*Review Article*

# Management strategies for improving survival of piglets from hyperprolific sows

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### *Abstract*

In efforts to improve profitability, sows have been subject to ongoing selection for larger litters. The current dogma is that larger litters improve sow productivity. This review, however, will question the validity of this assumption. It is inescapable that very large litters will have longer farrowing durations, lower average and more variable birth weights, and the sows will have insufficient teats available to feed their piglets. This is a recipe for increased piglet mortality with associated ethical considerations. This review will examine methods employed to address these challenges posed by larger litters in order to improve piglet survival. Producers, however, need a paradigm shift; their objective is not to produce pigs but rather to market kilograms of pork, and one does not necessarily lead to the other.

**Keywords:** Hyperprolific sows, nutrition, birth weight, litter size, pre-weaning mortality

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Received July 30, 2021
Accepted August 29, 2021
https://doi.org/10.14456/tjvm.2021.76

## Introduction

A primary objective of pig production is to cost effectively market the maximum weight of pork in the shortest possible time. Achieving this requires high pre- and post-weaning growth rates and minimal mortality, which in turn is dependent on the live birth of the optimum number of high viability piglets. Clearly, the ability to market the maximum weight of pork rests on sow farrowing performance. In terms of sow management, however, it would be a mistake to focus solely on farrowing per se as the sow's farrowing and lactation performance are the result of her management throughout gestation, particularly during the last two weeks before and the first week after farrowing. This review will discuss strategies for improving piglet pre- and post-natal growth and survival. Issues surrounding the large litters of hyperprolific sows include the effects of intrauterine crowding causing birth weight variation, piglet hypoxia during delivery, and litter mate competition post-partum. We will examine potential management strategies for improving survival in large litters, including effective piglet fostering techniques. Altering sow environments to reduce stress can also be effective, but this topic will not be addressed due to difficulties of implementation in most current sow confinement systems.

## Transition period

Final preparation of sows for farrowing and subsequent lactation is largely the function of the last 7 to 10 d of gestation and the first 5 to 7 d of lactation, which in common with dairy cattle is termed the transition period. Nutritional management during transition is the final opportunity to influence farrowing performance, lactation feed intake, and milk yield. Established dogma is that overfeeding sows throughout gestation will reduce their feed intake in lactation, although it is more likely that overfeeding produces fat sows, and it is fat sows that suffer a reduced lactation feed intake. More recently, it has been observed that increased sow feed intake in the transition period (the last 7 d of gestation) increased sow (but not gilt) lactation feed intake and piglet weaning weights (Langendijk and Fleuren 2018; Table 1). These observations have been confirmed more recently (Gourley *et al*. 2020), with sows fed ad libitum during the 2 or 3 d prior to farrowing demonstrating improved sow weight and backfat depth maintenance and increased piglet weaning weights. Regardless, there might be some concern about high pre-partum feed intakes and the occurrence of constipation. If sows become constipated in the immediate pre-partum period, it may impede piglet delivery and so increase farrowing duration (Oliviero *et al*. 2019). Additionally, due to a longer gut transit time, constipation can result in increased absorption of lipopolysaccharide (endotoxins from Gram negative cell walls) which would likely have a negative impact on prolactin and so increase the incidence of lactation insufficiency (Martineau *et al*. 1992). During hotter months, the effect of lipopolysaccharide could be exacerbated due to heat-induced "leaky gut" allowing for easier toxin absorption. As shown in Table 2, to protect against constipation the transition diet should contain up to 7% fibre (Oliviero *et al*. 2009). Interestingly, conventional transition strategies will drop feed allowance prior to farrowing in an attempt to avoid constipation. If, for example, feed allowance is reduced from 3.5 kg/d to 2 kg/d, and the gestation diet with 8% crude fibre is replaced by a lactation diet with 5% crude fibre, the combined result of these measures is that the intake of crude fibre is reduced from 280 g/d to 100 g/d, a threefold reduction in a period where increased fibre intake should be the aim. To further reduce the risk of constipation, sows must have access to adequate amounts of water and a cool farrowing area. Defecation should be monitored as it has been noted that sows may not defecate for up to 4 d post-farrowing. Constipation results in discomfort or pain, a loss of appetite, reduced total lactation feed intake, reduced sow weaning weight and increased wean-to-service interval, reducing breeding performance. Constipation is a serious problem often ignored in pig production (Carr *et al*. 2018).

