had access to wet sand for cooling and straw bedding for warmth. It is doubtful, however, whether any importance can be attached to the comparison of shelters obtained in this study. It does suggest that confining boars to small, air conditioned shelters may not be effetcive in preventing the decline in semen quality associated with high summer temperatures.

The Influence of Pig Birth Weight on Performance*

I. T. Omtvedt

Story in Brief

The production records for the herds in the swine breeding project were analyzed to determine the relative influence of various factors on pig birth weight and to evaluate the importance of size at birth on subsequent performance.

The records revealed that pig birth weight was increased by crossbreeding and that levels of feeding and climatic conditions during gestation also influenced the weights of pigs at farrowing. Temperature stress the week before farrowing reduced pig weight by 19 percent. Heavier pigs were farrowed by second litter sows than by first litter gilts and the records revealed that delaying the time of first breeding for gilts beyond 7 months of age resulted in heavier pigs at birth. As number of pigs in the litter increased, pig birth weight tended to decrease with the heaviest pigs being farrowed in litters of 4-6 pigs. Sex differences tended to have little influence on the weights of the pigs at birth in this study.

The average pig birth weight was 2.93 lbs. with 87.2 percent of the pigs weighing in the 2 and 3 lb. range. No pigs survived that weighed less than 1 lb. at birth while 95 percent of the pigs weighing 4 lbs. and over survived to weaning. Preweaning and postweaning growth rates were closely related to birth weight. Pigs weighing 4 lbs. at birth gained almost 0.3 lb. per day faster after weaning and reached 200 lbs. in 27 days less time than those weighing 2 lbs. at birth.

*In cooperation with USDA Agri. Research Service, Animal Husbandry Research Division.

Although the heritability of birth weight is close to zero and it will not respond to selection, its importance to the swine producer should not be underestimated. These data clearly show that maximum livability and performance is dependent upon starting out with good sized pigs at birth.

Introduction

How important is birth weight in swine? Research has shown that it is more a function of management conditions and nutrition rather than heredity. Although producers cannot expect to increase the birth weights of their pigs to any large degree just by keeping replacement boars and gilts for the breeding that have above average birth weights, this does not mean that birth weight is not important to the swine producer. The present study was initiated to investigate some of the factors that may influence birth weight and to determine the influence of birth weight on subsequent pig performance.

Factors Influencing Pig Birth Weight

Many factors are known to influence pig birth weight as illustrated in Figure 1. Within the past few years, the herds in the swine breeding projects at Stillwater and Ft. Reno have been used extensively to obtain a better understanding of the components of sow productivity and the findings relative to birth weights are summarized in Table 1.

Hereditary Makeup: Although an analysis of the variation in pig birth weights in the herds indicate that about 96 percent of the variation can be attributable to non-genetic causes, the breed composition of the pig and of the dam both play an important role. In a study involving 835 litters, straightbred Duroc and Beltsville pigs averaged 2.82 lbs. at birth compared to 3.09 lbs. for the Duroc-Beltsville crossbred pigs. In another

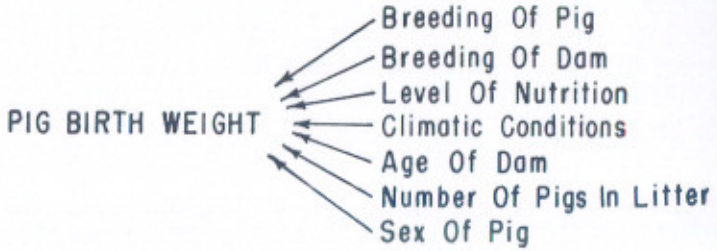

Figure 1. Factors Influencing Pig Birth Weight

Table 1. Summary of Some Factors Influencing Pig Birth Weight Based On Oklahoma Swine Breeding Herd Data

