Investigating a Genetic Solution for Decreasing Boar Taint Levels in Canadian Pigs

M. Jafarikia¹, J. Squires², F. Schenkel², F. Fortin³
S. Wyss¹, W. Van Berkel⁴, Y. Lou², B. Sullivan¹, D. Vandenbroek⁵

¹Canadian Centre for Swine Improvement Inc., Ottawa ON; ²University of Guelph, Guelph ON
³Centre de développement du porc du Québec, Québec QC; ⁴Western Swine Testing Association, Lacombe AB; ⁵Ontario Swine Improvement, Innerkip ON

The Problem of Boar Taint

Boar taint: Boar taint is an unpleasant odour produced by the accumulation of androstenone and skatole in fat tissues of intact male pigs. Boar taint compounds are pheromones secreted by boars to attract the sows in the wild. However, meat produced from intact males containing too much taint can affect the eating quality of pork.

Current solution of boar taint in Canada: Castration is a common practice for preventing boar taint. However, alternative solutions are of interest due mainly to animal welfare concerns.

Potential long-term solution: Genetic selection is a potential solution for decreasing boar taint levels in meat from intact males. Technologies are available to scan animals for candidate genes associated with boar taint, which would allow for selection against alleles responsible for increased levels of androstenone and skatole. Currently there are more than 100 single nucleotide polymorphisms (SNPs) associated with boar taint identified at the University of Guelph.

Potential negative impact of a genetic solution: Since boar taint compounds are pheromones, there is a concern that selection against boar taint alleles may negatively affect traits related to reproductive performance. However, previous research at the University of Guelph has found relatively weak correlations (unpublished data).

Research for Application

Objective: To provide tools for reducing boar taint using SNP markers in genes involved in the synthesis and degradation of boar taint compounds.

SNP frequency and influence on production: A total of 900 Landrace, Yorkshire and Duroc pigs will be genotyped to assess marker allele frequencies and the potential impact of the SNP markers on economically important performance traits.

Measuring boar taint and SNP effects: A total of 2100 boars will be genotyped and their boar taint compounds will be measured from fat samples. Genotypes and boar taint levels in the genotyped animals will be used for training the marker effects.

Validation: The predictability of marker effects will be validated using boar taint measured in fat from 900 additional boars, including 300 commercial crossbred boars.

Preliminary Results

SNP frequency: Genotype analysis of an initial set of 188 pigs showed 72 markers segregating with minor allele frequency (MAF) greater than 10%.

SNP redundancy: Estimated correlations between SNPs showed low redundancy among markers. More than 43% of SNPs showed correlations lower than 0.10 with other markers and 97% had correlations lower than 0.50.

Androstenone and skatole levels: An initial group of 90 boars weighing more than 110 kg (live weight) had average androstenone and skatole of 588 (85-4552) ng/g and 127 (10-1085) ng/g, respectively. In this sample, 17% and 12% of boars exceeded consumers’ acceptable levels for androstenone and skatole, respectively (Figure 1). In total, 26% of pigs exceeded the acceptance level in at least one of the compounds.

Take Home Message

Preliminary results show potential for a genetic solution to lower boar taint to acceptable levels. There exist high marker variability in genes associated with boar taint across Canadian pig breeds, in addition to wide variation in boar taint levels in intact males at current market weights.

Future steps include estimation of SNP effects and validation of genetic prediction in an independent sample of boars.

Acknowledgements: Financial support provided by the Canadian Agricultural Adaptation Program (CAAP), regional swine improvement centres across Canada and participating Canadian breeders.

Presented at the
CMSA/CMS 2012
Technical Symposium
Quebec City, QC

Figure 1: Androstenone and Skatole measurements on 90 mature intact males

Maximum acceptance level of Androstenone (1000 ng/g)

Maximum acceptance level of Skatole (200 ng/g)