In addition to increased dietary fibre, consideration should also be given to dietary calcium content during the transition period. It is evident that stillbirth rates increase in older sows, especially from parity 5 through 7. The aetiology of this parity effect is uncertain, but it is reasonable to assume that less effective uterine contractions result in longer farrowing durations with the associated increased risk of stillbirth. Indeed, recent observations show that in sows with at least one stillborn piglet, free calcium levels in the circulation dropped significantly in the last 10 h before farrowing started, whilst in sows with no stillborns this drop was not observed (unpublished results). Further, if the circulating calcium activity is relatively low, an adverse effect on subsequent lactation may also occur. Clinically, the potential hypocalcaemia can be treated by intramuscular injection of 15 mL (gilts) or 20 mL (sows) calcium gluconate if sows have poor uterine tone on palpation or, at the end of the day, have a milk stream and a history of > 1 stillbirth in previous litters. Alternatively, in the dairy industry, the problem of inadequate peripartum calcium mobilisation is addressed nutritionally by feeding negative dietary cation-anion difference (DCAD) diets; (mEq $K^+$ plus mEq $Na^+$) – (mEq $Cl^-$ plus mEq $S^{2-}$). These diets induce a compensated acidaemia resulting in increased parathyroid sensitivity, in turn causing increased renal calcium resorption and activation of vitamin D, which then improves calcium mobilisation (Constable *et al*. 2017). Further, these diets increase intestinal calcium absorption from 65% to 90% and repartitions the calcium to where it is needed, such as the mammary glands.

It seems reasonable to assume that the above will hold true for sows where a reduced DCAD in transition diets by formulating on the balance of Na, K, Cl, and S, would support calcium homeostasis of the sow. How much the DCAD needs to be reduced to be effective still needs to be established. In analogy to dairy transition strategies, it may be questioned whether periparturient sows should be supplemented or whether they are oversupplied with calcium in the transition period. Requirements for calcium to cover endogenous (faecal and urinary) losses, maternal accretion, and growth of a litter with 16 piglets, amount to 11 g/d of digestible calcium (Bikker and Blok 2017). At an intake of 3 kg/d of a lactation diet with 9 g/kg total calcium, the sow would only need to absorb 40% of her dietary intake. Considering that in reality calcium absorption is generally higher, the transition sow is probably over-supplied with calcium, and the effect of that may be that active absorption of calcium by the sow is not triggered. When calcium requirements increase around farrowing due to colostrum secretion and increased uterine contractions, intestinal absorption may suddenly be inadequate, resulting in a drop in circulating calcium.

**Table 1** Ad lib vs conventional feeding in late gestation on sow performance

| | Primiparous sows | | Multiparous sows | |
|---|---|---|---|---|
| | **Ad lib (n=17)** | **Conventional (n=16)** | **Ad lib (n=23)** | **Conventional (n=25)** |
| Birth wt, g | 1305 ± 52 | 1335 ± 49 | 1381 ± 47 | 1406 ± 48 |
| Litter size | 12.9 ± 0.4 | 12.9 ± 0.4 | 14.8 ± 0.6 | 15.0 ± 0.6 |
| Wean age, d | 24 ± 0.5 | 24 ± 0.4 | 25 ± 0.4 | 25 ± 0.4 |
| Pigs weaned | 11.6 ± 0.3 | 12.0 ± 0.3 | 12.7 ± 0.3 | 12.8 ± 0.4 |
| Wean wt, kg | 6.27 ± 0.19 | 6.52 ± 0.2 | 7.62 ± 0.21[a] | 7.1 ± 0.14[b] |
| ADG to wean, g/d* | 208 ± 7 | 218 ± 8 | 247 ± 6[a] | 231 ± 4[b] |
| Litter wean wt, kg* | 73.3 ± 2.5 | 75.9 ± 2.6 | 97.0 ± 2.3[a] | 90.2 ± 2.2[b] |
| Lactation ADFI, kg/d** | 5.3 ± 0.2 | 5.6 ± 0.2 | 7.3 ± 0.3[c] | 6.8 ± 0.1[d] |
| Sow wt loss, kg | 16.7 ± 3.0 | 17.5 ± 3.4 | 17.6 ± 3.2 | 17.6 ± 2.6 |

