Influence of Environmental Factors on Adaptation of Pigs

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Abstract
Decisions about adaptation of Swedish Yorkshires were made when analysing changes in data of phenotype (productivity) of imported pigs and offsprings born in Lithuania. The work has been carried out in the years 1998-2005. Thanks to adaptation to new environmental conditions, rate of piglets’ losses of Swedish Yorkshire breed, born in Lithuania, was less, to compare with imported primiparous sows. Lean meat percentage of Yorkshires didn’t change essentially from I (F₁) till V (F₅) generation and was ranging from 57.5 till 58.1 %. From IV generation (F₄) fattening indicators (speed of maturation and daily gain) for progeny of Yorkshire breed were improving. Using of new lines of Swedish Yorkshire breed boars imported in the year 2002 and later, had an influence on that. Thus, adaptation (acclimatization) is a complicated process, therefore when striving to preserve specific traits of imported pigs, and especially fattening performance and meatiness, besides omni-valued feeding and making of good keeping conditions, it is also purposeful regularly to import boars (each 3-4 years) or their semen.

Key words: pigs, breed, environmental, adaptation, performance.

Introduction
By the end of 2006, in the Lithuania breeding centres about 25 % of all purebred pigs were Lithuanian White, 31 % - Large White (Yorkshire), 42 % - Landrace and 2 % - Lithuanian native pigs (gene pool), Duroc and Pietrain (Rekštytis, 2006). Thus, recently the number of foreign pig breeds imported to Lithuania has increased. Animals imported from other countries get into different environmental conditions (climate, feeding, and housing) and strive to survive. It’s supposed that reproductive, fattening and meatiness traits (phenotype) of pigs even till 60 % depend on environmental conditions, and only till 40 % - on genotype (Close, 1970; Curtis, 1983; Verhagen, 1987; Cameron, 1993; Diekman et al., 1994; Verstegen et al., 1994; Lynch and Walsh, 1998; Hoste, 2003). Therefore it often happens, that after changing of environmental conditions, productivity of animals is getting worse (Cameron, 1993; Lynch and Walsh, 1998; Hoste, 2003). This is related with natural resistance of organism against unfavourable influences. In case when new conditions are very different from the earlier ones, adaptation can last even through several generations. During this period weaker animals die, and only normally adapted to new conditions remain. Adaptation, the same as reproduction, is directed towards survival. Provided the environmental conditions are favourable, all the processes may even have an improving effect on the animals. However, if more energy has to be spent for survival, then the performance dramatically falls down, especially that of highly productive animals. Thus, adaptation of pigs under new environmental conditions should be investigated.

The purpose of this work was to investigate influence of new environmental conditions on the reproductive traits, fattening performance and meatiness of Swedish Yorkshire pig breed in their adaptation process.
Material and methods

Decisions about adaptation of Swedish Yorkshires were made when analysing changes in data of productivity of imported pigs and offsprings born in “Draugas” breeding centre (Radviliškis district). Various breeding records for the years 1998 – 2005 have been studied (pedigree certificate of imported progeny, sow farrowing and offspring records, control fattening and slaughter data).

In September of the year 1998 to agricultural partnership “Draugas” from Sweden repeatedly were brought 25 gilts of Swedish Yorkshire breed at 5-7 months of age, belonging to Salla and Rila families, and 4 boars, belonging to Bjerbas, Knutas, Mozlas and Odenas lines. Boars of these lines were used for copulation of imported and born in breeding centre F1 and F2 gilts. In the year 2002 and later also there were brought boars of the lines Marichilas, Anelundas, Baronas, Kumas, Boras, Valas, Toras, Bliksnis and Husaras of this breed, which were used for copulation of the further generations (F3 and F4) of gilts of Salla and Rila families. Stalls are smaller, therefore only 5 pedigreed gilts and till 4-5 of sows (weaned and mated) are being kept in each of them. Pedigreed pigs are kept in stalls on straw litter; therefore main parameters of microclimate (temperature and relative humidity) correspond to zoo-technical requirements. Pigs are fed two times per day with compound of own production, made from barley, wheat and flour of peas. In one kilo of the compound designed for lactating sows there are 12.5 MJ of metabolizable energy and 16.4 % of proteins, in compound for farrowing sows - 12 MJ and 13.3 % correspondingly, and for piglets of 10 – 35 kg of weight – 13.2 MJ metabolizable energy and 19.3% proteins. Compound of own production is enriched adding to it supplements of mineral vitamins (Nr. KM – 43/2), designed for sows, which are made in stock company “Bio-factory of Ukmergė”, and supplements of proteins, vitamins and minerals, designed for piglets of 10-15 kilos of weight (Nr. KM – 39/1) and for piglets of 15-35 kilos of weight (Nr. KB – 33/1). Reproductive traits (litter size, number of piglets at 21 days of age and survival rate) of primaparous sows of imported (n=24) and born and raised in “Draugas” breeding centre F1 (n=24), F2 (n=24), F3 (n=24) and F4 (n=24) of Swedish Yorkshire breed have been analyzed. Totally 120 evaluations of primaparous sows of different generations were made in this breeding centre. Besides that, primary data of fattening performance and meatiness traits for Yorkshire breed offsprings born in “Draugas” breeding centre F1 (n=71), F2 (n=210), F3 (n=15), F4 (n=84) and F5 (n=25), were collected, systemized and analysed. Therefore fattening performance and meatiness traits of offsprings of 405 F1-F5 generations, born in Lithuania, were evaluated in control fattening stables of State Pig Breeding Station, according to accepted methodology (Saikevičius, 2003).

