Individual piglet birth weight

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Introduction

Beside the litter size at birth and at weaning the individual piglet birth weight is an important factor for a good litter quality. It is well known by pig producers that with increasing litter size the individual birth weights of piglets are reduced. However, in combination with a small variation between the birth weights of all piglets within a litter, the survival rate is not automatically reduced. On the other hand it is known that piglets with less than 1 kg birth weight in a litter in combination with a high variation in birth weight have a reduced survival rate.

Investigations about litter quality in terms of litter size, individual birth weights and variation in birth weight are not often published because the assessment of the individual birth weight of piglets is too expensive. On the experimental farm of the University of Göttingen, the individual birth and weaning weights of 21738 piglets from a total of 2286 litters were recorded from 1983 to 1994. 408 litters with 3622 piglets were purebred Landrace litters, 243 litters with 2179 piglets were Landrace*Large White litters and 1635 litters with 15937 piglets were litters from Landrace*Large White sows mated to a terminal sire line.

Individual piglet performances

In Table 1 the means, standard deviations and variation coefficients of the individual piglet performances are listed. The table shows that the piglets birth and weaning weight as well as the daily gain in suckling period show a very high variability with coefficients of variation around 25 % while the gain in later period show lower coefficients of variation.

Table 1.: Means (x), standard deviations (s), coefficient of variation (cv) and number of observations (n) for individual piglet performances

Trait	x	s	cv	n
Birth weight (kg)	1.44	0.39	27.3	21738
Weaning weight (kg)	6.74	1.60	23.7	18443
Gain in suckling period (g)	200	51.2	25.5	17836
Gain up to 28 kg (g)	422	79.1	18.8	17031
Gain from 28 to 100 kg (g)	670	98.3	14.7	12248
Liveweight daily gain (g)	531	75.4	14.2	13137

The relationship between the individual piglet birth weight and losses in suckling and weaning period are shown in Figure 1. The losses range from above 50% for piglets with birth weights lower than, 800 g, over 25% for birth weights below 1 kg and below

0410 % for all birth weights above 1.5 kg. Between the losses in weaning period and the birth weight there is no clear relationship although the piglets below 800 g birth weight show a slightly higher percentage of losses than all the others.

Figure 1. Losses in suckling and weaning period depending on birth weight
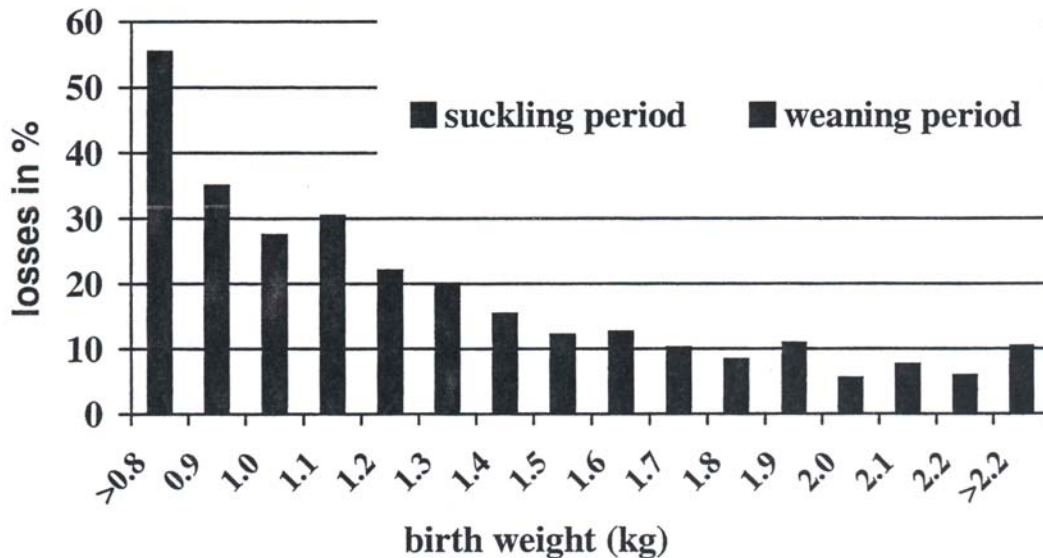
For birth and weaning weight and for the gain in the suckling period the effects of parity and the number of piglets born in the litter showed a high significant effect on the performance of the piglets. All piglets from the first parity show the lowest birth weights, lowest weaning weights and also the lowest gain in suckling period. After 28 kg of live weight these piglets show the highest gain, so that there is no significant difference between parity for liveweight daily gain. The least square means for piglet performances for parity are summarised in Table 2.