*Piglet average daily weight gain to weaning and litter weaning weight corrected for litter size
**Sow lactation average daily fed intake
Means with different superscripts differ, ab ($P$<0.05), cd ($P$<0.1)
From Langendijk and Fleuren (2018)

**Table 2** Influence of dietary fibre content and percent incidence and severity of constipation in peripartum sows (± 5 d)

| | **None (0 d)** | **Mild (2 d)** | **Severe (3 – 4 d)** | **Very severe (> 4 d)** |
|---|---|---|---|---|
| Low fibre | 14.4 | 22 | 41.5 | 22 |
| High fibre | 33.3 | 38.5 | 23.1 | 5.1 |

From Oliviero *et al*. (2009)

## *Impact of intrauterine crowding*

Genetic selection has resulted in conception of larger litters causing uterine capacity and blood supply to be limiting resources. In larger litters, when intrauterine crowding occurs, embryos first to attach can physically restrict the development of later attaching embryos (van der Waaij *et al*. 2010). Additionally, once the uterus has surpassed normal limits of uterine space, each additional embryo is associated with a reduction in individual fetal growth (Wolf *et al*. 2008; Lund *et al*. 2002) and larger litters are strongly correlated with a proportion of piglets being born underweight (<1.0 kg) (Schmitt *et al*. 2019; Madsen and Bee 2015). Indeed, Quiniou *et al*. (2002) documented that for litters of less than 11 and more than 16, respectively, mean piglet birthweights were 1.59 and 1.26 kg with the percent born < 1 kg being 7 and 23%, respectively (Table 3). Further, for pigs born < 1.0 kg, 11% were stillborn and a further 17% were dead by 24 h. Piglets having a low birthweight have a larger surface area to volume ratio and so are more susceptible to hypothermia, hypoglycemia and reduced vigor within the first 24 h of life (Baxter *et al*. 2008). Thus, low birthweight pigs have an increased risk of pre-weaning mortality compared to normal weight pigs. Variability within a litter makes it more difficult for low birthweight pigs to compete for a teat and ingest an adequate amount of colostrum. In addition, larger pigs compete indirectly with smaller pigs by draining and then having more milk directed to their respective teats (Orihuela and Solano 1995). This indirect competition between littermates may explain why differences in birthweights are often maintained, or even increased, during lactation (Skorput *et al*. 2018) with these effects being exacerbated in large litters. Due to the long farrowing process with large litters, the piglets born in the second half of the farrowing process have a higher risk of developing hypoxia which affects their vigor at birth resulting in lower intakes from the pool of colostrum which is already reduced by the time they are born, with associated consequences of an inadequate colostrum intake (Langendijk *et al*. 2018).

