LIFETIME REPRODUCTIVE PERFORMANCE OF GILTS WITH HIGH AND LOW EBV'S FOR LITTER SIZE

S. Hermesch[1], H. U. Graser[1] and M. Mingay[2]

[1] Animal Genetics and Breeding Unit*, University of New England, Armidale, NSW, 2351
[2] Aztec Farms, Griffith, NSW, 2680

SUMMARY

A data set comprising 16 years of performance data from 1980 to October 1996 was used to compare Estimated Breeding Values (EBV's) for litter size in gilts with their lifetime phenotypic reproductive performance. EBV's for litter size were obtained with the genetic evaluation program PIGBLUP in 10 evaluations, using the cut-off dates January 1989, June 1989 and so forth until June 1993. Gilts obtained an EBV in litter size based only on pedigree information and were grouped in 10 percentile classes according to their EBV in litter size. The comparison between the top and bottom 10 percentile showed a difference in EBV's for number born alive of 0.96 piglets per litter. In their later life these gilts realised a difference in phenotypic performance of 0.91 piglets per litter. PIGBLUP provides a reliable tool to predict genetic differences in litter size.
Keywords: Pigs, litter size, PIGBLUP

INTRODUCTION

" What about the genetic improvement of litter size " was the title of a paper by Skervold (1979) who discussed possible reasons for the lack of genetic improvement in litter size and showed strategies for selection methods to improve litter size. However, no significant genetic trends in litter size have been achieved in various countries as shown in a summary by de Vries and Kanis (1994). Skervold (1979) suggested that low heritability and/or low selection differential may be the reason for this lack of improvement, and suggested use of information on paternal halfsisters and the maternal granddam in addition to the dam's performance. Best Linear Unbiassed Prediction (BLUP) procedures make use of information from all relatives. This should make better selection for litter size possible. Longterm performance recording, as it is available on some farms today, allows the comparison of EBV's for litter size in gilts with their phenotypic performance in their later life. This will give an indication of the possibility for improving litter size using BLUP technology. The aim of this study was to obtain EBV's in litter size for gilts and to analyse how well these EBV's were later realised in their lifetime reproductive performance.

MATERIAL AND METHODS

Aztec Farms started performance recording in 1980 and therefore data were available comprising 16 years until October 1996. This total data set data included 178336 animals with production records and 6037 sows with reproductive performance from a synthetic line developed at Aztec Farms. PIGBLUP (Henzell 1995) has been used for genetic evaluation on Aztec Farms since

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November 1993. In order to obtain EBV's for litter size in gilts, genetic evaluations were performed using data from 1980 until January 1989, June 1989, January 1990, and so forth until June 1993. These EBV's were based only on pedigree information, since gilts had no records available themselves. On average a sow has 2.2 litters per year in Australia (Meo and Cleary, 1995) and with this time frame of 3 years and 3 months from the cut off date in June 1993, gilts had the opportunity to have had up to seven litters until October 1996. From the 10 genetic evaluations a total of 30018 gilts had EBV's for litter size. Grouping of gilts based on their EBV for litter size was done within each genetic evaluation. Gilts were then linked with their phenotypic performance as sows. From the original 30018 gilts, 1862 gilts were kept as breeding sows and had reproductive performance records.

RESULTS AND DISCUSSION

Mean EBV's of the four traits analysed in Pigblup are summarized in Table 1 for all gilts before selection and selected gilts only. The average EBV for number born alive was 0.103 for all gilts prior to selection and 0.075 for gilts that were kept in the herd as sows. Selected gilts had also a slightly lower EBV for 21 day litter weight and average daily gain in comparison to the unselected group. In contrast, the EBV for backfat was -0.023 for the selected group in comparison to 0.017 for all gilts. The main selection emphasis in gilts during 1989 to 1993 was therefore on reduction of backfat with the consequence of slightly reduced EBV's in other traits.

Table 1. Number of records (N) and EBV's for number born alive (NBA), 21 day litter weight (LW21), average daily gain (ADG) and backfat (BF) for unselected and selected gilts from genetic evaluations between 1989 and 1993

	N	NBA (piglet/litter)	LW21 (kg)	ADG (gr)	BF (mm)
All gilts	30018	0.103	0.952	13.55	0.017
Selected gilts	1862	0.075	0.844	13.08	-0.023

Before selection, the top and bottom 10 percentiles for litter size included 2948 and 2932 gilts, respectively. From these gilts, 172 gilts remained in the herd from the top class and 192 for the bottom class (Table 2). The difference in EBV's for litter size between these two classes was 0.96 piglets. However, this difference was not used in selection decisions, since more gilts were selected from the class with low EBV's for litter size. The higher proportion of gilts selected from the bottom 10 % class resulted from their lower EBV in backfat of -0.09 in comparison to 0.05 of the top 10 % class. EBV's for average daily gain and 21 day litter weight were slightly higher for the top 10 percentile class of gilts.

