

## **Biological Relationships of Birth and Weaning Traits in Pigs**

by: Gary L. Cromwell  
Professor, Swine Nutrition

The costs of maintaining the breeding herd can account for up to one-third of the total costs of production. Therefore, the productivity level of the sow herd has a major influence on the profitability of a swine enterprise. Litter size at birth and weaning, average pig weaning weight, and conception rate are important factors that influence sow reproductive efficiency and pounds of pork marketed per sow per year.

Approximately 15 years ago, we collected data from a series of experiments conducted at eight universities in the Southeastern U.S. to more clearly establish the relationships of litter size and pig weight at birth on survival to weaning and weaning weights in nursing pigs. The data from this study are somewhat “dated”, in that reproductive performance has improved over the past several years with improved genetics and better nutritional programs (primarily higher protein and lysine levels during lactation) than were used in this study; however, the patterns and relationships that we investigated should still apply.

The experiment from which these data were collected consisted of 10,898 pigs from 1,020 litters produced by 721 sows and 299 gilts. Animals were of various breeds and were kept in various types of housing (some in confinement, some in outside lots) during gestation. They were fed fortified corn-soy diets (14% protein) at 4 lb/day from March-November and 5 lb/day from December-February. In half of the sows, an additional 3 lb/day of feed was fed the last 3 weeks of gestation. All sows were full-fed the same diet during lactation. Pigs were not cross-fostered and creep feed was not given. All pigs were weaned at 3 weeks.

Overall litter size (not including mummified pigs) at birth was 10.66 total pigs and 9.95 live pigs. In litters of 13 pigs or less, 94% of the pigs were alive at birth (Figure 1). In litters of 14 or more, the percentage of live pigs was three times more variable, and averaged 89%. This suggests that uterine space may have been an important factor in litter sizes of 14 pigs or more.

Average birth weight of all pigs was 3.11 lb and of live pigs was 3.22 lb. As expected, there was an inverse relationship between litter size and average birth weight (Figure 2). For each additional pig born in a litter, the average birth weight decreased by 0.083 lb. For each additional live pig born in a litter, average birth weight decreased by 0.066 lb. The data also indicated that in litters of 9 pigs or more, stillborn pigs tend to be the smaller ones, whereas in small litters of 7 or more pigs, stillborn pigs tend to be the larger ones.

Litter size at weaning (3 weeks) averaged 8.36 pigs and pig weaning weights averaged 11.8 lb. As one would expect, the number of pigs weaned per litter was closely related to the number of live pigs born per litter (Figure 3). This relationship, however, was not constant for all litter sizes. In fact, the relationship was curvilinear, meaning that as litter size at birth increased, litter size at weaning also increased but at a diminishing rate. Had pigs been cross-fostered (i.e., pigs from large litters transferred to sows with small litters), the relationship between litter size at birth and litter size at weaning would probably have been more linear.

Average pig weaning weight was inversely related to litter size at birth and at weaning. For example, for each additional pig weaned per litter, there was a decrease in average pig weaning weight of 0.288 lb (Figure 4). Average pig weaning weight was also influenced by the pig's birth weight; that is, heavier pigs at birth were heavier at weaning (Figure 5). The relationship indicated that for each increase of 0.1 lb in pig weight at birth, there was nearly a two-fold increase (0.193 lb) in the pig's weaning weight.

The most interesting statistical relationship that we obtained from this large data set was the relationship of the pigs' birth weight and their chances of survival to weaning. The overall survival to weaning of pigs born alive was 84.9%, but it was highly dependent on birth weight (Figure 6). For example, looking at the extremes, survival of pigs weighing 1.0 lb at birth was only 12%, but for pigs weighing more than 3.5 lb or more at birth, survival was 92 to 98%. A detailed statistical analysis of the data indicated that there were two linear trends that intersected at approximately 2.8 lb. This was interpreted to mean that for pigs weighing 2.8 lb or less at birth, survival was increased by about 5 percentage units for each additional 0.1 lb of birth weight. In pigs weighing more than 2.8 lb at birth, survival increased by less than 1.0 percentage unit for each additional 0.1 lb of birth weight.

