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Genetic correlations between exterior traits and stayability in pigs

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Introduction

In general, the relevance of conformation traits in pigs depends mainly on their relationship with involuntary culling and on their productive value for other economically important traits. Reducing involuntary culling of sows will reduce animal cost of replacement, increase average number of piglets per litter because of decreasing first parity sows and increase opportunity for selection on other traits. A survival analysis (Brandt et al. 1999) has shown that sows with a better leg score have a reduced risk of being culled involuntary which resulted in a higher longevity. The aim of this study was to examine the genetic relationship between a linear scoring system in pigs and the longevity of sows, here measured as stayability from the first to the second (stayability$_{12}$) and the first to the third litter (stayability$_{13}$) .

Material and Methods

Within the Bundeshybridzuchtprogramm (BHZP) an linear scoring system for sows and boars was implemented in 1995. A total of 9 traits were included as shown in figures 1 and 2, using a five point scoring system. As seen in figure 1 most of the traits have an optimum at 3 points. On a total of 160.000 young sows from two dam lines (line 01 and line 03) genetic parameters for the 9 exterior traits were estimated. For 55.000 of these sows fertility traits and the stayability after first and second litter was available to estimate the genetic correlation between exterior traits and stayability. The number of animals and the average styability are summarized in table 1. All genetic parameters were estimated using the VCE program (Groeneveld 1994). For the exterior traits and the stayability an animal model was used to estimate the variance components. For the exterior traits beside the random animal effect the common litter environmental effect was use as additional random effect. Additionally for these traits the weight at test as covariate and a fixed herd-year-season class was used. In most of the herds the day of test within herd could be included as herd-year-season class. For the stayability also a herd-year-season effect was included as fixed effect beside the random animal effect. The analysis was done within the two lines separately.

Table 1.: Number of animals and average stayability by lines

	Line 01	Line 03
Linear Scoring System	140986	18828
Stayability 1	47264	6959
Stayability 2	43830	6483
Average Stayability $_{12}$	86.6 %	84.7 %
Average Stayability $_{13}$	73.3 %	71.4 %

