Nutritional challenge of new generations of hyperprolific sows

Genetic selection has led to a steady increase in litter size over the last three decades. It seems we have reached a new critical level with the rise of the last generation of hyperprolific sows in the market coming from northern Europe, such as Topigs Norsvin 70 or Danbred breeds. We now see litters of up to 20 piglets on commercial pig farms.

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The drawback of a large litter size is lower piglet birthweight, and moreover, heterogeneous litters with a high proportion of light piglets with poor viability (<1.1kg). Building design and nutritional management should be reconsidered and special focus must be paid to nutritional feeding of the neonates.

A lot of data can be collected from pig benchmarking institutes. The purpose of this article is to pinpoint accurate figures and tendencies from the field. For that, we will analyse more deeply the data collected by a feed cooperative, Le Gouessant, directly from its farmers.

The farmers are located in the west of France, one of the major pig breeding areas in Western Europe and 70 pig facilities are monitored.

	Total piglet weaned/ sow/year	Total born (TB)	Total born alive (TBA)	TB mortality rate (%)	TBA mortality rate (%)	Weaned/ litter
2016	31.0	16.2	14.9	24.7	16.9	12.7
2017	33.8	17.5	16.2	21.4	15.0	13.8
2018	34.7	18.1	16.6	21.8	14.5	14.1
2019	36.9	18.9	17.4	20.3	13.7	15.0

Fig. 1. Field data (Danbred, France).

The best performers, designated as the Top 14, gather several genetics.

What happens in the field?

Further to this panel of farmers, after a linear trend for increasing prolificacy with big size sows, the curve has reached a relative plateau. It was associated with breeds with better traits for robustness and maternal behaviour (and medium size). The spread in the market of new lines of hyperprolific sows has been leading the number of piglets born per sow to accelerate since 2016 (Fig. 2).

The gain in prolificacy is impaired by a growing mortality rate. This preweaning mortality is better controlled by the top 14 farmers (total born alive (TBA) mortality: 13.5% for Top 14 versus 15.8% for all farmers, and total born (TB) mortality rate: 18.5% for Top 14 versus 21.5% for all farmers). It highlights the importance of the technical management of hyper prolific sows. Around 20% of the total born piglets died before weaning which remains unacceptable. Collected records of average weight at birth show a linear tendency to decrease by 30g for each extra piglet.

Despite an intensive vaccination programme, weaning-to-finish mortality increases at the same time beyond 7% after a decade at 6%. This worrying trend is in accordance with French statistics.

Furthermore, real age at weaning is decreasing. This is due to the longer gestation period that has increased from 114 to 116 days old for the new sow breeds. Thus, for the same theoretical scheduled date of weaning of sow batches, piglets are weaned two days earlier. This means 0.5kg less.

Data shows no evolution of the return-to-service intervals, and the sow cull rate remains high (42% in France).

At the same time, average feed consumption per sow and per year remains the same since 2000, at approximately 1220kg/sow/year.

What is remarkable is the capacity of these new breeds of sows to combine reproductive performance (fertility, prolificacy) and maternal investment for their litter (milk production). Nevertheless, cull rates of the sows (especially primiparous) and piglet mortality are major economic and welfare concerns. Have some physiological levels been reached?

Limits of providing colostrum

One of the major challenges is providing enough colostrum to each piglet during the first hours after birth. The minimum quantity recommended is around 200g per piglet, and 250g is suitable to achieve a good growth before weaning. Mortality before weaning is

Fig. 2. Average total born per litter (TB), total born alive (TBA) by year, recorded by Le Gouessant (Top 14 farmers).

