NEW APPROACHES TO WEANER ROOM MANAGEMENT

John Pluske
School of Veterinary and Biomedical Sciences
Murdoch University
Murdoch WA 6150, Australia
E-mail: J.Pluske@murdoch.edu.au

ABSTRACT

Weaner room management encompasses the physical aspects of the nursery such as the correct temperature and lighting, the correct management of water and feeders, correct feeding strategies, an appropriate duty of care for sick and poor-performing piglets, and the filling and emptying of the nursery space. Incumbent should be an understanding of the growth and biology of the young pig and the effects of factors such as group size and stocking rate. Nurseries differ in many of these factors, but the unifying principle of most nurseries is the need to hit a mean target weight in an assigned time whilst minimising mortality and morbidity. This applies equally to wean-to-finish nurseries and nursery-only operations. This paper discusses several aspects of weaner room management in light of these principles.

INTRODUCTION

Charbonneau (2005) provided an excellent review concerning the treatment and management of poor-doing pigs at last year's conference. Of interest in the nursery are possible reasons why pigs perform variably in the period after weaning, and inherent in understanding this is nursery room management. However, a breakdown of which pigs perform best after weaning shows that not all pigs are equal, and that weight at weaning is not the sole predictor of subsequent performance. This paper discusses some particular factors that can influence post-weaning management and performance.

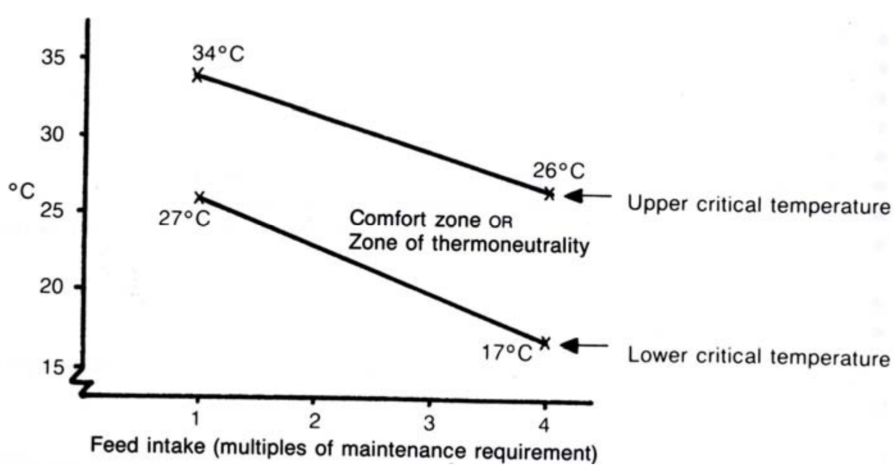
THE CORRECT ENVIRONMENT

A major cause of post-weaning trauma and a contributor to variation in weight gain is a poor environment. Dritz (2004) and Charbonneau (2005) have described the key elements associated with a sound nursery room for entry of pigs. Attention needs to be paid to factors such as ventilation, lighting, humidity, sanitation, space and flooring, the creation of a suitable microenvironment (if needed), water flow/quality, and feeders. Having done this, the next task is to ensure that the room is functioning efficiently, and temperature management is critical in this.

Temperature and Feed Intake

A key inspection aim in the nursery should be assessment of piglet behaviour, not the thermostat outputs, because observing the pigs will often provide clues as to whether a problem exists. In the post-weaning period where voluntary feed intake is low and often insufficient to meet the pigs' maintenance requirements, the temperature of the room can have a profound influence on the efficiency of growth and development, the incidence and severity of disease, and immune function (reviewed by Madec et al., 2003). The lower critical temperature (LCT) is defined as the ambient temperature at which, for a given energy intake, energy retention is maximal. The LCT corresponds to the 'optimum' temperature at weaning in as much as the main goal is to minimize heat loss to avoid excessive loss of body lipid, thereby minimizing the decrease in thermal insulation (Madec et al., 2003). The combination of low energy intake and a reduced body thermal insulation at weaning causes a temporary increase in the LCT (at pig level) from 22-23º C at weaning to 26-28º C in the first week after weaning (Le Dividich et al., 1980). Moreover, and as Figure 1 demonstrates, the LCT of pigs kept in groups of 10 and at maintenance feed intake is approximately 27° C, and can go as high as an upper critical temperature (UCT) of 34° C before problems may occur. Pigs eating more feed, or multiples of maintenance of feed (energy), have a reduced LCT, so that stimulating higher levels of feed intake after weaning is an obvious means to reduce the temperature requirement for newly-weaned pigs and save heating costs, eg, less days using heat lamps. I am unaware of any research investigating the LCT of weanling pigs kept in pens of 30-50, however it is probable that there would be little or no reduction in the LCT because pigs can huddle equally as effectively, thus minimizing the surface area from which heat can be lost. Comfort can be assessed quickly and easily by the rule-of-thumb that half the pigs should be sitting up and the other half lying on their sides (Charbonneau, 2005).