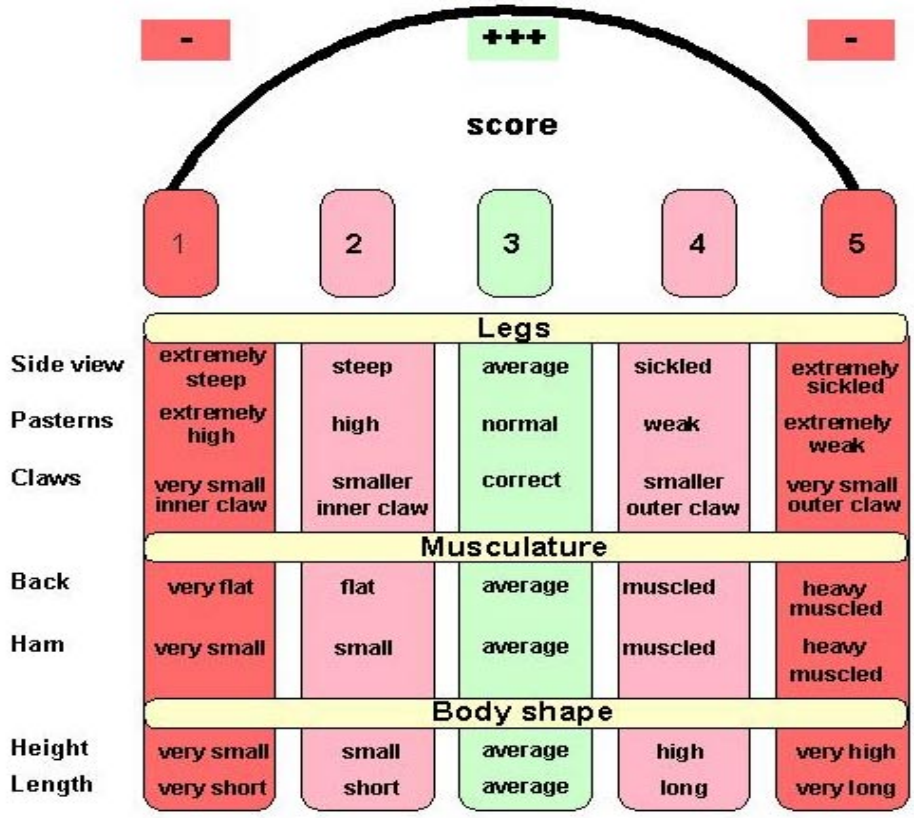

Figure 1. Linear scoring system for exterior traits for pigs

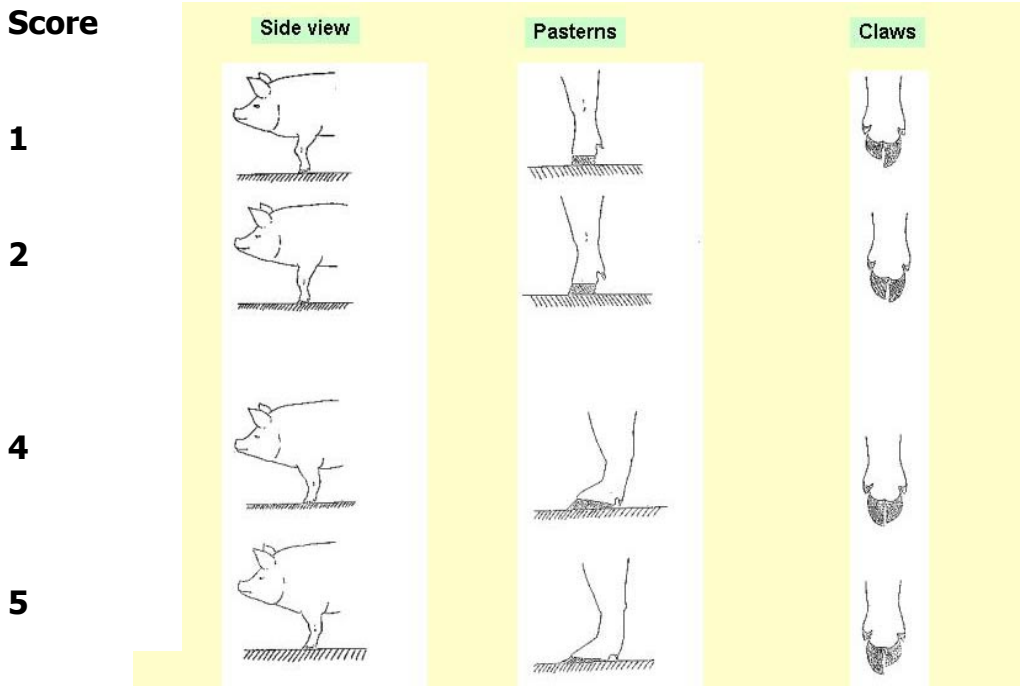

Figure 2. Linear scoring for forehand side view, pasterns and claws

3. Results

The 9 exterior traits show low to medium heritabilities between 0.03 and 0.25 (see table 2). For Line 03 slightly higher heritabilities are estimated. The heritability for stayability is low with 0.03 and 0.05 for both lines. The genetic correlations between stayability and hind leg side view and body length is for both lines negative with -.2 to -.3 (table 3) with the effect of a lower stayability with increasing body length and with hind legs more sickled or standing under. All other correlations are closer to zero and differ between lines and stayability $_{12}$ or stayability $_{13}$. The claws also show a consistent positive correlation between .14 and .24 to stayability within both lines.

Table 2. Heritability estimates for exterior traits and stayability for lines

Trait	Line 01	Line 03
Stayability $_{12}$	.03	.03
Stayabilitry $_{13}$	.05	.05
Fore leg side view	.11	.17
Hind leg side view	.05	.08
Fore leg pasterns	.11	.20
Hind leg pasterns	.08	.14
Claws	.03	.09
Height	.09	.11
Length	.07	.07
Muscling of ham	.12	.24
Muscling of back	.15	.25

Table 3. Genetic correlations between exterior traits and stayability

Trait	Stayability 1		Stayabiility 2	
	Line 01	Line 03	Line 01	Line 03
Fore leg side view	0.128	-0.007	0.331	0.079
Hind leg side view	-0.337	-0.247	-0.173	-0.301
Fore leg pasterns	0.000	-0.150	-0.045	-0.013
Hind leg pasterns	0.222	-0.157	0.197	-0.069
Claws	0.235	0.139	0.209	0.178
Height	0.010	-0.149	-0.099	-0.147
Length	-0.246	-0.318	-0.339	-0.332
Muscling of ham	-0.280	-0.057	0.031	-0.017
Muscling of back	-0.119	0.066	0.120	0.091

4. Discussion

The heritability estimates for the exterior traits are in agreement with other literature results (Canadian Centre for Swine Improvement Inc. 2001, Larochelle 1999, Lundeheim 1996, Van Steenbergen 1990). These studies use 5 or 10 point scoring systems partly with half points included. Schulze et al. (1998) estimate higher heritabilities for exterior traits from station test results for Large White and Landrace young boars also using a 5 point scoring system. The low heritability estimates for stayability confirm the results of Tholen et al. (1996) and Lopez-Serrano et al. (2000) with estimates of .05 to .09 and .06 to .09 respectively. Both authors also estimate unfavourable genetic correlations between stayability and daily gain and backfat. Lopez-Serrano et al. (2000) found a favourable

relationship of stayability to the leg score for Large White and Landrace. For most of the linear scoring of exterior traits a positive genetic correlations to a production traits does not necessarily mean an improvement in the production trait with an improvement in conformation because both high and low scores are undesirable for most of these traits. The negative genetic correlations between the hind leg side view and the body length to stayability in the present study, however, clearly lead to the conclusion that longer animals and animals with more sickled hind legs have a reduced stayability. These animals will probably fall in the category of involuntary culling because of leg problems. Beside productivity and fertility problems the rear legs are to a high percentage a culling reason (Brandt et al. 1999, Canadian Centre for Swine Improvement Inc. 2001).

5. Conclusion

Using a 5 point linear scoring system exterior traits show low to medium heritabilities between 0.07 to 0.25 which allows genetic progress by breeding for these traits.
Stayability from first to second and first to third litter show an expected low heritability of 0.03 and 0.05 respectively.
From the genetic correlations of the exterior traits to stayability it can be concluded that longer sow or sows with more sickled hind legs will show a reduced stayability in all lines. Genetic correlations between other exterior traits are not very high and vary between lines.

6. References

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