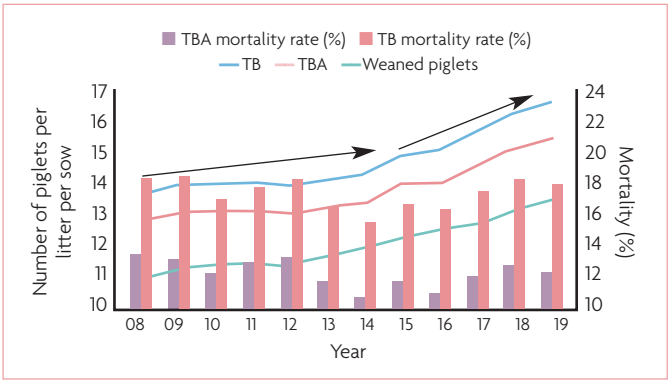
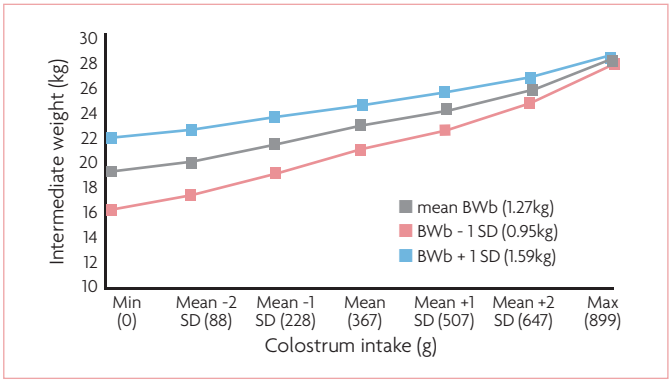


Fig. 3. Predicted intermediate weights by colostrum intake for male DanBred piglets (Herlev, Denmark) with a mean interval between birth and first suckling. The positive association between colostrum intake and weaning weight was more pronounced in low birthweight piglets as weaning weight increased more steeply with higher colostrum intake in low versus high birthweight piglets. BWb = birth weight (Declerck et al., 2016).



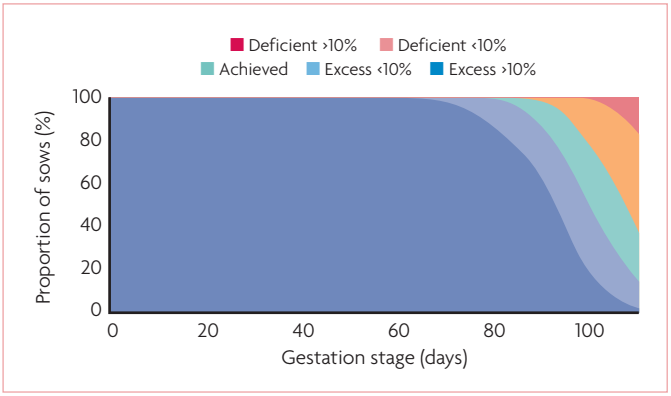


Fig. 4. Effect of one phase feeding strategy during gestation on the proportion of sows that received adequate, deficient or in excess lysine supplies (adapted from Dourmad et al., 2017).

highly correlated to colostrum intake. Functions of colostrum are to provide energy for the metabolism of the newborns, to ensure immunological protection and to develop the gut.

Unlike milk production, colostrum production does not increase with litter size or only marginally (96g per piglet). Average colostrum yield ranges 3.4-4.9kg/sow. Colostrum intake by piglet decreases by around 20g per additional piglet.

Furthermore, farrowing duration, associated with a large litter can impair the colostrum yield (-2.2g/ additional minutes of farrowing).

Another underestimated point in large litters is the number of functional teats. Before fostering, during the colostrum intake period, sow teats access can be overloaded by the littermates.

It is well established that the piglet's weight at birth and preweaning mortality are linked. Runt piglets represent the majority of preweaning mortality. Besides, light piglets need more colostrum to have a better chance of survival compared to the others (minimum of 250g/piglets, +15.4%) due to a greater surface area/BW to maintain homeothermic balance.

Even if birthweight is independent from birth order of the piglet during farrowing, the birth order is highly important for large litters. Serum IgG concentrations at two days of age are lower in late born piglets than their earlier born littermates.

Late born piglets have access to colostrum with lower IgG concentration and, maybe due to poorer vitality, suckle capacity can be impaired.

A positive correlation between birth to first suckling interval and preweaning mortality is clearly established. Some experts presume that early born piglets have access to colostrum 50% more concentrated in total protein and immunoglobulins.

