Crossbreeding influence on fertility traits of Estonian Large White sows

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Introduction

Efficient production is essential for pork producer to survive in uncertain economic times. Sow fertility has a large influence on economical profitability of pig production. Litter size, piglet vitality and daily gain depends on genetic factors and environmental conditions. Fertility traits of the sows are generally of low heritability, but good results can be received with crossbreeding (Johansson, 1985). Full benefits from crossbreeding can be gained only by careful combination of available breeds and considering impact of different environmental factors (Pond and Maner, 1984; Buchanan et al., 1990).

First large-scale experiments with pigs in Estonia were carried out in Kuremaa Swine Testing Station in 1931…1939 by L. Voltri and E. Sauer (Šmigelskite, 1995).

As recent years have shown an extensive import of pig breeds to improve performance of the local breeds, it was necessary to investigate the effect of the relative breeds on fertility traits of local breeds, the possibilities of increasing fertility by using crossbreeding. For that purpose the fertility of the Large White breed as well as the possibilities of fertility improvement by using crossbreeding on fertility was investigated.

Material and methods

To study the influence of effectiveness of crossing of the Large White (ELW) breed sows and the Estonian Landrace (EL) boars the fertility traits of the sows of the Tartu Swine Testing Station (STS) in 1995...1996 and the Kõpsta Farm of the Ao Producers Union (PU) in 1991...1997 were used.

The study was based on data from 216 Large White sows with 434 purebred litters and with 28 crossbred litters (ELW/EL), 22 single cross sows (ELW/EL) with 22 crossbred litters (75%ELW/25%EL) (Table 1). Large White sows were mated with Large White and Estonian Landrace boars. Selected sows from crossbred litters were mated with Large White boars. Piglet weaning age was 8 weeks in order to use better the mothers ability to produce milk. Large White sows previously improved by the Finnish Yorkshire boars and some Finnish Yorkshire sows were mated with Large White boars.

Semen of Estonian Landrace boars was bought from Kehtna AI Station and the semen of Large White boars was collected on the same farm where the experiment was carried out.

For all litters the farrowing date, boar, sow identification number and parity were recorded. Litter size and litter weight were recorded at birth, at the age of three and at eight weeks. Litter weight at three weeks is also described as lactation yield as the growth rate of the piglets up to this time depends almost entirely on the milk they receive (Reiner et al., 1995). Due to different management systems; litter traits at eight weeks were not recorded at the Tartu Swine Testing Station. Estimation of feeding situation based on influence of year and season.

Based on the recordings made, piglet vitality, piglet average daily gain from birth to eight weeks were calculated by using SAS software (SAS Inst. Inc., 1988).

Parity numbers above 2 are in the statistical analyses described as parity group two and first parity as parity group one. The farrowing year was divided into four parts: spring = March, April, May; summer = June, July, August; fall = September, October, November and winter = December, January, February.

Statistical analyses. The General Linear Model (GLM) procedure (SAS Inst. Inc., 1988) was used for analysing the dataset by analyses of variance. Analysing litter weight, the regression on number of piglets born was included in statistical model:

$$Y_{ijklm}=\mu+H_i+S_j+B_k+P_l+bX_{ijklm}+e_{ijklm}, \text{ where}$$

Y_{ijklm}	=	dependent variable
μ	=	general mean
H_i	=	effect of farm x year combination (1-5)
S_j	=	effect of season (1-4)
B_k	=	effect of combination of breeds (1-3)
P_l	=	effect of parity (1-2)
e_{ijklm}	=	random residual effect
bX_{ijklm}	=	regression on number of piglets born

Level of significances is expressed conventionally: a, b, c, d, e - least square, within each effect with one letter in common do not differ significantly.

Results and discussion

Crossbreeding is not a widely used method to produce slaughter pigs in Estonia. Experiment data showed that simple crossbreeding increased sow fertility at birth only by 6.5%, at three weeks by 4.7% and at weaning by 6.0% (by 0.44…0.67 piglets) (Table 1). However, when using crossbred sows fertility increased significantly - 11.8%, 17.3% and 19.1% respectively (by 1.22…1.68 piglets).

Crossing of two swine breeds, bred in Estonia, was investigated also by V. Laanmäe, E. Meisner and A. Timmi. According to the results obtained by E. Meisner (1985; 1990) it was more effective to use crossbred sows whose fertility was by 7…15% higher than that of purebred sows. Simple crossbreeding increased fertility only by 1.5…3.3%. The results obtained by A. Timmi (1988) showed that simple crossbreeding also increased swine fertility.

Table 1. Least-square means for the effect of breed combination on sow fertility

Traits	Breed combination (♀x♂)		
	ELW x ELW	ELW x EL	ELW/EL x ELW
No. litters	434	28	22
No. piglets			
born alive	10.31[a]	10.98[a]	11.53[a]
at 3 weeks	9.29[ab]	9.73[bc]	10.90[c]
at 8 weeks	8.79[ab]	9.32[bc]	10.47[c]
Litter weight, *kg*			
at birth	13.39[a]	13.05[a]	13.19[a]
at 3 weeks	56.08[a]	58.47[a]	56.37[a]
at 8 weeks	166.91[a]	190.27[b]	159.48[a]
Piglet mean daily gain, *g/ day*			
from birth to 3rd week	236[a]	247[a]	208[a]
from birth to 8th week	318[a]	361[b]	284[c]
Piglet liveability, *%*			
from birth to 3rd week	90.78[a]	89.76[a]	95.13[a]
from birth to 8th week	85.65[a]	82.39[a]	91.83[a]

Purebred and crossbred litters were about of the same weight at birth and also at the age of three weeks. The litters were heavier at weaning than purebred and backcrossed piglets and litters when using simple crossbreeding. Realisations of arisen heterosis in lactation yield by using crossbreeding obviously depend more on feeding-keeping conditions. Significant differences were found between breed combinations in daily gain at the age of eight weeks ($P<0.05$). Whereas the daily gain of the simple crossbred piglets was higher than that of the purebred ones, and the daily gain of purebred piglets was higher than that of crossbred piglets from backcross litters. Piglet vitality did not differ significantly between breed combinations.

Swine crossbreeding studies carried out abroad since 1930, with both inbred and noninbred animals, showed that heterosis for reproductive traits, litter

size, piglet vitality, piglet weight and litter weight ranged from 5 to 25%, having been highly dependent upon breeds used in the cross (Drewry, 1980).

Crossbreeding can increase litter size, whereas litter and piglet weight by changing environmental factors. To increase pig production profitability, the crossbred sows giving larger litters must be used for producing slaughter pigs. To realise heterosis arising in crossbreeding, feeding conditions must be improved to get higher daily gain, litter and piglet weight.

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