Nutritional opportunities for modern hyperprolific sows

The objective of modern pig production is to maximise the quality and quantity of pig meat produced per sow per year and per lifetime at minimal costs. A crucial first step is to ensure that the sow produces an adequate number of piglets, and that those piglets survive and grow efficiently and economically through to slaughter.

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	Brittany, France		Quebec, Canada		Treatment effects
	Control	Bio-Mos	Control	Bio-Mos	
Total born	13.47	12.59	13.64	14.84	0.78
Born alive	12.99	11.85	12.72	13.58	0.80
Litter size (adjusted)	12.18	11.39	12.13	12.92	0.99
Birth weight (adjusted)	1.27	1.41	1.45	1.48	0.32
Growth rate: 0-24h (g)	83	123	138	166	0.04
Colostrum intake (g)	204	261	364	384	0.02
Piglets weaned	9.96	10.09	10.64	11.69	0.09
Mean piglet weaning weight (kg)	5.94	6.13	7.16	7.93	0.23
Litter weaning weight (kg)	58.17	61.55	71.63	79.30	0.02
Survivability (birth→weaning) (%)	86.1	81.6	88.6	91.9	0.02

Table 2. Effect of Bio-Mos/Actigen on sow and piglet productivity (Le Dividich et al., 2009).

One of the major achievements in pig production over the past few decades has been the considerable improvement in sow productivity; in many countries, it is not uncommon to wean at least 30 piglets per sow per year. However, a more realistic key performance index is the number of piglets weaned per sow lifetime and an achievable target should be at least 50-60 piglets over 4-5 parities.

To achieve these targets, it is important to ensure that sows are properly fed and managed. Some important nutritional practices to adopt on the path to success are included in this article.

Minerals matter

Minerals are essential for the metabolic, endocrine and physiological control of growth, reproduction and immunity, meaning they have a major influence on the overall health and productivity of the herd.

Research has established that trace minerals provided in an organic form better meet the needs of the modern hyperprolific sow than their inorganic counterparts.

For example, the inclusion of organic forms of selenium (Se) and iron (Fe) in the diet significantly increased their concentration in colostrum, milk and blood, as well as in the total body content of newborn and weaned piglets.

This improved the metabolic, physiological and oxidative status of the piglets, resulting in better performance and overall health.

Close (2008) reported that the partial replacement of inorganic minerals with organic minerals resulted in a 0.5 (range 0.3-0.8) increase in litter size.

Mahan and Peters (2008) compared the performance of sows fed either organic or inorganic sources of minerals at NRC or industry levels over six parities. Sows fed organic trace minerals produced more piglets per litter ($p<0.05$) compared with sows fed inorganic minerals: 12.2 vs. 11.3 total born and 11.3 vs. 10.6 born alive, respectively.

Similarly, Bertechini et al (2012) evaluated the performance of sows fed inorganic or organic minerals at either 1 or 2kg/tonne.

As indicated in Table 1, the inclusion of organic minerals resulted in greater sow productivity.

At the 1kg inclusion level, the increase was an extra 1.1 piglets and at the 2kg inclusion rate, an extra piglet per litter. Along with the higher litter size, the birth and weaning weights of the piglets were significantly higher from sows fed organic minerals.

Acha and Chae (2002) and Peters and Mahan (2008) also reported that feeding lower levels of organic minerals to sows resulted in heavier weaning weights of piglets compared to when higher levels of inorganic minerals were fed.

Table 1. The performance of sows and piglets fed different trace mineral sources and levels. Values with different superscript: $p<0.05$ (Bertechini et al. (2012).

	Inorganic		Organic	
	1kg/t	2kg/t	1kg/t	2kg/t
Piglets born alive	10.8^{b}	11.2^{ab}	11.9^{a}	12.2^{a}
Piglet birth weight (kg)	1.50^{b}	1.52^{b}	1.64^{a}	1.68^{a}
Piglet weight at 21 days (kg)	6.18^{b}	6.92^{b}	7.64^{a}	7.83^{a}

Ensuring colostrum quality and quantity

It is essential that newborn piglets consume an adequate amount of good quality colostrum in the first 24 hours of their lives for both survival and growth. The production of colostrum by sows, however, is variable, and the major elements that influence colostrum quality and quantity are not well-defined.

