

GENETIC AND PHENOTIPIC CHANGE OF CERTAIN TRAITS OF PIGS IN RELATION TO SELECTION CRITERIA

Vidović V., Boboš S., Štrbac Lj., Punoš D., Lukač D., Stupar M.

University of Novi Sad, Faculty of Agriculture, Department of Veterinary medicine, Novi Sad, Serbia

In pig production, the most important traits from economical point of view can be as follow: number of weaned piglets per sow per year, feed conversion, growth and meat content in carcass then protein level in meat. To provide optimal selection effect for each of them it is important to determine genetic correlation between them and size of heritability as well. According to knowledge of negative genetic correlations between fertility or milk yield and meat content in carcass it is necessarily to developed different selection criteria or better says specialized breeds.

Since of purpose of selection effects on farm production in analysis we separate due to selection criteria two groups of breed, e.g.: fertility and milking breeds – Landrace and Yorkshire and terminal breeds, e.g.: Duroc and Pietrain. Following literature sources we can accept some trend which can depends from selection criteria, farm, year and season effect of management on the farm too. The research was defined to analyzed selection effects during 11 years of selection on farms. Selection criteria were different for terminal breeds (Duroc and Pietrain) compare Landrace and Yorkshire where selection has been concentrate on litter size and milk yield.

**Material and Methods.** The experiment has been done at 4 farms since 2000 up to 2011. We included 4 breeds, L, Y as mother line and D and P as terminal one. The following pictures give different selection criteria that were used. To follow litter size were used data of 1.658 sows of L and Y. Average alive weight at slaughter of all animals was 103 kg and standard deviation of 2,6 kg.

Table 1 – Breed structure and number of animals in trial

Breed	Sire	Dam	Progeny	No. carcasses
Landrace	11	80	196	36
Yorkshire	12	74	182	36
Duroc	10	66	102	36
Pietrain	10	62	80	36

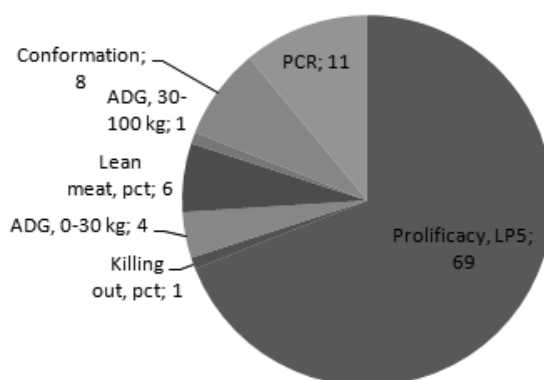


Figure 1. Used selection criteria for mother breeds: – Landrace and Yorkshire

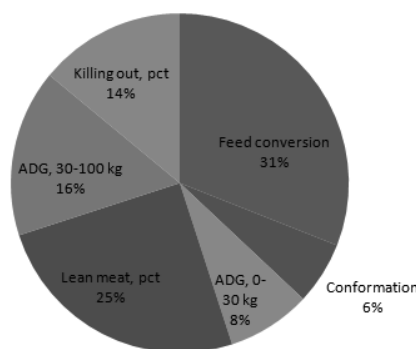


Figure 2. Selection criteria used for terminal breeds: – Duroc and Pietrain

Following MME LS model has been used to analyze influences of FYS (Farm, Year and Season) then Breed as fixed effect and Sire as random one (Vidović 2011a).

$$Y_{ijkl} = \mu + HYS_i + B_{ij} + S_{ijk} + E_{ijkl}$$

- $Y_{ijkl}$  – Number of observations hierarchically distributed;
- $\mu$  – General mean of observations;
- $HYS_i$  – Fixed effect of farm, year and season;
- $B_{ij}$  – Fixed effect of different breeds;
- $S_{ijk}$  – Random sire effect;
- $E_{ijkl}$  – Residual

**Result and Discussion. Litter size.** First of all we used totally different selection criteria to do selection in specialized breeds. Litter

size was not of selection interest for D and P. So, we analyzed trend for L and Y. After generations of selection, selection trend were little less than expected. Probably one of limited factors was FYS effect and feeding regime of sows it can be redefined in the future. Even that selection effect tendency was positive and similar for both L and Y. Similar results have been done by Nielsen, 1994. and Vidović at al. 2011. Genetic variation has shown similar value and trend at the beginning and end of analysis. Inbreeding coefficient was just about zero. Present variation opening possibility for new selection progress.