Figure 1. Upper and lower critical temperatures of pigs weighing 5 kg kept in groups of 10 on mesh flooring and on different levels of feed/energy intake (Bruce, 1982; cited by English et al., 1988).



It is essential, therefore, that pigs are maintained in their zone of thermal comfort so that absorbed nutrients are used for body growth and not thermogenesis, although anecdotally I have heard that some producers deliberately lower night time temperature of nursery rooms to stimulate pigs to eat, once the stress associated with weaning has abated. There is some research to support this notion because there is a circadian rhythm in metabolic rate that is lower during the night (Madec et al., 2003), and Shelton and Brumm (1988) showed that a 4-9° C reduction in nocturnal temperature does not negatively impact upon pig performance but markedly decreases heating costs (Table 1). Data from Kurihara et al. (1996) suggests that a fluctuation of ± 3° C around the mean daily temperature does not impact upon performance after weaning. Collin et al. (2001) modelled the effects of a high, constant temperature on food intake in young growing pigs and reported that during the overall post-weaning period, food intake starts to decline markedly at ambient temperatures higher than 25º C. This underscores the importance of reducing nursery room temperatures once pigs start to consume 2-3 times their maintenance energy requirement, which is generally achieved after the second week post-weaning. Monitoring the prevailing nursery ambient temperature at pig level after the first couple of weeks should be included as part of routine management in nurseries.

Table 1. Effect of reduced nocturnal temperature (RNT) during the nursery phase on pig performance[a] (after Shelton and Brumm, 1988).

Treatment	Control (º C)	RNT (º C)
Average daily gain, g	340	360
Average daily feed intake, g	530	570
Feed:gain (kg/kg)	1.57	1.61

[a]256 pigs per treatment, initial body weight 6.7 kg. Pigs were exposed to either a constant regime (30 º C for 1st week reduced by 2º C/week for 4 weeks) versus a cycling daily temperature regime (same temperature as Control in 1st week but night temperature lowered to 22 º C on week 2 and further by 2 º C/week thereafter).

Sanitation

Dritz (2004) has previously summarized the principles and benefits associated with proper cleaning, disinfection and drying of nursery rooms prior to the pigs' arrival. Deterioration of sanitary conditions limits growth and induces a moderate immune response, however there is relatively little data demonstrating the effects of 'bad' sanitary conditions on production and biology after weaning. Le Floc'h et al. (2006) used pairs of littermates weaned at 4 weeks of age, with pairs housed either in a 'clean' environment and fed an antibiotic-supplemented diet, or housed in unsanitary rooms, mixed with non-experimental piglets, and fed a diet devoid of antibiotics. Not surprisingly, pigs kept in the 'bad' environment performed worse than pigs kept in the 'clean' environment, and displayed higher plasma concentrations of haptoglobin (an acute-phase protein), copper, vitamin B_{12} and lysine but lower concentrations of glutathione, pyridoxal-5-phosphate (coenzyme for amino acid metabolism), folic acid, threonine and tryptophan. Poor sanitation in the nursery appears to affect performance by modifying nutrient utilization and activating the pigs' defence system, reiterating the need for attention and vigilance when it comes to preparation of nurseries.

As another example, Dritz (2004) remarked that drying time in nurseries was longer in the latter winter and early spring and if an allowance (eg, cleaning a day earlier) is not made for this, then pigs can be placed into nursery spaces with moist surfaces and humid environments that could, in turn, exacerbate the post-weaning check. Together, these data reiterate the importance of managing the nursery in accordance with the prevailing conditions. Newly weaned pigs will take longer to adapt to a poor unhygienic environment and will alter their metabolism and immune function accordingly.

