What will take the place of piglet castration?

by Nic Daley, Pfizer Animal Health.

As the campaign against the castration of male piglets gathers momentum, what are the viable alternatives for reducing boar taint?

The search for an alternative to physical castration as a way of reducing the presence of boar taint compounds in pork is not a new one. For decades, the carcase changes and loss of feed conversion efficiency associated with this age-old management technique have prompted researchers to look for a more financially rewarding method of boar rearing.

Over 10 years ago, this search resulted in the launch of a new, immunological product. This novel technology was the result of ground-breaking research in Australia, particularly by the Victorian Department of Agriculture, and the resulting commercial product, mainly sold under the name Improvac (Pfizer Animal Health), has since been licensed in almost 60 countries around the world, including recently in the USA.

In the time since Improvac was first used commercially, welfare concerns over the use of physical castration have added to the existing economic and quality reasons for adopting alternatives such as the immunological approach. In the EU, the welfare issue looks likely to lead to an almost complete ban on physical castration in the next few years. Not surprisingly, this rapidly developing scenario has once more focused attention on alternative methods to the scalpel. But, apart from vaccination with Improvac, most are still a long way from being practical solutions.

Breeding

Breeding low taint pigs is an obvious goal. Taint levels vary considerably between individuals and it is logical to assume that the level of taint may be related to the genetic make-up of the pig.

Selective breeding of low taint individuals would be the traditional way of 'engineering' a more acceptable animal. Unfortunately, early attempts to select low boar taint pigs resulted in reproductive problems.

This reflects the well known fact that selecting for one trait can easily de-select for another, so production advantages, fertility or disease resistance may be lost in exchange for low taint meat.

The wide range of different breeds and types raised around the world complicate the issue further.

A more refined approach is being followed

by a number of companies and research groups who are working to identify genetic markers which could potentially be used as part of a selective breeding programme.

The aim is to find single nucleotide polymorphisms (SNPs) linked to the enzymes which synthesise and degrade boar taint compounds such as androstenone and skatole.

Researchers at Norvin (the Norwegian Pig Breeders Association) for example have been investigating the relationship between genetic factors involved in the production of androstenone, skatole and indole with the aim of discovering ways of reducing taint without decreasing fertility related compounds.

Their studies have identified over 30 regions either at genome wide or chromosomal levels which appear to be significantly related to boar taint compounds.

Gene sequencing and cloning technology has been used to investigate the 3ß-hydroxysteroid dehydrogenase (3ß-HSD) gene which is thought to play an important part in androstenone metabolism in the liver, and thus the level of this boar taint compound in meat. Researchers at Bristol University in

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the UK have compared DNA sequences from different breeds which vary in tissue androstenone levels in an attempt to identify the reasons for differing expressions of the gene.

Last year, researchers from the University of Guelph in Canada presented an update on boar taint genetic markers at the London Swine Conference. They claim to have found genetic markers that can reduce skatole fat levels by 20-54% and androstenone by 26-61%, without any negative effect on production traits.

Their aim is to identify a handful of key genes and then use these as the basis for a marker assisted selective breeding programme.

However, although this approach is feasible on paper, it remains to be seen if/when it will bear fruit in the commercial setting.

Another form of genetic manipulation which has been suggested for the avoidance of boar taint is to breed female only pigs. Researchers have looked at the possibility of sexing semen, so that AI can be used to produce gilt only litters.

However, this approach still misses out on the inherent production benefits associated with raising boars and may be more applicable for the production of replacement breeding stock.

On farm

At the farm level, a number of approaches have been suggested to address the castration/boar taint issue. Skatole is a by-product of bacterial action in the gut and changing ration or including compounds such as inulin or chicory can potentially influence the levels of this particular taint compound.

Keeping pigs in a clean, manure-free environment can also help to avoid high levels of skatole which can be absorbed through the skin when it is in contact with manure.

However, none of these approaches is 100% effective and none addresses androstenone which is produced directly by the testes.

When welfare concerns over physical castration started to become an issue in Europe, the use of anaesthesia and/or analgesia was proposed as a suitable answer to those concerns. However, more recently, it has become apparent that this will not be considered an acceptable long term solution to the problem.

The cost and impracticalities associated with some of the methods, the inability to monitor that they are being performed, and concerns that they may not fully resolve welfare issues, explain why they have not received a more enthusiastic response and why the search for other options continues.

Research carried out on behalf of Pfizer Animal Health among European consumers has demonstrated that even with the use of anaesthesia, physical castration is not a preferred option compared to vaccination.

Improvac was confirmed as the most acceptable on-farm alternative for reducing boar taint.