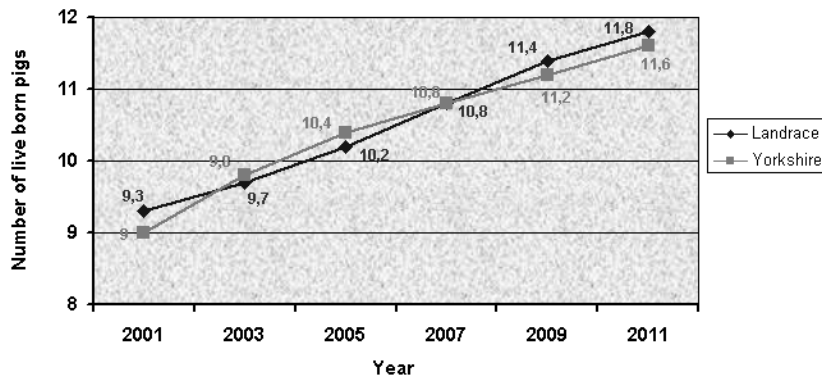


Figure 3. The effect of selection on litter size at first farrowing of Landrace and Yorkshire.

**Fattening days and feed conversion.** The line (Figure 4) showed expected tendency. It means the selection criteria for most economically important traits have been well defined. Selection intensity was controlled by number of doses per jump. In case of feed conversion (FC) improvement were 90 kg per head. Most fast improvement was at first 5 years. Since that FC is average heritage there are new possibilities to continue with selection effect, e.g. to decrease FC, reduce cost and increase profit per kg of gain. Similar trend has been showed by Brascamp 1985., Rotschild 1990., Park at al. 1986., Bergsma at al. 2010., Vidović et. al. 2011a; 2011b.

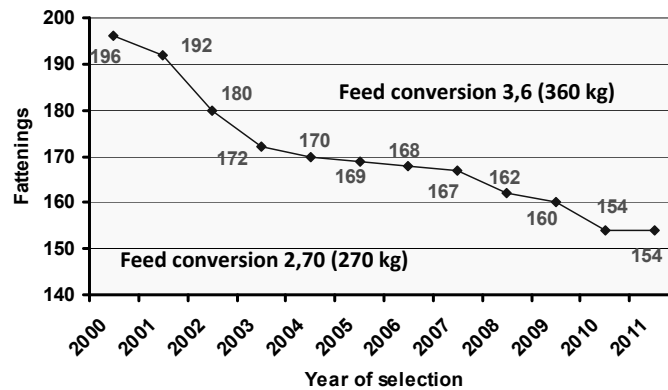


Figure 4. Effect of selection on age at slaughter (indirectly on growth) and feed conversion for Landrace, Yorkshire and Duroc

**Effects:**

1. Less of feed : 90 kg
2. Less fattening days : 42

Notes: There are no selection differences between Landrace, Yorkshire and Duroc. Pietrain had significantly less daily gain and age at slaughter compare to three other breeds. According to fattening period we can recognize improvement of 42 days. Economically it is improvement of about 20 euro per pig. Comparisons of age and FC between Duroc and Pietrain differences are present. Duroc had 32 days shorter period to the certain commercial weight and used 88 kg less food. Feed cost in Duroc are 19 euro less.( Figure 5). These result are similar to Vidović and Šubara 2010., Vidović et al. 2011c., Višnjić et. al. 2012.

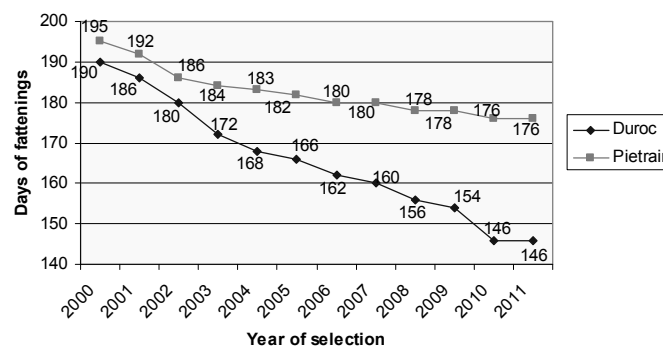
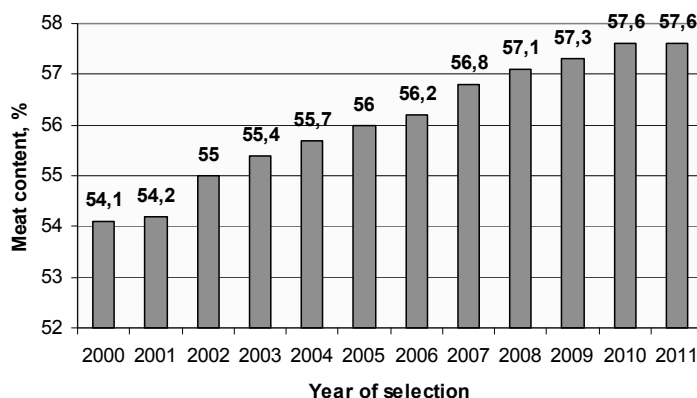


