Effects of chelated trace minerals on the gestating and lactating sow

Trace minerals are essential components of swine diets, directly impacting the modern sow's health and reproductive performance.

During gestation, a sow's trace mineral status can affect not only her health but the size and the health and birth weight of her litter.

by Laurentia van Rensburg, Technical Mineral Manager, Alltech. www.alltech.com

Experts believe that late gestation and lactation are critical stages for mineral nutrition as this is when the sow's nutritional requirements are extremely high.

Possible depletion of trace mineral levels in sows can influence increased oxidative stress, resulting in decreased milk production, diminished reproductive performance and reduced longevity.

In fact, during the last 14 days of gestation, up to 50% of both macrominerals and microminerals are retained in developing piglets.

Supplementation with organic trace minerals can improve sow reproductive performance and increase the trace mineral amounts transferred into the sow's milk and, consequently, the developing foetuses.

These benefits are likely influenced by the increased bioavailability of Bioplex trace minerals, which can be included at lower levels, helping offset the negative excessive mineral excretion and inefficiency associated with overuse of inorganic trace mineral (ITM) sources.

Reproductive performance, litter birth weight and piglet viability benefits

Long-term reproductive benefits have been associated with Bioplex trace minerals supplementation (Table 1). Compared to sows given higher levels of ITMs, sows supplemented with lower levels of Bioplex have significantly more piglets born and alive ($P<0.05$).

Berthechini et al. (2012) also observed higher numbers of live births, along with better birth and weaning weights in piglets fed lower levels of Bioplex versus higher levels of ITMs ($P<0.05$). Similarly, Ma et al. (2019) observed more piglets born alive per litter.

Peters and Mahan (2005) evaluated the effects of supplementing Bioplex at National Research Council (NRC) recommended levels or higher industrial levels across four parities. More piglets were born alive from sows supplemented with Bioplex at NRC levels (Table 1).

When looking at the effects of industrial levels from both mineral sources on reproductive performance, sows fed Bioplex had more piglets born alive compared to the ITM diet (Table 1).

Effects of organic trace minerals on weaning weight

Regardless of the inclusion rate, feeding trials providing Bioplex trace minerals report higher weights.

When Ma et al. (2019) compared high levels of ITM with lower levels of Bioplex, those fed Bioplex had a 6.5% increase in piglets with birth weights higher than 1.0kg ($P<0.05$) and a 15.8% increase in litter weaning weights ($P<0.05$). Similarly, Peters and Mahan (2008) found heavier litter birth weights because of larger litter sizes ($P<0.05$).

Starter or weanling pigs

The benefits of organic trace minerals are not only limited to sows. Weaning is an extremely stressful time for piglets, typically resulting in decreased feed intake and increased susceptibility to health challenges. Having optimal trace mineral status can especially benefit pigs during this stage.

Therefore, supplementation with inorganic trace mineral sources (sulphates and oxides) at levels exceeding requirements is not uncommon. However, due to inorganic trace

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Table 1. Summary of trial findings comparing Bioplex trace minerals to inorganic trace minerals (ITMs) on live pigs born per litter, weight at birth and weight at weaning.

		Live pigs born per litter			Piglet weight at birth (g)			Weight at weaning (g)		
		ITM	Bioplex	Difference	ITM	Bioplex	Difference	ITM	Bioplex	Difference
Bertechini et al. (2012)	Low	10.8^{b}	11.9^{ab}	1.1	1,496^{b}	1,636^{a}	140	6,176c	7,639a	1,463
	High	11.2^{ab}	12.18^{a}	0.98	1,516^{b}	1,677^{a}	161	6,915b	7,832a	917
Ma et al. (2019)		11.05	11.28	0.23	1,430^{a}	1,490^{b}	60	6,480	6,720	240
Peters and Mahan (2008)		10.44	11.08	0.64	1,720	1,660	-60	6,330	6,330	
Peters and Mahan (2005)	NRC	11.6	11.8	0.2	1,600	1,640	40	6,160	6,400	240
	Industry	10	11.1	1.1	1,740	1,630	-110	6,460	6,280	-180
	Average	10.85	11.56	0.71	1,584	1,622	38.50	6,420	6,867	536

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minerals' low bioavailability, only limited amounts might be absorbed, with the balance excreted into the environment.

Several countries also have regulations regarding copper and zinc supplementation. Here, utilising organic trace minerals at lower inclusion rates (and higher bioavailability) has become a viable alternative.

Several studies look at replacing inorganic trace minerals with lower levels of Bioplex. Mullan et al. (2002) reported that feeding piglets Bioplex zinc at significantly lower levels resulted in higher growth rate and, thus, would benefit starter or weanling diets.

Other advantages of feeding Bioplex trace minerals as part of a total replacement programme in weanling diets include:

- Hernandez et al. (2008) reported that feeding pigs low levels of Bioplex (even at 25% of the control diet) did not compromise animal performance and that faecal concentrations of copper and zinc reduced when lower levels of Bioplex were included in the diet, suggesting increased animal efficiency.

- When studying its effects on growth performance and immune function in weaned pigs, She et al. (2017) reported that Bioplex Zn supplementation improved growth (increased average daily gain), supports immune function and antioxidant capacity in weaned piglets.

- Zhang (2021) looked at replacing inorganic trace minerals with lower levels (1/3) of Bioplex and reported that total replacement helped to enhance IgG and reduced faecal excretion of copper, zinc, manganese and iron, mitigating environmental pollution.

Finisher diets

During this production phase, the emphasis is on efficiency, lean gain and meat quality. Important parameters include growth rate, feed conversion and carcase quality.

- Finisher pigs receiving Bioplex trace minerals yielded 2.0kg extra carcase weight and had higher slaughter efficiency, resulting in positive economic benefits due to improved performance and lower mineral inclusion levels.

- Ma et al. (2018) looked at the effect of Bioplex trace minerals on growth performance, serum indexes and micromineral excretion in finisher pigs and found that using low-dose Bioplex trace minerals can significantly reduce heavy metal emissions and improve antioxidant levels of growing-fattening pigs without impacting growth performance.

- Mullan et al. (2004) found that pigs receiving Bioplex Cu and Zn were significantly leaner (depth of backfat) than those receiving the same inorganic minerals.

- Hernandez et al. (2008) reported improved feed efficiency when including Bioplex Cu and Zn at lower levels in finisher diets.

Thus, Bioplex trace minerals can substitute high levels of inorganic trace minerals, addressing environmental concerns and enhancing critical parameters such as lean gain and feed efficiency.

Summary

Trace minerals are an integral swine diet component. Research on trace mineral source effects shows that trace mineral nutrition goes beyond sow health and maintenance, benefitting her litters and growing and finishing pigs as well.

A Bioplex trace mineral programme has been shown to benefit litter birth weight, weaning weight, number of piglets born and alive and health and feed efficiency during later stages ■

References are available from the author on request