**Table 3** Effects of litter size on piglet birth characteristics

| | | | | |
|---|---|---|---|---|
| Litter size class | ≤ 11 | 12 – 13 | 14 – 15 | ≥ 16 |
| Mean litter size | 9 | 12.5 | 14.4 | 17 |
| No. litters | 324 | 262 | 230 | 149 |
| Mean birth wt, kg | 1.59[a] | 1.48[b] | 1.37[c] | 1.26[d] |
| Birth wt variation* | 0.26[a] | 0.27[ab] | 0.28[b] | 0.30[c] |
| Pigs < 1.0 kg, % | 7[a] | 9[a] | 14[b] | 23[c] |

Calculated as the mean SD of each litter within class
Means with different superscripts differ, $P$ < 0.001
From Quiniou *et al*. (2002)

## Farrowing duration

Once nutritional strategies to ensure sows are not too fat at farrowing (aim for 18 mm P2 in Large White and Landrace sows) have been implemented and they have been fed and housed during transition to minimise constipation and enable an appropriate calcium mobilisation, attention can be directed to the farrowing process. During the last decades, selection for hyperprolific sows and their larger litter sizes has resulted in a 'normal' farrowing duration increasing from a maximum of 5 h to an average of more than 5 h, meaning more than 50% of sows are possibly suffering an overly prolonged farrowing duration (Bjorkman and Grahofer 2020). These longer farrowing durations associated with larger litters can adversely affect sow health (Bjorkman *et al*. 2017) but of more immediate concern is the higher numbers of stillborn piglets and the delivery of live pigs having lower birthweights, increased numbers of lower viability piglets, and increased birthweight variation. Together, the result is an increased preweaning mortality. An increased farrowing duration would also involve an increased metabolic energy requirement. Interestingly, it was recently documented that if the interval from last feeding to onset of farrowing was 3 h or less, arterial glucose concentrations were higher and the farrowing duration and the odds for farrowing assistance or stillbirths were lower (Feyera *et al*. 2018); the challenge is achieving this in practice.

## Farrowing induction and management

An expedited delivery process should result from appropriate transition management but, if not, consider farrowing induction. If successfully induced, the ability to supervise piglet delivery with increased opportunities to intervene as needed can save piglets (Holyoake *et al*. 1995). During piglet delivery, myometrial contractions temporarily restrict blood flow to the unborn piglets, which is not a problem in the short-term. However, with prolonged farrowing, the repeated restrictions of utero-placental blood flow result in significant fetal hypoxia and increased risk of stillbirth. If supervised, a prolonged farrowing can be accelerated by injection of oxytocin (2.5 to 5.0 IU into the vulva). Induction also potentially increases the risk of further reducing birth weights so the economic and welfare cost/benefit must be considered.

Whilst control of farrowing time can improve the ability to supervise, over-management of the farrowing process should also be avoided. In some anecdotal cases, a high level of intervention during the farrowing process, in the form of manual exploration and/or injection of oxytocin, increased the percentage stillborn. In one example of a sow herd with 20 total born piglets (n=192), sows that farrowed overnight, and therefore received no assistance, had 12.5% stillborn as opposed to sows farrowing in the daytime of which 40% received assistance and had 14.5% stillborn (unpublished results). In another example of a herd with 19.9 total born (n=228), stillbirth rate decreased from 14.6% to 11.7% when application of assistance during farrowing and oxytocin were systematically reduced. Most intervention protocols are based on the assumption that if the interval between two successive piglets is extended beyond a certain threshold, the risk of stillbirth increases and therefore assistance should be provided. However, as shown in Table 4, the total time that a sows has been farrowing is much more of a determinant for the risk of a piglet to be stillborn than the time between piglets (Langendijk *et al*. 2021). The percentage stillborn only increased when a piglet was born >90 min since the previous one and this represented only 6% of the population. The risk of stillbirth, however, increased with every 30 min that elapsed since the sow started farrowing. This makes sense when it is the cumulative time of the farrowing process, and cumulative effect of contractions that result in insufficient oxygenation and asphyxia of the foetuses (Langendijk *et al*., 2018). After all, the majority of stillbirths occur in the latter part of the farrowing process and, therefore, injecting oxytocin early in the farrowing process is unnecessary and it should not be administered unless a need for it has been determined.

