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INFLUENCE OF SOME GENETIC AND ENVIRONMENTAL FACTORS ON THE PRODUCTIVITY OF DANUBE WHITE PIGS
I. STUDY ON THE EFFECT OF BLOOD INTRODUCTION IN BOARS WITH SIMILAR GENOTYPES

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ABSTRACT

The effect of using boars with different origins Large white (LW) x English landrace (EL) and Danube white (DW) from the Gerana farm on the productive traits of Danube White pigs for three generations has been studied. Objective of the study were the basic selection traits – growth rate and lean meat percentage measured at 90kg live weight with Piglog 105. Other traits of productive performance have been included in the analysis as regression effects. Estimation of productive traits of pigs with different blood grading was performed by means of multitrait animal model (Sire model).The hybrid combinations were characterized by neutral to favourable effects including those of new origins. The analysis of animal model results established better productivity for crosses' progeny and with respect to sex – for the male animals.

Keywords: Danube White, growth rate, lean meat percentage, Animal model (sire model)

INTRODUCTION

Genetic improvements in purebred breeding are based on intra-linear selection which is a cumulative process. The changes during the particular periods are accumulating and lead to future improvement of populations. The degree of genetic changes decreases at reaching the selection plateau, changes in the effective population size etc.

The breed formation process (creation of new lines) and the fast achievement of desired improvement for certain important economic traits are realized by introduction of blood from animals having emphasized advantages with respect to the trait improved. The purpose of blood introduction is such that individuals in the next generation become carriers of the desired qualities of the improver breed and at the same time not differ considerably from the initial breed.

Genetic improvements can be realized only when the results from the traits measured and the relationships between the individuals from the pedigree are taken into consideration, which can be achieved to the highest extent by BLUP – animal model (Simianer, 1994). According to Lo et al. (1997) and Lutaaya et al. (2001), information from the crossing of progeny in the reproducers can be used for breeding value estimation of the initial (purebred) parental forms by using such models.

The optimal use of the genetic resources and the efficiency of different systems of crossing are based on interbreed differences related to the heterosis value and the recombination effects. Dickerson (1973) introduced the term "recombination loss" to measure deviations from linear association of heterosis with degree of heterozygosity and it describes "the average fraction of independently segregating pairs of loci in gametes from both parents which are expected to be non-parental combinations".

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The selection pressure, for traits characterized by favourable genetic correlations between them, cumulates epistatic effects enhancing the productivity of farm animals, whereas the unfavourbale correlations disperse the epistatic effects and negatively influence the productive traits. So, these effects of specific traits can be both favourbale and unfavourbale depending on the genetic correlations between the selection traits (Cassady, J. et al., 2002).

The objective of this study was to investigate the effect of blood introduction in boars with similar genotypes.

MATERIAL AND METHODS

A study comprising 960 pigs of Danube White breed was carried out during the period 2004-2008. The influence of sires with different origins (LWxEL and DW from the Gerana farm) was studied. The choice of these genotypes was based on the fact that they were used for the breed creation. Objective of work was to study the basic selection traits of productive performance for three generations. The animals were raised under conventional conditions which were characterized by lowered criteria with respect to feeding and breeding.

Objective of the study included the basic selection traits – growth rate and lean meat percentage measured at 90 kg live weight by the device Piglog 105. Other traits of productive performance were included in the analysis as regression effects.

The information was processed by multifactor analysis (Harvey, 1990). The significance of the factors was estimated by Fisher's test whereas the differences between the levels of factors (LS – means) – by Student's t - test.

Sires' ranking is showed on the basis of animal model (Sire model) (Groeneveld, 1990). The model includes the sires as random factor (R) and fixed effects of sex (F).

Model

Lean meat percentage = sires sex

Age = sires sex

The statistical model can be represented as an estimated breeding value "y_{ijk}" of the individual *"j"* who is offspring of the sire "*i*".

$$\mathbf{Y_{ijk} = Fixed + A_{ik} + PE_{jk} + e_{ijk}}$$

where:

Fixed are the fixed effects of the herd for the relevant trait;

A_{ik} is the random effect of the sire

"*i*", PE_{jk} random effect of the individual

"j" for the trait measured

"k", e_{ijk} residual effects.

