EVALUATION OF GENETIC PARAMETERS ON CROSSING IN PIGS BRED

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Abstract: Genetic improvement of sow prolificacy is a major way to increase the economic efficiency of pig production in the near future. Different ways are now available to achieve this goal; among them, the valorization of the exceptional reproductive abilities of some pig breeds is likely to provide the largest improvement in sow annual productivity. On the evaluation of genetic parameters on crossing of LW х DУ the reproduction indexes, which are represented by 7 variables, are studied and production indexes are represented by two variables are also studied. For that the mix model (Henderson, 1984) is used as follows:

\[ Y = Xb + Zu + e \]

On the basis of that model the influence of genetically and environmental effects are determined. According to this evaluation can do the determination of main research areas in animal breeding work in pigs.

Key words: pigs, crossing, parameters, traits, breeding

Introduction

Processing experimental data according to the mathematical models carries out the estimation of the productive and reproductive traits. The objective of this study is, the evaluation of the productive and reproductive indexes in large White and Duroc breeds. Apart from the values of the additive and heterosis effects classic remark, the importance of the epistatic interaction will be presented since the third generation crossing.

Materials and Methods

This paper aims to estimating genetic parameters in pure breeds and crossbreed (LW x D). Duroc breed herd consisted of a very few numbers of heads – 1 male
and two females, where the semen of two Duroc breed boars of another herd were used. So, 40 pigs (29 females and 11 males) were included in. As Large White breed pig herd consisted of 33 heads (25 females and 8 males). There was no inbreeding in all two herds.

**Modality of control and measurable variables:**

1-reproduction

- total number of piglets born in each farrow.
- number of pigs born alive.
- number of weaned pigs.
- survival rate (birth-weaning).
- body weight at born (12 hours after birth each of pigs was weighed).
- body weight at weaning (individual weighing).
- the feed amount consumed by each of sows was measured every day during this period.

The following model analyzed the reproductive indexes in female:

\[
Y_{ijklmn} = \mu + A_i + B_j + M_k + P_l + (BM)_{jk} + (MP)_{kl} + t_{km} + e_{ijklm}
\]

where:
- \(\mu\): overall mean.
- \(A_i\): fixed effect of farrow \((i=1, \ldots, 27)\).
- \(B_j\): fixed effect of number of litters \((j=1,2,3)\).
- \(M_k\): fixed effect of sow \((k=1, \ldots, 4)\).
- \(P_l\): fixed effect of boar \((l=1,2,3)\).
- \((BM)_{jk}\): interaction effect (sow \times litter number).
- \((MP)_{kl}\): interaction effect (sow \times boar).

\(t_{km}\): random effect of sow, mean and variance \(\sigma^2_t\). This effect was not found in the analyze of survival rate.

\(Y_{ijklmn}\): residual variance.

2-production

The control of female live weight gain was carried out between 70-154 days. Gilts (young sows) were weighed at the beginning and the end of fattening period. In addition these variables were analyzed to these females:

- average daily gain from birth to 154 days old.
- body weight at the day of 154.
The data of female growth was analyzed according to the following model:

\[ Y_{ijklmnop} = \mu + B_i + L_{ij} + M_k + P_1 + (MP)_{kl} + t_{km} + P_n + c + e_{ijklmnop} \]

where:

- \( \mu \): overall mean.
- \( B_i \): fixed effect of fattening group.
- \( L_{ij} \): fixed effect of location (intra group component).
- \( M_k \): fixed effect of sow.
- \( P_1 \): fixed effect of boar.
- \( (MP)_{kl} \): interaction effect (sow \( \times \) boars).
- \( t_{km} \): random effect of pigs born.
- \( P_n \): linear regression on age at the end of control.
- \( c \): linear regression on inbreeding coefficient.
- \( e_{ijklmnop} \): residual variance.

