Abstract M168

Characterization of a negative halothane gene commercial multibreed swine population for growth and conformation traits in tropical western Thailand

S. Koonawootrittriron[*], M. A. Elzo[†], T. Suwanasopee[*]

[*] Department of Animal Science, Kasetsart University, Bangkok 10900, Thailand

[†] Department of Animal Sciences, University of Florida, Gainesville, FL 32611-0910, USA

SUMMARY

Genetic parameters and estimated breeding values for birth weight (**BW**), weaning weight (**WW**), body length (**BL**), shoulder width (**SW**), hip width (**HW**), and age at first estrus (**AE**) were computed using multivariate animal models. Fixed effects were contemporary group (year-month), sex, parity of dam, direct heterosis, and animal genetic group. Random effects were animal, dam (BW-WW only), common environment (BW-WW only) and residual. Computations were performed using the ASREML program. All fixed effects were important for all traits (P < 0.001). Estimates of heritabilities for direct genetic effects were 0.07 ± 0.01 for BW, 0.08 ± 0.02 for WW, 0.13 ± 0.03 for BL, 0.18 ± 0.04 for SW, 0.15 ± 0.04 for HW, and 0.33 ± 0.06 for AE. Maternal heritabilities were 0.06 ± 0.01 for BW and 0.20 ± 0.01 for WW. Monthly phenotypic means tended to increase for BW, BL, and HW, and to decrease for AE. Monthly genetic means tended to increase only for HW and to decrease for AE.

INTRODUCTION

The Thai market demands lean pork. Producers are attempting to meet this demand by breeding pigs of larger size and superior lean content. Pietrain is one of the major breeds used to achieve this goal. Unfortunately, Pietrain has a high frequency of halothane (i.e., porcine stress syndrome) genes that can produce low quality meat and death by heat stress under conditions of high temperature and humidity. The objective of this research was to evaluate a large commercial negative halothane gene multibreed swine population in western Thailand for growth and conformation traits.

MATERIALS AND METHODS

Animals and Data. The dataset consisted of 37,628 birth weights (BW) and 12,404 weaning weights (WW) from male and female piglets, and 2,980 body lengths (BL), shoulder widths (SW), hip widths (HW), and ages at first estrus (AE) from gilts born from 2003 to 2006. Breeds represented in this population were Pietrain (P), Large White (LW), and Landrace (L). Crossbred groups were F1 LW x P and F1 L x P. Pigs were weighted at birth and at weaning (21 days). Body composition traits were measured at first detected estrus .

Climate, Nutrition, and Management. Seasons were winter (November to February: cool and dry), summer (March to June: hot and dry), and rainy season (July to October: hot and humid). Pigs were kept in open barns. All pigs received the same diet within each growth period. Feed composition depended on the stage of growth of the piglet [pre-starter (22% protein; 3,600 Kcal DE), starter (19% protein; 3,400 Kcal DE), grower (18% protein; 3,300 Kcal DE), and finisher (17% protein; 2,900 Kcal DE)], and condition of the sow [gestation (14% protein; 3,000 Kcal DE), and lactation (17% protein; 3,300 Kcal DE)]. The lactation period ranged from 18 to 25 days. Weaned gilts were moved to a replacement barn and measured for conformation traits (BL, SW, and HW) when they showed their first estrus. Here, BL = distance from shoulder point to hip bone, SW = distance between left and right shoulder points, and HW = distance between left and right hip edges. Replacement gilts were selected based upon their growth and body conformation at first estrus (approximately 6.5 mo age). Weaned boars with above average growth, body structure (HW and BL), and health were selected to be replacement boars at approximately 6.5 mo age.

Mating Strategy. Boars from all breeds were mated to P sows. The LW females were used only to produce replacement boars. The mating strategy resulted in 4 breed groups of piglets: P, LW, F1 LW x P, and F1 L x P. Estrus detection was performed by staff in the presence of boars. Sows were mated only by artificial insemination (up to 2 inseminations per sow).

Table 1. Number of piglet by breed group of boar x breed group of sow

Breed Group of Sow	Breed Group of Boar			
	Pietrain 176	Large White 72	Landrace 9	Total 257
Pietrain 1,575	22,122	821	5,305	28,248
Large White 496	0	9,380	0	9,380
Total 2,071	22,122	10,201	5,305	37,628

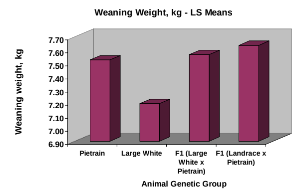
Means, Variances, and Genetic Parameters. Least squares means were estimated using SAS Proc Mixed with single-trait mixed models. These models contained the same effects as those used to compute variance components with ASREML, except for common environmental effects (BW and WW), and the assumption of unrelated animals. Estimates of variance and covariance components and breeding values (EBV) were obtained by multiple trait animal models. Fixed effects were year-month of birth, litter size (BW and WW only), sex, parity of dam, direct heterosis, and animal genetic group. Random effects were animal, dam (BW and WW), common environment (BW and WW), and residual. Variance components were used to compute direct genetic and maternal heritabilities for BW and WW and to compute direct genetic heritabilities for BL, SW, HW and AE.