RESULTS AND DISCUSSION

The results characterizing the productive performance of pigs from the Danube White breed are given in Table 1. From the informational analysis it has been seen that the crosses grew up more intensively and significant differences were established between the purebred animals and crosses with 50% blood grading for the sire - 6.4 days ($P \leq 0.05$), as well as between

Table1: Productive performance of Danube White pigs

	Trait	Number	Meat percentage in carcass, % LSC±SE	Age, Days LSC±SE	Significance of differences: Meat percentage	Significance of differences: Age
blood grading	1. 100% blood grading (pure-blooded)	755	0.58±0.40	17.3±5.4	2+++	2+
	2. 50% blood grading F_1	117	1.47±0.40	10.9±5.6	1	1
	3. 25% blood grading F_2	76	0.26±0.41	11.6±5.7	5+ 3+++	5+++ 2+++
	4. 50% (25% + 25% GGP) F_2	3	-0.62±1.19	-14.7±16.5	2	5
	5. 12.5% blood grading F_3	9	-1.69±0.76	-25.16±10.5	5++	3+++
Sex	1. Male	170	0.06±0.11	-3.18±1.53		1 - 2+
	2. Female	790	-0.06±0.11	3.18±1.53		
Regression	Point L1		$-0.499\pm0.015^{+++}$	$-0.988\pm0.21^{+++}$		
	Point L2		-0.001±0.001	0.00±0.00		
	Depth of MLD^{+++}		$0.196\pm0.015^{+++}$	0.145±0.21		
	Live weight		$-0.045\pm0.009^{+++}$	$0.916\pm0.130^{+++}$		

GGP –great-grandparents

those animals with blood grading 12.5% - 42.5 days ($P \leq 0.001$). Significant differences have been established also between the genotypes of the crosses and the crosses with blood grading 12.5% ($P \leq 0.001$) grew up most intensively.

The results concerning the meat percentage in carcass are not unidirectional. The semi- blood crosses had the highest meat percentage - 51.76% ($P \leq 0.001$) as compared to the purebred animals, whereas in the third generation after crossing the values of the same trait decreased by 1.69% ($P \leq 0.05$). The differences between the crosses were significant $P \leq 0.01$ except for the crosses from the second generation (25% from the grandmother and 25% from the grandfather), which is due to their smaller number.

The influence of sex is given in the same Table. The male animals were characterized by better productive traits and the growth rate was higher by 6.3 days ($P \leq 0.05$).

The variation of traits was within normal limits. The values of determination coefficients (R = 0.822 for meat percentage in carcass and R = 0.620 for growth rate) gave us grounds to think that the factors included in the model reliably describe the variation of selection traits.

The variance analysis showed significant influence of sires with different blood gradings ($P \leq 0.001$ – for meat percentage in carcass and $P \leq 0.01$ – for growth rate). The influence of sex was significant for the age at 90 kg live weight ($P \leq 0.05$).

Table 2: Analysis of variance of the traits studied (ANOVA)

Trait	Degree of freedom DF	Meat percentage in carcass, %	Age, Days
LSM±LSE		50.28±0.47	260.25±6.53
C		4.90	12.43
R		0.822	0.620
Sires	4	+++	++
Sex	1	ns	+

R – Coefficient of determination; C – Variation coefficient

Boars' ranking gave us grounds to think that breeding value estimation by sires was highly influenced by the interaction between different genotypes (Table 3 and 4). Ranking by genotype of sire and sex showed that the boars from the new origins as well as the male animals were characterized by better performance traits. For example, the differences of 9.4 days and 0.57% for lean meat in favour of the boars were close to those mentioned above. However, it should be noted that the variance-covariances of selection traits included in the sire's model gives us an unbiased estimation of the deviations both for the sires and sex.