Factors Compared	Pig Birth Weight	
	Actual Difference, lbs.	Percent Increase
Hereditary Makeup:		
Crossbred pigs vs straightbred pigs	0.27	9.6
Crossbred sow vs straightbred sow	0.08	2.7
Gestation Management:		
No heat stress vs heat stress	0.50	19.2
Limited fed sows vs full fed sows	0.15	5.0
Age of Dam at Farrowing:		
2nd litter vs 1st litter	0.20	6.9
Sex of Pig:		
Male pigs vs female pigs	0.02	0.7

study involving 2,303 three-line cross pigs (½ Hampshire - ¼ Duroc - ¼ Beltsville), the pigs farrowed by Hampshire sows weighed 2.98 lbs. compared to 3.06 lbs. for those farrowed by Duroc-Beltsville crossbred sows. Both of these studies clearly indicate that crossbreeding results in hybrid vigor for birth weight.

Gestation Conditions: Swine producers have witnessed seasonal variation in productivity associated with climatic conditions. In a recent study at Ft. Reno, 28 sows were maintained under the conventional sow-herd facilities for the first 101 days postbreeding and then divided into two groups with 14 sows being subjected to 8 days of extremely high ambient temperatures (100° F from 4 p.m. to 9 a.m. and lowered to 90° F from 9 a.m. to 4 p.m. each day) and the other 14 sows subjected to a control chamber maintained at 74° F continuously during the same stage of pregnancy. The pigs farrowed by the sows subjected to the heat-stress chamber averaged 2.6 lbs. at birth compared to 3.1 lbs. for those farrowed by the control chamber sows.

Level of feeding during various stages of reproduction is also known to influence productivity. In a recent study, 20 sows were fed at a level of approximately 4½ lbs. per day while another 20 sows were fed at the rate of 7 lbs. per day during gestation. Those on the lower plan of nutrition farrowed pigs averaging 3.16 lbs. compared to 3.01 lbs. for those farrowed by sows on the higher level.

Age of Dam: Research has shown that productivity can be increased by delaying breeding until the third estrous period after puberty and that second-litter sows are generally superior to first-litter gilts. The results given in Table 1 are based on the birth weights of pigs farrowed by 216 first-litter gilts compared to their second litters when mated to the same boar. Average pig weights were 3.1 for second litters compared to 2.9 lbs. for first litters.

The relationship between age of gilt at breeding and pig birth weight based on 390 gilt records in the swine breeding project is shown in Table 2. In this study, gilts were bred to farrow at approximately one year of age; therefore, age at breeding was not widely spread, but the general relationship was very apparent. The average age at breeding in this study was 252 days with a range from 205 to 310 days. The partial correlation between age at breeding and individual pig weight, holding litter size constant was 0.25.

Number of pigs in litter: The relationship between pig weight and litter size based on the 691 records clearly indicates that as the number of pigs in the litter increases, the size of the individual pigs decrease (Table 2). The birth weights for litters of various sizes are plotted in Figure 2.

Table 2. Factors Associated With Pig Birth Weights

Traits Correlated	Phenotypic Correlation
Average pig birth weight and:	
Number of pigs in litter	—.55[1]
Gestation length	0.12[1]
Age of gilt at breeding	0.16[1]
Breeding weight	0.06
Gestation weight gain of sow	0.16[1]
Percent males in litter	0.02

[1]Significant at the 1% level.

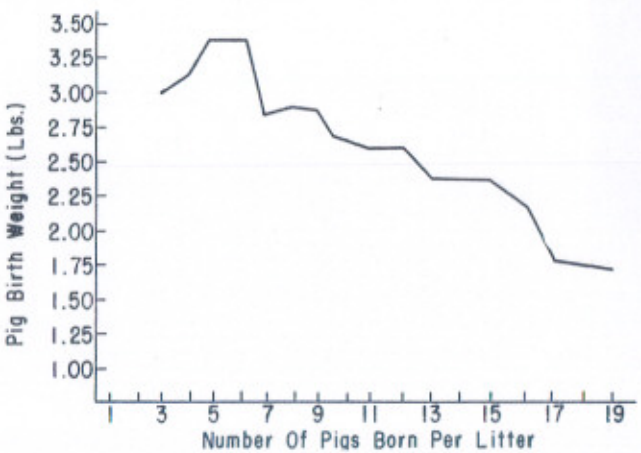

Figure 2. Relationship betwen litter size and average pig birth weight among gilt litters.