It seems that, when litter size increases, the colostrum intake per suckling piglet decreases.

The average piglet needs to consume 250g of colostrum to meet its nutrient, metabolic and endocrine needs and to optimise its immunological status. A sow will not produce more colostrum due to larger litters, however, and it has been proven that, for each extra piglet born, colostrum intake is reduced by around 35g.

Similarly, for each extra piglet born, birth weight is reduced by about 40g, which in turn will diminish vitality and suckling capacity and hence reduced colostrum intake and survivability as well as growth rate through to slaughter.

The question is: what nutritional and other strategies can be employed to enhance colostrum quality and quantity?

It is important to provide a well-balanced diet to the sow during late gestation to maximise the number of mammary secretory cells, as this influences colostrum and milk yield and hence piglet survival and weaning weight. Such diets need to be well balanced for amino acids, minerals and vitamins.

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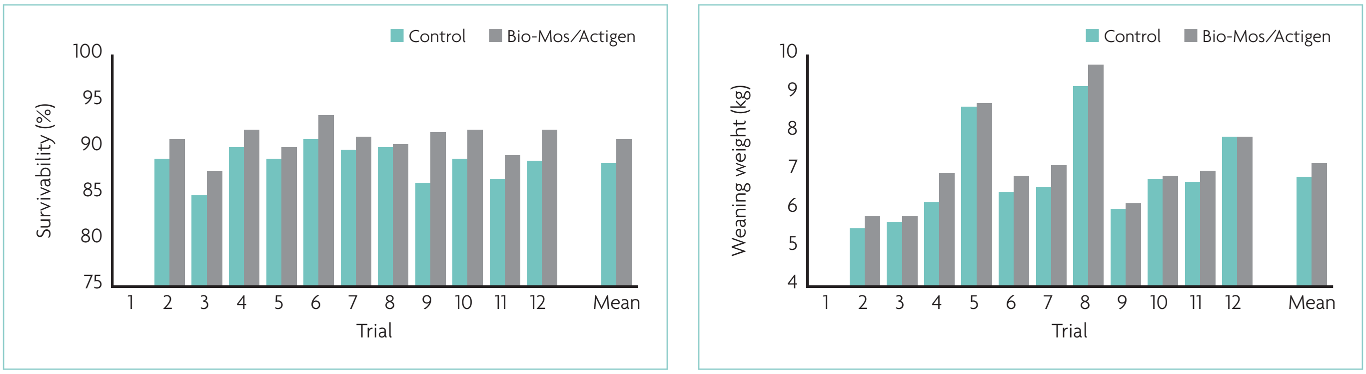

Fig. 1. Effect of Bio-Mos/Actigen on piglet survivability and weaning weight (Close & Taylor-Pickard, 2010).

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For example, threonine may be the first limiting amino acid for the production of the immunoglobin IgG, and both Se and vitamin E are critical antioxidants which have been shown to improve the Ig concentration of colostrum.

Other minerals such as Zn, Fe and Cu are also important and the inclusion of polyunsaturated fatty acids and omega-3 fatty acids (DHA and EPA) are essential. Providing a diet containing these proactive nutrients may be key.

Another important ingredient in a sow's diet is fibre. Some of the proven benefits of supplementing transitional diets with fibre include better intestinal health, reduced constipation, enhanced gut capacity, increased water intake, fewer problems at farrowing and more colostrum and milk of elevated quality.

Loisel et al. (2013) reported that increasing the fibre level of a hyperprolific sow's diet also increased the colostrum intake of low-birthweight piglets, which led to a higher rate of survival and, subsequently, improved growth performance.

Including Bio-Mos in the diet of the sow has also been shown to support colostrum quality and quantity. Le Dividich (2009) compared the performance of sows and piglets when Bio-Mos/Actigen was included in their diet during gestation and lactation.

The results of the study (presented in Table 2) show that the production of colostrum with a higher Ig content significantly increased during the first 24 hours of life, resulting in a significantly increased postnatal growth rate, higher weaning weight and piglet survivability.

These results have been confirmed in a review of 12 worldwide trials involving over 3,000 sows. One notable aspect of these studies was the consistency of the response in relation to the improvement in piglet survivability and weaning weight when Bio-Mos/Actigen was included in the diet (Fig. 1).