The results characterizing the productive traits showed that the crosses have had higher growth rate. With respect to meat percentage in carcass the values were not unidirectional which can be explained by the epistatic loss in formation of the crosses' genotypes. The negative and unfavourable values of the regression coefficients between the percentage of lean meat in carcass and fat depth in points L1 and L2, and live weight are probably due to recombination gene effects. Baas et al. (1992) found heterosis and recombination effects for some slaughter traits which were analyzed in pigs of the following origins: Landrace, Hampshire, their reciprocal crosses and backcrosses in second and third generations. The same authors pointed out unfavourable heterosis and direct recombination effects with respect to increase in fat depth and decrease in body length, while with respect to dams' recombination effects there was increase in slaughter length. In a study with purebred animals and crosses up to sixth generation, Cassady and colleagues. (2002) established that the productive traits were influenced mainly by the breed and dam's genotype and to a lower extent by the genotype of grand dam. The crossbred pigs grew up more intensively than the purebred ones, whereas with respect to the slaughter traits the differences were not unidirectional, which in fact corresponds to our study. According to the same authors the new allele combinations in crossbred offspring have increased the growth rate, feed conversion, body length, and the loin eye area was found to decrease in some origins, whereas in others it increased.

IMPLICATION

The hybrid combinations are characterized by neutral to favourable effects including those of new origins. The analysis of results by means of animal model has established that the crosses and boars are characterized by better productive traits.

Table 3: Ranking of boars by blood grading and sex

Boar/trait	Purebred	New origins	Male	Female
Meat percentage	0.00	2.25	0.57	0.00
Age	0.00	2.07	9.41	0.00

Table 4: Ranking of boars

Boar's number and origin	Lean meat percentage, %	Age, days	Boar's number	Lean meat percentage, %	Age, days	Boar's number	Lean meat percentage, %	Age, days
LW x EL			LW x EL			DW with external origin		
2	0.869	24.3	49893	0.247	1.1	2802	-0.403	- 1.7
7	0.217	7.7	89893	- 0.038	- 16.6	2818	- 0.108	- 6.4
						2826	- 0.710	- 6.2
Boars from the basic herd of DW								
150	0.139	4.4	4457	0.049	3.0	9534	0.055	12.1
223	- 0.381	- 4.5	4484	- 0.116	2.8	9612	- 0.061	- 3.4
317	- 0.235	- 5.8	4504	0.218	2.5	3247	0.184	1.9
386	0.067	- 1.0	4509	0.044	3.8	3254	- 0.162	- 4.3
422	0.166	- 1.5	4517	0.509	0.6	3274	- 0.375	- 0.2
432	- 0.413	- 6.9	4523	0.033	- 0.2	3800	- 0.055	4.1
456	0.058	3.0	4553	0.277	4.0	4299	0.210	4.3
769	0.180	6.4	4609	0.331	3.8	4304	- 0.008	2.1
807	0.455	15.4	4766	0.191	2.7	4341	0.306	3.8
836	- 0.141	- 7.2	4936	0.399	1.0	4347	0.011	6.8
970	- 0.011	0.9	5019	- 0.347	- 9.8	4358	0.076	4.6
997	0.108	3.8	5049	0.003	2.0	4397	0.109	1.8
1043	- 0.202	- 4.0	5157	- 0.196	- 2.5	4404	0.240	6.3
1071	- 0.327	-8.1	5222	- 0.223	- 6.8	4416	0.060	0.6
1227	0.101	3.2	6136	- 0.059	0.3	9641	0.002	1.6
1402	- 0.107	- 1.3	6461	0.075	1.1	9770	0.035	- 3.2
1593	- 0.153	- 4.7	7290	- 0.413	- 7.5	9836	- 0.074	- 5.6
1601	0.150	1.2	7309	- 0.289	0.9	12733	- 0.307	- 8.2
1676	- 0.010	- 1.7	7409	0.183	6.0	12799	- 0.199	- 8.0
1728	- 0.074	- 2.5	7806	- 0.139	- 6.8	12812	- 0.746	- 20.5
1824	0.121	3.7	7842	0.449	15.2	12903	- 0.305	- 8.1
2028	0.239	9.9	7945	0.058	- 0.6	12912	- 0.045	- 3.1
2636	0.065	7.9	8480	0.043	- 1.8	13009	- 0.233	- 10.0
2800	- 0.089	- 1.9	9113	0.211	7.5	111843	- 0.193	- 2.5
2857	0.280	2.0	9340	0.306	13.5	111864	- 0.418	- 8.6
2951	0.560	- 1.3				112462	- 0.322	- 11.0

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