Figure 5. The differences in feed use and age at slaughter between Duroc and Pietrain in test production  
**The differences:** Age: 32 days Feed: 88 kg

**Carcass quality.** Meat content in Landrace and Yorkshire has no statistical differences even they showed optimal trend. Since those to breed are treated as dam line to provide heterosis effect at F<sub>1</sub> daughters selection criteria were concentrate more on fertility traits. Expected trend were very close to realized one. It is going to back fat between 16- 20 mm at that age. Later on these animals if they are going to be parents mast has some reserve to produce progeny (Figure 6).

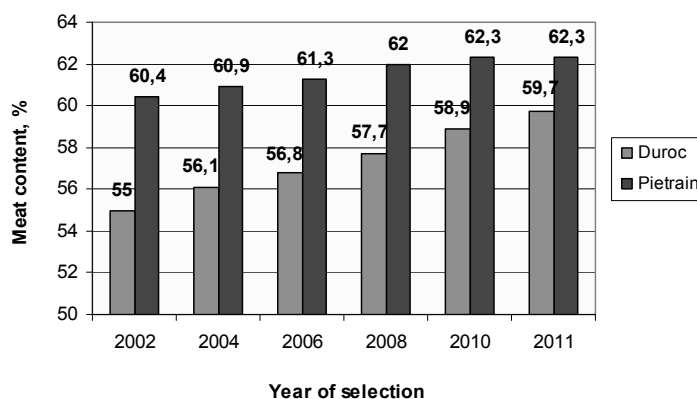
Bones density did not differ significantly between Landrace, Yorkshire and Duroc. Pietrain bones were significantly easier. This demonstrates the viability of lower growth in this race compared to the other and longer feeding for 24 to 32 days. When it comes to the only growth was significantly lower in Pietrain animals were compared to their peers of other races. The content of meat in the carcass was approximately 57.6% in fertile breeds and Duroc 58.9%. It was not significantly different. Pietrain had 62.1% of meat in the carcass which is significantly higher than in other races. Intramuscular fat content was: 0.8% of Pietrain, Duroc 2.6% 2.0% Landrace and Yorkshire 1.8%. The level of protein as the most important parameter of meat quality was the lowest in Pietrain (20.1%), Landrace and Yorkshire were 21.8% and 22.5% and 22.9% Duroc. Selection criteria relate to the last eight generations of selection and the effects show the expected trends.

Just to remind case of present negative genetic correlations between milk yield and meat content in carcass mean that breeders have to optimize selection criteria and use specialized sire and dam lines in breeding program. In our experiment we divided into two different groups: L and Y as mother line and used totally different selection criteria compare to terminal sire lines: D and P. After 11 years of selection or 8 generations result were present (Figure 6 and 7).



**Figure 6.** The trend of selection for percentage of meat content for Landrace and Yorkshire

At figure 6 can be recognized the differences between Duroc and Pietrain even they have the same selection criteria. The only differences were at the beginning of start trial. In conclusion we can say the trend were more or les the same as selection effect. The differences of 3,4% of meat content or raptly 2,5 kg meat between them provide about 8 euro more profit in fewer to P. But in total D made about 14 euro more profit including FC and fattening period as well. Similar conclusion were defined by Gama at al 1990., Rotschild 2010., Bergsma at al. 2010., Vidović et. al. 2011c,d,e., Višnjić et. al. 2012.



**Figure 7.** The effects of selection for meat content of Duroc 59.7 and Pietrain

**The effects in meat content, %:** - Duroc : 3,9  
 - Pietrain: 1,9

**Conclusion.** Selection criteria for certain traits have been optimal. It showed clear genetic trend for certain traits. Litter size were with expected trend e.g. 0,25 alive born more piglets per generation. The feeding regime and management of gilts and sows was changed to previous one. This change has significant influence on genetic potential of sows.

There have no been selection differences for gain and age at slaughtered Y, L and D. Pietrain showed significantly les gain and needed longer period to reach certain weight. So that means more cost and less profit in case of P.