The results indicate that distinct biological relationships exist between number and weight of pigs at birth and at weaning. Pigs born into large litters tend to be lighter in weight at birth and at weaning and are less likely to survive to weaning than heavier weight pigs born into small litters. Fortunately, some of the negative impacts of large litter sizes can be overcome with a good cross-fostering program. Transferring pigs from large litters to sows that have small litters is an excellent management practice that improves pig survival and performance to weaning, provided the transfer is done early (generally within the first 12-24 hours after farrowing).

If a swine herd is experiencing a large proportion of newborn pigs with small birth weights, this may indicate that sows are not being properly fed during gestation. A simple adjustment such as feeding additional energy during gestation, or even during the last 3-4 weeks of gestation, can have a profound impact on pig birth weights. This will be addressed in a later article.

**Published in The Farmer's Pride, KPPA News, Vol 12, No. 47, May 23, 2001**

Figure 1.—The Relationship of Total and Live Pigs at Birth

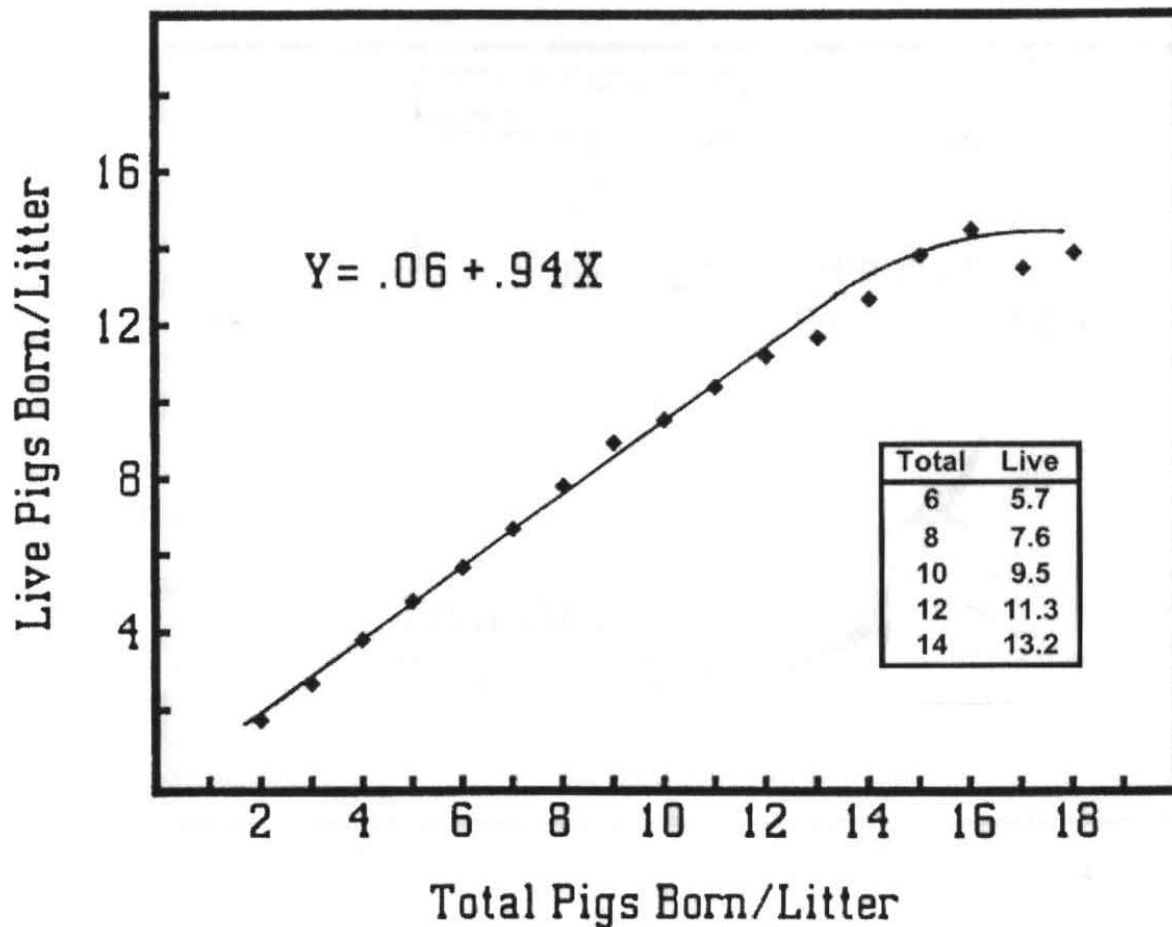
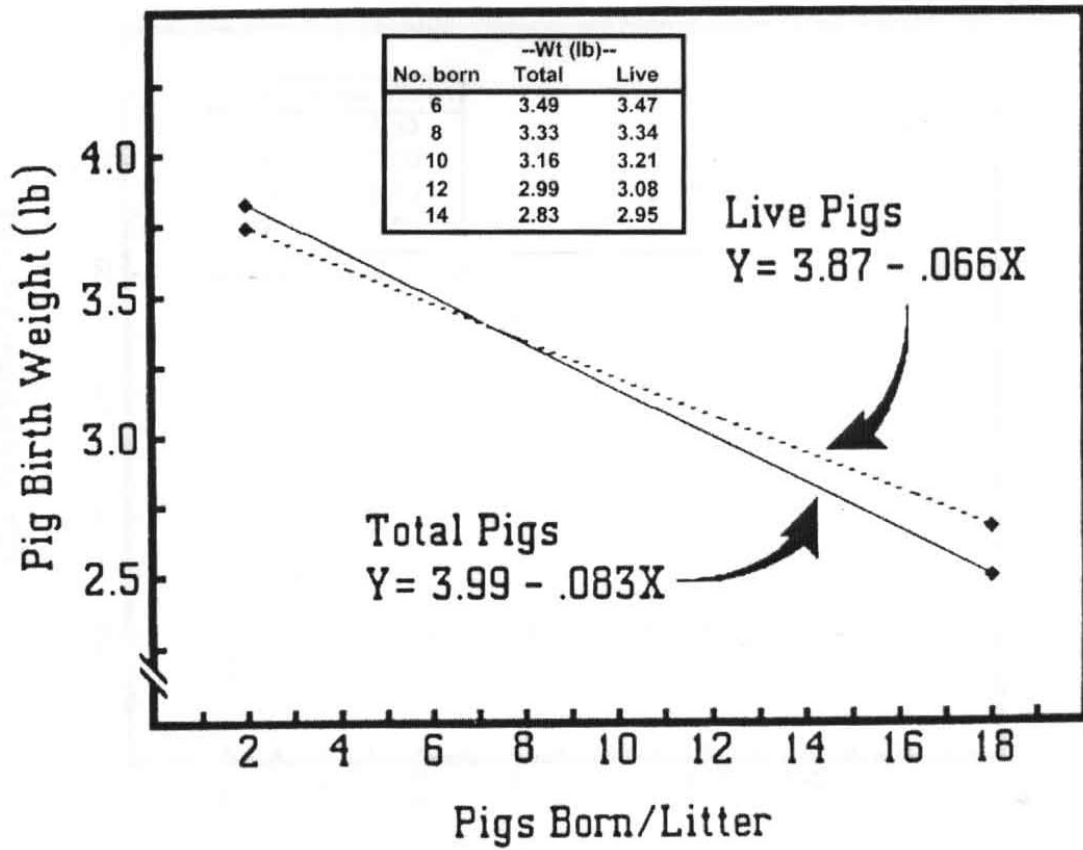
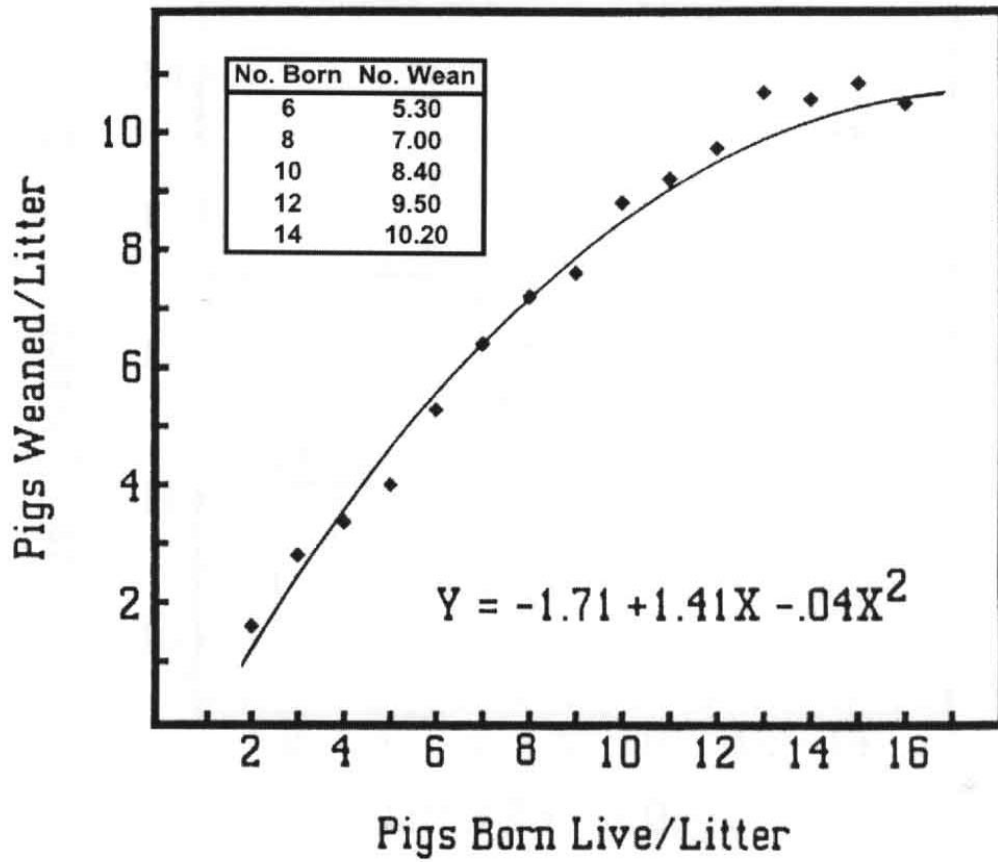


