OPTIMIZING OF THE CHARACTERS SUBJECT TO SELECTION IN A PIG SINTETIQUE POPULATION PERIS 345

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Abstract
The goal of this paper is optimization of 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 age of 182 month (BW), (2) meat percentage 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 objective (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 six selection indices build included the following characters: (a) Meat percentage + live weight; (b) Meat percentage + average daily spore; (c) Meat percentage + carcase spore; (d) Meat percentage + live weight + average daily spore; (e) Meat percentage + live weight + carcase spore and (f) Meat percentage + live weight + average daily spore + carcase spore. The genetic parameters were computed using REML method. The biologic importance of the traits were estimated on linear multiple regression. In order to establish the best combination of the traits which maximize the expected genetic progress, were used the following parameters: the accuracy of selection, overall genetic progress (ΔH) and the genetic progress for each trait (ΔG_i). The best index was the last one, which included all traits. Its parameters were: 1,087 (r_{HI}); 2,144 (ΔH) and 3, 35% (ΔG for MPB).

Keywords: pig, traits, selection, optimisation, parameters, genetic, economic, efficiency, amelioration

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1. INTRODUCTION

Economic efficiency of pigs breeding depends on the prolific character, spore, and carcase quality, all these characters competing to enter in the objective of genetic improvement. Production of hybrid pigs require crossing of three or four populations, so that the purpose of selection is simplified: the native populations are selected for prolific character and growth (average daily spore or live weight), and paternal populations are selected for growth in and carcase quality (Henderson, 1963; Grosu et al., 1997).

In order to establish the selection objective must be taken into account the following principles:

(a) The objective of the selection to be *specifically* formulated, so that the features in question are objectively measured as far as possible;

(b) The objective of the selection to be constant for 3-4 generations, to ensure that the time required for the formation of a new genetic structure of the population in the direction of the breeder. Inconstancy of the selection objective can annihilate the previously progress.

(c) The objective of the selection to be simple, in order to include only essential, important economic characters

Each quantitative character is a combination of simpler characters, until the character controlled by a small number of genes. For example, the production of meat per sow is a complex character, composed of simpler character: prolificity, speed of growth and carcass weight of progeny. Prolificity depends on other simpler characters, such as ovulation rate. Too simple characters have no longer the phenotype expression but they became metabolic characters, so as the objective character of the selection are typically complex, some relating to quantity production (prolificity, spore growth, specifically), other

production quality (carcase quality) (Movileanu, 2008).
Each new character included in the selection objective reduces the intensity of the selection for other characters, implicit the genetic progress, equal to the amount of $\sqrt{n^{r_G - 1}}$ from what would get if the selection would be made only for the new character (r_G is genetic correlation between characters considered).

2. MATERIAL AND METHODS

There were used the results obtained in testing the performance from 3617 individuals from Synthetic Line-345 Periș, from 105 boars 1040 sows. The average size of boars livestock was 34, 44 and for sows livestock the average size was 3, 45. Characteristics concerning the rate of growth and carcass quality were the following: live weight, meat percentage in carcase, average daily spore and spore in meat carcase.
The objective of the selection is to achieve maximum genetic progress, per unit of time and expenses.
As a result it has to be optimized by imagining more than one possible objective that may enter in the competition, retaining the one which maximizes the winnings of genetically annual cost, with minimum cost (although to optimize on economic grounds is not covered by the present work).
Having regard to the characters considered, have been studied six possible goals compiled in accordance with the technique of selection indices (Hazel, 1943; Henderson, 1963; Popescu-Vifor, 1990; Van Vleck, 1993; Grosu et al, 1997).
The six selection indices build included the following characters:
(a) Meat percentage + live weight;
(b) Meat percentage + average daily spore;
(c) Meat percentage + carcase spore;
(d) Meat percentage + live weight + average daily spore;
(e) Meat percentage + live weight + carcase spore and
(f) Meat percentage + live weight + average daily spore + carcase spore. Whereas the percentage of meat is an important goal within a terminal line has sought to maintain this character in each index built.
The composition of the selection indices requires knowledge of genetic and economic parameters in the population researched (Movileanu, 2004).
In order to estimate the genetic parameters have been used the REML method (Schaeffer, 1999).
The economic importance of the characters has a central role in amelioration decision-making process, depending from this the inclusion of characters in the objective of amelioration.
The economic value of a character is defined by the relative impact that its growth with a genetic unit on a global indicator (profit), the other characters remaining constant (Sandu, 1983). Whereas the prices and costs show a high variability in time and space, it sought to replace the biological effectiveness with economic efficiency. In this context, the global pointer is represented by maximizing increased average daily meat in the carcase (Movileanu, 2008).
In this paper, the biological importance of each character was estimated by multiple regression method, considering average daily spore of lean meat in carcase as the dependent variable (the global index) and the following characters: live weight, percentage of meat in the carcase, average daily spore and spore in carcase, as independent variables.
Whereas the characters treated shall be expressed in different units of measure, partial regressions have been standardised in order to obtain comparable results.

3. RESULTS AND DISCUSSION

3.1. The average performance of the tested sample

The average performance of the four characters considered and their statistical analysis are presented in table 1.

