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STABILIREA OBIECTIVULUI SELECȚIEI ÎNTR-O POPULAȚIE DE PORCINE

THE ESTABLISHMENT OF THE SELECTION OBJECTIVE IN A PIG POPULATION

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The goal of this paper is to optimization the selection objective in a paternal pig line. Therefore, we simulated six types of indexes, which differ among them on the number of traits. There were analysed the following traits: (1) body weight at 182 month age (BW), (2) meat percent in empty body (MPB); (3) average daily gain between 0-182 month age and (ADG); (4) average daily gain on empty body (ADGB). MPB trait was included in each objectve (index). The six indexes were: (1) MPB+BW; (2) MPB+ADG; (3) MPB+ADGB; (4) MPB+BW+ADG; (5) MPB+BW+ASDGB, and (6) MPB+BW+ADG+ADGB .The genetic parameters were computed using REML method. The biologic importance of the traits were estimated on linear multiple regression. For establishing of the best combination of the traits witch maximize the expected genetic progress, some parameters were used, that is: the accuracy of selection, overall genetic progress (ΔH) and the genetic progres for each trait (ΔG_i). The best index was the last, which included all traits. Its parameters were: 1,087 (r_{HI}); 2,144 (ΔH) and 3,35% (ΔG for MPB).

Introduction

The economic efficiency of the pigs breeding depends on the prolification, output, consumption and the quality of the carcase, all of them being part of the improvement target. The achievement of hybrid pigs needs the crossbreeding of three or four populations, thus the objective of the populations selection is simplified: maternal populations are selected for their proficiency and the rate of growth (daily average gain or the living weight) , and the paternal populations are selected for the growing rythm and the quality of the carcase.

When the selection objective is established, the following principles must be taken into account : (a) The selection objective must be precisely expressed, meaning that the traits referred to have to be as much as possible objectively measured ; (b) The selection objective must be constant, for 3-4 generations, in order to assure the needed time for a new genetical structure of the population to come into being, following the direction the improver wants. The inconstancy of the selection objective can annihilate the previously got success. (c) The selection objective must be simple, meaning that, it has to include only essential traits, economically important. Each quantitative trait is an assembly of simpler traits, until the traits controlled by a small number of genes, are obtained. For example, the production of meat provided by a womb sow is a very complex character, made of simpler characters : prolification, the rate of growth and the carcase weight of the descent. At its turn, the prolification depends on other simpler characters, such as the ovulation rate. The two simple characters do not have phenotypical expression anymore, they become methabolical characters, that is why, in the selection objective, the medium characters are taken into account, some of them refer to the production quality (prolification, growth rate, specific consumption), others to the production quantity (carcase quality).

Each new character included in the selection objective reduces the selection intensity for the other characters, implicitly the genetic progress, with a quantity equal to $\sqrt{n^{r_G-1}}$ of what would be obtained if the selection were done only on it (r_G, represents the genetic correlation between the considered characters).

Materials and Methods

There were used the results obtained in a test according to the own performances of 3617 specimens from the Synthetic Line-345 Peris, belonging to 105 boars and 1040 sows. The average size of the boar family was 34,44 and that of the sow family 3,45. The traits refering to the rate of growth and the carcase quality were as follows: the living weight, the percentage of meat in carcase, the daily average rate and the average rate in carcase meat.

The selection objective is that of getting a maximum genetic progress per unit of time and expenses. As a result, it has to be optimized, by imagining more possible objectives that can compete against one another, those that can maximize the yearly genetic gain at low cost, being taken into account (though the optimization on economical criteria is not the point of the present paper).

Taken the considered characters into account, six possible objective were studied, elaborated according to the selection indexes techniques (L.N. Hazel, 1943, C.R. Henderson, 1963, Şt. Popescu-Vifor, 1990; Van Vleck, 1993, H.Grosu şi col., 1997).