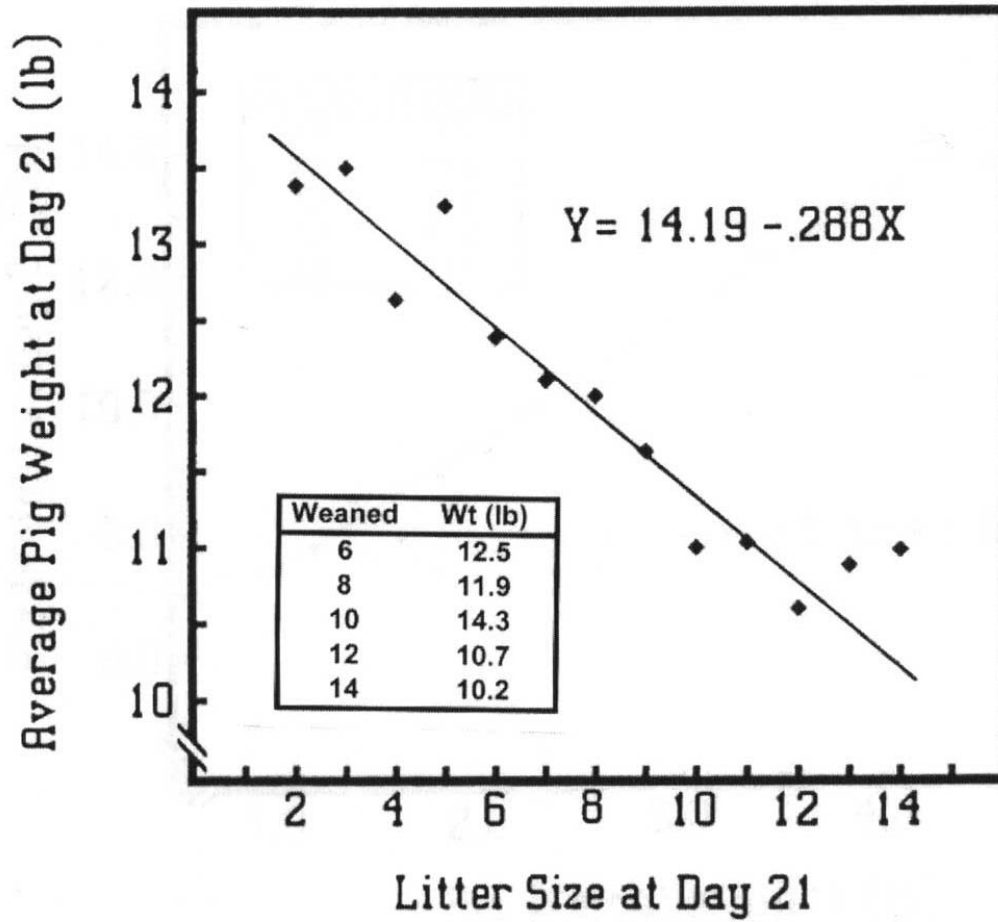
Figure 2.—The Relationship of Litter Size and Pig Weight at Birth



