Supporting the nutritional needs of hyperprolific sows improves piglet performance.

Manage the mother for piglet performance

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MATT BEKKER and ERMIN MAGTAGNOB* focus on management strategies, including trace mineral nutrition, to tackle the challenges of breeding from hyperprolific sows that produce large litters.

Traditionally, a high performing swine farm would target production of 70kg of weaned piglet weight per sow per lactation - a nice, neat litter of 10 x 7kg piglets. Modern sows across the globe are now regularly delivering more than 16 piglets per litter (or 30 pigs per annum over multiple pregnancies).

Challenges with hyperprolific sows

This hyperprolific rate of production has presented new problems for the industry. These include the apparent metabolic cost to the sow who then presents progeny of lower average birthweight as well as inconsistent birth and weaning rates. A key indicator of herd performance is uniformity. If we consider a litter of 10 to 11 piglets average 1.67 kg birthweight with 17.4 coefficient of variation (CV) we should understand that litters of 16 or more piglets weigh 1.38kg on average with a 23.7% CV.

Industry adoption of hyperprolific sows certainly improves the performance in terms of the number of piglets born, but along with non-uniform size each piglet competes for nutrients even before it leaves the womb. This leads to intrauterine growth restriction. Piglets that don't receive the nutrients they need while in the womb can experience a reduction in both the number of muscle fibers and muscle fiber diameter. They may also see less lean muscle weight and total weight of the gastrointestinal tract.

This reduces the muscle volume available to grow into saleable consumer cuts and the overall absorptive area and efficiency of the gut.

Feeding strategies for hyperprolific sows

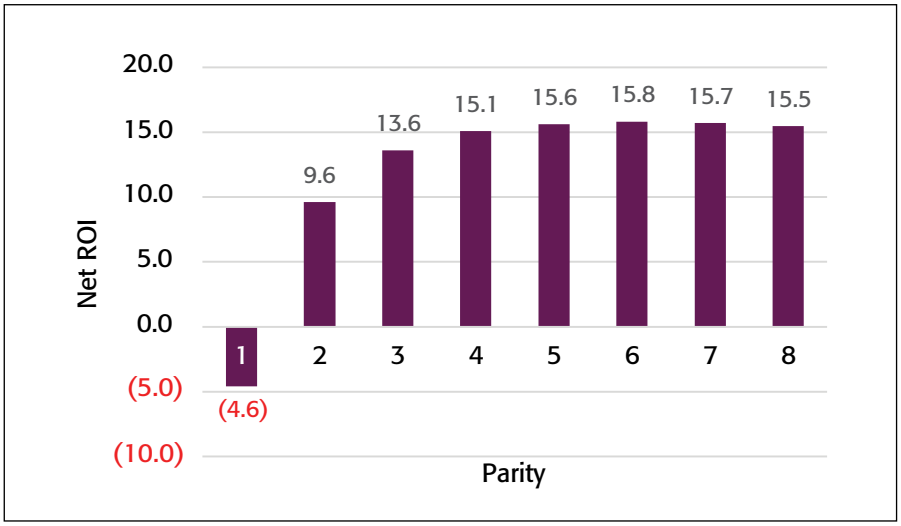
Start with the replacement gilt

Maximizing the potential of these sows must begin with the development of an ideal gilt. Management of replacement gilts is often conducted at 45kg-plus when females are chosen on phenotype (growth and development) and structural soundness after being on a standard grower/finisher diet with the rest of her contemporaries. In an ideal world, however, she should come from a high-performance line, reflecting good genetic potential. She should have received adequate colostrum and reared from weaning in a cohort that is fed and managed to optimize structural integrity. She should have a development profile that delivers her to the point of joining at the optimum weight and body condition score. This management protocol will lay the foundation for maximum fertility, lactation, recovery and return-to-service while weaning healthy piglets every five months.

A good example of the importance of bodyweight and condition for gilts is the return-to-service interval. According to research, gilts that achieved target bodyweight and backfat of under 6 millimeters took 6.5 days to return to service. Gilts at the same weight but achieving 14 to 18 millimeters of backfat reached post-lactation service interval in under 6 days.