SORTING AND MIXING PIGS

Mixing of unfamiliar pigs at weaning causes aggression and fighting as pigs seek to establish dominance hierarchies. It is common to see pigs fighting in the first 1-6 days after weaning, with some pigs having scratches over their face and flanks displaying the spoils of battle. But is this behavior detrimental? Many studies have been conducted quantifying fighting behaviours and establishment of the social order, but as a reflection of both the time-consuming nature of such research (usually necessitating small groups) and the period when the research was conducted (1970s, 1980s, where large pens were not used), the relevance of this research to today's production systems is questionable. In Australia for example where weaners can be placed into deep-litter (barley/wheat straw or rice hulls) shelters (hoops) in groups exceeding 250, the relevance of establishing a social order and subsequent effects on production is spurious because pigs can hide and (or) run away from any dominant pigs. Our own research (Pluske and Williams, 1996a) showed that mixing unfamiliar pigs at weaning caused fighting but no adverse effects on production, whereas co-mingling non-littermate piglets during lactation (which is still practised by some producers) or treatment of pigs at weaning with a psychotropic compound reduced aggression (and stress) but failed to improve production indices. Regardless, mixing of pigs at weaning inevitably occurs and the associated fighting is simply accepted as part of the process. Nevertheless, vices after weaning are of welfare concern and should be monitored. Main et al. (2005) conducted a study to investigate the impact weaning age (12, 15, 18 and 21 days of age, n = 2,272) had on belly-nosing behaviour and umbilical lesions after weaning. Belly-nosing behaviour and umbilical lesions were less frequent as weaning age increased, with nosing activity and umbilical lesion scores nearly doubling as weaning age decreased from 15 to 12 days.

Should I sort pigs? Conventional wisdom suggests that sorting pigs into similar weight groups will reduce variation in subsequent growth, but evidence to support this notion is equivocal. Dritz (2004) suggested that in multi-site production systems with a fairly narrow weaning age window per group, there is no advantage in growth performance to sorting by weight categories upon initial placement into the nursery. Brumm (*pers. comm.*) suggested that once a pig is placed in a pen then the only way out is at sale, if it's suffering from bleeding or major injury, or if it is dead. Nevertheless many producers use hospital pens or sick pens to care for poor-doing pigs, and both Dritz (2004) and Charbonneau (2005) have provided tips as to how best manage such piglets.

GROUP SIZE AND STOCKING RATE

Changes in production systems in the last 10-15 years have seen a re-examination of the recommendations for group size and stocking rates for pigs. Group size (number of pigs per pen) is an important factor in the design and management of facilities for pigs as it can influence capital requirement, welfare, and performance. Groups of 30 in commercial practice were previously considered as large, whereas today groups of 100 to 1,000 pigs are used on some farms. In a recent paper, Payne et al. (2006) reviewed the literature on group size and performance for weaner (and also grower and finisher) pigs and, across studies, these authors surmised that increasing group size from 5 to 100 pigs per pen appeared to have a small, negative effect on performance provided that floor space, and the number of feeders and drinkers supplied, was adequate. Both growth rate and feed intake decreased slightly but with little effect on feed efficiency. Payne et al. (2006) suggested that in practice, the economic consequence of increasing group size would depend on relativities between prevailing construction, labour and feed costs. Housing pigs in large groups decreases construction, maintenance and cleaning costs, but may increase labour associated with inspection, treatment and marketing of pigs. Feed efficiency is unlikely to be affected greatly, although slight decreases in growth rate may reduce throughput or sale weight marginally. In Australia for example, the construction of deep-litter systems for pigs between weaning and finish is a cheaper option than concrete and steel and suits the contract nature of such operations.

An important element of the post-weaning environment is feeder design and feeding behaviour, and in this regard group size and/or stocking rate can have an impact. Two recent studies have investigated various aspects of group size, stocking rate and interactions with feeders in nursery pigs. Smith et al. (2004) determined the effects of group size and feeder trough opening in nursery pens on performance by conducting a study with 3 group sizes (16, 20 or 24 pigs per pen, providing 0.35 m^2, 0.28m^2 or 0.23 m^2 per pig, respectively) and 5 feeder gap openings (9.2-31.5 mm) with a trough-type feeder. These authors found that increasing space from 0.23 m^2 to 0.35 m^2 per pig increased body weight gain, and that optimal growth and feed efficiency was seen when the feeder gap opening permitted 25-60% of the feeder trough to be consistently clear of feed. Smith et al. (2004) surmised that the capacity of a nursery feeder space was 11 pigs when the feeder gap opening allows 25-60% of the feeder trough to be clear of feed. These data reinforce the observations made by Charbonneau (2005), but also show that space allowance has an impact on feeding behavior and growth.