Boar taint detection

The alternative to preventing boar taint is to implement some form of detection system on the slaughterhouse line and remove any heavily tainted carcases from the fresh meat supply chain. Using trained operators to smell carcases is one approach but it is labour intensive and very subjective.

In order to be commercially viable on a large scale any such system would have to be fast enough to deal with up to 1,000 carcases per hour on major lines, and able to detect tainted carcases with high accuracy and minimal false negative results.

A number of rapid throughput methods are currently being investigated based principally on either solid phase (fat samples) or gas phase testing.

A wide range of analytical technologies has been applied to this problem, including gas chromatography, spectroscopy, colorimetry and biosensors.

A gas phase Fourier Transform Infra Red (FITRA) plus photo acoustic spectroscopy (PAS) system has been reported to be under investigation, as is an 'electronic nose' that can sense tainted carcases. One of the more unusual methods that has been reported is the use of trained insects (wasps) to rapidly assess carcases.

Different analytical methods are being used in different laboratories and this has made comparison and standardisation of results very difficult; there is still no recognised standard method or certified reference material for measuring androstenone and skatole that can be used to validate results.

Even if the considerable technical and practical issues can be overcome, there are

still a number of issues facing any slaughterhouse QC system.

It is generally accepted that androstenone and skatole are the main causes of taint, but there are others – so which ones should be tested for?

Studies have shown that skatole can enhance the sensory perception of androstenone and vice versa; pork with a high concentration of both compounds has been shown most likely to be unacceptable to consumers. Clearly, any effective system should be able to test for both compounds and possibly others.

A more fundamental question is what levels of these compounds should be considered unacceptable? It is well known that sensitivity to boar taint varies between people and between countries, based on individual genetic susceptibility and cultural factors. The Japanese and German markets, for example, appear to be particularly sensitive.

Generally, the threshold for taint perception is considered to be 1.0µg per g of fat for androstenone and around 0.2µg/g for skatole. However, there is currently no agreed limit laid down by legislation.

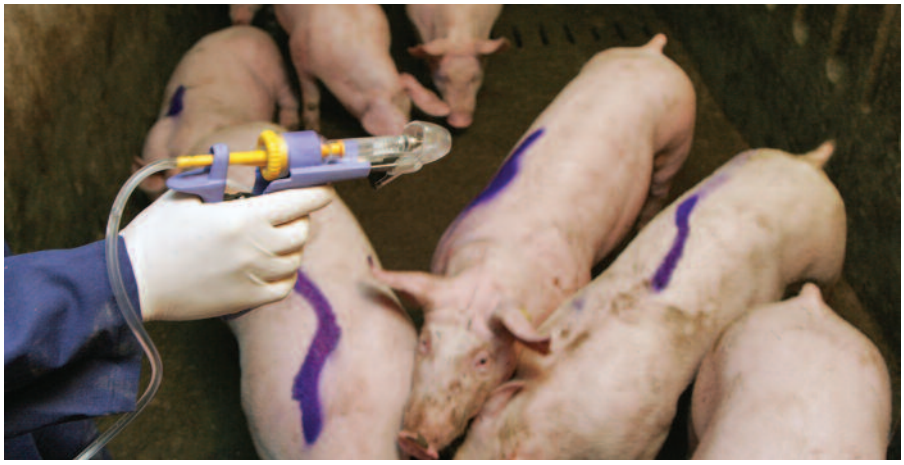
The EU is currently vague in its direction on the issue of taint and simply states that meat is unfit for human consumption if it has 'organoleptic anomalies, in particular a pronounced sexual odour' (regulation 854/2004). It is left to member states to establish their own definitions of what is or is not acceptable for consumer supplies.

Before any QC system could be widely adopted, some form of agreed standardisation would be required in order to validate its use.

Despite all the efforts to develop an objective boar taint detection system for the slaughter line, a rapid and reliable method has not yet been developed or proven in the commercial environment.

Even the most promising systems are associated with false classifications of 5-20%; until they can offer much greater reliability they cannot realistically be employed in the commercial setting.

The final barrier to commercial use would of course be cost: high tech often carries a high price tag and only the largest abattoirs would be able to justify the use of an expensive system.



Vaccination

Despite a considerable amount of research, for the foreseeable future the most acceptable and practical alternative to physical castration for the reduction of boar taint is likely to remain the immunological product Improvac.

Potentially it also offers the highest level of efficacy as it reduces boar taint through a temporary suppression of testicular function, which is a similar physiological mechanism to physical castration and has a marked effect on both compounds. ■