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Improvement of algorithm of criteria of selection of pigs of male parental form with use of BLUP method

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The purpose. To improve algorithm of criteria of selection of pigs of male parental form by results of assessment of animals of 4 generations with the help of BLUP method. **Methods**. Theoretical and methodological basis of research were works by Ch.R. Henderson, R.A. Mrode, V.M. Kuznetsov, N.P. Yudina, and other scientists on the investigated problem. During researches they applied general trial-and-error method: measurement, comparison, simulation; and special — BLUP, zoo-technical, instrumental, etc. Biometrical analysis of data was carried out with the help of statistical and mathematical methods, realized in package Statistica 6. **Results.** Researches testify to the following: selection of pigs in herd with the use of BLUP-index assessment is necessary for realizing in some stages, proceeding from the reached level of productivity, and also the purposes and problems of selection. For preliminary determination of the best alternatives of selection of young boars and pigs they simulated 5 levels of selection pression on terminal BLUP-index. With increase of selection pression they traced dynamics of values of attributes of specific breeding value of animals which treated to different pleiads, for the purpose of stabilization of their reproductive qualities. At the final stage the selection of young boars and pigs was spent on minimum acceptable values: terminal BLUP-index, specific breeding value of daily average increase, width of fat, length of a trunk and amount of papillae. Simulation of results of selection at the improved algorithm of criteria of selection in herd testifies to the following: selection effect for one generation on specific breeding value of width of fat and daily average increase makes – 0,53 mm and +4,66 g accordingly. **Conclusions.** By results of researches it is established that development of algorithm of selection of animals of male parental form promoted increase of genotypic consolidation of young boars on specific breeding value of daily average increase and width of fat on 50,8 and 65,6%, and young pigs — on 23,1 and 32,6% accordingly.

Keywords: *biometrical analysis, genotypic consolidation, breeding value, selection effect.*

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Recently, the concept of genotype evaluation has become more and more important in Ukraine. This relates to the evaluation of pigs with the involvement of proband productivity data, as well as an array of performance information for all related animals [1]. Mixed linear models and method for predicting breeding value are used to combine information about the animal and obtain additive estimates. The general provisions of this method were defined by Professor Henderson K. R. in the 70-ies of the last century [2]. It was named Best Linear Unbiased Prediction (BLUP) - the best unbiased forecast. But the use of the method in breeding practice began much later. This became possible after adjusting the calculation methods and developing models that would best split the performance into genetic and non-genetic components. The method has become widespread in the world and is used to estimate the breeding value of most species of farm animals. Previous studies by foreign and domestic scientists indicate that the use of the BLUP method for estimating the breeding value of animals increases its accuracy [3-5].

The production testing of the BLUP method in Ukraine was started several years ago [6, 7] for the implementation of the Order of the Ministry of Agrarian and Industrial Policy and the National Academy Agrarian of Science №569/72 of September 17, 2010. The relevance of the research is due to the need to standardize the procedures for assessing the breeding value of pigs for the implementation of the state

course on accession to the WTO and the European Union. It should be noted that the simulation of different variants of selection was initiated in the work of N.P. Judine [8]. To model the selection, she applied six levels of terminal BLUP-index (95 to 120 points) and the minimum acceptable values (criteria) of three phenotypic traits (the length of the trunk, the age of reaching the live weight of 100 kg and the thickness of the spica). To improve the selection and genotypic effect of consolidation, selecteden for the reproduction of animals by the breeding value of the main features of productivity we proposed another algorithm selection. It is based on five levels the selection pressure according to the terminal BLUP-index and the minimum permissible metrics of two specific breeding values and two phenotypic traits. **The purpose** of the work was to improve the algorithm of criteria of selection of the parental form on the results of evaluation of pigs of four generations by the BLUP method.

Materials and methods of research. The theoretical and methodological basis of the study were the works of leading scientists [2-5] on the problem under study. Collection of primary data of zootechnical accounting was carried out, according to methodological recommendations [9] in the LLC "Selection Enterprise "Zolotoniske" of Cherkasy region. Material and technical resources were used to conduct the research. In particular, this is a herd of synthetic lini alba pigs, scales for individual weighing, measuring tape, the ultrasonic gaugen of thickness of spica of firm Renko, a computer with "Plem Office Pig" accounting software. Determination of the breeding value of pigs was carried out using special software [10] by using a common model of a single animal, which looked like:

$$y_i = x_i'b + a_i + e_i, \quad (1)$$

where y_i - observation of breeding trait in the i-th animal; x_ib - is the sum of the fixed effects pertaining to the i-th animal; a_i - is a random additive genetic effect of an i-th animal; e_ij - is a random (residual) deviation.

Genotype consolidation coefficients were determined based on the formula of Yu.P. Polupana in the modification of I.A. Rudyk, R.V. Stavetskaya [11]. The essence of which is to determine by of breeding value of animals for a specific selection trait, in particular:

$$K_1 = 1 - (\sigma_r : \sigma_o), \quad (2)$$

where K1 - is the coefficients of genotype consolidation; σ_r - is the root mean square deviation of the group of animals; σ_o - is the root mean square deviation of the total population of evaluated animals.