In a wean-to-finish production system, DeDecker et al. (2005) used 1,296 pigs to evaluate 3 stocking rate treatments (22, 27 or 32 pigs per pen, with floor and feeder spaces per pig of 0.78 m^2 and 4.2 cm, 0.64 m^2 and 3.4 cm, and 0.54 m^2 and 2.9 cm, respectively), between weaning (15 ± 1 days of age) and 24 weeks after weaning. From week 8-18, week 18-24, and overall from weaning to week 24, both daily gain (688, 660 and 635 g/day for the overall period, respectively) and body weight (121.8, 117.1 and 113.1 kg at week 24, respectively) decreased linearly with increased stocking rate, as did mortality and morbidity rates. DeDecker et al. (2005) concluded that in such systems, decreasing group size and thereby increasing floor and feeder space per pig had beneficial effects on performance.

FACTORS ASSOCIATED WITH NURSERY PIG PERFORMANCE

A recent study from the Ontario Veterinary College (de Grau et al., 2005) aimed to determine the association between body weight of pigs at 7 weeks of age, specific management factors, and previous body weight. A total of 3,736 pigs from 8 commercial farms were used that varied in size from 150-1,200 sows and included farrow-to-finish pigs, farrow-to-feeder pigs, and off-site nursery units. Data gathered included age, sex and clinical disease, the number of pigs per pen, feeder spaces, water access, pen space per pig, and regrouping of pigs. All-in/all-out (AI/AO) by room or by nursery was practiced on 5 of the 8 farms, with the other 3 farms being continuous flow (CF). Weaning age varied between 14 and 29 days of age with a mean of 19.7 ± 3.7 days, however weaning age data were analysed and piglets were classified either as 'early' (17.2 ± 2.9 days), 'moderate' (21.2 ± 1.5 days) or 'late' (27.4 ± 1.1 days) with respective weaning weights of 5.2 ± 1.3 kg, 6.1 ± 3.7 kg and 6.9 ± 1.9 kg. At a standardized age of 7 weeks, pigs from the 3 weaning age groups weighed 16.5 ± 3.8 kg (CV 23.4%), 13.6 ± 3.2 kg (CV 23.6%) and 12.8 ± 3.0 kg (CV 23%), respectively.

De Grau et al. (2005) found that birth weight and weaning weight both had a significant influence on nursery pig performance (Table 2), accounting for 12.7% and 4.7% of the total variation, respectively. Light-weight pigs (< 4.1 kg) entering the nursery had a higher rate of death/culling (49.6%) and were lighter at 7 weeks of age than pigs weighing more than 5.8 kg, again underpinning the importance that weaning weight as a whole has on subsequent post-weaning performance. Rates of gain after weaning were greater in AI/AO farms compared to CF farms.

Table 2. Factors associated with weight of nursery pigs at 7 weeks of age (after de Grau et al., 2005).

Variable[a]	Coefficient[b]	Standard error	Partial r^{2c} (%)	P value
Intercept	7.08	0.70	-	<0.001
Birth weight	1.58	0.16	4.7	<0.001
Weaning weight	0.80	0.04	12.7	<0.001
Standard weaning age	-0.86	0.28	0.4	<0.01
Late weaning age	-2.60	0.38	2.2	< 0.001
AI/AO flow	5.42	0.93	0.3	<0.01

[a]Farm and sow nested within farm were included as random variables.
[b]Indicates the predicted change in the 7-week weight as the variable changes by 1 unit, eg, if weaning weight increased by 1 kg, the 7-week weight increases by 0.8 kg.
[c]Indicates the proportion of the variation in 7-week weight explained by the variable, eg, changes in weaning weight accounted for 12.7% of the total variation in 7-week weight.

An obvious outcome from the work of de Grau et al. (2005) was that better/different management strategies are needed in the post-weaning period for lightweight pigs than medium- and heavy-weight pigs. This is supported by relevant physiological data concerning light-for-age pigs (see Dunshea, 2003). An obvious strategy at the point of sorting is to place all pigs below a pre-determined weight/size into pens together and possibly treat these differently to heavier pigs, such as with liquid/gruel feeding or a continuation of feeding the most nutrient dense diet beyond the usual period of time. The need to optimize throughput and minimize variation in weight at slaughter in swine facilities has highlighted the problem that slower growing, lightweight nursery pigs present. Variability in post-weaning growth performance should ideally be minimized in order to maximize space utilization, especially in AI/AO systems (Becker, 1998).