Also selection on meat content had positive trend. Selection efficiency were higher at D compare with P. Pietrain it self still have 3,4% more meat in carcass but much longer period of fattening. Intramuscular fat was much lover at P (0,5%) compare to D (2,5%). This has negative effect on meat quality in case of P.

References

1. Bazer, F.W., Tergui, M., Martinat, F. B. (1990): Physiological limits to reproduction. WCGALP, XVI, 281 – 292, Edinburgh.
2. Bergsma, R., Kanis E., Varstegen M.W.A, Knol E.F. (2010): Genetic Correlations between Lactation Performance and Growing – Finishing Traits in Pigs. WCGALP, 41, Leipzig.
3. Brascamp E.W., Smith C., Gur D.R. (1985): Derivation of economic weight from profit equations. Anim. Prod. 40, 175-180.
4. Gama, L.T., Harder, R.R., Johnson, R.K. (1990): Change in ovulation rate and uterine capacity in swine selected for litter size. WCGALP, XVI, 351- 354.
5. Krnjajić, J., Vidović, V., Lukač, D., Štrbac, Lj., Punoš, D., Stupar, M. (2012). Genetski parametri važnijih reprodukcijskih svojstava visoko plodnih rasa svinja. XVII Savetovanje o biotehnologiji. Agronomski fakultet Čačak. In press.
6. Leymaster, K.A., Johnson, R.K. (1994): Second thoughts on selection for components of reproduction in swine. WCGALP, 17, 307-315. Guelph.
7. Nielsen, M.K. (1994): Selection experiments for reproductive rate in mice. WCGALP, 1994, 219-226, Guelph.
8. Park, Y.I., Kim, J.B. (1986): Heritability of litter size and litter weight at birth in swine. WCGALP, X, 59-62, Lincoln.
9. Rotschild, M. F. (1990): The role of biology in future pig breeding programs. WCGALP, XV, 415-427, Guelph.
10. Vidović, V., Lukač, D. (2010): Genetika životinja. Poljoprivredni fakultet, Novi Sad.
11. Vidović, V. (2011a): Teorija oplemenjivanja životinja. Poljoprivredni fakultet, Novi Sad.
12. Vidović V., Šubara V. (2011b): Farmski menadžment – ključ uspeha. Poljoprivredni fakultet, Novi Sad.
13. Vidović V., Višnjić, V., Jugović, D., Punoš, D., Vuković, N. (2011c): Praktično svinjarstvo. APROSIM, Novi Sad.
14. Vidović, V., Trivunović, S., Punoš, D., Štrbac, Lj., Lukač, D., Stupa, M., (2011d) : Selection efficiency on bone and meat yield in pigs. Biotechnology in Animal Husbandry. 27, 1787-1792.
15. Vidović, V., Lukač, D., Štrbac, Lj., Punoš, D., Stupar, M., (2011e): Genetic trends using different criteria of selection on specialized breeds in pigs. Biotechnology in Animal Husbandry. 27, 1779-1786.
16. Višnjić, V., Vidović, V., Štrbac, Lj., Lukač, D., Punoš, D., Stupar, M. (2012). Intenzitet porasta hibridnih svinja u tovu očeva rase pitren i durok. XVII Savetovanje o biotehnologiji. Agronomski fakultet Čačak. In press.
17. Vidović, V., Lukač, D., Štrbac, Lj., Punoš, D., Stupar, M. (2012). Effect of different selection criteria on growth traits and carcass quality in pigs. 6th Central European Congress of Food, Novi Sad. (In press).

### **ГЕНЕТИЧНИ І ФЕНОТИПІЧНИ ЗМІНИ ДЕЯКИХ ЯКОСТЕЙ СВИНЕЙ ЩОДО ВИДІЛЕНИХ КРИТЕРІЇВ**

**Відовіч В., Бобош С., Стрбак Д., Пунош Д., Лукач Д., Ступар М.**

*Університет Нови Сад, сільськогосподарський факультет, відділення ветеринарної медицини, Сербія*

*У свинарстві найбільш важливими якостями з економічної точки зору є: кількість поросят на свиноматку в рік, конверсія корма, вихід м'яса з туші, вміст білка в м'ясі. У зв'язку з тим, що існує негативний генетичний зв'язок між рівнем народжуваності та вмістом м'яса в туші необхідно розробити різні критерії відбору.*

*Дослідження включає в себе чотири породи (ландрас і йоркшир як фертильні) та (п'єтрен і дюрок в якості терміналу). Метою дослідження було проаналізувати ефекти відбору протягом 11 років селекції на фермах. Критерії відбору були різними для терміналу (породи дюрок і п'єтрен) та для фертильних порід (ландрас і йоркшир).*