Trace Minerals and Feed Additives in Post-Weaning Pig Nutrition: A Synergistic Approach?

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The post-weaning period is one of the most stressful phases in pig production, where piglets face sudden changes in diet, environment, and immunity. This phase often results in reduced feed intake, diarrhoea, and poorer growth. For decades, pharmacological doses of zinc oxide (ZnO) were relied upon to control enteric pathogens and stabilise gut health in weaned piglets. However, growing concerns around antimicrobial resistance and environmental zinc accumulation have led to strict regulatory restrictions on its use.

Beyond these environmental and public health concerns, it is now a well-supported hypothesis that high levels of ZnO may have masked underlying inflammation in young pigs, rather than resolving it. As a result, the industry is now confronted with a critical challenge: how can we safeguard piglet health and performance without relying on pharmacological ZnO?

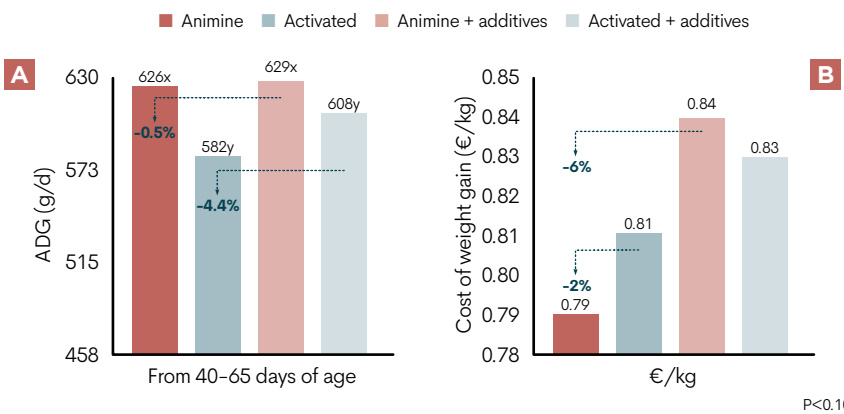
This shift offers a unique opportunity to re-evaluate the true impact of nutritional interventions.

With pharmaceutical levels of ZnO removed from the toolbox, more attention is being placed on functional feed additives, such as essential oils and organic acids, as well as the use of highly bioavailable trace mineral sources. These alternatives are increasingly seen as promising strategies to support gut health, immune resilience, and growth during the vulnerable post-weaning period. Yet the real question lies not just in identifying new tools, but in understanding how they work together in practice.

Can one solution effectively replace another? Or do these strategies interact synergistically to provide a more robust response? Exploring these combinations is key to designing sustainable, effective feeding programs in the post-ZnO era.

Recent trials have explored how the physico-chemical properties of trace minerals, along with accompanying functional feed additives, impact growth, gut health, and overall performance. Across different studies in Europe, Animine's products: HiZox, a potentiated zinc oxide, and CoRouge, a monovalent copper oxide, were evaluated against competitive sources such as activated Zn and Cu (processed inorganic oxides designed for higher reactivity), and Cu chelate of hydroxy analogue of methionine. In

Fig. 1. (A) Average daily gain (ADG) of piglets from 40 to 65 days of age fed two different mineral sources ± functional feed additives; (B) Cost of weight gain (€ per kg).



addition, commercial feed additives, containing blends of essential oils and organic acids, were tested – both independently and in combination with mineral solutions, to assess potential synergies and their impact on post-weaning piglet performance.

A controlled field trial in a commercial farm was conducted in Hungary, where we compared Animine products with activated mineral sources, both with and without the combination of essential oil and organic acids in the piglet starter phase. As shown in Fig. 1A, piglets fed Animine products tended to achieve higher ADG than those fed activated minerals, regardless of whether feed additives were included. Notably, the reduction in ADG after removing feed additives was minor for Animine treatments (-0.5%) but more pronounced with activated minerals (-4.4%).

As shown in Fig. 1B, the cost of weight gain was reduced by 6% within Animine treatments and by 2% compared with activated minerals. Moreover, piglets receiving additives, regardless of mineral source, tended to show higher feed intake than those without. These findings demonstrate that Animine's mineral solutions deliver a consistent and reliable response, even in the absence of functional feed additives and further position Animine as a scientifically sound and cost-effective strategy for production systems operating under financial constraints. A complementary trial in Spain extended these findings by looking specifically at the effects of copper. Together with HiZox, piglets were fed diets containing either CoRouge or Cu chelate, with or without an acidifier. During the starter phase, pigs fed CoRouge, regardless of acid addition, consumed significantly more feed than pigs fed Cu chelate alone (Fig. 2A). Similar to the study that was conducted in Hungary, where Animine minerals supported consistent growth, the trial in Spain showed CoRouge drove higher feed intake at a time when piglets were most susceptible to environmental stressors due to post-weaning transition.

Beyond performance, gut health indicators provided further evidence of copper's role. Faecal scores were significantly lower in pigs fed CoRouge or Cu chelate with acidifier compared with Cu chelate alone (Fig. 2B). In other words, Animine copper showed a stabilising effect on gut function, similar to what was seen when acids were included, but without relying solely on the additive

Faecal pH measurements followed a similar trend, with Cu chelate plus acidifier tending toward higher values, suggesting less favourable fermentation conditions in the gut compared with pigs fed CoRouge (Fig. 2C). While acidifiers lower gastric pH, their absorption in the upper gut reduces microbial fermentation downstream, resulting in less acid production and thus higher faecal pH. Although enterobacteria counts did not differ significantly, the alignment of faecal score and pH outcomes supports the role of CoRouge in stabilising the post-weaning gut environment.

Conclusion

Across both studies, the conclusion becomes clear – not all minerals are equal. The differences between them have become even more apparent following the ban on pharmaceutical ZnO. Previously, the high-dose effect of ZnO often masked variation in mineral bioavailability and performance.

Now, in its absence, the true impact of mineral source and quality is exposed. Beyond their chemical form, their interactions with additives play vital roles in securing both performance and gut health. HiZox and CoRouge not only deliver trace minerals more effectively but also reduce the dependency on costly feed additives to keep piglets performing consistently. For producers, this means greater flexibility.

Animine's precise mineral solutions can serve as a foundation that ensures pig performance, while additives like essential oils and acids can be used strategically rather than as a necessity.

The trials demonstrated that Animine products provide stability with or without additives, whereas competing mineral forms are likely more dependent on feed additive support to attain the same results.

As the industry adapts to pig production after pharmacological ZnO ban, these findings underline a simple but clear message: choosing the right trace mineral source is not just about meeting requirements, it is about securing performance, health, and profitability in the most vulnerable stage of pig production.

By providing stability and flexibility in the starter phase, HiZox and CoRouge help producers meet post-weaning challenges with less reliance on costly additives. ■

Fig. 2. (A) Average daily feed intake (ADFI) of piglets from 38 to 58 days of age fed two copper sources ± acidifier; (B) Faecal scores (d28); (C) Faecal pH (d42).