Table 2.: Least square means for piglet traits for parity classes

Trait	parity					
	1	2	3	4	5+6	>6
Birth weight (kg)	1.39	1.54	1.54	1.51	1.46	1.42
Weaning weight (kg)	6.65	7.19	7.12	7.03	7.07	6.83
Gain in suckling period (g)	196	213	212	212	213	203
Gain up to 28 kg (g)	418	423	419	417	416	418
Gain from 28 to 100 kg (g)	675	671	671	665	671	668
Liveweight daily gain (g)	530	532	533	529	531	526

The relationship between piglet's birth and weaning weight to the number of piglets born in the litter is shown in Figures 2 and 3. Both figures show a nearly linear relationship between the number of piglets in the litter and the piglet's average birth and weaning weight. There is an increasing total birth and weaning weight in a litter with increasing number of piglets while the average piglets birth and weaning weight decrease with increasing number of piglets in a litter.

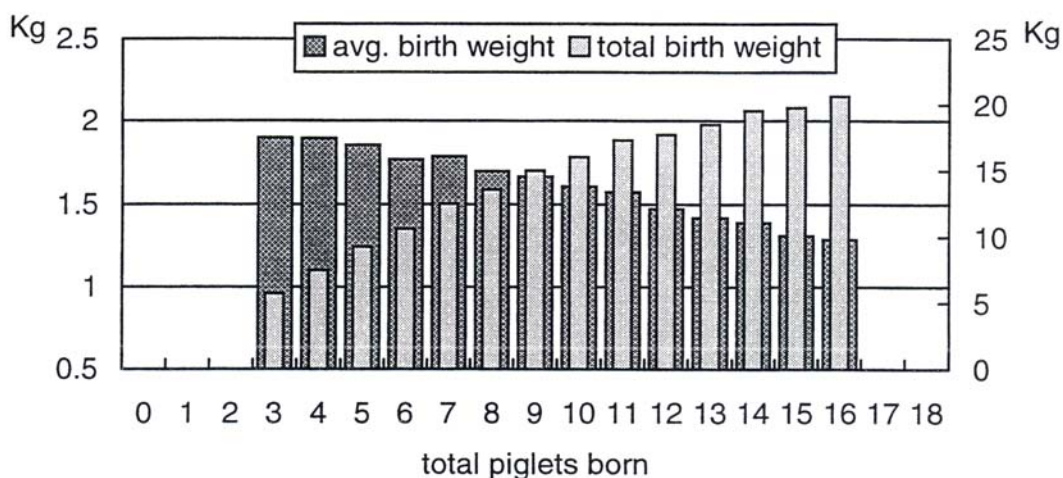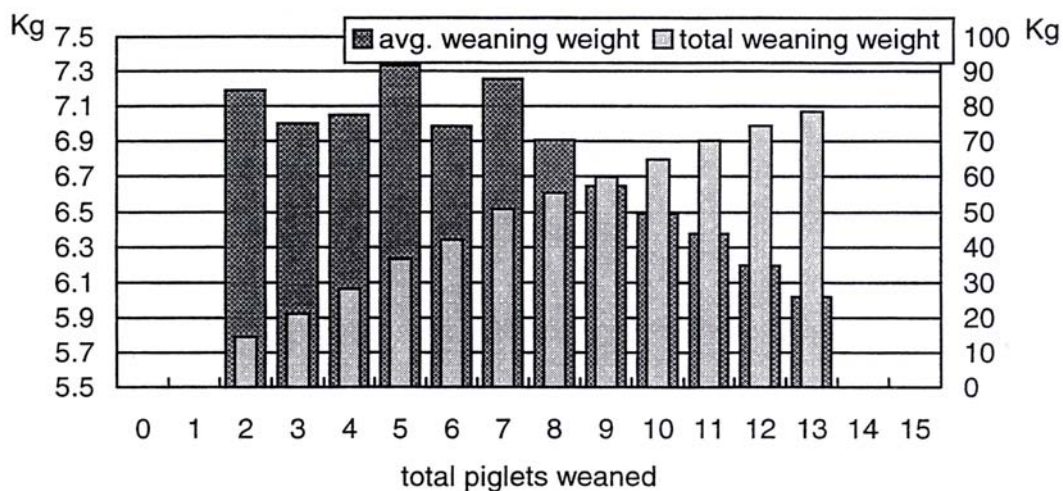**Figure 2. Average and total birth weight depending on number of piglets born**