The research materials were processed by biometric methods on a computer using Statistica 6 software

Research results. Scientists of the Cherkase RSB of NAAS and specialists of LLC "Selection Enterprise "Zolotoniske" have formed a database of zootechnical and breeding information by of animals synthetic line alba. She counts 4,056 head of breeding pigs of four generations. To improve the algorithm of selection criteria,we conducted a detailed analysis of by productive qualities data and the results of the evaluation of animals using the BLUP method. Then identified the average productivity of the array of estimated animals of the parental form on reaching their live weight of 100 kg. Productivity was as follows: age - 200.0 days, average daily gain - 544 g, thickness of the spica - 11.0 mm, length of trunk - 127 centimeters. The mean value of the terminal BLUP index was 100.8 points. The productive qualities of the animals were evaluated according to the leading breeding characteristics. After that, five levels of selection pressure were modeled according to the indicator of the parent BLUP index (Table 1).

1. Effect of selection pressure by BLUP-index on the value of genotypic traits and correlation relationships between traits

Indicator	Graduation of BLUP index of parent lines, points					
	Average	**95 i**	**100 i**	**105 i**	**110 i**	**115 i**
n	**4056**	**3722**	**2493**	**834**	**147**	**9**
Selection pressure, %	**100**	**92**	**61**	**21**	**3**	**0,22**
The value of I_b	**100,8±**0,1	**101,6*******±**0,1	**103,7*******±**0,1	**107,3*******±**0,1	**111,5*******±**0,2	**117,1*******±**0,6
	Genotypic traits					
STV TS, mm	-0,38±0,01	-0,45***±0,01	-0,57***±0,01	-0,78***±0,02	-0,94***±0,06	-0,85±0,43
r	**-0,53*****	**-0,42*****	**-0,32*****	**-0,14*****	0,15	0,54
STV DI, g	-0,47±0,05	-0,16**±0,05	0,91***±0,05	2,97***±0,09	5,68***±0,26	11,6***±1,59
r	**0,78*****	**0,77*****	**0,71*****	**0,60*****	**0,66*****	**0,81*****
STV M, head	-0,10±0,01	-0,07*±0,01	0,04***±0,02	0,15***±0,03	0,31***±0,07	0,32***±0,05
r	**0,26*****	**0,25*****	**0,14*****	**0,12*****	0,03	-0,36
STV PW, kg	-0,01±0,02	0,08**±0,02	0,25***±0,03	0,36***±0,04	0,34***±0,09	-0,37±0,28
r	**0,25*****	**0,18*****	0,08***	-0,01	-0,11	**-0,52**
	Correlation Relationships Between Pairs of Specific Tribal Values:					
TS - DI, r	0,00	**0,12*****	**0,30*****	**0,59*****	**0,77*****	**0,91*****
TS - M, r	-0,07***	-0,04**	-0,02	-0,02	0,02	0,19
DI - PW, r	**-0,10*****	**-0,17*****	**-0,28*****	**-0,36*****	**-0,31*****	0,29
DI - M, r	0,06***	0,04	**-0,10*****	**-0,16*****	-0,15	-0,14
M - PW, r	0,06***	-0,04*	-0,01	-0,04	-0,15	0,29

Note. Hereinafter:* p<0,05; ** p<0,01; *** p<0,001 - the likelihood of difference calculated to the average of the in herd; Ib - the value of the index BLUP parental lines; STV or EBV (Estimated Breeding Value) – specific tribal value or predicted deviation of breeding traits in offspring from average population values; STV PW – the specific tribal value of the live weight of the piglets when weaned, kg; STV DI – the specific tribal value of the averages daily increas upon reaching the mass 100 kg, g; STV TS – the specific tribal value thickness of spica in 100 kg, mm; STV M – specific tribal value of uterus with first farrowing, heads; r – correlation coefficient between the BLUP-index and the specific tribal value of some traits.

It was determined that, starting from a selection pressure of 92%, the BLUP-index and trait specific values significantly trait exceeded the average of the estimated animals. A positive significant correlation was found between the BLUP**-**index and the specific tribal value of the daily average gain (0.60**-**0.81) for the five levels of breeding pressure. The same pattern occurred between a couple of features of the specific tribal value of the thickness of the spica and the average daily gain (0.12-0.91). Further studiedis the selection situation in a population of estimated animals. Then graded the young animals by sex with by five levels selection pressures according the BLUP**-**index. Data analysis of the efficiency of the selection system is presented in table. 2.