Of immediate and vital concern, regardless of litter size and birthweight, is colostrum management. This is one argument supporting the use of induction. At farrowing, the amount of colostrum available to the litter is fixed and does not increase with litter size. Due to competition, some pigs may consume less than the minimum 250 g needed for good performance (Ferrari *et al*. 2014), and others may consume an adequate quantity but of poorer quality colostrum due to being born late in the birth order. Overall, there is a positive correlation between birth weight and colostrum intake (Declerck *et al*. 2016). The decreasing quality of colostrum post-partum is due, at least in part, to the closure of mammary cell tight junctions preventing the transfer of macromolecules (e.g., immunoglobulins, growth factors and hormones) into colostrum/milk. Interestingly, injection of oxytocin (75 IU) 12 to 20 h after birth of the last pig prolonged the duration of the leakiness of mammary tight junctions, improving the quality of early milk and, potentially, the immune status of the neonatal piglets (Farmer *et al*. 2017). Implications for sow mammary health, however, remain unknown. Piglets should consume colostrum from their birth sow for optimal passive immunity. Therefore, with large litters, especially if the number of piglets exceeds the number of functional teats, split suckling is necessary to achieve a more even distribution of available colostrum.

**Table 4** Risk of stillborn in relation to interval between two piglets (upper part) or to cumulative farrowing time (lower part) in 3924 farrowed piglets.

| | **Time since previous piglet** | | | | |
|---|---|---|---|---|---|
| | **0 - 30 min** | **30 - 60 min** | **60 – 90 min** | | **>90 min** |
| n | 2978 | 539 | 162 | | 245 |
| % stillborn | 5.6 % | 6.8 % | 7.4 % | | 18 %* |
| | **Cumulative farrowing time, time since first piglet** | | | | |
| | **<2 h** | **2 to 4 h** | **4 to 6 h** | **6 to 8 h** | **>8 h** |
| N | 1827 | 1226 | 535 | 164 | 172 |
| % stillborn | 2.7 % | 6.9 %* | 10.7 %* | 13.4 %* | 27.3 %* |

*significantly different from first value

## *Colostrum management*

It cannot be emphasised enough that adequate colostrum intake is vital for piglet survival and growth and must be achieved before consideration of cross fostering. The minimum of 250 g mentioned above is indeed critical for survival and, in addition, intake of colostrum by individual piglets or by the litter is related to growth during lactation (Devillers *et al*., 2011) and after weaning (Declerck *et al*. 2016), indicating that factors in colostrum impact on neonatal development and subsequent performance. To illustrate this, in a recent study we compared the gain of piglets with birth weight around 1000 g and an intake of colostrum below 250 g, with litter mates of the same birth weight and colostrum intake >250 g. The piglets with insufficient colostrum intake were 1 kg lighter at weaning (unpublished results). Therefore, ensuring sufficient colostrum intake may not only improve survival, but also reduce variation between piglets in weaning weight.

Optimal colostrum intake can be achieved by improving distribution of the available colostrum among the litter and by optimising colostrum production by the sow. Gilts generally produce less colostrum than do multiparous sows and, therefore, their litters may need more attention than older sows. Colostrum production in a herd may vary between 1.5 and 6 kg and it was estimated that one-third of sows may not produce sufficient colostrum to provide the 250 g per piglet needed to maximise survival (Quesnel *et al*., 2012). One way to increase colostrum production is by increasing feed allowance, or even feeding sows ad libitum, in the transition period. Assuming adequate dietary fiber content, this may relieve constipation and reduce endotoxaemia, reducing the risk of developing dysgalactia. It has been demonstrated that sows fed 3 x 1.5 kg/d during the last week of pregnancy produced 4.0 kg colostrum whilst the control sows that were fed only 1.5 kg/d produced 3.5 kg colostrum (DeCaluwe *et al*. 2014). In the same study, fat sows (>23 mm back fat) produced 0.9 kg less colostrum than sows in optimal condition, again emphasising the importance of condition management during gestation. A high feed intake during the transition period may also reduce progesterone in the circulation by increased hepatic clearance, and allow an increased prolactin production approaching farrowing.