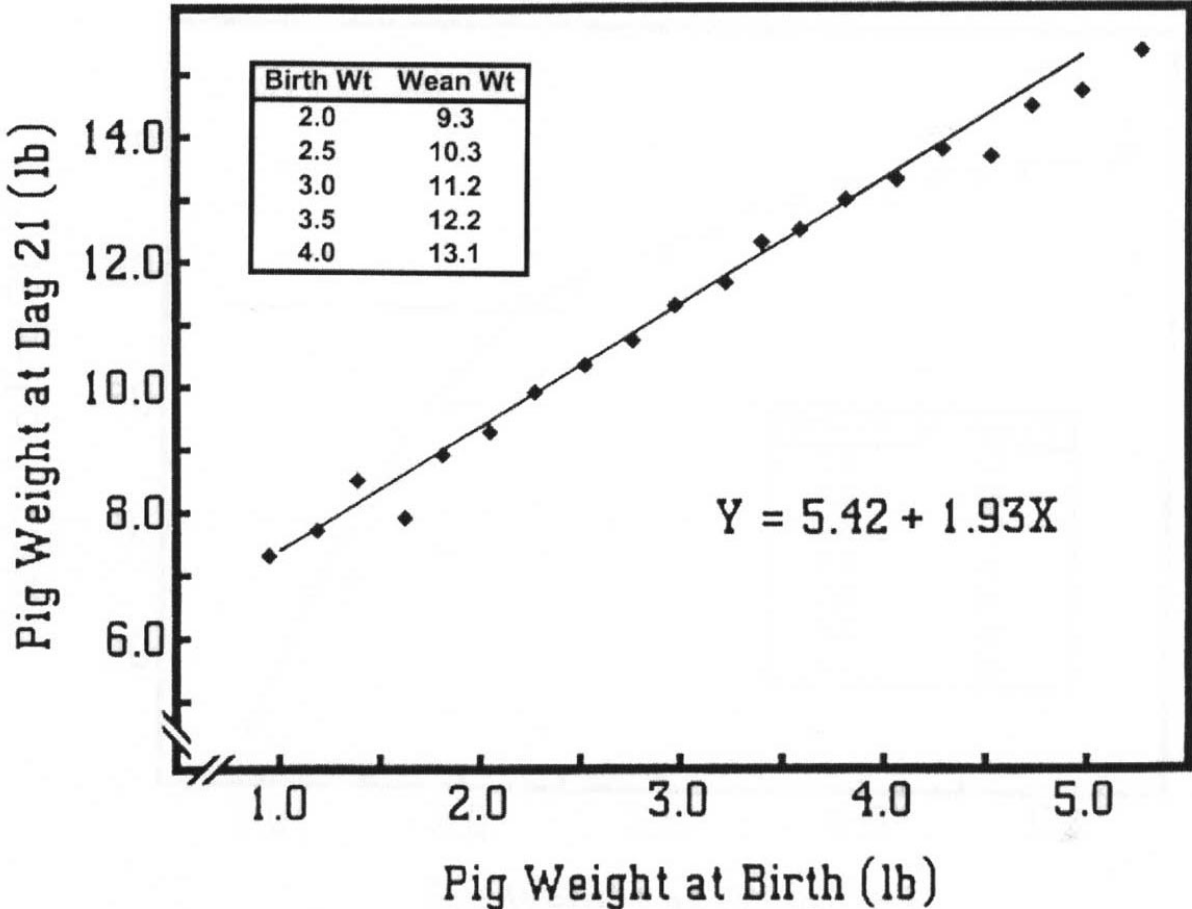
**Figure 3.—The Relationship of Litter Size at Birth and at Day 21**



**Figure 4.—The Relationship of Litter Size and Average Pig Weight at Day 21**



**Figure 5.—The Relationship of Pig Weights at Birth and at Day 21**



**Figure 6.—The Relationship of Pig Weight at Birth and Survival to Day 21**

