Genetic Trend for Certain Traits in Pigs Using Different Selection Criteria

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Abstract
The trial during 8 generations or 11 years of period has been done at 4 different breeds: Landrace and Yorkshire as dam line and Duroc and Pietrain as sire one. Included were 68 sires, 1.994 dams, 6.794 progeny and slaughtered 868 heads in total. There have no been selection differences for gain and age at slaughtered Y, L and D. Pietrain showed significantly less gain. It means more cost and less profit in case of P. The feeding line of gilts and sows were changed to previous one. It has significant influence to number of piglets at birth. It mean we have to, optimize, feeding regime and milk yield of sows. Phenotypic and genetic improvement was in average 0.25 piglets per generation. Genetic variation was similar from beginning to last generation of selection. Selection on meat content had positive trend. Selection efficiency were higher at D compare with P. Pietrain itself still have 3.4% more meat in carcass but much longer period of fattening. Intramuscular fat was much lover at P. This has negative effect on meat quality. Litter size showed positive effect. There are no significant differences between L and Y.

Keywords: age, genetic trends, litter size, meat content, pigs

1. Introduction

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

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2. Materials and methods

The experiment has been done at 4 farms since 2000 up to 2012. We included 4 breeds, L, Y as mother line and D and P (Table 1) as terminal one.

Table 1. Breed structure and number of animals in trial

Breed	Sire	Dam	Progeny	No. carcasses
Landrace	20	684	2742	232
Yorkshire	19	640	2586	236
Duroc	17	482	1163	226
Pietrain	12	188	303	174

The following pictures (Figure 1 and Figure 2) represent different selection criteria that were used. To follow litter size were used data of 1.994 sows, 68 sires and 6.794 of progeny and slaughter 868 head in total. Average alive weight at slaughter of all animals was 103 kg and standard deviation of 2.6 kg.

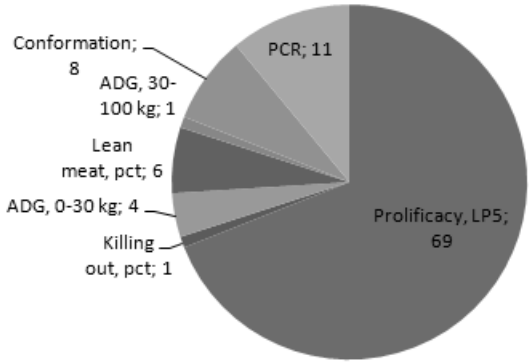

Figure 1. Used selection criteria for mother breeds: - Landrace and Yorkshire

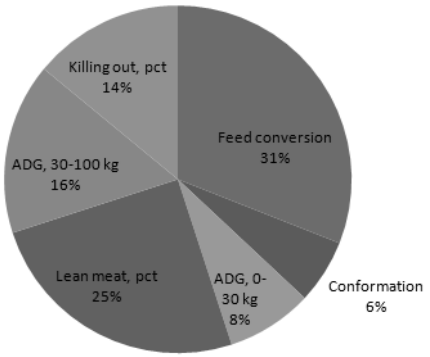

Figure 2. Selection criteria used for terminal breeds: – Duroc and Pietrain

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.

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

Y_{ijkl} -Number of observations hierarchically distributed;
μ -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

3. Results 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 (Figure 3).

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 [1, 2]. 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.

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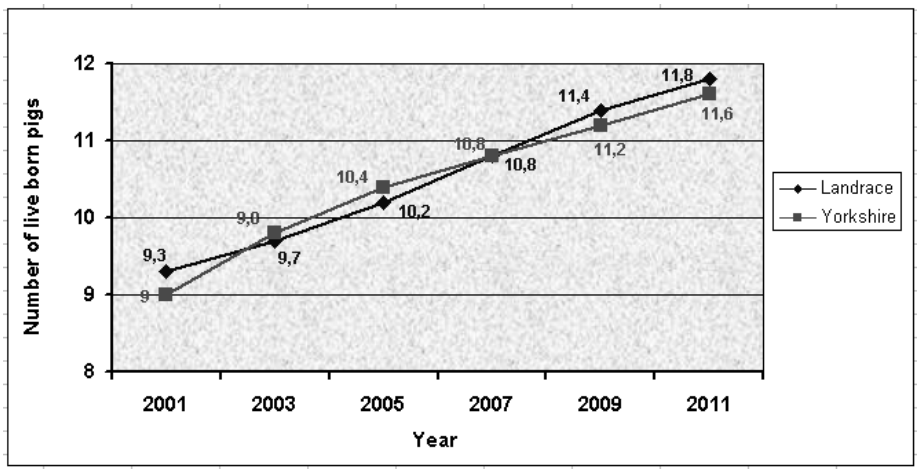

Figure 3. The effect of selection on litter size at first farrowing of Landrace and Yorkshire

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 [3-8].