Various protocols to optimize colostrum intake are available. Piglets can be collected at delivery, dried and put into a creche at about 34$^o$C. After 2 h or 7 pigs have been delivered, place them on the sow for a 2 h suckling period (group 1). Further pig deliveries are placed in the creche (group 2) and after a further 2 h the groups are swapped, and group 2 is given 2 h of teat access. Piglets born after 4 h (group 3) are allowed 45 min of teat access after group 2. Then, group 1 gets 45 min access then groups 2 and 3 combined get 45 min access; then allow all pigs free access. If further intervention is practiced, remove only the largest pigs for 1 or 2 hours to give the smaller pigs an added advantage. If there is a parity 1 (gilt) and a multiparous sow farrowing at the same time, collect the multiparous sow's piglets, dry them, place in a creche for 1 h, and place the entire gilt litter on the sow for the hour and then replace them with their mother. Clearly, the above requires farrowing to be supervised which, if 24 h supervision is not employed, militates in favour of induction. A compromise that will provide some benefit is, immediately after feeding the sows, the biggest pigs in litters born overnight are placed in a creche for 2 h to allow the smaller littermates better access to the remaining colostrum. Indeed, the primary purpose of split suckling, especially of large litters, is to improve the performance of the smaller pigs (Huser *et al*. 2015). Hyperprolific sows have larger litters with lower birth weights and greater birth weight variation. As birthweight variation increases, piglet survival decreases, and this is particularly evident in litters having the greatest birthweight variation (Milligan *et al*. 2002).

## *Cross fostering*

As with neonates of any species, a piglet is best left with its' birth sow, but cross fostering of piglets is indicated when the litter size exceeds the number of functional teats. When performed, target to cross-foster between 12 and 24 h post-partum. This timing accounts for the up to 12 h for passive cellular immunity to transfer as piglets only absorb immune cells from their own mothers (Bandrick *et al*. 2011). If deemed necessary to cross-foster piglets prior to 12 h, appropriate consideration is needed of colostrum quality and piglet ability to absorb immunoglobulins. Colostrum immunoglobulin content, and piglet capacity for intestinal macromolecule absorption, decrease rapidly after first suckle. Nowadays, with the very large litters being delivered, cross fostering simply to even up litter sizes is usually not an option and the supernumerary piglets will require the creation of nurse sows.

