Using trace mineral nutrition to improve sow performance

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Sow reproductive numbers continue to increase (improve) according to several measures such as pigs weaned per sow per year (Table 1).

However, it could be argued that measures such as sow mortality and sow replacement rates are not improving.

Peet (2008) reported that sow turnover rates continue to increase, even though we supposedly have improved genetics, nutrition, facilities and management (Table 2).

In the data he presented, sow turnover rates ranged from 46 to 57% in the year 2000 in Great Britain and the United States, respectively.

Moving forward to 2005, replacement rates increased to 54% in Great Britain to over 63% in the United States. Canada had intermediate levels of replacement for both years but the trend for increasing turnover was consistent. At the same time, death rates of sows increased in all three countries, from 3.9% in Great Britain in 2000 to almost 9% in the United States in 2005.

Trait	2003 Pig Champ Summary Mean	2003 Pig Champ Summary Top 10%	2008 Pig Champ Summary Mean	2008 Pig Champ Summary Top 10%
Pigs weaned/sow/year	19.0	22.2	22.86	26.6
No. born alive/litter	10.1	10.8	11.29	12.19
Farrowing house mortality (%)			12.23	8.13
Weaning age (days)	18.0	21.1	19.88	21.87
No. weaned/litter	9.0	9.7	9.97	10.71
Farrowing rate (%)	74.8	84.8	78.71	88.10
Sow mortality (%)	7.8	3.0	7.93	3.63

Table 1. Sow benchmarking key performance indicators (USA).

Recently, Culbertson (2008) reported data from 11 sow farms in a single system showing that the percentage of gilts entering the farm that produced four litters varied from 38 to 67%, with an average of 46%.

This variation suggests there is potential for improvement. But what are the factors involved?

Lameness is a major reason for decreased sow longevity in swine breeding herds. Claw lesions are associated with lameness in sows. Despite the high prevalence of claw lesions, minimal research has focused on claw lesions in swine. Lack of research limits development of management practices to reduce claw lesions and lameness. Although housing conditions and management practices are important factors contributing to development of claw lesions in swine, nutritional factors, especially the role of trace minerals, are presumed to act as predisposing factors.

Increasing sow longevity is an important consideration in commercial pork production because of the cost of gilt replacement

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Country	Canada		USA		Great Britain	
Year	2000	2005	2000	2005	2000	2005
Average sow death rate (%)	4.7	8.1	6.9	8.9	3.9	5.8
Average sow replacement rate (%)	49.6	60.3	56.9	63.1	45.9	54.0

Table 2. Sow mortality and turnover rates (Peet, 2008).

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and the need for greater efficiency in producing pork protein to meet world demands for food.

Nutrition can also affect culling of sows. Over feeding energy during gestation or under feeding protein and energy in lactation can have dramatic effects on sows remaining in the herd. Anil and co-workers (2006) found that sows consuming 3.5kg or less of feed per day during the first two weeks of lactation were more likely to be removed from the herd. The odds of removing a sow from the herd before the next farrowing decreased by 30% with an increase in lactation feed intake of 1kg.

The odds of removal were highest for sows that did not consume any feed during any one day in the first 14 days of lactation. In addition to protein and energy, macrominerals, trace minerals and vitamins have been implicated in maintaining claw health.

Sow trace mineral status has been shown to decrease with increased parity. Recently it has been suggested that the level of trace minerals and vitamins fed to sows should be modified as the sow ages to account for changes in body mass.

Data in the dairy cow suggests that improved bioavailability of trace minerals by feeding Zinpro minerals improved claw health. Given the similarity in production environments and productivity expectations between cows and sows, it is logical that this response is likely for the sow also.

Early data suggested that piglet production was related to a depletion of sow micromineral stores. However, these data were based on a few observations of gilts that were never bred relative to a few peergroup females that were killed after three reproductive cycles.

Micro-mineral accretion

More recent data from the same laboratory found that sow body micro-mineral (copper, iron, selenium and zinc) content increased with increasing parity when evaluating multiple sows at several parities.

Other data from this group showed that micro-mineral accretion by the foetus/piglet increased dramatically during gestation and suggested that the trace mineral requirement of high producing sows may be higher than current recommendations.

Research by Crenshaw and co-workers (2010) evaluated parity 0 to 7 hyperprolific sows for bone, liver and muscle mineral concentrations.

In contrast to some reports, these researchers reported that bone iron concentration was decreased by parity, but bone copper, manganese and zinc concentrations were not changed by parity.

Liver copper and zinc concentrations tended to increase with time (parity), but the differences were not significant. Liver manganese concentrations varied with parity but a consistent trend with increasing parity was not evident.

Thus, there appears to be some lack of agreement regarding the trace mineral status of sows with increasing parity. There could be many reasons for the inconsistent observations including genetic differences, management differences or feed formulations differences. Additional basic research is needed to elucidate the etiology of these differences. Mechanistically it seems that trace mineral form may impact a number of areas metabolically including claw health and hoof lesions.

Improving sow welfare

Anil et. al. (2009) found that sows fed trace mineral amino acid complexes (ZPM, Zinpro Performance Minerals) had 14% fewer total claw lesions, 15% fewer hind limb lesions), and 36% fewer sole lesions compared with sows fed inorganic trace mineral sources. Furthermore, sows fed ZPM had 12.5% less severity of lesions and 16.5% less lameness. The impact of organic mineral (ZPM) on sow well being was dramatic. These data support improved trace mineral nutrition as a means of improving sow welfare, not to count the improved economics due to decreased sow lameness and improved performance.

A study by Peters and Mahan (2008) supports this response, although trace mineral source and level were somewhat confounded in this study. Research by Payne et al. (2006) showed that sows fed zinc amino acid complexes weaned more pigs per litter and had increased feed intake in lactation.

Other data (unpublished) showed that sows fed isolevels of trace minerals as amino acid complexes had improved return to oestrus rates, increased lactation feed intake, and decreased culling rates.

Future research will solidify the connections between improved trace mineral nutrition, sow comfort, productivity and profitability. ■

References are available from the authors on request