**Results and Discussion**

Direct additive genetic effects are not significant. The difference between breeds shows advantage of Large White breed of 0.8 pigs in birth and that disappeared in weaning. Survival rate (birth-weaning) increases to Duroc breed. Maternal effects on sow fertility are significant with a superiority of Duroc breed compared to Large White breed. This advantage is sustainable from birth to weaning; so much as the maternal effect on survival rate is relatively low. The difference between reciprocal crosses is less evident to productive traits. This result is due to large difference of live weight between offspring F\(_1\) derived from Duroc (mother line) and Large and White one. Live weight gain (200 g/day) of Du Females is lower than LW ones. Live weight difference at the age of 154 days is about 15 kg. While pure breed pigs have the highest live weight gain with the exception of Du backcrosses (paternal line) which is comparable to Du one, as well as a little lower (nearly 150 g/day) than \( \frac{3}{4} \) Du one. The best results have been noticed to females F\(_1\) and \( \frac{3}{4} \) Du. Important estimations of maternal and paternal heterosis effects have been also carried out for the growth traits, in the case of maternal heterosis, these values are positive (+39 g ADG and 4.6 kg for the live weight at the age of 154 days. As to paternal heterosis those are negative (-46 g ADG and -4.1 kg for live weight at the age of 154 days. These uncommon results are mainly due to large difference noticed between crosses according to cases, where father or mother is crossed.
Table 1. Crossing parameters for reproduction traits

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Total</th>
<th>Live</th>
<th>Weaning</th>
<th>Body weight (kg)</th>
<th>Survival rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>At born</td>
<td>28 Days</td>
</tr>
<tr>
<td>$g^o_{DU-BM}$</td>
<td>-0.78</td>
<td>±0.96</td>
<td>0.74</td>
<td>-1.18 ±0.99</td>
<td>-3.08 ±3.91</td>
</tr>
<tr>
<td></td>
<td>2.80</td>
<td>±1.00</td>
<td>3.44</td>
<td>1.6 ±1.03</td>
<td>1.59 ±4.07</td>
</tr>
<tr>
<td>$g^m_{DU-BM}$</td>
<td>0.39</td>
<td>±0.47</td>
<td>0.21</td>
<td>±0.07 ±0.63</td>
<td>±0.58 ±2.00</td>
</tr>
<tr>
<td>$h^o$</td>
<td>0.30</td>
<td>±0.67</td>
<td>0.88</td>
<td>±1.24 ±0.48</td>
<td>±7.92 ±2.72</td>
</tr>
<tr>
<td>$h^m+1/4r^o$</td>
<td>2.21</td>
<td>±0.33</td>
<td>2.51</td>
<td>±2.35 ±0.34</td>
<td>±19.25 ±1.35</td>
</tr>
<tr>
<td>$h^p+1/4r^o$</td>
<td>0.34</td>
<td>±0.44</td>
<td>0.28</td>
<td>±0.00 ±0.45</td>
<td>±0.25 ±1.79</td>
</tr>
<tr>
<td>$r^m +0.25t^o$</td>
<td>0.41</td>
<td>±0.46</td>
<td>0.59</td>
<td>±0.51 ±0.48</td>
<td>±1.9 ±3.54</td>
</tr>
</tbody>
</table>

(1) Evaluation ± standard deviation.
(2) $g^o$, $g^m$, $g^n$: difference between direct additive effect, maternal and maternal grandfather to breeds Du and LW.
$h^o$, $h^m$, $h^p$: direct maternal and paternal heterosis effect between Du and LW breeds.
$r^o$, $r^m$: effect of direct epistatic recombination and paternal loss.