FEEDING IN LACTATION AND POST-WEANING FEEDING AND GROWTH

The problem of suboptimal intake of feed (and hence energy and nutrients) and water after weaning needs no explanation or reiteration, and is partly the focus of my other paper in these proceedings. It is little surprise that pigs seem disinterested in feed and water given the simultaneous stressors that they have just been exposed to, yet the industry generally expects pigs to reach target weights in set times despite the perturbations that occur. But can we predict post-weaning performance of individual pigs based on pre-weaning characteristics?

Can We Associate Milk and Creep Feed Intake in Lactation with Post-Weaning Performance?

The young sucking pig has little control over its food (milk) intake (rate and total sum) and will consume all the nutrition that the dam can provide. It is evident that at some point during early- to mid-lactation the ability of the sow to satisfy the capacity of her piglets for intake of her milk is exceeded. One would predict, anthropomorphically perhaps, that piglets would then seek out other sources of nutrition to counteract the reduced quantity of milk they receive per suckling episode. This is part of the rationale for providing 'creep' feed or supplemental milk liquid diets. Additionally, it might be anticipated that familiarity with feed and water before weaning would be advantageous to the pig after weaning with respect to both commencement of feeding and gastrointestinal adaptation, however there is an overall lack of compelling evidence to support this notion.

As a consequence of the weaning process, there is enormous variation between individual piglets in feeding-associated factors such as latency to first meal, rate of feed intake, and the pattern of feed intake (summarised by Brooks and Tsourgiannis, 2003). Some pigs can take up to 54 hours to take their first meal even though pen mates were already consuming feed, suggesting that some individual pigs, for whatever reason(s), simply maladapt to their new feeding environment. One philosophy always recommended is to provide enough feeding space so that pigs learn to eat together – but does this facilitate quicker adaptation to feed?

This is a tough question to answer. Morgan et al. (2001) examined whether 'experienced' weaned pigs, with respect to eating, transferred their knowledge about eating to 'inexperienced' (newly weaned) pigs. These authors presented some evidence that the presence of 'experienced' pigs with 'inexperienced' pigs facilitated eating behavior sooner, but the study had very large variation between individual pigs. Similarly, Brooks and Tsourgiannis (2003) remarked that pigs that suckled together in lactation tended to approach the feeding trough together after weaning, but this did not necessarily mean that eating occurred. Nevertheless, and as explained previously, it is crucial to provide enough trough feeder space so that if a pig wants to eat, it can.

Not unexpectedly, therefore, numerous articles and reviews (eg. Dritz, 2004 and Charbonneau, 2005) describing the importance of feeding behavior and management after weaning have been written, even though we still appear to understand some aspects very little. Attention to non-eating pigs would appear to be crucial, although Dritz (2004) claimed that with proper nursery management the number of pigs requiring attention (i.e. active intervention) is 2-4%. In this respect, Dritz (2004) provided a 'checklist' for stockpersons in identifying the poor-doing pigs.

Is it always the lightweight pigs that don't eat though? English et al. (1988) presented data showing that pigs failing to thrive after weaning were on average the 'lighter' ones, but some of the 'heavier' pigs also give problems (Table 3). In this study, when the 10% of pigs that performed 'best' were compared to the 10% of pigs that performed 'worst' in the 28 days after weaning, it can be seen that among the 'best' 10% were some light pigs while among the 'worst' 10% were some heavy pigs. The 'best' 10% were only 23% heavier than the 'worst' 10% at weaning at 18 days, however this difference had ballooned to 150% after 4 weeks, indicating that for one reason or another, the 'worst' 10% failed to adapt adequately to the post-weaning system. English et al. (1988) stated that pigs failing to handle the transitions at weaning should receive preferential treatment and could be fostered back to the sow (unlikely these days), kept in a warmer environment, offered a higher quality diet and/or be left on a starter diet and the first stage of rearing accommodation for a longer period of time. Hospital/sick pens could also be employed. In units where there are some but not too many poor-doing pigs, English et al. (1988) advised one of two strategies: improve the whole system for the most vulnerable pigs or leave the general system as it is for the great majority of the pigs and strengthen part of it for the small minority of problem pigs. Modern-day production dictates that the latter strategy is generally employed, except in worst-case scenarios where the entire weaning system requires an overhaul.

