2B-101: Quantifying variation in environments within and across herds

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Background

Animals vary in their response to differences in the environment. This environmental sensitivity may lead to genotype by environment interactions if genotypes differ in their response to diverse environments. These interactions have implications for breeding programs if animals are selected in one specific environment and progeny are expected to perform well in a wide range of environments. Specific information about environmental conditions is usually not available on farm. Pigs raised together are exposed to similar overall environmental conditions. Therefore, the quality of an environment may be quantified by the mean performance of a group of pigs raised together.

Methodology

Performance records from over 265,000 pigs recorded in nine herds over a ten-year period were used for the analyses. Methodology and random regression models were developed to quantify variation in environments within and across herds and to evaluate whether there were any breed by environment interactions or sire by environment interactions.

Key Findings/Conclusions

Variation in environments. Mean performance of contemporary groups varied by about 150 g/day for growth rate and by about 5 mm for backfat across herds and years independent of the model used. A similar spread of mean performance was also found within herds and within years showing that even in these well-managed farms, considerable environmental variation existed between individual groups of pigs.

Breed by environment interactions. Breeds differed in their responsiveness to variation in environmental conditions with Large White being the most environmentally sensitive or least robust breed for growth rate and backfat. This breed was the leanest breed in comparison to Landrace and Duroc supporting the hypothesis that leaner genotypes tend to be less robust and less able to perform consistently across a range of environments.

Sire by environment interactions. Extensive analyses were performed using random regression models to evaluate sire by environment interactions which were found for growth rate but were less apparent for backfat.

Potential Users of Information

Producers. The unadjusted mean performance of a group of pigs is a simple environmental descriptor that can easily be derived from standard performance records collected on farms to quantify variation in environmental conditions within herds.

Breeders. The methodology developed in this study to quantify sire by environment interactions can be used to obtain estimated breeding values (EBVs) for the intercept and slope of sires. These EBVs should be used to select sires with consistently superior performance across environments. This is a long-term breeding goal. Further, the variation in EBVs for the intercept and slope can be used to select sires whose progeny are best suited for a specific environment. This information should be used by breeders and producers to better match sires to the environments their progeny are likely to encounter.

Researchers. Multiple environmental descriptors were significant for growth rate, highlighting the need to develop methodology that combines multiple environmental factors. Further, it was shown that residual variance was lower in superior environments for growth rate. Therefore, the environmental descriptor may be extended by taking variation between animals within the same environmental into account