Table 1. The average performance of the tested sample

Character		X ±S_X	s	v%	t	t_{tab}
Live weight (kg)	F	100,65±0,356	14,25	14,159	2,67**	2,57
	M	101,99±0,354	15,91	15,603		
Lean meat percentage (%)	F	54,61±0,099	3,98	7,30	10,22***	3,29
	M	55,99±0,091	4,09	7,31		
Average daily spore during birth-slaughter (gr.)	F	0,507±0,002	0,071	14,142	$1,63^{NS}$	1,96
	M	0,511±0,001	0,076	14,95		
Average daily spore in carcase (gr.)	F	0,397±0,001	0,067	16,77	2,18*	1,96
	M	0,402±0,001	0,070	17,565		

The data presented in table 1 show that between the two sexes there are statistical differences provided for three of the characters considered. In addition, the variability of the characters is within normal limits

3.2. Genetic parameters

3.2.1. The components of the phenotypic variance. In view of the composition of selection indices there were determined the phenotypic, genetic and environmental variances and co-variances, obtaining values from the table 2.

Table 2. The observance components of the variances and co-variances of the characters analyzed

Couple of characters	S_F^2/cov_F	S_I^2/cov_I	S_i^2/cov_i
Live weight (A)	231,50	22,57	208,926
Lean meat percentage (B)	16,831	1,304	15,527
Average daily spore per life (C)	0,0055	0,00031	0,0052
Average daily spore 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. On the basis of the data presented in table 2 were calculated values of the four characters, as shown in table 3.

Table 3. The heritability values of the analyzed characters

Character	$h^2 \pm S_{h2}$
Live weight	0,31±0,058
Lean meat percentage	0,39±0,070
Average daily spore per life	0,23±0,048
Average daily spore in carcase	0,27±0,053

In the data table is found that all four characters studied are intermediate heritable with heritability values between 0, 23 for average daily rise and 0, 39 for live weight.

Phenotypic, genetic and environmental correlations Phenotypic variances and co-variances, inter- and in-family (table 2) were the basis for estimating the correlation of the phenotypic, genetic and environmental coefficients (table 4).

Negative genetic correlations are found between the percentages of meat with a live weight (-0,586), daily average spore (-0,397) and spore in carcase (-0,440). Instead it is found very close genetic correlations between live weight and the two spore categories as well as between.

Table 4. The values of phenotypic, genetic and environmental correlations between the characters analyzed

Couples of characters	$r_F \pm Sr_F$	$r_G \pm Sr_G$	r_M
Live weight X meat percentage	-0,087***±0,017	-0,586***±0,060	0,089
x average daily spore	0,884***±0,008	0,836***±0,030	0,911
x spore in carcase	0,908***±0,007	0,941***±0,011	0,904
Lean meat percentage x average daily spore	-0,091***±0,016	-0,397***±0,081	-0,015
x spore in carcase	-0,092***±0,016	-0,440***±0,075	0,005
Average daily spore x spore in carcase	0,885***±0,008	0,857***±0,027	0,893

Table 5. Selection indices for different combinations of characters

The Index	Character	v_i	b_i	S_I^2	S_H^2	$R_{H,I}$	ΔH	ΔG_i per intensity unit of the selection
I_1	Lean meat percentage + live weight	0,35 0,65	0,692 0,289	25,22	44,57	0,75	5,02	1,45% 6,95 kg
I_2	Lean meat percentage + average daily spore	0,33 0,67	0,099 -1,27	0,181	0,554	0,57	0,42	1,31% -0,011 kg
I_3	Lean meat percentage + spore in carcase	0,33 0,67	0,098 -1,81	0,186	0,552	0,58	0,43	1,33% -0,013 kg
I_4	Lean meat percentage + live weight + average daily spore	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	Lean meat percentage + live weight +spore in carcase	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	Lean meat percentage + live weight + average daily spore + spore in carcase	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

Phenotypic correlations follow the same trend as the genetic ones, the negative ones being weak as intensity. However, it must be noted that all correlations are very significant (α= 0.001).

3.3. The relative importance of character and selection indices

The data presented in table 5 shows that the best variant was found to be index six (**I_6**), which includes all four characters.

This index has recorded the best effectiveness ($r_{H,I}$, I = 1,087), and the best partial genetic gains (genetic progress for each character, expressed in the selection intensity unit) for the percentage of meat (3.35%) and live weight (6, 87 kg.).

The weakest result (even negative) were obtained in variants of indexes two (**I_2**) and three (**I_3**), which include average daily spore and spore in carcase.

It was found that when the spore participating in the composition of the two indices, genetic gain was-0,011 kg for average daily spore (**I_2**) and -0,013 kg for spore in carcase (**I_3**).

In the two variants of indices were also obtained the lowest values of the correlation between aggregate genotype and the selection criteria: 0, 57 and respective 0, 58.

4. CONCLUSIONS

Following the application of Student test it was found that there are statistical differences between individuals of the two sexes, at three of the four characters (live weight, percentage of carcass meat and average spore in carcase);

Heritability values ranged from 0,27 for average spore in carcase, up to 0,39 for meat percentage, the four character being in the category of intermediate heritable;

Phenotypic correlations ranged from -0,087 (live weight x percentage of meat) to 0,908 (live weight x spore in carcase);

Genetic correlations ranged from -0,397 (meat percentage x average daily spore) to 0,941 (live weight x spore in carcase);

Environmental correlations ranged from -0,015 (meat percentage x average daily spore) to 0,911 (live weight x average daily spore). All correlations have been found to be very significant;

Biological share held by the percentage of meat in the carcase was 33-35%, the rest being distributed to other characters;
The best variant of the index which maximizes the effect selection has proven to be one that includes all four characters (**I_6**).

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