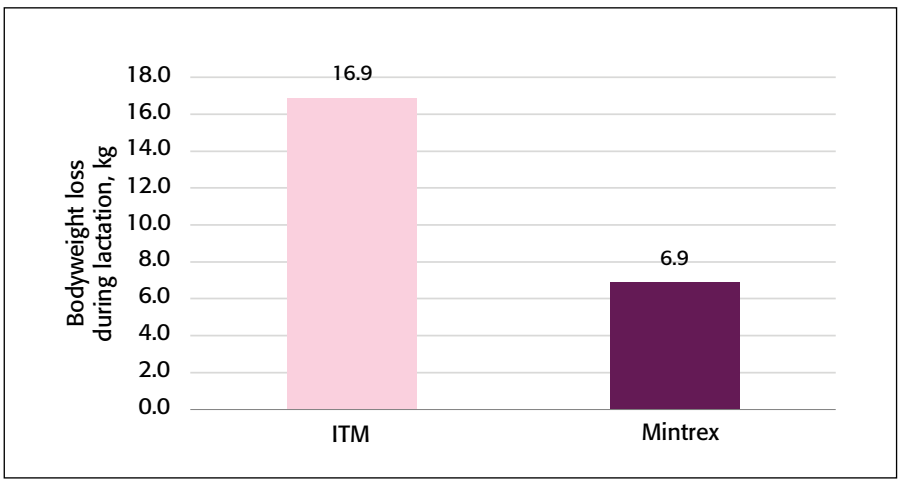
Gilts only pay for themselves past parity 3, once feed consumption, housing and management costs are taken into account. An allocation of around 400 – 450kg of gestation and lactation feed per sow breeding cycle will be about half of the investment. It is of utmost importance to have good quality weaning piglets and have more parities for the investment in each gilt to be profitable. Economic analysis in 2017 examined culling sows after parities 6 through 9. The analysis showed the greatest returns when cost associated with replacement gilt rearing and management expenses are reduced.

Figure 1: Net return on investment (%) of 5000 Sow-Breed to Wean System.



Gruhot *et. al*, 2017

Figure 2: Mintrex bis-chelated trace minerals supplementation reduced sow bodyweight loss during lactation.



Jang *et al*, University of North Carolina, 2018

Recovery of investment is seen in Figure 1.

Improve feed intake

The key to maintaining production consistency in sows past their first parity is feed intake. A targeted daily feed intake for early pregnancy should exceed 6kg but not all nutrient requirements can be met from the diet as the womb, carrying multiple fetuses increasingly compete for space. Fetal growth more than triples in the last 40 days of pregnancy, with average piglet weight soaring from around 350 grams at 80 days of gestation to around 1,200 grams at 120 days.

Sows must maintain a minimum bodyweight to support the impending lactation and body condition score (measured in backfat at the P2 region), which will allow them to return swiftly to service. Lactation needs to support all live piglets and drives overall farm performance as every gram of weaned bodyweight contributes to the potential of each growing pig. Every extra hundred grams of bodyweight at weaning translates to a day earlier to market.

Knowing the potential returns a sow can deliver to enhance farm production and profitability, how can the industry better support this animal to ensure she has the necessary care and feeding to meet or even exceed expectation.

Minerals matter

Where feed is concerned, understanding the benefit of

delivering just the right amount of each nutrient in perfect balance is key. A comprehensive feed program must include all nutrients down to the essential trace minerals. By changing this one nutritional intervention – replacing traditional mineral salts with a highly bioavailable form of bis-chelated trace mineral (Mintrex bis-chelated trace minerals from Novus International, Inc.), research shows sows can maintain a consistent bodyweight compared to sows that were being fed inorganic trace mineral salts (ITM). (Figure 2).

Along with sow bodyweight improvements, a study found a subsequent increase in birthweight by 9% in piglets from sows having their inorganic mineral source replaced with organic bis-chelated trace minerals and a 9% reduction in piglet mortality.

