A Comparison of Six Maternal Genetic Lines for Sow Longevity

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Summary and Implications

Data from the National Pork Producers Council Maternal Line National Genetic Evaluation Program were used to compare the sow longevity of six different genetic lines, and to estimate the associations of gilt backfat thickness, age at first farrowing, litter size at first farrowing, litter weight at first farrowing, average feed intake during lactation, and average backfat loss during lactation with sow longevity. The lines evaluated were American Diamond Genetics, Danbred North America, Dekalb-Monsanto DK44, Dekalb-Monsanto GPK347, Newsham Hybrids, and National Swine Registry. The results suggest that the sows of Dekalb-Monsanto GPK347 had a clearly lower risk of being culled than the sows of other five lines. Moreover, the shape of the survival distribution function of Delkab-Monsanto GPK347 is clearly different than the other five lines. There were high culling rates due to reproductive failure after first weaning in the sows of the five other lines, however this increased culling rate did not exist in the Dekalb-Monsanto GPK347 line. The results further suggest that sows with lower feed intake and greaterer backfat loss during lactation had the shorter productive lifetime. These between line differences indicate that it is possible to select for sow longevity. More research is needed to show the most efficient methods to select for sow longevity.

Introduction

It has been shown that sow longevity plays an important role in economically efficient piglet production (Lacy and Stalder. 2004). Moreover, heritability estimates presented in the literature indicates that genetic variation exists in sow longevity (Serenius and Stalder, 2004; Yazdi, et al., 2000; Tholen et al., 1996). Thus, one might expect that between line differences exist in the sow lines available to commercial swine producers. However, the comparison of different commercial genetic lines has been almost impossible. Naturally, most sow lines are advertised to have the "best" genetics for many traits including sow longevity.

The comparison of different lines is possible only by standardizing the management factors or by having the ability to model the environmental effects. The Maternal Line National Genetic Evaluation Program (MLP) was conceived to evaluate the reproductive performance and sow longevity of different maternal lines available to US swine producers. The program was designed and conducted by National Pork Producers Council (NPPC) Genetic Programs Committee (GPC). The lines/suppliers attended on that study were American Diamond Swine Genetics (ADSG), Danbred North America (DB), Dekalb-Monsanto DK44 (DK44), Dekalb-Monsanto GPK347 (GPK347), Newsham Hybrids (NH), and National Swine Registry (NSR). A more complete description of MLP study is presented by Moeller et al. (2004).

One objective of this study was to compare the sow longevity of different genetic lines presented above, and to evaluate the associations of sow longevity with gilt backfat thickness, average daily gain, age at first farrowing, litter size at first farrowing, litter weight at first farrowing, backfat loss during lactation, and feed intake during lactation.

Materials and Methods

The longevity analyses were carried out by fitting proportional hazard models on the data obtained from MLP study. The analyses were carried out in three steps. First, the line comparison was done by fitting one baseline hazard function for all the lines. Second, the effects of gilt backfat thickness and average daily gain on sow longevity were estimated by fitting different baseline hazard functions for each genetic line. Each genetic line was analyzed separately because the survival distribution functions differ between the genetic lines, especially between the GPK347 and the other lines studied (Figure 1), and the associations between the traits might be different between the genetic lines. Third, the effects of age at first farrowing, litter size at first farrowing, litter weight at first farrowing, backfat loss during lactation and feed intake during the lactation on sow longevity were studied similarly as the second approach, but the information was utilized only from the sows that had farrowed at least once because gilts that never farrowed did not have records on these traits. In addition to these effects, a contemporary group effect was included in the statistical model. The statistical analyses were carried out with The Survival Kit package (Ducrocq and Solkner, 2001).

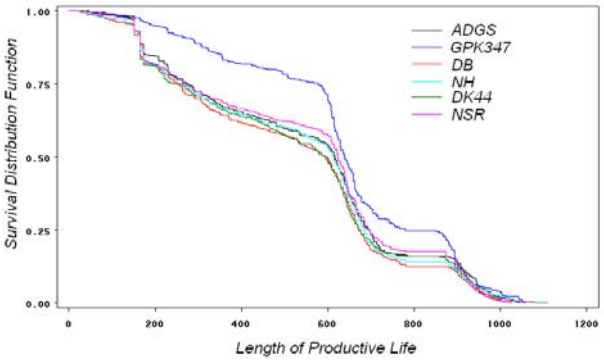

Figure 1. Survival distribution functions for different genetic lines studied.