The six selection indexes built included the following characters : (a)meat percentage + living weight ; (b) meat percentage+ daily average rate ; (c) meat percentage + rate in the carcase ; (d) meat percentage + living weight + daily average rate ; (e) meat percentage + living weight + rate in the carcase and (f) meat percentage + living weight + daily average rate + rate in the carcase. Because the meat percentage is an important objective within a terminal line, there was a concern on keeping this character in every built index.

The selection indexes forming, implies the genetical and economical parameters cognition within the investigated population.

The REML method was used in order to estimate the genetic parameters (L.R. Schaeffer, 1999).

The economical importance of the characters has a central role in the improvement decision to make, the including of the characters in the improvement objective depending on it.

The economical value of a character is defined by the relativ effect on a global indicator (profit) given by its genetic growth with a genetic unit, the rest of the characters being constant. As the prices and the costs have a great variability in time and space, there were preocupations on replacing the economical efficiency with the biological one. Within this context, the global indicator is represented by the maximization of the daily average rate of the meat in the carcase.

In the present paper, the biological importance of each character was estimated by the multiple regression method, considering the daily average rate of carcase meat as the dependent variable (global indicator) and the charcters such as living weight, carcase meat percentage, daily average rate and medium carcase rate, as independent variables. As the considered characters are expressed in different measure units, the partial regressions were standardized in order to obtain comparable results.

Results and Discussions

1. The medium performances of the analized sample

The medium performances of the four considered characters and their statistical analysis are presented in Table 1.

Table 1

Average performance of the analysed sample

Character		**$X \pm S_X$**	**s**	**v%**	**t**	**t_{tab}**
Living weight (kg)	F	100.65±0.356	14.25	14.159	2.67**	2.57
	M	101.99±0.354	15.91	15.603		
Meat percentage in the carcase (%)	F	54.61±0.099	3.98	7.30	10.22***	3.29
	M	55.99±0.091	4.09	7.31		
Daily average rate in the birth-oblation period (gr.)	F	0.507±0.002	0.071	14.142	1.63^{NS}	1.96
	M	0.511±0.001	0.076	14.95		
Daily average rate in the carcase (gr.)	F	0.397±0.001	0.067	16.77	2.18*	1.96
	M	0,402±0,001	0,070	17,565		

From the data presented in Table 1, it results that there are differences statistical assured between the two sexes, for three of the considered characters. The characters variability is in normal limits, too.

2 Genetical parameters

2.2.1.The phenotypical variance components. In order to make up the selection indexes, there were determined the phenotypical variance and covariance, genotypical and environmental, the values being presented in Table 2.

Table 2

The observational components of variance and covariance of the analysed traits.

Characters couple	S_F^2/cov_F	S_I^2/cov_I	S_i^2/cov_i
Living weight (A)	231.50	22.57	208.926
Meat percentage (B)	16.831	1.304	15.527
S.m.z. in life (C)	0.0055	0.00031	0.0052
S.m.z. in meat (D)	0.0047	0.00032	0.0044
AxB	-5.405	-3.179	-2.226
AxC	0.998	0.070	0.928
AxD	0.948	0.080	0.868
BxC	-0.0276	-0.008	-0.019
BxD	-0.0259	-0.009	-0.017
CxD	0.0045	0.0027	0.0042

Heritability. Based on the data presented in Table 2, the values of the four characters were computed and are presented in Table 3.

Table 3

Heritability values of the analysed characters

Character	$h^2 \pm S_{h2}$
Living weight	0.31±0.058
Meat percentage	0.39±0.070
S. m.z. in life	0.23±0.048
S. m. Z. In carcase	0.27±0.053

Out of the data presented in the table, we can notice that all the four studied characters are intermmediate heritable, having heritability values of 0,23 for the daily average rate and 0,39 for the living weight.

Phenotypical, genotypical and environmental correlations. The phenotypical variances and covariances, inter- and intrafamilial (Table 2) were the base of the phenotypical, genotypical and environmental coefficient estimation (Table 4).