2. The efficiency of selection of repaird knurtsi and pigs of the according to the terminal BLUP-index at different selection pressure, M ± m

Breeding pressure		n	BLUP-index:		EBV on:			
%	*point*	heads	I_b, *point*	Im, *point*	*TS, mm*	*Dl, g*	*M, head*	*PW, kg*
Knurtsi								
100	100,8	1924	100,8±0,11	99,2±0,34	-0,37	-0,49	-0,10	-0,02
90	95 i	1726	101,7±0,09***	100,4±0,34*	-0,45	-0,10	-0,07	0,06
56	100 i	1087	104,0±0,09***	103,1±0,41***	-0,59	1,11	0,03	0,24
18	105 i	354	107,5±0,11***	105,0±0,64***	-0,81	3,08	0,10	0,33
4	*109 i*	*72*	*110,9±0,22***	*107,4±1,09***	*-0,94*	*5,23*	*0,25*	*0,39*
0,7	112 i	14	113,9±0,11***	106,7±2,34***	-0,64	8,70	0,45	0,06
Pigs								
100	100,9	2132	100,9±0,10	99,4±0,33	-0,39	-0,45	-0,10	-0,01
91	95 i	1939	101,7±0,09***	100,8±0,32**	-0,45	-0,13	-0,07	0,12
56	100 i	1207	104,0±0,09***	103,9±0,39***	-0,57	1,08	0,07	0,28
29	*103 i*	*625*	*106,3±0,11***	*105,9±0,55***	*-0,69*	*2,42*	*0,14*	*0,41*
7	108 i	151	110,3±0,17***	108,3±1,11***	-0,86	4,87	0,31	0,43
1,3	112 i	27	114,0±0,39***	109,0±1,99***	-0,91	7,63	0,33	0,49

Note: I_m **-** the BLUP-index of maternal lines, point

Thoroughly analyzed the effectiveness of selection of knurtsi and pigs. He testified that the values of the average daily growth and thickness of the spicen increased significantly after reaching a breeding pressure of 56% or less. Modeled the system of selection of animals in the form presented in table. 3 at a selection pressure of for knurtsiv 4.0% and sows 29.0%.

3. Improvement of algorithm of criteria of selection of pigs of parental form according to terminal BLUP-index

Sexual and age group	BLUP-index	EBV		Phenotypic trait	
	I_b, *point*	*TS, mm*	*Dl, g*	*TL, cm*	*NN, pieces*
Boars and knurtsi	min 109	**-**0,5 i	+3,2 i	min 118	6/6
Sows and pigs	min 103	**-**0,3 i	+0,4 i	min 115	6/6

Note: TL - length of trunk in 100 kg, centimeter; NN - the number of nipples, pieces.

According to research data, 55.6% younge of knurtsiv and 55.5% of pigs were vyranzhyrovkai by selection on by terminal BLUP**-**index and additional criteria from the breeding process. They were of the EBV characterize by a worsening average daily gain, the spica thickness, the length of the trunk in pre-selected animals.

It was found that improvement of the algorithm of criteria for selection of sows and pigs by terminal BLUP**-**index allowed increasing the coefficients of genotypic consolidation of animals on some grounds of breeding value of two Pleiades. In particular, this applies to the signs of average daily growth and thickness of the spica. The by genotype consolidation ratios increased from **-**0.08 ... 0.09 to 0.507... 0.240 and from **-**0.197 ... 0.04 to 0.459 ... 0.330, respectively.

Were conducted research modeling the expected selection results for by improved algorithm for selection criteria in the herd. They indicate a significant breeding effect for one generation of animals. Thus, the breeding effect on the specific tribal value of the thickness of the spica, the average daily gain, of multiplicity sows and weight of piglets is respectively: **-**0.53 mm, +4.66 g, +0.39 head and + 0.22 kg (Table 5).

5. Modeling the efficiency of selection of pigs of the parent form on the basis of the BLUP index estimation with the improved selection algorithm

Animal	**The average value of the index, point**	**EBV breeding trait**				**The phenotypic value of the trait**	
		TS, mm	***DI, g***	***M, head***	***PW, kg***	***TL, cm***	***NN, pieces***
Father	111,2	-0,99	+5,38	+0,28	+0,18	128,6	12
Mother	107,2	-0,82	+3,00	+0,01	+0,23	127,0	12
F_0	109,2	-0,91	+4,19	+0,29	+0,21	127,8	12
Herd	100,8	-0,38	-0,47	-0,10	-0,01	126,9	12
	8,4	-0,53	+4,66	+0,39	+0,22	+0,90	0
The breeding effect: - for generations		-0,53	+4,66	+0,39	+0,22	x	x
- for the year		*-0,27*	*+2,33*	+0,20	+0,11	x	x
The economic effect on one average annual sow, UAH / year		*70,40*	*327,20*	*64,42*	*45,76*	*=507,78*	
		For receipt: 2.2 farrowing, multiplicity 10 head, age of live weight 100 kg 197.4 days, a yield piglets of one sows 20.2 head.					

Conclusions

Improvement of the algorithm of selection of pigs according to the terminal BLUP-index provides breeding effect one generation by the specific tribal value of the thickness of the spica respectively on – 0.53 mm and the average daily increase a +4.66 g. In addition, it allows us to increase the genotypic consolidation of boars on the grounds of breeding value of the two Pleiades, in particular: average daily increase by 50.8%, spica thickness by 65.6% and sows – by 23.1% and 32.6%, respectively.

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