Figure 3. Average and total weaning weight depending on number of piglets weaned

Litter quality index

For all litters a litter quality index including number of piglets born alive, average birth weight of piglets adjusted for litter size and variation (standard deviation) of birth weight within a litter with weighting factors of 50%, 25% and 25% respectively was calculated. The index was standardised to an average of 100 and a standard deviation of 20 points. In Table 3 the least square means for litter traits for different index classes are shown as well as the correlation of the index to litter traits.

Table 3. Least square means for litter traits for litter quality index classes and correlations between index and litter traits

Litter trait	Correlation to index	Quality index class			
		< 80 n = 339	80 - 100 n = 724	100 – 200 n = 916	> 120 n = 306
Piglets born alive	0.51	6.3	9.0	10.4	11.1
Average birth weight	0.22	1.39	1.43	1.48	1.61
Stand.deviation of birth weight	-0.37	0.31	0.28	0.25	0.18
Piglets weaned	0.56	5.0	7.6	9.2	9.9
Average weaning weight	-0.07	7.1	6.9	6.8	6.8
Percent weaning losses	-0.11	17.3	13.6	10.9	10.7

The results in Table 3 clearly show that the selection based on the litter quality index would have a positive effect on all litter traits except the number of piglets weaned, which does not show any significant correlation to the quality index. From a practical point of view the calculation of such a quality index assumes that individual birth weights have to be measured. Since in practical herds no individual piglet birth weights are taken it was tried to score the average piglet weight and the uniformity of birth weight within litters in three classes each (low, medium and high). With a multiple regression approach the exact calculated quality index was estimated using litter size and the scoring of birth weight and uniformity of birth weight with a multiple correlation of 0.77 (scoring based on known individual birth weights). With a small sample of 224 litters the scoring was done with unknown individual birth weights which resulted in a correlation to the exact calculated quality index of 0.78 (range between 0.83 and 0.75 for three different persons).

Although the data seems to be very small a first analysis to estimate genetic parameters for all litter traits (including the quality index) was done. In Table 4 the heritability estimates for first and second litters are shown.

The average birth weight adjusted for number of piglets born show a reasonable heritability of 22 to 24 % while the weaning weight seems not to be heritable. This could probably be explained by the crossfostering practice in the experimental farm. The variation of birth weight (standard deviation of individual birth weights within a litter) shows heritabilities of 5 and 20 % for first and second litters respectively. Similar heritabilities were estimated for the exact and the practical litter quality index.

Table 4. Heritability estimates for litter traits for first and second litters

Litter trait	first litter	second litter
Average birth weight [1]	0.22	0.24
Standard deviation of birth weight	0.05	0.20
Average weaning weight [1]	0.03	0.00
Exact quality index	0.11	0.22
Practical index	0.04	0.12

[1] adjusted for number of piglets

These preliminary heritability estimates seem to be promising to increase litter quality successfully in breeding programmes even with a scoring of average birth weight and uniformity of birth weight within a litter. Further investigations in breeding programmes with larger number of daughters each boar are recommended.