mineral products in every bite of the final feed. With

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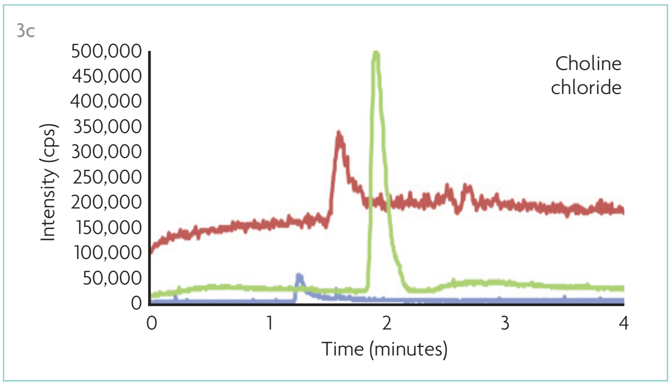
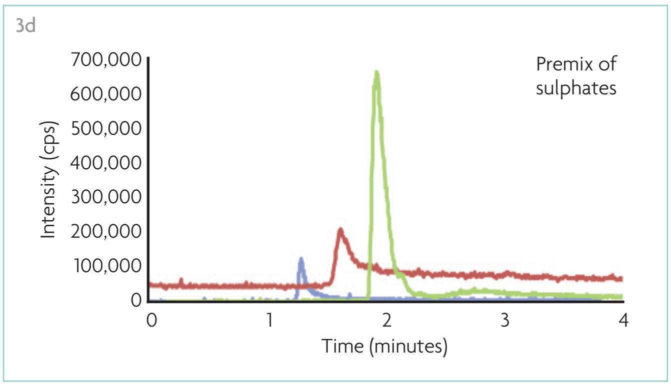
Fig. 3c and 3d. The recovery of B-TRAXIM 2C products (Mn, Zn and Cu) as glycinates in different premixes.





	Phase	Zn	Mn	Cu
Control	Gestation	83	60	11
	Lactation	110	80	15
Chelate	Gestation	83	50	8
	Lactation	80	50	8
BT2C	Gestation	83	50	8
	Lactation	80	50	8

Table 1. Mineral supplementation levels per dietary treatment.

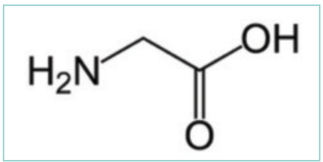


Fig. 7. Chemical structure of the amino acid glycine.

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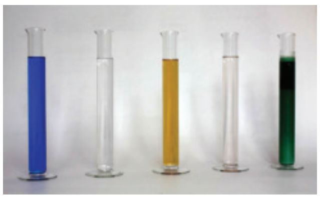
the production and quality standards in place to ensure the exact same composition in every particle, B-TRAXIM PRO3-S, goes a step further in providing every individual animal with the nutrients it requires. It provides sows with three of the most essential minerals in glycinate form, with superior bioavailability, handling characteristics and homogeneity.

Available data in sows

A sow trial was conducted by the University of Wroclaw (Poland) to test the effect of mineral supplementation with organic trace minerals (OTMs). A total of 210 sows were randomly assigned to three dietary treatments.

Fig. 6. Perfect solubility of B-TRAXIM 2C products compared to a main competitor (first from the right).



The diets were supplemented with inorganic minerals at commercial levels (Control), with reduced mineral levels of which 50% consisted of soy-based chelates (Chelate), or with reduced mineral levels of which 50% consisted of glycine-based complexes (BT2C) (Table 1).

Per treatment, 10 sows were selected for the lactation period (weaning at day 21). After farrowing, dead piglets and piglets with BW <1200g on day two were removed and after weaning the insemination success of the sows was monitored.