Results and discussion

The results clearly show that the sows in GPK347 line have a lower risk of being culled than the other five lines studied (Table 1). Moreover, the survival distribution functions (Figure 1) indicate that the highest difference in the sow removal appears after the first parity. Sows from the other five lines have difficulties to rebreed after the first weaning, whereas the GPK347 sows does not have such difficulties. The differences in sow longevity appears to be relatively low among the other five genetic lines.

Table 1. Risk ratios of being culled between the six genetic lines studied.

Breed	Risk Ratio
NH	1.0000
NSR	0.9731
ADSG	0.9813
DK44	1.0358
GPK347	0.7114
DB	1.0915

Litter size, feed intake during lactation, and backfat loss during lactation are the factors more strongly associated with sow longevity for all the breeds (Tables 2 and 3). Lower feed intake and higher backfat loss during lactation is also associated with higher risk of a sow being culled.

Although the associations between the most significant effects are in the same magnitude between the genetic lines, it should be noted that there are differences in the association estimates between the genetic lines (Tables 2 and 3). Moreover, the associations of sow longevity with gilt backfat thickness and average daily gain seemed to differ between the full and reduced dataset analyzed.

References

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Table 2. Estimates for regression coefficients (*b*) and proportions of reduced model R^2 out of the full model R^2 (%), when the effect is not accounted in the statistical model. All the pigs are included in the survival analysis.

	ALL		NH		NSR		ADSG		DK44		GPK347		DB	
	b	%	*b*	%	*b*	%	*B*	%	*b*	%	*b*	%	*b*	%
giltBF	-1.03	72.98	-0.99	77.50	-1.46	49.14	-0.87	69.05	-1.58	62.58	-0.17	99.16	-1.24	78.20
ADG	-0.50	96.58	-1.03	84.15	-0.51	96.85	0.05	100.00	-1.93	73.98	0.85	90.54	-0.35	98.28

giltBF = gilt backfat thickness, ADG = average daily gain.

Table 3. Estimates for regression coefficients (*b*) and proportions of reduced model R^2 out of the full model R^2 (%), when the effect is not accounted in the statistical model.

	ALL		NH		NSR		ADSG		DK44		GPK347		DB	
	b	%	*b*	%	*b*	%	*b*	%	*b*	%	*b*	%	*b*	%
giltBF[b]	-0.60	98.46	-1.25	95.47	-1.04	97.52	-0.27	99.81	-1.61	95.62	0.04	100.00	-0.44	99.71
ADG[b]	0.83	98.19	-0.02	100.00	0.71	99.22	1.51	97.06	-1.85	96.85	1.95	90.60	1.24	97.52
LW[b]	0.00	99.95	0.00	99.88	-0.02	99.09	0.01	99.62	0.03	98.21	0.00	100.00	0.00	99.97
FI[b]	**-0.01**	**68.43**	**-0.01**	**85.53**	**-0.02**	**67.92**	**-0.01**	**77.97**	**-0.01**	**84.56**	**-0.01**	**75.42**	**-0.02**	**70.22**
BFloss[b]	**4.13**	**87.71**	**7.50**	**75.10**	**4.86**	**89.27**	3.99	92.1	**6.20**	**86.19**	1.43	98.58	4.39	95.26
AFF[b]	0.00	99.82	0.00	99.92	0.00	100.00	0.00	99.81	0.00	99.92	0.00	99.36	0.00	97.93
TNB[b]		94.35		**82.05**		**89.89**		**80.44**		**80.81**		**69.83**		**87.544**

[a] Only sows that farrowed at least once are included in the survival analysis.

[b]giltBF = gilt backfat thickness, ADG = average daily gain, LW = litter weight at birth, FI = feed intake during lactation, BFloss = backfat loss during lactation, AFF = age at first farrowing, TNB = total number of piglets born.