Notice that there is a general trend toward larger litters to have lighter pigs, but that the heaviest pigs were obtained in litters of four to six pigs.

Sex of pig: The sex of the pig apparently has little influence on the weight of the pig at birth. These data show a slight trend for males to be heavier than females but this difference was not significant.

Influence of Birth Weight on Performance

The farrowing and performance records for 1965-1969 in the control-line herd at Ft. Reno were analyzed to determine the influence of birth weight on subsequent performance. The data included 2,375 pigs from first and second litter sows. Gilts were bred to farrow their first litters at one year of age and their second litters six months later. These data are unique in that productivity was not considered when deciding which sows would be kept over for a second litter in this herd. Each season approximately one half of the first-litter gilts were randomly selected for a repeat mating and the other half were sold after their first litters. No sows were maintained beyond two litters. All second litters represented repeat matings with each boar mated to only one sow.

Sows were individually fed according to condition during gestation and self-fed during lactation. Pigs were not given access to creep feed until after 21-day weights were recorded. Each sow and litter was maintained in separate pens in confinement until weaning at 42 days.

Since sex is known to influence postweaning performance, boar records were not included and only gilts were used to evaluate backfat thickness.

All pigs were divided into one of 5 classes based on their birth weights as shown in Table 3. In this herd the average pig birth weight was 2.93 lbs. with 87.2 percent of the pigs weighing in the 2 and 3 lb. range at birth. During the 4 years studied, no pigs weighing less than 1 lb. at birth survived while over 95 percent of the pigs weighing 4 lbs.

Table 3. Influence of Pig Birth Weight on Survival Rate and Preweaning Growth Rate

Trait	Pig Birth Weights, lbs.					
	Below 1	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	Overall
No. pigs	7	191	1041	1030	106	2375
Weight distribution, %	0.3	8.0	43.8	43.4	4.5	100.0
Death loss, %	100.0	60.7	19.5	9.6	3.8	18.1
Pig 21-day weight, lbs.	----	8.1	10.8	13.0	14.9	12.0
Pig 42-day weight, lbs.	----	19.2	25.4	30.2	33.8	27.9
Postweaning daily gain, lbs.[1]	----	1.41	1.59	1.62	1.70	1.60
Age at 200 lbs., days[1]	----	173	170	154	146	161
Probe backfat, in.[2]	----	1.55	1.61	1.48	1.48	1.54

[1]Includes barrows and gilts only
[2]Includes gilts only

and over survived. It is readily apparent from examination of the death losses for the various weight groups that birth weight is of tremendous importance to the swine producer.

The data in Table 3 also reveal that preweaning growth rate is closely related to birth weight with the larger pigs at birth weighing more at 21-days and at weaning. Postweaning gain was also influenced by birth weight with almost 0.3 lb. per day faster daily gain by pigs weighing over 4 lbs. at birth compared to those weighing under 2 lbs. at birth. On an average, it took the 2-lb. pigs 27 days longer than the 4-lb. pigs to reach market weight. Backfat thickness also tended to be influenced by birth weight in that the 3-lb. and 4-lb. pigs had less backfat probe at 200 lbs. than those weighing 1 and 2 lbs. at birth.

These data clearly indicate that the importance of birth weight should not be underestimated. Maximum production and performance from a swine herd is dependent upon starting out with good sized pigs at birth.

Genetic Aspects of Sow Productivity, Growth Rate and Backfat Thickness*

Ronnie L. Edwards and I. T. Omtvedt

Story in Brief

Variation in litter records and performance records involving 3860 pigs in the swine breeding herd at Ft. Reno was analyzed. Based on regression of offspring on sire, it was concluded that most of the observed variation in sow productivity traits was due to non-genetic causes since the heritability estimates were low for number of pigs per litter, pig

*In cooperation with USDA Agr. Research Service, Animal Husbandry Research Division