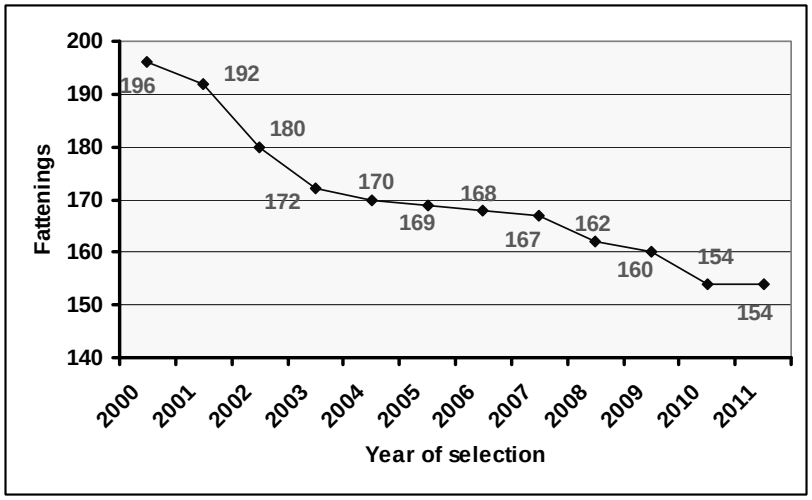

Figure 4. Effect of selection on age at slaughter (indirectly on growth) and feed conversion for Landrace, Yorkshire and Duroc

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 is 19 euro less (Figure 5). These results are similar to [8-10].

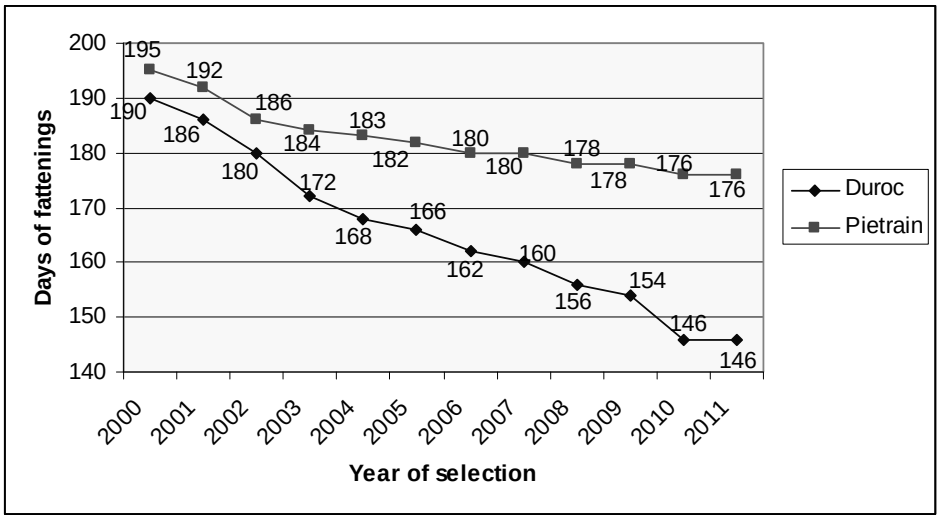

Figure 5. The differences in feed use and age at slaughter between Duroc and Pietrain in test production

The differences: 1. Age: 32 days
2. 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_1 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).

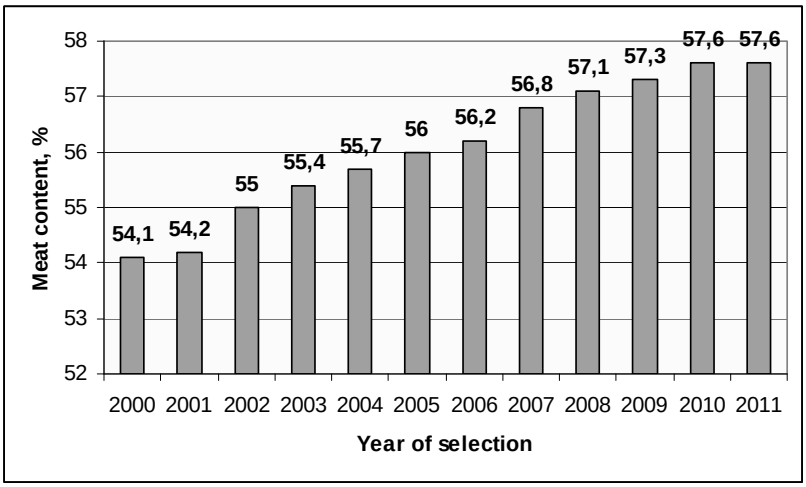

Figure 6. The trend of selection for percentage of meat content for Landrace and Yorkshire

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).