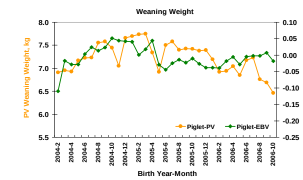
Phenotypic and Genetic Trends. Weighted monthly means of phenotypic values (PV) and EBV for each trait were plotted by year-month to show phenotypic and genetic trends. Linear regression for PV and EBV monthly means on months were also computed for each trait.

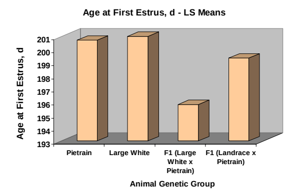
RESULTS AND DISCUSSION

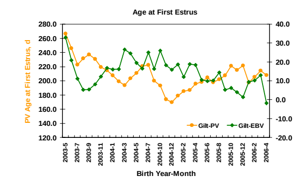
Means, Variances, and Genetic Parameters. Least squares means were 1.7 kg for BW, 7.3 kg for WW, 92.0 cm for BL, 31.6 cm for SW, 30.9 cm for HW, and 207.8 d for AE. Differences between least squares means showed that Pietrain (P) had higher (P < 0.05) BW, WW, SW, and HW and shorter (P < 0.05) BL than LW, but that their AE were similar. The F1 LW x P performed from 1 to 4 percent better than the average of purebred LW and P. Furthermore, the F1 LW x P crossbreds had larger BW, BL, SW, and HW, and shorter AE than the F1 L x P crossbreds (P < 0.05).

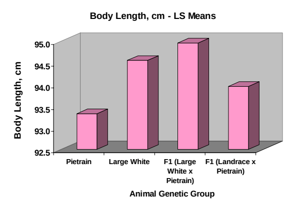
Phenotypic variances were 0.1 kg^2 for BW, 1.4 kg^2 for WW, 275.8 day^2 for AE, 14.1 cm^2 for BL, 3.1 cm^2 for SW, and 2.4 cm^2 for HW. Heritability estimates were 0.07 ± 0.01 for BW, 0.08 ± 0.02 for WW, 0.13 ± 0.03 for BL, 0.18 ± 0.04 for SW, 0.15 ± 0.04 for HW, and 0.33 ± 0.06 for AE. Maternal heritabilities were 0.06 ± 0.01 for BW and 0.20 ± 0.01 for WW. Ratios of common environment on phenotypic variance were 0.14 ± 0.01 for BW and 0.16 ± 0.01 for WW were larger than estimates of heritabilities for these traits. Factors that may have contributed to the low estimates of heritability are: 1) harsh tropical environmental conditions: animals were managed in an open-house system exposing them to a wide range of temperature and humidity conditions that may have affected performance, 2) limited genetic variation: the population had been essentially closed for at least 10 years; semen from at most 2 to 3 outside boars used per year, and all sows are produced within the population, 3) frequent personnel changes may have affected the quality of management and the accuracy of data collection. Until contributing factors determining the low heritabilities for these traits are unambiguously identified and corrective measures taken, genetic improvement in this population will remain low or nonexistent. The medium value of the heritability estimate for direct AE suggests that there is a good potential for genetic improvement (i.e., lowering AE) in this population.

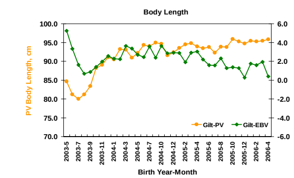


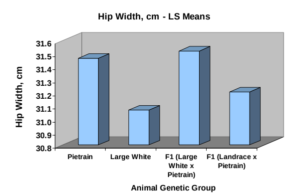


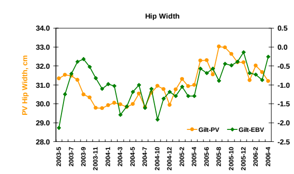












Phenotypic and Genetic Trends. Phenotypic and genetic trends were low. Monthly phenotypic means tended to increase for BW, BL, and HW, and to decrease for AE. Monthly genetic means tended to increase only for HW, and to decrease for WW, BL, and AE. Genetic changes for HW and AE were favorable, but those for WW and BL were unfavorable. The presence of favorable and unfavorable genetic trends for weight and body conformation traits indicates that improvement in the selection process need to be undertaken in this population. Selection was primarily based on individual phenotypic information, and conformation traits were only measured in gilts. Possible alternatives include: 1) measurement of body conformation traits on both boars and gilts; 2) develop genetic-economic indexes appropriate to the selection and economic goals of the enterprise; 3) select animals based on the developed indexes; 4) monitor genetic progress and economic returns, and 5) modify system as needed.

FINAL REMARKS

- **Selection for younger AE and wider HW resulted in genetic changes in the desired direction in a negative halothane gene commercial multibreed swine population**
- **Pietrain piglets had higher BW and WW, and Pietrain gilts had wider SW and HW, but shorter BL than Large White animals**
- **F1 Large White x Pietrain piglets had higher BW and similar WW, and gilts had shorter AE, longer BL, and wider SW and HW than their F1 Landrace x Pietrain counterparts**