Table 3. Comparison of the best 10% and the worst 10% of pigs in a sample of 150 pigs weaned at 18 days of age (after English et al., 1988.)

	Live weight at start, kg		Live weight gain, g/day			
	Mean	Range	Week 1	Week 2	Week 3	Week 4
Best 10%	5.59	4.6-7.4	105	240	544	589
Worst 10%	4.54	3.6-6.6	-38	85	164	61
			Live weight, kg			
Best 10%	5.59		6.33	8.01	11.82	15.87
Worst 10%	4.54		4.27	4.87	6.02	6.35
LW benefit of Best 10%	23%		48%	64%	98%	150%

The influence of weight at weaning into the nursery on subsequent performance is not linear even though straight lines are often seen in data sets and 'rule of thumbs' are commonly used to underscore the relationship. On a population (room, pen) basis this generalization holds true, however these data reveal that whilst we generally consider pigs above a certain weight to better handle weaning than pigs below this weight, a proportion of the heavier pigs still fail to thrive after weaning. De Grau et al. (2005) reported that sow-to-sow variation explained a greater proportion of the variation in 7-week weight than farm-to-farm differences, and although stockpersonship and other farm variables likely impact on 7-week weight, these were overwhelmed by the within-farm variation (de Grau et al., 2005). Perhaps, and as I allude to in the next section and in my other paper, we need to identify factors back in the production chain that might assist our understanding in this area.

But can we identify the poor-doing pigs before weaning? And if so, would this be of any benefit? Piglets that suck from the posterior teats seemingly grow slower than those sucking from teats anterior to these and so tend to be lighter at weaning (Pluske and Williams, 1996b; Kim et al., 2000). Pigs are not equal at birth with respect to birth weight, the functionality of the mammary glands is not uniform and, combined with the lower ability of small pigs to compete at the udder and extract milk, it is little wonder that more of the small, lightweight pigs struggle. When sucking piglets are given the opportunity to be curious with dry feed and eventually eat some of it, usually at weaning ages greater than 26 days, there is some evidence that piglets sucking a less productive teat will consume creep feed more readily than their counterparts sucking anterior (more productive) teats (Brooks and Tsourgiannis, 2003). At Murdoch University, we have modified a technique developed in The Netherlands that uses a dye as a fecal marker to classify piglets as 'good eaters', 'moderate eaters' or 'non eaters' of creep feed during lactation.

Using this methodology with pigs weaned at 31 days of age, we (Kim et al., 2005a, 2005b) observed that piglets categorized as 'good-eaters' at the end of lactation had numerically lower daily gains in the first 12 days of lactation (238, 248 and 253 g/day for 'good', 'moderate' and 'small-eaters', respectively) and tended to occupy the posterior teats. After weaning on day 31, the growth rate of 'good eaters' was maintained indicating no reduction in feed intake, however between days 34 and 38 the production of 'good eaters' declined markedly (due to diarrhoea, as no antimicrobials were in the diet). The growth rate and intake of 'small-eaters' decreased immediately after weaning but this was associated with a reduced incidence of diarrhoea, while production in the 'moderate' eaters was intermediate. Piglets suckling anterior teats grew 40 g/day more than piglets sucking the posterior teats up to weaning (278 g vs. 237 g/day, respectively), but after weaning, the growth rate of piglets suckling anterior teats decreased to day 34 but started to recover from day 38 onwards. In contrast, piglets suckling posterior teats maintained their growth rate after weaning and between weaning and day 59 of age, grew faster than piglets sucking from the anterior teats. These data suggest that piglets not consuming 'enough' creep feed suffer a growth check up to 4 weeks after weaning, and confirm that piglets sucking from the posterior teats consume the most creep feed but this is insufficient overall to boost their growth rate to the level of their counterparts drinking from the more anterior teats. Ironically, the consumption of more milk in lactation in piglets drinking from anterior teats may actually limit the intake of creep feed that, in turn, exacerbates the post-weaning growth check. But whether or not this is related to a ‘poor-doing’ pig in the nursery remains to be elucidated.

CONCLUSIONS

Weaner room management, even before the pigs even arrive, is a pivotal part of ensuring a good start for young pigs. Good stockpersonship is critical to the success of managing the nursery. Systems that assist the poor-doing pigs, whilst taking some time and effort, should be considered.

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