Title: Association of compositional traits and structural soundness with the ability of commercial line of sows to complete parities four and five – NPB#06-192
(A continuation of the original project 2005 titled: Association of compositional, structural soundness, and health with the ability of a commercial line of young sows to successfully complete parity one (NPB#05-081) and the 2006 project titled: Association of compositional, structural soundness, and health with the ability of a commercial line of young sows to successfully complete parities two and three (NPB#06-031))

Investigator: Dr. Kenneth J. Stalder

Institution: Iowa State University

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Scientific Abstract

The objective of this study was to estimate the phenotypic and genetic associations of gilt compositional and structural soundness traits with reproductive and longevity traits (longevity defined as the ability to complete the fourth and the fifth parity), in order to determine factors measured or evaluated early in a sow’s life that are associated with superior lifetime production.

The study involved in total 1447 commercial females from two genetic lines. Evaluated compositional traits included body weight, loin muscle area, 10th rib backfat and last rib backfat. Soundness traits consisted of body structure traits (body length, depth and width, rib shape, top line and hip structure), leg structure traits (front legs: legs turned, buck knees, pastern posture, foot size and uneven toes; rear legs: legs turned, weak / upright legs, pastern posture, foot size and uneven toes) and overall leg action. Studied lifetime reproduction traits included lifetime total number born, lifetime number born alive, number born alive per lifetime days and percentage productive from total herd days. Lifetime, herd days and removal parity were considered as longevity traits.

The summary statistics were evaluated using standard statistical software (SAS version 9.2, SAS, Cary, NC). The least square means and models used for variance component estimation were obtained using mixed model methodology (PROC MIXED, SAS, Cary, NC). Survival analyses were conducted using PROC LIFETEST (SAS, Cary, NC). AI-REML and the DMU-package were used to estimate variance components using single trait or bivariate animal models. Additionally, to implement censoring, MCMC approach and Gibbs sampling procedures were used in GIBBS2CEN. The sampled covariance components for calculating heritabilities, genetic correlations and standard deviations were obtained using POSTGIBBSF90.
About 70% of the females were removed before reaching the sixth parity. Reproductive failure was the most frequent culling reason during the first three parities. Feet and leg problems were most distinctive prior to the third parity. Litter performance became the most important culling reason by the fourth parity. The median survival times were 546 herd days, 723 days of age or a mean removal parity of 3.7. At the time of removal females had farrowed on average 44.6 piglets of which 40.4 were born alive. They averaged $0.039 \pm 0.001$ live born piglets per a lifetime day and the percentage of productive days from total herd days was 61%.

The heritabilities of longevity traits ranged from 0.12 to 0.16 and lifetime reproduction traits from 0.13 to 0.17. Compositional traits had high heritabilities ($h^2 = 0.50 - 0.70$). The heritabilities were low to moderate for body structure ($h^2 = 0.11 - 0.34$) and in general relatively low for leg structure traits ($h^2 = 0.07 - 0.29$). The heritability of overall leg action was 0.12.

Most of the genetic correlations of growth, body composition and structural soundness traits with longevity and lifetime reproduction traits were low and non-significant ($P > 0.05$). In general, loin muscle area and body structure traits had a favorable trend in their genetic correlations with longevity and lifetime reproduction traits, while an unfavorable trend was observed in the associations of backfat and days to 113.5 kg body weight with longevity and lifetime reproduction. The genetic correlations obtained in this study indicate that in terms of improving sow lifetime reproductive performance and hence the profitability for pork producers, the most important gilt body composition, growth and structural soundness traits in commercial replacement gilt selection would be closer to intermediate growth rate and body length, more ideal rib shape (more of a barrel shape) and less upright rear legs. It is important to note, that the studied animals were preselected for their growth potential and structural soundness by the genetic supplier and the results obtained from this study need to be interpreted within the distributions of observations present in the dataset.