Table 2. Analysis of variance for female growth trait of second phase

<table>
<thead>
<tr>
<th>Sources</th>
<th>Ddl</th>
<th>$ADG_m$</th>
<th>$ADG_t$</th>
<th>$W_{154}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd litter</td>
<td>67</td>
<td>22882***</td>
<td>7452NS</td>
<td>17786t</td>
</tr>
<tr>
<td>Mother</td>
<td>3</td>
<td>195954***</td>
<td>85181***</td>
<td>210156***</td>
</tr>
<tr>
<td>Father</td>
<td>2</td>
<td>297151***</td>
<td>100340***</td>
<td>2461,72***</td>
</tr>
<tr>
<td>Father mother</td>
<td>6</td>
<td>72300</td>
<td>33155***</td>
<td>798,49</td>
</tr>
</tbody>
</table>

***: $P<0.001$; t: $P<0.1$
N.S: No significant

Table 3. Parameters of growth and fattening traits

<table>
<thead>
<tr>
<th>Parameters</th>
<th>$ADG_m$(gr/ditë)</th>
<th>Weight at 154</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fattening</td>
<td>Born-154 days</td>
</tr>
<tr>
<td>$g^o_{DU-BM}$</td>
<td>-228±37</td>
<td>-136±22</td>
</tr>
<tr>
<td>$g^m_{DU-BM}$</td>
<td>-39±41</td>
<td>-30±25</td>
</tr>
<tr>
<td>$g^n_{DU-BM}$</td>
<td>24±23</td>
<td>13±14</td>
</tr>
<tr>
<td>$h^o_{DuxBM}$</td>
<td>147±27</td>
<td>107±16</td>
</tr>
<tr>
<td>$h^m+1/4r^o$</td>
<td>39±15</td>
<td>29±9</td>
</tr>
<tr>
<td>$h^p+1/4r^o$</td>
<td>-46±17</td>
<td>-26±11</td>
</tr>
</tbody>
</table>
Table Nr 4. Parameters of growth for productive traits

<table>
<thead>
<tr>
<th>Variables</th>
<th>d(DU-BM)</th>
<th>g*(DU-BM)</th>
<th>h*(BMxDU)</th>
<th>r^m+1/4r^d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in fattening (g/days)</td>
<td>-103±36</td>
<td>32±31</td>
<td>0.9±24</td>
<td>-26±42</td>
</tr>
<tr>
<td>Age of slaughtering (days)</td>
<td>9.0±4.5</td>
<td>-0.8±2.8</td>
<td>0.4±2.6</td>
<td>0.8±4.8</td>
</tr>
<tr>
<td>Feed conversion ratio, kg/kg.</td>
<td>0.45±0.05</td>
<td>0.17±0.05</td>
<td>0.08±0.04</td>
<td>0.05±0.06</td>
</tr>
</tbody>
</table>

\[ d(DU-BM): \text{Distance in crossing between Du and LW breeds.} \]

**Conclusion**

1. Experimental mechanism creates the possibility of estimating a linear contribution of direct and maternal effects of loss due recombination.
2. Taking into consideration the importance of heterosis effect, non-continuous crossing plans apriority represent the most interesting way of short-term use of breeds due to the highest hybrid power.
3. Geneticist to this purpose may anticipate two solutions:
   a-choose (selection) of line taking part in crossing (in our case Du breed).
   b-creating and selecting a mixed line.
   The first solution encounters with some problems relevant with difficulties of controlling male parameter.

The second solution depends on a large rate by the way of how the fertility advantage will be maintained, advantage showed in F1 generation.

**Evaluacija genetskih parametara u ukrštanju svinja**

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**Rezime**

Cilj ovog rada je ocena genetskih parametara u čistorasnim svinjama i melezima (LW x D). Zapat svinja rase durok se sastojao od malog broja grla – 1 nerast i dve nazimice, gde je korišćeno seme dva priplodna durok nerasta iz drugog zapata. Prema tome, 40 svinja (29 nazimica i 11 nerastova) su uključeni u ogled. Zapat svinja rase velika bela se sastojao od 33 grla (25 nazimica i 8 nerastova). Nije bilo inbridinga u dva zapata. Obrada oglednih podataka je bila u skladu sa matematičkim modelima za ocenu produktivnih i reproduktivnih osobina.
Cilj ovog ispitivanja je bio ocena produktivnih i reproduktivnih indeksa svinja rase velika bela i durok. Osim vrednosti aditivnog i heterozis efekta, važnost epistatičke interakcije se pojavljuje od treće generacije meleza.

References


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