Abstract W34

Genetic association between age and litter traits at first farrowing in a commercial Pietrain-Large White population raised in an open-house system in Thailand.

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SUMMARY

Genetic associations between age at first farrowing (AFF) and litter traits total born alive (TBA), stillborn and mummy (LOST), and total birth weight of live piglets (TBW) were researched using a dataset from a negative halothane gene commercial population composed of Pietrain (PT) and Large White (LW) pigs raised in an open-house system in Thailand. Restricted maximum likelihood estimates of variance and covariance components for AFF, TBA, LOST, and TBW were used to compute heritabilities and genetic correlations. The 4-trait animal model (AFF-TBA-LOST-TBW) accounted for contemporary group (year-month) and breed as fixed effects, and animal and residual as random effects. Computations were performed with the ASREML program. Pietrain had longer AFF (10.00 2.34 d; P < 0.01), lower TBA (-1.20 0.22 piglets; P < 0.01), higher LOST (0.20 0.11 piglets; P < 0.01), and lighter TBW (-1.11 0.30 kg; P < 0.01) than LW. Heritability estimates were 0.07 0.03 for AFF, 0.11 0.04 for TBA 0.08 0.04 for LOST and 0.08 0.03 for TBW. Genetic correlations between AFF and TBA (0.19 0.26), LOST (-0.12 0.33), and TBW (0.14 0.32) were low and had high standard errors. Low correlation estimates indicate that selection for AFF may be carried out in this commercial swine population without severe undesirable effects on litter traits.

INTRODUCTION

Economic conditions in Thailand have transformed the swine industry into an increasingly competitive business. Producers are striving to increase productivity and to decrease costs. A trait of economic importance is age at first farrowing. The goal is to reduce costs by lowering age at first farrowing without detrimental effects to other economically relevant litter traits. Thus, the objective of this research was to evaluate genetic associations between age at first farrowing (AFF) and 3 litter traits: total born alive (TBA), stillborn and mummy (LOST), and total birth weight of live piglets (TBW), in a negative halothane gene commercial population composed of Pietrain (PT) and Large White (LW) pigs raised in an open-house system in Thailand.

MATERIALS AND METHODS

Animals and Data. Data consisted of pedigree, age at first farrowing (AFF), and 3 litter traits: total born alive (TBA), stillborn and mummy (LOST), and total birth weight of live piglets (TBW). These data were from 1,777 Pietrain (PT) and 450 Large White (LW) sows gathered from 1999 to 2006 in a negative halothane gene commercial population in Thailand.

Climate, Nutrition, and Management. Weather in Thailand is influenced by tropical monsoons. Seasons were summer (March to June: hot and dry), rainy (July to October: hot and humid), and winter (November to February: cool and dry).

Animals were raised in an open-house system and received the same nutrition, management, and health care. Floor (slats) in all barns was lifted approximately 2.2 to 2.5 meters from the ground. Animals were raised on the floor, and the space under the floor was used for ventilation and drainage. In summer, when temperatures were too high (above 35 ºCelsius), fans and water dripping were used to reduce heat stress.

Feed rations were pre-starter (22% protein; 3,600 Kcal DE), starter (19% protein; 3,400 Kcal DE), grower (18% protein; 3,300 Kcal DE), finisher (17% protein; 3,300 Kcal DE), gestation (14% protein; 3,000 Kcal DE), and lactation (17% protein; 3,300 Kcal DE).

The pre-weaning period ranged from 18 to 25 days. Weaned gilts were moved to a replacement barn, where estrous was detected by trained personnel, and estrous date recorded. If they had good body condition, good health, and weighed between 100 and 120 kg, they were mated to a selected boar of the ***same breed*** (PT or LW) using artificial insemination (up to 2 inseminations per gilt). Pregnancy was checked between 4 to 5 weeks after each mating. Pregnant gilts were placed in a nursing barn for farrowing. When gilts delivered their piglets, they were recorded for age at farrowing (AFF = farrowing date – birth date), and litter traits (TBA, LOST, and TBW).