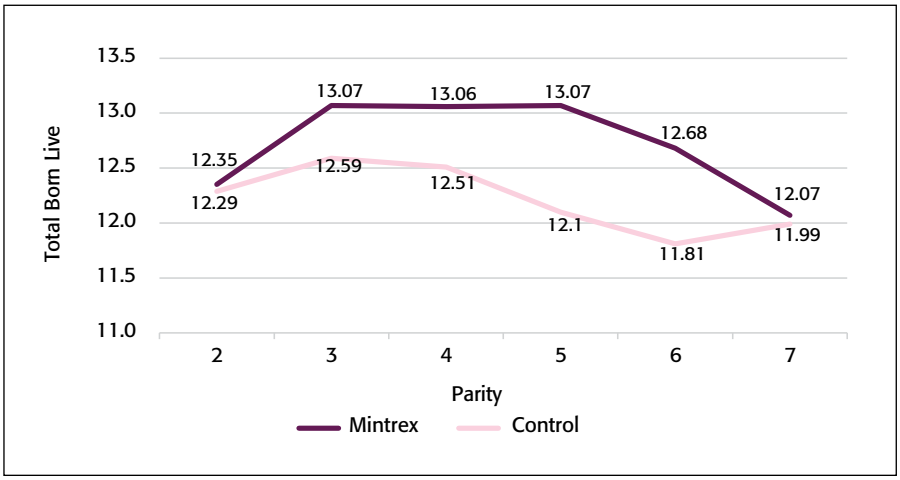
In fact, a number of studies agree that when summarizing a dataset boasting greater than 200,000 farrowing events, we are able to report with some confidence on what to expect when this highly bioavailable organic bis-chelated trace mineral programme is either fully or partially adopted. Common responses to bis-chelated trace mineral treatment include a significant increase of 6% in gilts reaching greater than parity 3 and beyond, 9% fewer sow mortalities, a reduction in piglet mortality rate (more than 1%). Also seen is a significant increase in weaned pigs per sow lifetime (Figure 3) in a commercial study with over 17,000 sows, which delivered 2.9 extra weaned piglets per sow lifetime. According to these studies, when sows have their entire trace mineral requirement met by the more bioavailable source, Mintrex, improved performance can be seen.

There are several modes of action to consider when evaluating the impact an organic bis-chelated trace mineral program for both sow and litter performance.

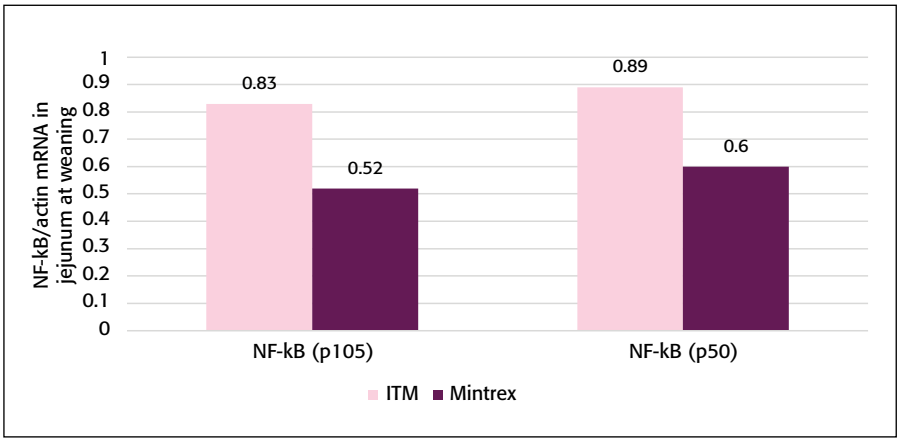
Research trials demonstrated that the addition of Mintrex Cu to nursery diets significantly promoted piglet growth by improving bodyweight gain and feed-to-gain ratios. This is an example of direct intervention of mineral source.

Another mode of action is believed to be epigenetic pathways that may assist the sow directly and modify the piglets' growth potential.

Figure 3: Piglets per parity.



Figures 4: Inflammatory markers in piglet gut tissue.



Epigenetics

As discussed in a previous article (see *Asian Poultry Magazine* March 2021, Improving broiler chick performance before they hatch) epigenetics is the study of heritable phenotype changes that do not involve alterations in the DNA sequence. Epigenetics effectively prepares progeny for the environment they can expect to enter by changing the frequency of DNA expression.