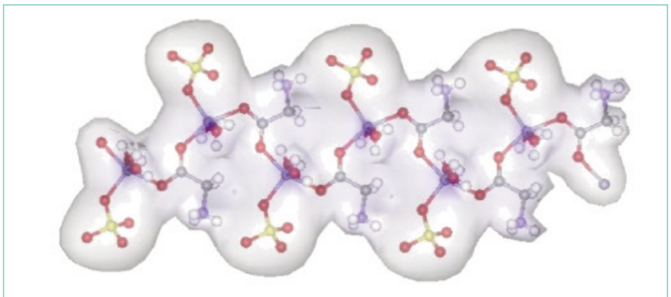
The offspring from sows fed OTM were heavier at birth ($P<0.05$), which resulted in less removals ($P<0.05$, results not shown). In addition, the sows fed OTM showed numerically decreased loss of bodyweight and increased ($P<0.05$) insemination success 30 days after farrowing (including first and second insemination).

There was no significant difference between Chelate and BT2C for these parameters, but there was a consistent numerical advantage for BT2C (Fig. 9).

This data indicates that a reduced trace mineral supplementation, partially with OTM had even improved the performance of the sow and their offspring. This clearly indicates that over-supplementation is not the solution to meet the sow's mineral requirements.

Mineral supplementation of sows partly with OTMs may either have influenced the trace mineral transfer to the foetus or to the newborn piglet via milk. In the present study, the improvements in number of live born piglets and newborn piglets BW, especially using BT2C, strongly suggest that the foetus was positively influenced.

Fig. 8. The molecular structure of B-TRAXIM 2C Cu or Zn.



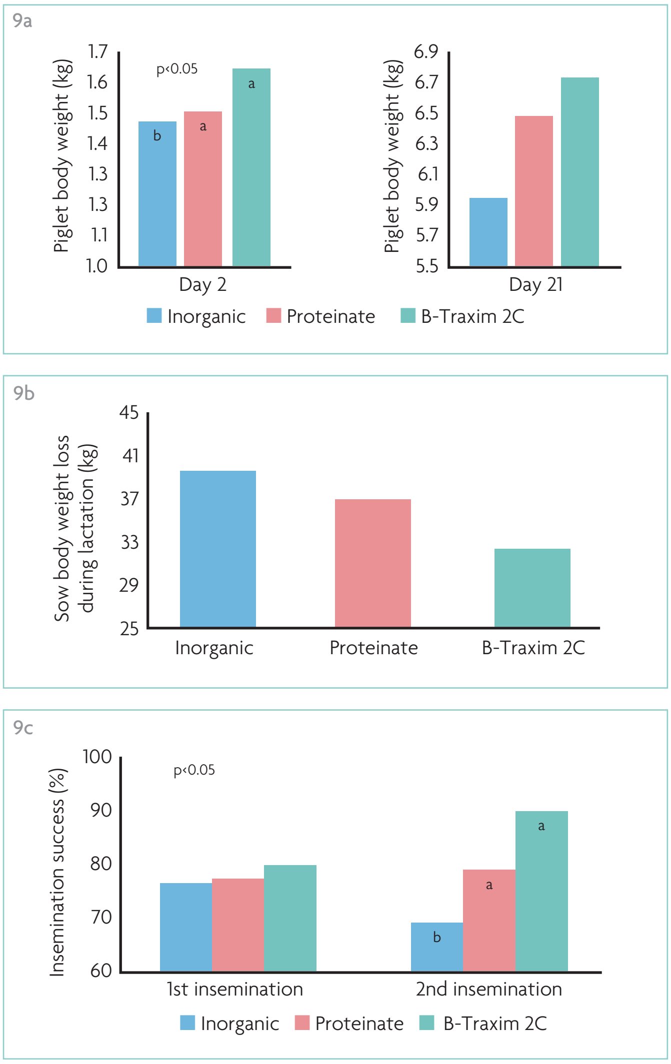


Fig. 9a, 9b and 9c. Sow and offspring performance before weaning.

Conclusion

Mineral supplementation for sows is essential both for the welfare and performance of the sow. With increasing pressure from society for higher welfare of sows, mineral supplementation is a key factor to improve hoof quality, fertility and development of offspring. Inorganic mineral sources are an inefficient method of supplementation due to the many antagonisms between them and other nutrients.

Supplementing highly prolific sows with OTMs in general and B-TRAXIM 2C in particular can improve both reproduction and offspring performance.

Using the all-in-one B-TRAXIM PRO3-S will take mineral supplementation to the next level. ■