Breed Effects and Genetic Parameters. Estimates of ***breed effects*** for age at first farrowing (AFF), total born alive (TBA), stillborn and mummy (LOST), and total birth weight of live piglets (TBW) were ***estimated as deviations from LW***. Restricted maximum likelihood estimates of variance and covariance components for AFF, TBA, LOST, and TBW were used to calculate heritabilities and genetic correlations. The statistical model was a 4-trait animal model (AFF-TBA-LOST-TBW) that included the fixed effects of contemporary group (year-month of birth of sow) and breed, and the random effects of animal and residual. Additive relationships among animals were accounted for. Computations were carried out with the ASREML program.

RESULTS AND DISCUSSION

Breed effects. ***Pietrain had longer AFF, lower TBA, higher LOST, and lighter TBW than LW (Table 1).*** Differences between PT and LW for AFF, TBA, LOST, and TBW may be due to differences in energy body reserves. Pietrain is a leaner breed that is known to have has lower body energy reserves than LW (Moody et al., 1978). Lower energy reserves have been found to have a negative impact on reproduction (Whittemore, 1996; Grandinson et al., 2005). Lower energy reserves in PT sows may have decreased their performance for AFF and litter traits relative to LW sows. Results here lend support to the idea of using LW as a maternal breed because of its superiority for litter traits (high TBA, low LOST, and large TBW), and PT as a paternal breed for its desirable meat and carcass traits (high lean production and muscularity) in commercial swine crossbreeding programs

Table 1. Estimates of breed effects for age at first farrowing (AFF), total born alive (TBA), stillborn and mummy (LOST), and total birth weight of live piglets (TBW)

Trait	Breed Effect (Pietrain – Large White)	P-value
Age at first farrowing	10.00 ± 2.34 d	0.0001
Total born alive	-1.20 ± 0.22 piglets	0.0001
Stillborn and mummy	0.20 ± 0.11 piglets	0.0001
Total birth weight of live piglets	-1.11 ± 0.30 kg	0.0001

Genetic Parameters. ***Heritability estimates were low for all traits, and they ranged from 0.07 0.03 for AFF to 0.11 0.04 for TBA (Table 2).*** These low heritability estimates may have been influenced by:1) high variability in temperature and humidity within and across years in Central Thailand (heavily affected by Monsoon weather); 2) limited genetic variability in the breeding population (population nearly closed for the past 10 years, all boars (except for 2 to 3 outside boars) and sows were replaced within the population each year; and 3) variability in quality of management and data collection due to frequent changes of personnel. Thus, although positive changes due to selection for AFF, TBA, LOST, and TBW are possible, larger changes would be expected from improvements in management aspects than selection for these traits.

Genetic correlations between AFF and TBA, LOST, and TBW were low and had high standard errors, and phenotypic correlations were all zero (Table 2). These results indicate that improving AFF in this commercial swine population would have no undesirable effects on litter traits (TBA, LOST, and TBW).

Table 2. Heritabilities (diagonal), genetic correlations (above diagonal) and phenotypic correlations (below diagonal) between age at first farrowing (AFF), total born alive (TBA), stillborn and mummy (LOST), and total birth weight of live piglets (TBW)

Trait	AFF	TBA	LOST	TBW
AFF	0.07 ± 0.03	0.19 ± 0.26	-0.12 ± 0.33	0.14 ± 0.32
TBA	-0.03 ± 0.02	0.11 ± 0.04	-0.65 ± 0.18	0.93 ± 0.04
LOST	-0.00 ± 0.02	-0.49 ± 0.02	0.08 ± 0.04	-0.60 ± 0.21
TBW	0.00 ± 0.02	0.92 ± 0.01	-0.49 ± 0.02	0.08 ± 0.03

FINAL REMARKS

- Pietrain had longer AFF, lower TBA, higher LOST, and lighter TBW than Large White
- Genetic correlations between AFF and litter traits (TBA, LOST, and TBW) were low and phenotypic correlations were zero
- Selection for younger AFF would not be detrimental to litter traits in this population

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