Consider that DNA strands in each and every cell could stretch well over a metre in length if laid in a straight continuous line. As such, DNA must be bundled tightly in the cell nucleus. When the cell is required to produce a specific protein (think hormone, enzyme, etc.) the spool of DNA presents the relevant section of the chain to be copied by RNA (the copier), which then assembles the required amino acids in sequence to build the necessary protein. Epigenetics changes the frequency that particular sequences allow themselves to be exposed for 'copying'.

A study at North Carolina State University discovered that while replacement of trace mineral salts reduced sow bodyweight loss and the performance factors as discussed earlier, feeding Mintrex trace minerals to sows resulted in the reduction of inflammatory markers in their progeny, particularly Nf-KB which results in less inflammatory cascades that can impede general health and response to stressors, particularly along the gastrointestinal tract at the crucial point of weaning (Figure 4).

What is important for the producer however is the ability to grow saleable carcass. In Figure 5, piglets from sows that were fed the more

Figure 5: Muscle mRNA development marker.

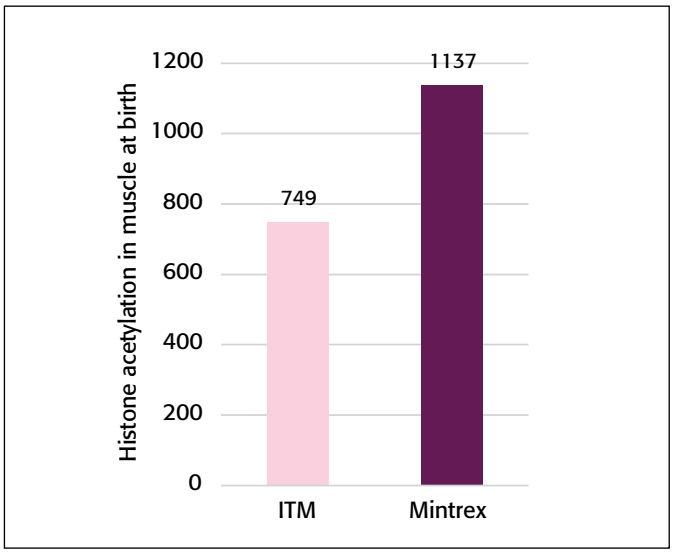
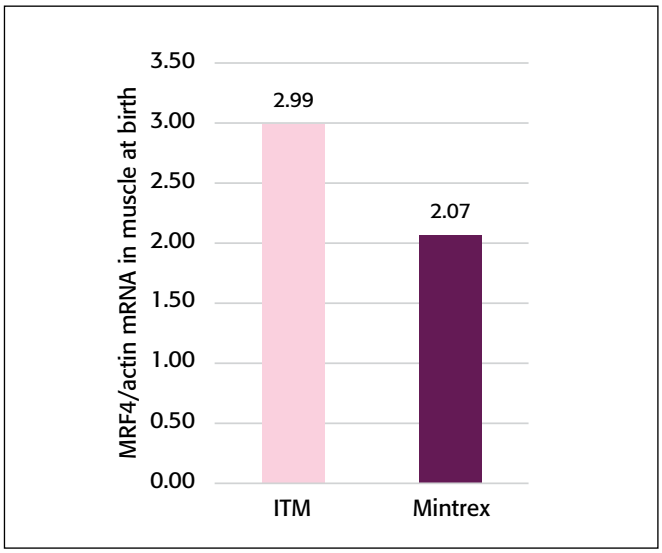


Figure 6: MRF4/actin.



bioavailable source of mineral had increased histone acetylation, which allows for proliferation of muscle cells. Importantly, for growth potential, the piglets from sows fed Mintrex showed a concurrent reduction in the transcription of factors (as seen in the levels of actin in Figure 6) that reduce myogenesis, so the same muscle fibers can grow at a rate closer to greatest genetic potential.

Conclusion

When considering trace mineral sources, producers must look at animal benefits and benefits to profit. With a consistent sow nutrition program that include bis-chelated trace minerals, improved development and consistency of gilts, which is reflected in extended productive lives, more sows retained for greater parities, more weaned piglets per lifetime and greater piglet performance beyond weaning can be expected. AP

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