The difference in EBV's for litter size was 0.96 piglets per litter for gilts and the difference in phenotypic performance in their later life is expected to be of the same magnitude. Number born alive was analysed using repeated records, and this difference in EBV's has to be compared with the average difference in number born alive over all parities. Table 3 shows an average difference over the first seven parities of 0.91 between the two classes. Sows with unsatisfactory performance

in litter size were culled in later parities, which is indicated by a greater reduction in records for the bottom class than for the top class. The observed difference in litter size is in good agreement with the difference in breeding values estimated by PIGBLUP.

Table 2. Number of gilts (N), means and standard deviations (s.d.) for EBV's in number born alive (NBA) and 21 day litter weight (LW21), average daily gain (ADG) and backfat (BF) for gilts with 10 % highest and 10 % lowest EBV's for number born alive

EBV for	top 10 percentile			bottom 10 percentile			Diff.
	N	Mean	s.d.	N	Mean	s.d.	
NBA (pig/litter)	172	0.57	0.16	192	-0.39	0.10	0.96
LW21 (kg)	172	1.36	1.78	192	0.63	1.76	0.73
ADG (gr)	172	13.91	15.20	192	12.59	15.20	1.32
BF (mm)	172	0.05	0.66	192	-0.09	0.58	0.14

Table 3 also lists the difference in phenotypic performance between both classes for individual parities. The genetic potential for litter size seems not fully expressed in the first two parities. For these two parities the phenotypic performance differs by 0.82 and 0.78 piglets. In contrast, the difference between both classes was 1.31 for the third parity and 1.06 for the fourth parity. Differences for later parities are influenced by culling decisions and are calculated using fewer animals, which limits our ability to draw conclusions from these parities.

Table 3. Means and standard deviations for phenotypic performance in number born alive from the first to seventh parity for gilts with 10 % highest and 10 % lowest EBV's for number born alive

	Top 10 percentile			Bottom 10 percentile			
	N	Mean	s.d.	N	Mean	s.d.	Diff.
NBA_1	159	9.19	2.77	192	8.37	2.63	0.82
NBA_2	133	9.84	2.92	147	9.06	2.50	0.78
NBA_3	107	10.81	2.73	114	9.5	2.57	1.31
NBA_4	70	11.11	2.52	74	10.05	2.93	1.06
NBA_5	46	10.37	2.78	45	10.13	3.09	0.24
NBA_6	29	9.96	2.64	27	9.26	3.28	0.70
NBA_7	13	10.85	1.67	13	9.38	2.10	1.47
Average		10.30			9.39		0.91

Besides mean phenotypic difference between the top 10 % and bottom 10 % classes, the phenotypic performance for individual parities is of further interest, to draw conclusions about reliability of EBV's in litter size for selection decisions. EBV's for litter size are shown for each

10 percentile class in Table 4. Each class contains approximately the same number of animals. Therefore, differences in EBV's between classes are larger between the extreme classes on either side. The extreme values in EBV's for the two bottom and two top classes, are expressed in their average phenotypic performance over the first three parities which are 8.98 and 9.09 for the bottom two classes and 9.83 and 9.84 for the top two classes. Phenotypic differences between groups are not linear for intermediate classes which is due to smaller differences in EBV's between these groups.

Table 4. EBV's in number born alive (EBV-NBA) and phenotypic performance in number born alive from the first to fifth parity for gilts grouped according to their EBV in number born alive (10 % classes)

Group	EBV-NBA	NBA_1	NBA_2	NBA_3	NBA_4	NBA_5	Average litter size for NBA_1 to NBA_3
1	-0.37	8.37	9.06	9.50	10.05	10.13	8.98
2	-0.18	8.21	9.00	10.06	10.08	9.79	9.09
3	-0.08	8.62	9.32	10.13	10.90	11.94	9.36
4	0.00	8.44	8.91	10.18	10.39	9.72	9.18
5	0.07	8.55	9.01	10.44	10.41	10.79	9.33
6	0.14	8.80	9.30	10.67	11.24	11.08	9.59
7	0.21	8.81	9.25	10.56	11.07	10.86	9.54
8	0.28	8.61	9.25	10.32	10.58	9.78	9.39
9	0.39	9.19	9.84	10.47	10.80	11.17	9.83
10	0.59	9.00	9.70	10.83	11.11	10.37	9.84

A number of traits are incorporated in selection decisions and this information on litter size provided by PIGBLUP can be used in different ways, depending on the main emphasis of the breeding program. If the breeder wants to put the main emphasis of selection decisions on litter size, selection of gilts from the top two classes will maximise response in this trait. When more emphasis is put on growth rate and backfat, at least avoiding gilts with low EBV's will be a possibility to avoid deterioration in litter size, as was seen in the past.

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