Piglets of Swedish Yorkshire breed were brought from the breeding centre to the fattening performance test station at the age of 77–85 days and of 24–26 kg average weight. Four piglets (two gilts and two castrates) were selected from the same litter for control fattening test from 30 to approx. 100 kg weight. Housing and feeding conditions were the same for all pigs. The piglets were kept in individual pens. The average air temperature was 18-20 °C and relative humidity was not higher than 70 %. During the control fattening, the animals were twice daily fed special dry compound feed. Feed was weighed individually for each pig. A kilogram of compound feed contained 13.84 MJ of metabolizable energy and 16.0 % of proteins. The pigs had free access to water for 24 hours. When the pigs were fattened to approx. 100 kg weight, their age in days, average daily gain and feed conversion (metabolizable energy) per kg gain were estimated.

At the control fattening test station the pigs (approx. 100 kg weight) were measured with ultrasonic apparatus before their delivery to meat-processing plants. The lean meat percentage was determined with Piglog 105 by measuring the backfat thickness (mm) on live pigs at two points (Piglog 105 User’s Guide, 1991):

1) between the 3rd and 4th last lumbar vertebrae and 7 cm sideways from the middle dorsal line (FAT-1);
2) 10 cm from the last rib towards the cranial part and 7 cm sideways from the middle dorsal line (FAT-2).

The thickness (mm) of the loin lean (musculus longissimus dorsi) is also measured at this point.

The lean meat percentage was determined according to the in-coded Piglog 105 formula. Age (in days) and live weight of pigs were introduced to the apparatus before backfat measurements. The control slaughters of on the average 100 kg pigs and evaluation of the carcasses were carried out at the meat – processing plants. Half carcass length, backfat thickness at 6-7 rib and the last rib, loin lean area and ham weight of cooled carcasses (at 0…+4 °C in 24 - hours period) were recalculated at 100 kg weight of pigs, using accepted coefficients of regression (Saikevičius, 2003). The investigation data were processed using statistical package Statistica for Windows version 6.0 (StatSoft, 2001) and following the basic guide to the statistical analysis of biological data by Tucker (2003). The difference was considered significant if \( P<0.05 \).
Results and discussion

The results of reproductive traits during adaptation course of Yorkshire sows, kept in “Draugas” breeding centre, presented in Table 1. If litter size of primaparous sows, investigated in this breeding centre in 1998 - 2005 is essentially similar, then, comparing to imported pigs, the rest indicators of reproductive traits (number of piglets at 21 days of age and survival rate percent) for F1 – F3 generations were considerably better (p<0.05–0.001). It can be noted, that reproductive traits of F1 and F2 sows was not reliably different. Primaparous sows of F3 Yorkshire breed, born and raised in Lithuania, practically distinguished by the best traits of productivity, mentioned above. Reproductive traits of F4 and imported sows were similar. Besides that, preserving of piglets, delivered by F4 sows, comparing to F1 – F3 generations, was by 5.7 – 7.6 % less (p<0.05 – 0.01). Though F4 sows were adapted to existing environmental conditions, however, as results of specialists’ questioning have shown, feed compound of inappropriate composition (increased proportion of wheat flour), with which namely sows of this group were fed for certain period, could have influence on higher rate of piglets losses.

Table 1. Reproductive performance of primaparous sows of Swedish Yorkshire breed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Imported pigs</th>
<th>F1 generation</th>
<th>Pigs born and raised in Lithuania F2 generation</th>
<th>F3 generation</th>
<th>F4 generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of sows</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Litter size</td>
<td>10.7±0.4</td>
<td>10.7±0.2</td>
<td>10.5±0.3</td>
<td>11.0±0.2</td>
<td>10.5±0.2</td>
</tr>
<tr>
<td>No. of piglets at 21 days of age</td>
<td>8.7±0.4</td>
<td>10.3±0.3</td>
<td>10.1±0.2</td>
<td>10.4±0.3</td>
<td>9.3±0.2</td>
</tr>
<tr>
<td>Survival rate %</td>
<td>83.6±3.2</td>
<td>96.2±1.2</td>
<td>96.1±1.2</td>
<td>94.3±1.3</td>
<td>88.6±1.5</td>
</tr>
</tbody>
</table>

Results of changes in fattening performance and meatiness of progeny in the course of adaptation for Swedish Yorkshire breed are presented in Table 2. F1 Yorkshires, born in “Draugas” breeding centre, distinguished by the speediest maturation (they reached 100 kg weight in 169 days) and by the biggest daily gain (881 g, p<0.05–0.001), but the muscularity of the latter was less (57.5 %). F3 progeny distinguished by the least consumption of feed per kg gain (2.84 kg): to compare with F1 and F2 progeny, difference is statistically reliable (p<0.05). Using of boars of new lines (Marichilas, Anelundas, Baronas, Kumas, Boras, Valas, Toras, Bloksnis and Husaras) imported in the year 2002 and later had influence on bettering of fattening performance (speed of maturation and daily gain) of F4 and F5 Yorkshires.

