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# Relationship between piglet birth weight and growth performance: Implications for system management

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## Variation in pig birth weight

Variation in body weight of pigs within a group can have a significant impact on commercial pig production systems, particularly those implementing all-in all-out animal management. A wide variation in body weight within a group of pigs having a similar age begins at birth and remains to market weight. Recent research has shown weight at birth to be closely related to pig body weight at market in a commercial production system (Bertelsen, 2005). Therefore, birth weight may be a means by which to classify pigs for subsequent management strategies focused on reducing body weight variation within a group in an all-in all-out production facility. Previously, management strategies aimed at reducing body weight variation in pigs at market have largely focused on manipulating the growth of certain pigs within the population prior to weaning, and generally have been unsuccessful (Wolter, 2002). There is paucity of data; however, in which to evaluate the impact of managing populations of pigs on the basis of birth weight on variation in body weight near the close of a group within a commercial production system.

Size and scale of modern sow production units present large groups of pigs with similar age; however, variation in body weight among pigs at birth remains practically significant. The distribution of body weight at birth within groups of pigs born in a commercial pig production system is summarized in **Table 1**. These data from recent years suggest piglet body weight and variation in body weight within a group at birth among units is for practical purposes similar within the system. To that end, potential may exist with today's modern sow production systems to employ management schemes to significant size groups

of pigs having a common birth weight and age that allow for reduced variation in weight within a group, and thereby increase system throughput. The objective of the current review is to evaluate the potential for strategies aimed at managing piglet populations based on birth weight to improve system productivity.

## Birth weight and piglet survival

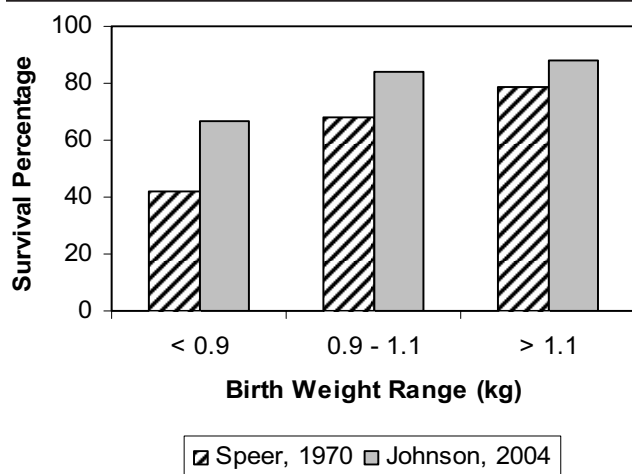
Previous research has demonstrated a close relationship exists between piglet birth weight and survival with increased birth weight likely to increase piglet survival (Lawlor et al., 2004). A recent study completed in our system evaluated the impact of birth weight on piglet survival prior to weaning, and found a significant decrease in the likelihood of survival for pigs weighing < 900 g at birth (Johnson et al., 2004). Results of this study and that of one completed over 30 years earlier are illustrated in **Figure 1**. These data suggest absolute rates of survival may have increased with time; however, its relationship with birth weight remains similar.

Wolter et al. (2002) segregated piglets into two populations of light or heavy by creating litters with reduced variation in piglet weight at birth, and reported pre-weaning mortality increased from 5.2% to 9.4% for pigs that weighed 1.8 kg and 1.3 kg, respectively. Similarly, Bertelsen (2005) demonstrated pre-weaning mortality was 75% higher for piglets that were on average 1.1 kg compared to 1.5 kg at birth, and reported mortality rate post-weaning to market tended to be greater for the lighter-birth-weight pigs. Factors associated with light-birth-weight piglets that influence pre-weaning mortality include but are not limited to crushing, hypothermia, dominance ranking, and availability of nutrients.

Table 1: Summary of data on piglet birth weights among sow farms within the same production system at different time periods in recent years.

Study	Sow farm	Average body weight at birth (kg)	Standard deviation of piglet birth weight within a group having similar age (kg)
Wolter, 2003	Farm A	3.52	0.80
Wolter, 2003	Farm B	3.43	0.72
Peterson, 2005	Farm A	3.62	0.83
Bertelsen, 2005	Farm C	3.42	0.75

Figure 1: Relationship between piglet birth weight and survival in separate studies completed in 1970 and 2004.



Additional research is needed to better understand relationships between piglet birth weight and survivability.

Previous research has demonstrated litters that contain high variation in birth weight of pigs result in lower survival and more variable body weight at weaning (Milligan et al., 2002). Therefore, a management scheme sorting light pigs at birth to create litters with low variation in weight may be considered as a means of increasing survival rate of light piglets. Moreover, housing sows with litters of light weight pigs in designated areas within a production unit could allow for strategic employment of extra care techniques shown to improve survival of low-birth-weight piglets (Dewey, 2002).

### Birth weight and pig growth performance

Dwyer and Stickland (1991) demonstrated a wide distribution of individual weights exists within a litter of piglets beginning at birth, and described differences in body composition, prenatal-growth rate, and other aspects such as the number of muscle fibers among the piglets. A summary of recent data regarding the effects of birth weight on post-natal pig growth performance is presented in Table 2. In general, these data suggest that pigs lighter at birth have a lower growth rate and require significantly

more days to reach a targeted market body weight. Previous studies have shown that pigs lighter at birth have a lower growth rate and feed intake, but similar feed conversion efficiency (Wolter et al., 2002). It remains unclear regarding a specific causal relationship between birth weight and post-natal growth performance, but published data suggests lighter compared to heavier piglets at birth weight have fewer number of muscle cells, poorer competing ability for maternal milk, increased vulnerability to nutritional stress, and less physical capacity to consume food which may explain, in part, the absolute slower growth performance (Wolter, 2002).

Most research has reported an increased number of days required for lighter pigs at birth to reach slaughter weight (Table 2). In support, recent research completed within our production system found a significant correlation between birth weight and body weight near the time of market (Bertelsen, 2005). However, carcass measures indicate similar tissue composition among light and heavy birth weight pigs at a fixed market weight (Wolter and Ellis, 2001; Wolter et al., 2002). While it appears birth weight has little impact on the amount of body tissues accreted within the range of traditional market weights, the increased time required by lighter pigs for accretion has a significant negative impact on the throughput of an all-in all-out system when both heavies and lights are reared together.

In summary, weight of piglets at birth has a significant impact on their subsequent growth performance and the time required to market. From a practical perspective, pig management schemes must take into account variation exist among pigs at birth, and strategies that manipulate post-natal growth of animals based on birth weight in an effort to reduce variation within groups of pigs at market should continually be evaluated.

### Conclusion

Variation in individual pig growth rates presents significant limitations to maximizing animal flow through a commercial production system. Piglet birth weight appears to have a substantial impact on subsequent survivability and variation in growth performance within a production system. Therefore, practical management schemes may consider the potential to group pigs at birth on the

Table 2: Relationship between heavy and light piglet birth weight and subsequent growth performance.

Study	Difference in piglet weight at birth <sup>A</sup>	Difference in lifetime daily gain <sup>A</sup>	Difference in time to reach 110 kg <sup>A</sup>
Wolter and Ellis, 2001	18%	4.8%	- 8.6 days
Wolter et al., 2002	29%	5.5%	- 8.0 days
Bertelsen, 2005	28%	6.5%	- 7.0 days

<sup>A</sup>Response of pigs with heavy compared to light birth weight.

basis weight to improve the survivability of light weight pigs prior to weaning. Moreover, groups of pigs that differ on the basis of birth weight may be reared separately in an effort to reduce the variation in weight within a group of pigs when barns are emptied for market.

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