## *Nurse sows*

Hyperprolific sows often require the farm to provide nurse sows to compensate for the shortfall in available teats for the extra piglets produced. Three options for creating nurse sows are the simple nurse sows, bump fostering nurse sows, and double suckling nurse sows. For an example of a simple nurse sow, in one study the litter of a primiparous sow was weaned at 3 wk of age and the same number of 7-d old piglets, subjectively assessed to be small for age, were fostered onto her for a further 2 wk of lactation (Hidalgo *et al*. 2014). The advantage of this was a reduction in within litter competition and access to a foster sow with a greater milk yield (21 d of lactation) than their own sow (7 d of lactation) and a 2-pig increase in the subsequent litter size for the sow, presumably due to a longer lactation but with reduced metabolic demands (Hidalgo *et al*. 2014). The disadvantages, however, were that the age variation in the weaning group was increased potentially destabilizing nursery health, the nurse sow's farrowing crate was not available for a new litter for an additional 2 wk, and the sows were not bred until after the second litter was weaned. This has the potential to interfere with appropriate pig flow. Litter weight gains were not recorded, but a slower growth rate in pigs moved and mixed at greater than 24 to 48 h of age is likely. Bump weaning involves the weaning of a litter at (eg.,) 3 wk and replaced with another entire litter of 5 to 7 d old pigs; she becomes nurse sow 1. The sows donating these pigs are then used as a nurse sow (nurse sow 2) for supernumerary piglets from large litters at 24 to 48 h of age. Again, the use of nurse sow 1 takes her out of piglet production for an extended period, interfering with the pig flow. The last option is double nursing, whereby sows nurse two litters simultaneously from 24 h after farrowing to weaning (Houben *et al*. 2017). This requires the making of a heated creep area (crèche) in front of the sow, with access to milk replacer in a feeding trough. At approximately 12 h, the nursing and the creched litters are switched. Intuitively, there was an expectation of reduced sow fertility, which proved to be limited with a reduction in subsequent total born litter size of about one pig. Although not insignificant, it should be remembered that relatively few sows will double nurse and so the herd impact would be very small but access to milk replacer to minimize any adverse litter growth effects is required (Kobek-Kjeldager *et al*. 2020). When considering large litter sizes (eg., average 16 born alive) and the use of nurse sows, with the need to limit suckled litter size to an average of, say, 13, then there may be 20% of crates housing nurse sows. Even if we assume zero preweaning mortality, for every 5 crates the number of pigs weaned per crate will not be 16 but instead 12.8. If the aim is to achieve a target of 12 pigs weaned per farrowing place, a farm with 100 farrowing places (ie. 20 sows/wk, about 450 sow unit) will need 14.5 pigs born per sow. However, if we set aside, say, two farrowing places to provide for nurse sows, then the hyperprolific sow will need to deliver 18.5 pigs to achieve the same weaning result. It is expected that the hyperprolific sow will produce more total pigs at birth but, with more pigs at birth, the born dead (stillborn, mummified and none-viable piglets) increases from, say, 7 to 10% and, further, an increase in pre-weaning morality from, say, 10 to 14% (or more) will become evident. These numbers can be quite distressing to the stockpeople having to cope with the increase in piglet numbers.

## *Stockmanship*

The power of good stockmanship to reduce perinatal mortality should not be underestimated. Practical changes to pig management to improve availability of expert personnel can also be encouraged. Many farms wean on a Thursday to allow breeding on Monday and Tuesday. The result is farrowing on Friday through Sunday when staffing levels are lowest and so encourages the use of induction agents, potentially reducing gestation length and piglet birthweights. If weaning is on a Sunday or Monday, breeding now occurs on Thursday and Friday allowing for farrowing to occur midweek when staffing levels and expertise are maximised. The reduced use of induction agents results in increased birthweights (Carr and Smith 2012). Further, at 48 h after weaning when recognition of poor doing pigs is most easily achieved, staffing levels in the nursery can also be maximised. With hyperprolific sows, the need for good stockmanship extends beyond the farrowing house. The farrowing house team may do an excellent job in producing live weaners, but these weaners are likely to be 1 kg lighter than target. The nursery and finishing team then have to work extremely hard to keep the performance of these animals within acceptable targets. However, it has to be expected that post-weaning mortality will rise from 5 to 7%, the smaller pigs will grow slower (an extra week to finish) and the killing out percent is likely to decline with the slower growth rates, from, say, 78 to 76%. Taken together, we suggest that while hyperprolific sows may provide more pigs for market, it would be optimistic to assume that the weight of pork marketed will similarly increase.

## *Summary*

In summary, breeding companies have successfully produced hyperprolific sows each capable of delivering more than 30 pigs per year. Associated with production of large litters are reduced average birth weights, increased birth weight variation, and a level of preweaning mortality incompatible with acceptable pig welfare. Further, the post-weaning performance of these weight-compromised pigs is likely to result in an increased days-to-market. Interestingly, the Netherlands is now actively attempting to reduce litter sizes in order to reduce piglet mortality. The positive association between increases in litter sizes and pre-weaning mortality can result in an optimal litter size beyond which further increases result in minimal improvements in numbers weaned (Walgren and Rudstedt 2012). Some words of wisdom from a Smithfield's sow farm manager, "I don't want litters of 16 pigs, just give me 12 I can keep alive". When considering the purchase of genetics, remember that the genetic supplier is selling you numbers of gilts but you are selling kilograms of pork, and they are not the same.

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