Long-term effect of colostrum intake

Most piglets that die during the suckling period are characterised by low birth weight and poor colostrum intake. Nevertheless, these two parameters are better predictors for mortality occurring during the first few days than for IgG status of the piglets at two days. Hence it shows the crucial role of the colostrum by supplying energy.

The study of Declerck has established a positive association of colostrum intake on weaning, intermediate (entrance to fattening) and finishing weights (Fig. 3).

Immunoglobulins provided by the colostrum ensure better protection against non-lethal infections and health status.

Besides, colostrum and milk contain other bioactive compounds stimulating gastrointestinal maturation. Litters with piglets receiving a high quantity of colostrum will better initiate lactation and finally get better weights at weaning. Milk intake is the best stimulator of lactation.

We assume that this higher proportion of piglets coming to the nursery with poorer immunity or gut maturation accounts for the increase of the weaning-to-market mortality.

Corporal status of highly prolific sows

Keeping the reproductive sows in a good corporal status cycle after cycle is crucial. Breeds selected for prolificacy invest more in their litter (litter weight at birth, litter weight at weaning). The consequence is a poorer body condition at weaning compared to other breeds. Increase of feed intake capacity is not enough to cover the need for milk production.

Altered sow body condition impairs the reproductive ability and develops other welfare concerns such as shoulder lesions. 30% of gilts are replaced before or after the litter is weaned.

Pre farrowing feeding seems to have a relevant importance for the farrowing duration and colostrum quality. Dietary fatty acids composition or compounds affecting the gut microbiome and state of constipation have been studied for their effect on colostrum.

Management of backfat thickness through gestating feeding programmes can act on farrowing duration and colostrum yield.

Building management has to be reconsidered

Standard farrowing crates tend to be too small for large litters. New designs of welfare farrowing pens lead to a better expression of sows' maternal behaviour and access to the udder.

To compensate for inadequate production of colostrum or milk in the first days, automation of liquid feeders has to be considered as well.

In the case of the number of teats available exceeding the number of piglets, a new practice of choosing foster sows is emerging. Instead of going back to the next breeding group, a sow is chosen to stay in the farrowing pen for another milking cycle for the foster piglets. This has serious disadvantages.

Another widespread practice is to select sows known for their high maternal capacity and offer them extra piglets. A rotation of suckling sequences will occur. Since 2012, double nursing strategies have been challenged in the Netherlands.

In this design, lactating sows feed the equivalent of two average litters at the same time and have currently reared up to 28 piglets successfully. On average 15% of the Danish sows are used as nursed sows for extra litters.

Feeding sows and feeding the foetus

Gestation feeding aims to restore sows in a good body condition and to cover the needs for foetal growth. To fix this equation, farmers turn to two or three types of diets during pregnancy.

Diets are formulated according to different lysine/energy ratios. Depending on the physiological stage, daily feed allowance ranges from 2.5 to 3.5kg (U pattern: 3.5/2.5/ 3.0/3.5 kg/day).

The first diet for the first month focuses on rebuilding the sows' protein and fat reserves, favouring fecundation, ovum implantation and utero-placental growth. Oxidative status of the sows is critical during this period.

The second diet targets amino acids increasing demands of the foetus and quality of the microbiome. It aims to achieve a perfect body condition of the sows at farrowing (without excess of fat), a very good transit and a high feed intake capacity. As mentioned previously, these parameters sustain a good colostrum. This necessity to feed the sows more precisely is illustrated in Fig. 4.

A lactation diet should start as soon as the sows enter the farrowing rooms, for the week before farrowing. If sows show constipation issues, a common way is to prolong use of the gestating diet up to three days after farrowing. Requirements for foetal growth is so high in the last days prior to farrowing that nutritional concentration of a lactating diet has to be favoured.

An alternative to ensure better transition is to consider a peripartum diet (-7 days up to +3 days after farrowing). This diet can be upgraded by hepatoprotectors agents, antioxidants and stimulants of blood flows for piglet vitality at birth.

Regarding records of pig data in France over the last two decades, we do not see any increase of average quantity of feed per sow per year.

Over 30 years, Etienne in 2000, estimated that milking production has doubled. It highlights the importance of nutritional density of the lactating diets.