Table 4

The values of the phenotypical, genotypical and environmental corelation betwwen the analysed characters

Characters couples	$r_F \pm Sr_F$	$r_G \pm Sr_G$	r_M
Living weight			
x meat percentage	-0.087***±0.017	-0.586***±0.060	0.089
x daily average rate	0.884***±0.008	0.836***±0.030	0.911
x carcase rate	0.908***±0.007	0.941***±0.011	0.904
Meat percentage			
x daily average rate	-0.091***±0.016	-0.397***±0.081	-0.015
x carcase rate	-0.092***±0.016	-0.440***±0.075	0.005
Daily average rate			
x carcase rate	0.885***±0.008	0.857***±0.027	0.893

There are negative genotypical correlations between the meat percentage with living weight (-0,586), the daily average rate (-0,397) and the carcase rate (-0,440). In exchange, there are very tied genotypical correlations between the living weight and the two categories of rates and, between the latest ones.

The phenotypical correlations follow the same trends as the genotypical ones, the negative ones being weak in intensity. It can be noticed however, that all correlations are semnificative (α=0.001).

1. The relative importance of the characters and the selection indexes

Table5

The selection indexes for several combinations of traits

Index	Characters	v_i	b_i	S_I^2	S_H^2	$R_{H,I}$	ΔH	ΔG_i per intensity unit of the selection
I_1	Meat percentage +living weight	0.35 0.65	0.692 0.289	25.22	44.57	0.75	5.02	1.45% 6.95 kg
I_2	Meat percentage + daily average rate	0.33 0.67	0.099 -1.27	0.181	0.554	0.57	0.42	1.31% -0.011 kg
I_3	Meat percentage + carcase rate	0.33 0.67	0.098 -1.81	0.186	0.552	0.58	0.43	1.33% -0.013 kg
I_4	Meat percentage + living weight + daily average rate	0.33 0.20 0.47	0.275 0.280 -41.158	5.550	5.900	0.97	2.35	2.68% 7.34 kg 0.0079 kg
I_5	Meat percentage + living weight + carcase rate	0.34 0.16 0.50	0.243 0.272 -45.23	4.290	4.33	0.99	2.07	3.07% 6.38 kg 0.0099kg
I_6	Meat percentage + living weight + daily average rate + carcase rate	0.33 0.15 0.17 0.35	0.227 0.320 -26.410 -30.280	4.550	3.895	1.087	2.144	3.35% 6.87 kg 0.0079kg 0.012kg

Out of the data presented in Table 5, it results that the best option proved to be index 6 (**I_6**), which includes all of the four characters. This index had the best efficency ($r_{H,I}$ =1,087), and the best partial genetic gains (the genetic progress for each character expressed in terms of intensity unit of the selection), for the meat percentage (3,35%) and for the living weight (6,87 kg.).

The poorest results (even negative) were obtained for the alternatives of index two (**I_2**) and three(**I_3**), which include the daily average rate and the carcase rate.

It was observed that when the rate takes part in the two indexes making up, the genetic gain was -0,011 kg for the daily average rate (**I_2**) and -0,013 kg., respectively, for the carcase rate(**I_3**). For the two index alternatives, the lowest values of the correlation between the aggregate genotype and the selection criterion: 0,57 and 0,58 respectively.

Conclusions

1) Following the Student test use, it resulted that there are differences statistically assured between the specimen of the two sexes, in case of three of the four characters (living weight, carcase meat percentage and average rate in the carcase);
2) The heritability values varied from 0,27 for the average rate in the carcase to 0,39 for the meat percentage, thus including the four characters in the category of the intermmediar heritable ;
3) The phenotypical correlations varied from –0,087 (living weight x meat percentage) to 0,908 (living weight x rate in the carcase) ;
4) The genotypical correlations varied from –0,397 (meat percentage x daily average rate) to 0,941 (living weight x rate in the carcase) ;
5) The environmental correlations varied from –0,015 (meat percentage x daily average rate) to 0,911 (living weight x daily average rate) ;
6) The biological percentage in case of meat in the carcase was between 33-35%,, the rest of it being distributed for the other characters ;
7) The best index option, that maximizes the selection effect, proved to be that one including all of the four characters.

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