Mean piglet survivability was increased from 88.4 to 90.9%, equivalent to an extra 0.32 weaned piglets per litter and weaning weight was increased by 0.30kg per piglet. These resulted in significant productive and economic benefits.

Several other management techniques can also help improve colostrum intake by piglets, including exogenous colostrum, split-suckling, cross-fostering and artificial systems of rearing.

Mycotoxin management

The quality of the raw materials included in sow rations must not be compromised. Avoid using poor-quality ingredients, especially those that have been contaminated with mycotoxins, which significantly reduce sow and piglet productivity.

Mycotoxins produce a myriad of effects in sows including embryonic failure and abortions, reduced litter size, birth of weak, stillborn and splay-legged piglets, swelling and reddening of the vulva, enlarged mammary glands, rectal and vaginal prolapses, increased wean-mating interval, reduced litters per sow per year and per lifetime, reduced appetite in lactation and even complete reproductive failure.

Boar performance is also affected as boar libido is lower and the quality and quantity of sperm reduced with lower fertilisation rate. The major mycotoxins influencing sow performance are zearalenone, DON, aflatoxin and fumonisin.

The loss of productivity due to mycotoxicosis can be reduced or eliminated, however, by including an effective mycotoxin adsorbent or binding agent in the feed. Although several types of adsorbents are available, one of the most effective is the glucomannan-containing product, Mycosorb A+.

As illustrated in Table 3, Mycosorb A+ has proven effective when included in a diet containing mycotoxin-contaminated grains.

The results of that study also included increased born alive, increased litter size, improved growth rates and higher overall sow productivity. These results are consistent with field observations of supplementing the sow's diet with Mycosorb A+.

It is also essential that a proper mycotoxin monitoring and control system be implemented in both the feed mill and on farm.

The Alltech 37+ mycotoxin analysis program was developed to accurately quantify the details of more than 37 different mycotoxins in complex matrices, such as feed ingredients, complete feedstuffs, forages and bedding.

Compared to the mycotoxin guidelines and threshold levels for pigs, the risk for these 37 individual mycotoxins may be assessed and those that pose a serious threat to the health and productivity of the animals identified. An effective strategy may then be proposed to combat the problem, including the use of Mycosorb A+.

In addition to the 37+ programme, a farm audit programme, known as Alltech Pig Assist has been developed to assess whether mycotoxins are affecting on-farm performance.

This audit compares the actual performance on farm against good commercial targets and then analyses those parameters that may be limiting performance based on a scoring system according to whether they meet good commercial standards.

An overall score is established to evaluate the potential risk for mycotoxins – and if the score is above the threshold level, appropriate solutions will be suggested. Notably, the results of the on-farm audit confirm those of the 37+ analysis. Alltech 37+, combined with the Alltech Pig Assist programme, provides a more detailed and effective way to assess the mycotoxin risk not only in the feed but also within the herd.

Table 3. Effects of feeding blends of grains naturally contaminated with Fusarium mycotoxins on feed intake and performance of sows in late gestation (Diaz-Llano et al. 2006, 2007).

Gestation	Control diet	Contaminated grains	Contaminated grains + Mycosorb
Feed intake (kg/d)	2.41^{a}	2.12^{a}	2.15^{a}
Growth rate (kg/d)	1.14^{a}	0.62^{b}	0.80^{ab}
Feed : gain (kg/kg)	2.18^{a}	3.50^{b}	2.75^{ab}
Born alive (%)	90.5^{ab}	80.7^{a}	95.4^{b}
Piglets born/litter	9.8	10.0	10.8

^{a,b,c} Means within a row differ ($p<0.05$)

Conclusions

To achieve a high level of performance in modern hyper-prolific sows, it is important that their needs are met at all stages of production and some nutritional practises are highlighted.

It has been proven that organic minerals are more beneficial to animals than their inorganic counterparts and, as such, they should be included in all sow diets.

Similarly, nutritional strategies need to be developed to ensure that the sow produces a sufficient quantity of high quality colostrum so that each suckling piglet receives an adequate supply to enhance its immunity and health, and hence survival, as well as growth performance. It is also important to minimise the risks of mycotoxins and the inclusion of an effective adsorbent as well as a risk management and audit strategy is essential to overcome their adverse effects on sow productivity. ■

References are available from the author on request