Fig. 5 illustrates the evolution of the concentration of SID Lysine (and other AA balanced to this reference)

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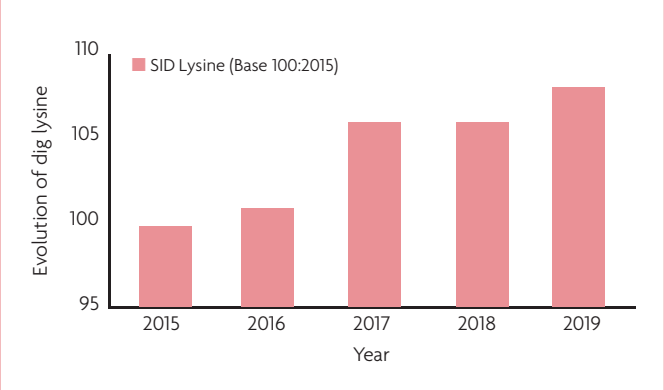
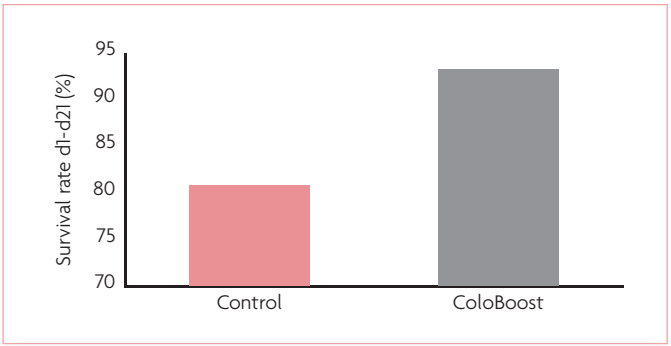
Fig. 5. Evolution of digestible lysine in the highly prolific lactating diet.





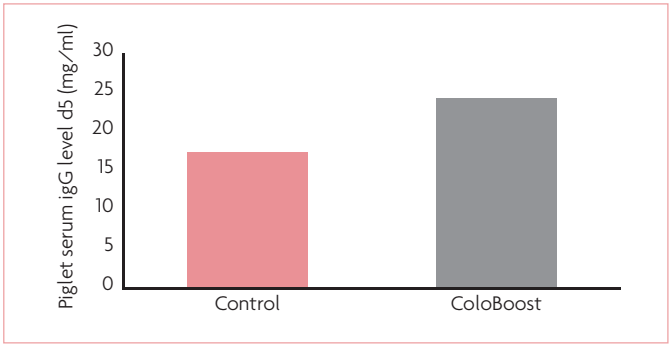


Fig. 6. Effect of a colostrum supplement administration (2x5ml of ColoBoost) on newborn piglets <1.35kg BW survival (adapted from Muns et al., 2017).

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in the commercial lactating diet used by the Top 14 farmers.

Oral supplementation

As shown, hyperprolific sows can produce more liveborn piglets than they can suckle. Large litters are associated with long farrowing duration and lower immunoglobulin content in the colostrum for the last born piglets.

Farmer assistance to newborn piglets is necessary to avoid high mortality: for example help at birth, and split suckling technique. Other care consists of providing oral administration of nutraceuticals in order to save piglets and to get better uniformity at weaning. Two types of oral nutraceuticals can be provided to piglets just after birth.

For last born piglets, litters with more piglets than functional teats or long farrowing, we advise using a colostrum supplement (Fig. 6).

For light piglets or weak piglets, an energy supplement is recommended (Fig. 7).

Conclusion

Optimisation of new generations of hyperprolific sows from northern Europe breeds is not fully achieved in the field. It seems we have reached the maximum of some physiological levels. Updated scientific data and models have to be further implemented. It brings us back to farming management to counteract the lack of robustness of sows and their piglets.

Nutritional interventions in the farrowing period are valuable tools.

To compensate for light piglets and lack of colostrum intake (in quantity or quality), oral supplementation of nutraceuticals should be considered. ■

References are available from the authors on request

Fig. 7. Effect of an energy booster administration (2x2ml of PiggyBoost) on mortality of newborn piglets until weaning (Peltoniemi et al., 2004; Ramírez, 2005).