Table 2. Control fattening and carcass traits of Swedish Yorkshire breed offsprings

<table>
<thead>
<tr>
<th>Item</th>
<th>F1 generation</th>
<th>Offspring born in Lithuania F2 generation</th>
<th>F3 generation</th>
<th>F4 generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of pigs</td>
<td>71</td>
<td>210</td>
<td>15</td>
<td>84</td>
</tr>
<tr>
<td>Age at 100 kg weight, d.</td>
<td>169±1</td>
<td>187±1</td>
<td>196±2</td>
<td>182±1</td>
</tr>
<tr>
<td>Daily gain, g</td>
<td>881±9</td>
<td>763±6</td>
<td>733±12</td>
<td>797±11</td>
</tr>
<tr>
<td>Conversion per kg gain:</td>
<td>3.01±0.02</td>
<td>3.31±0.27</td>
<td>2.84±0.04</td>
<td>2.94±0.04</td>
</tr>
<tr>
<td>Compound feed, kg Metabolizable energy, MJ</td>
<td>41.66±0.28</td>
<td>45.81±3.74</td>
<td>39.31±0.55</td>
<td>40.69±0.55</td>
</tr>
<tr>
<td>Half carcass length, cm</td>
<td>100.0±0.2</td>
<td>95.2±0.2</td>
<td>93.5±0.4</td>
<td>93.2±0.4</td>
</tr>
<tr>
<td>Backfat: At 6–7 rib, mm</td>
<td>20.2±0.5</td>
<td>19.3±0.2</td>
<td>16.1±0.8</td>
<td>17.1±0.4</td>
</tr>
<tr>
<td>thickness: At last rib, mm</td>
<td>14.1±0.7</td>
<td>15.5±0.2</td>
<td>12.6±0.7</td>
<td>14.4±0.3</td>
</tr>
<tr>
<td>Loin lean area, cm²</td>
<td>34.7±0.6</td>
<td>38.4±0.3</td>
<td>40.0±0.7</td>
<td>37.5±0.4</td>
</tr>
<tr>
<td>Ham weight, kg</td>
<td>11.2±0.1</td>
<td>11.6±0.1</td>
<td>11.6±0.1</td>
<td>11.6±0.1</td>
</tr>
<tr>
<td>Lean meat % (Piglog 105 data)</td>
<td>57.5±0.5</td>
<td>58.1±0.1</td>
<td>58.1±0.5</td>
<td>57.9±0.1</td>
</tr>
</tbody>
</table>

Age in days after gaining 100 kg weight was reliably less for F4 and F5 progeny, having blood of later imported Yorkshire breed boars, when daily gain reliably higher than of F2 and F3 progeny, having blood of Yorkshire boars, imported in the year 1998 (p<0.05–0.001). Half carcass length became less in the process of adaptation for progeny, born in Lithuania. However in modern selection of pigs less attention is paid on this indicator of meatiness traits. Main indicator of carcass evaluation is their muscularity (lean meat) percent, which is closely related to the backfat thickness and loin lean area. Lean meat percentage of Yorkshires in adaptation course didn’t change essentially. Muscularity of F3 progeny, born in Lithuania, was by 0.5 % bigger than of F1 progeny, however difference is not statistically reliable. According to the data of other research (Мейснер, 1991; Смирнов, 1991; Klimiene, 1993; Kriauziene et al., 2005), Yorkshires are more
sensitive for changed conditions of fattening than of keeping. Thus, striving to preserve specific traits of pigs of imported breeds, it’s necessary to investigate influence of adaptation on their reproductive traits and fattening performance, and on meatiness. After analysing indicators of productivity and tendencies of their changing for imported pigs and for born in country of no less than of two generation, to determine which breeds pigs adapt to new conditions of environmental easier or harder.

**Conclusion**

Thanks to adaptation to new environmental conditions, rate of piglets’ losses of Swedish Yorkshire breed, born in Lithuania, was less, to compare with imported primiparous sows. Lean meat percentage of Yorkshires didn’t change essentially from I (F₁) till V (F₅) generation and was ranging from 57.5 till 58.1 %. From IV generation (F₄) fattening indicators (speed of maturation and daily gain) for progeny of Yorkshire breed were improving. Using of new lines of Swedish Yorkshire breed boars imported in the year 2002 and later, had an influence on that.

Adaptation (acclimatization) is a complicated process, therefore when striving to preserve specific traits of imported pigs, and especially fattening performance and meatiness, besides omni-valued feeding and making of good keeping conditions, it is also purposeful regularly to import boars (each 3-4 years) or their semen.

**References**


