Genetic opportunities exist to stop castration

by Dr Jan Merks, director breeding and quality, Topigs, Postbox 86, 5268 ZH Helvoirt, The Netherlands.

As an industry we already know a considerable amount about the risk that meat from entire male pigs may have an unpleasant odour and taste when cooked. This possibility is usually called boar taint. It has provided the economic justification over many years for the practice of surgical castration of all male piglets soon after birth, except those intended for breeding.

However, castrating pigs takes time and labour. It is work that many producers and their workers dislike. The surgery can pose a threat to the health of the piglets as well as inflicting pain. No less important, when we talk about economics, is the fact that castrated male pigs are between 5% and 12% less efficient than entire boars at converting feed into meat.

None of that is new, but the situation has changed in a number of countries because of a growing public concern about the animal welfare aspects of castration. An intensive international search is in progress to find a reliable and acceptable way of avoiding the risk of boar taint in pork without the need to intervene surgically.

Several procedures have been proposed. One is an injection that interferes with the process by which taint compounds are formed in the pig's body, but its acceptability to consumers must remain a key question. By contrast, public opinion is not likely to oppose the idea of selecting to avoid boar taint as part of a genetics programme that already delivers valuable improvements in the pork produced for safe and enjoyable consumption around the world.

High heritability boar taint

Work done by Topigs has shown that selection against boar taint is far more than a vague concept. We have found high rates of heritability for the concentrations of three chemical compounds mainly responsible for instances of tainted pork. In our view, the genetic opportunities definitely exist to stop castration and produce meat free of boar taint as a long term and cost effective solution to the problem.

Where taint in pork occurs, it is known to be caused largely by the presence in back fat of compounds called androstenone, skatole and indole. Androstenone is a steroid formed in the boar's testes. Its smell is generally described as being like that of urine. When released next to sows in oestrous, it has a pheromone effect that stimulates their standing response.

Skatole and indole come from the breakdown of the tryptophan amino acid in dietary protein, by bacteria in the hind gut. More obviously unpleasant than androstenone and detectable to more people, skatole has a sharp odour similar to the smell of faeces. Indole by comparison tends to be considered a minor contributor to off-flavour and off-taste problems in meat.

The concentration of all three offending molecules in pig fat varies according to the age and weight of the animal at slaughter. Sometimes, non-castrated male pigs are marketed at a lighter weight than usual (like in the UK) to reduce the risk of tainted pork, although this obviously reduces their price and profitability.

Long years of experience around the world have also demonstrated the difficulty of measuring the compounds routinely in pigs on the slaughter line. No device is available currently for this purpose, except in Denmark for skatole. Additional research is going on in several countries.

Laboratory analysis

One Topigs study has used laboratory analysis of fat samples to test androstenone and skatole levels in about 7000 purebred and crossbred entire males from various sire and dam lines. In addition, several of these samples were allocated to a so-called hot wire test, meaning that they were heated so they could be evaluated for odour by an expert panel of five people with regular experience of testing pork for boar taint. As a further examination the Dutch boar taint research consortium invited a group of 155

Continued on page 31

Continued from page 29

consumers to judge the appearance, taste, smell, saltiness and other characteristics of samples associated with a high or low estimated breeding value for androstenone.

Dam lines higher values

From our measurements, the dam lines had higher average values than the sire lines for androstenone and for skatole. The average value for androstenone in crossbred animals was between those of the sire and dam lines, but the average of the crossbreds for skatole was lower than the lowest parental level. Farm management factors such as feed composition and hygiene are known to influence skatole concentrations.

Highly significant correlations were found between the concentrations of androstenone and skatole measured in samples from carcases and the scores given by the expert panel after the hot-wire test. It seemed from our measurements that the levels of these compounds were strong predictors of the panel scores. The results also pointed to a promising heritability for a boar taint that had been scored subjectively in samples collected at the slaughter line. Genetic correlations between this trait and androstenone and skatole were high enough to support the view that reliable selection could be accomplished on the basis of their concentrations. Other checks on Topigs crossbred progeny from three sire lines have suggested that significant genetic differences could be expected in the market pigs depending on the different sire line choices.

This study measured androstenone and skatole concentrations in melted samples of fat from the neck of boars slaughtered at approximately 125kg live weight. The crossbreds originated from sire lines with the genetic background of Topigs Talent, Tempo or Top Pi.

Within a tolerable range

Most pigs from the first two lines in particular were rated as being within a tolerable range for the concentration of taint compounds in their fat, with the threshold values set at 2.56μg/g for androstenone and 2.00μg/g for skatole. On this basis, 68% of the 474 carcases examined in the study would not be classified as affected by boar taint.

So, the proportion with boar taint was already very low in the commercial crosses. But there was still strong evidence that the choice of an appropriate term sire line can further reduce risk of having undesirable odour and taste in pork from entire males. It was clear that the boar taint components differed considerably between the crossbreds depending on the breed or sire lines used, the genetics with a Duroc background showing the highest androstenone values as also reported in other international research work.

Our results suggested the components had a strong genetic influence and therefore would respond favourably to selection. Relatively high heritabilities ranging from 0.25 for indole and 0.36 for skatole to 0.64 for androstenone indicated a good genetic foundation for improvement through selection.

Elimination in sight

Simulations by computer modelling have encouraged our belief that it is possible genetically to reduce the concentration of androstenone, skatole and indole below threshold levels for boar taint. In this way, according to the simulation results, taint risks in pork from entire male pigs can be eliminated in approximately four generations of selection.

The prize of being able to stop castration is therefore within reach. Through genetics, we should in the near future have non-castrated pigs at slaughter that the market can process and sell without risk, giving pork that the consumer can enjoy without complaint. Moreover, pig producers who change the production system from castrates to entire males in combination with low boar taint Topigs genetics will also have highly positive consequences for their farm economy. ■