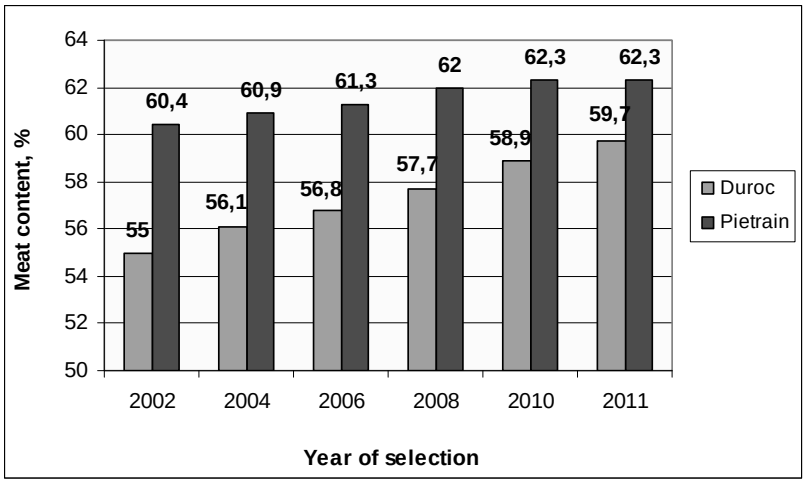

Figure 7. The effects of selection for meat content of Duroc 59.7 and Pietrain

The effects in meat content, %: - Duroc: 3.9
- Pietrain: 1.9

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 less 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 [4, 6 ,9,11-14].

4. Conclusions

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 less 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 itself 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. Nielsen, M.K., Selection experiments for reproductive rate in mice. WCGALP, Guelph, 1994, pp. 219 – 226.

2. Vidović, V., Lukač, D., Štrbac, L.J., Punoš, D., Stupar, M., Genetic trends using different criteria of selection on specialized breeds in pigs, Biotechnology in Animal Husbandry, 2011, 27, 1779-1786

3. Brascamp, E.W., Smith, C., Gur, D.R., Derivation of economic weight from profit equations, Anim. Prod., 1985, 40, 175 – 180

4. Rotschild, M.F., The role of biology in future pig breeding programs. WCGALP, Guelph, XV, 1990, pp. 415 – 427.

5. Park, Y. I., Kim, J.B., Heritability of litter size and litter weight at birth in swine. WCGALP, Lincoln X, 1986, pp. 59 – 62.

6. Bergsma, R., Kanis E., Varstegen, M.W.A., Knol, E.F., Genetic Correlations between Lactation

Performance and Growing – Finishing Traits in Pigs. WCGALP, Leipzig, 2010, 41.
7. Vidović, V., Teorija oplemenjivanja životinja. Poljoprivredni fakultet, Novi Sad, 2009, pp. 342.
8. Vidović, V., Šubara, V., Farmski menadžment – ključ uspeha. Poljoprivredni fakultet, Novi Sad, 2011, pp.140.
9. Vidović, V., Višnjić, V., Jugović, D., Punoš, D., Vuković, N., Praktično svinjarstvo. APROSIM, Novi Sad, 2011, pp.287.
10. Višnjić, V., Vidović, V., Štrbac, Lj., Lukač, D., Punoš, D., Stupar, M., Intenzitet porasta hibridnih svinja u tovu očeva rase pitren i durok. XVII Savetovanje o biotehnologiji. Agronomski fakultet Čačak. 2012, In press.
11. Gama, L.T., Harder, R.R., Johnson, R.K.,Change in ovulation rate and uterine capacity in swine selected for litter size. WCGALP, XVI, 1990, pp. 351 – 354.
12.Vidović, V., Trivunović, S., Punoš, D., Štrbac, Lj., Lukač, D., Stupa, M., Selection efficiency on bons and meat yeald in pigs, Biotechnology in Animal Husbandry, 2011, 27, 1787-1792
13. Vidović, V., Lukač, D., Štrbac, LJ., Punoš, D., Stupar, M., Genetic trends using different criteria of selection on specialized breeds in pigs, Biotechnology in Animal Husbandry. 2011, 27, 1779-1786
14. Vidović, V., Lukač, D., Štrbac, Lj., Punoš, D., Stupar, M., Effect of differnt selection criteria on growth traits and carcass quality in pigs. 6th Central European Congress of Food, Novi Sad. 2012, (In press).