Cutting out castration with an innovative immunological alternative

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For many years, the castration of male piglets has been an established practice in swine production for the reduction of boar taint and the control of boar-like behaviour. Unfortunately, this method has a downside: boars are naturally high performing animals and the removal of the testes takes away the source of boar-like efficiency. Producers who castrate therefore lose the growth performance and leanness that result from natural boar physiology.

In the past, the lack of any commercially viable alternative to physical castration meant that the veterinarian had little opportunity to help clients regain some of the losses associated with castration. Physical castration is associated with pre-weaning mortality due to infections and trauma, but even here there is limited opportunity for the veterinary help.

Increasing concern over the animal welfare implications of physical castration in some countries, and the increasing importance of the commercial and environmental benefits that could come from re-gaining boar-like performance, have driven considerable research into alternatives to this age-old practice. Thanks to this research, veterinarians in many markets are now in a position to advise their clients on a new production option that can avoid the losses associated with castration.

Immunological alternative

Improvac from Pfizer Animal Health is an immunological product which temporarily suppresses testicular function in boars and thus can replace piglet castration as the preferred method of reducing boar taint. But, because Improvac has its main physiological effects only during the last few weeks of fattening, it allows male pigs to grow like boars for most of their lives so they are more muscular, less fat and more metabolically efficient than either females or castrates (see inset).

This immunological technology has been used commercially for over 10 years in Australia, where it was initially developed, and is now being made available in many

more countries around the world. The promise of improved production efficiency and a more animal and environmentally friendly approach, has meant that this novel technology is now being advocated and adopted by many veterinary and commercial opinion leaders.

Feed conversion

Feed is the most important factor in the economics of swine production, so the improved feed conversion rate (FCR) that is associated with immunisation compared to castration is an attractive benefit to producers. Until the second dose of Improvac is given, typically at around 17-18 weeks, pigs grow as intact boars, with a lower average daily feed intake (ADFI), lower backfat and better FCR (lower feed:gain ratio) compared to castrates. Before the second dose there may be lower average daily gain (ADG), which is perhaps surprising and is thought to reflect the negative effect on voluntary feed intake of male behaviour patterns when pigs are housed in groups (the same effect is not seen in solitary animals).

The key point is that growth in this phase is highly efficient and any decrease in ADG is more than made up for by a larger reduction in feed intake and consequent improvement in FCR. Up to this point, immunised pigs typically have an FCR that is about 7% better than that of comparable castrates.

The physiological effects of immunisation develop only after the second dose is given. One of the most obvious effects is a significant increase in appetite, with pigs eating as much as, or even more than, physically castrated animals.

Blocking testicular function results in far less male behaviour, such as fighting and mounting, thus reducing energy expenditure and increasing the amount of time available for feeding. The reduction in oestrogen (which is high in male pigs and acts as an appetite suppressant) may also play a role.

After the second dose of Improvac, ADG increases markedly and may temporarily be up to 15% higher than for castrates of the same age, so that many animals finish with a higher slaughter weight than castrates.

During this final phase FCR is typically 11-12% better than it is for castrates.

Professor Frank Dunshea of Melbourne University has conducted a number of studies to evaluate the effect of immunisation on growth patterns and efficiency.

"Over the entire weaning to market period, males immunised with Improvac use approximately 6-9% less feed per kilo of liveweight gain than physically castrated male pigs, resulting in less feed utilised and less effluent to be disposed of or processed.

"Males immunised with Improvac also con-

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How Improvac works

Improvac works by temporarily blocking the action of natural gonadotrophin releasing factor (GnRF) and thus suppressing the function of the testes.

The first dose primes the immune system but has little physiological effect; the second dose stimulates a rapid but temporary rise in anti-GnRF antibodies and thus blocks its stimulation of the testes.

The first dose can typically be given any time after week eight; the second should normally be administered 4-6 weeks before slaughter (but refer to the product label for country-specific directions for use).

Up until the second dose, animals follow natural boar growth patterns. Following the second dose, boar taint is reduced and animals begin to behave and grow more like castrates.

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tain less carcase fat and are more lean than their physically castrated contemporaries."

On a whole herd basis, these are figures that amount to a significant economic benefit to producers, as Neil Ferguson from Nutreco Canada Agresearch explains: "In markets where castration is mandatory, Improvac affords the opportunity to utilise entire males for a period of time, which significantly improves overall farm efficiency relative to physically castrated pigs, and therefore has the potential to improve profitability."

Dr Mark Bertram of First Choice Livestock in the USA agrees: "As a result of the ability to capture the natural efficiency advantages of entire males, return over feed costs can be greater while decreasing waste production and feed input requirements of swine production.

"Due to the biological difference in entire males compared to castrates, one can expect improvements in ADG and FG of up to 10 and 14% respectively when fed a diet that is not limiting in amino acids."

	Boars	Immunised males	Physical castrates
Backfat (mm)	8.9*	9.14	11.43
% lean	58.63*	58.08	56.79

**p <0.01 vs immunised males and castrates*

Table 1. Effects on the carcase from using Improvac.

The question of the most appropriate diet for immunised pigs is a good one and the subject of on-going research. It is possible that this work will yield data which will allow the development of more specific nutritional guidelines which will allow even greater feed efficiency to be achieved.

Timing

After puberty, entire males display more aggression and sexual behaviour (mounting) than castrates. This can become especially problematic in late fattening and during transport to slaughter, when established social hierarchies are disrupted and there is contact with unfamiliar animals, possibly resulting in high levels of injury and stress. Not only does this have welfare implications, but also potential economic impact.

The blocking of testicular function by Improvac effectively reduces this boar-like behaviour. It takes a week or so for the physiological and behavioural effects to begin to become apparent, but by that time testosterone levels are already reduced to levels equivalent to a castrate. Immunised pigs show much less aggressive and mounting behaviour after the second injection compared with entire pigs of the same age, which can be important for both on-farm management and ensuring high meat quality after slaughter.

The physiological effects, including the elimination of boar taint are only temporary. In most pigs they will last for over 16 weeks after the second injection. However, the recommended target period between the second dose and slaughter is typically 4-6 weeks, with slaughter possible up to 10 weeks with minimal risk of boar taint (as always, the local product label must be checked for the approved directions for use).

This maximises the production gains and allows a generous margin to ensure that the effect does not wear off in any individual pig. It is very important therefore that immunisation and, in particular, the second dose is given at the optimal time.

Using Improvac also has effects on the carcase. Slaughter studies show that immunised males have a backfat thickness that is between that of entire boars and castrates; likewise, lean meat content was found to be between that of boars and castrates (see Table 1).

Detailed analysis of meat quality parameters has shown that using Improvac has no deleterious effects compared to meat from castrates.

"Improvac improves carcase composition and yield of cuts with no adverse effects on

meat quality. Colour, water holding capacity and pH are not impacted," comments Floyd McKeith from the University of Illinois.

Of course the final and most discerning arbiter of meat quality is the consumer. Consequently, numerous sensory panels have been conducted in markets around the world to gauge the reaction of ordinary consumers and trained sensory experts to pork from immunised males. The results from these studies are consistent: pork from immunized pigs is at least equivalent in sensory quality (odour, flavour, juiciness, tenderness and overall acceptability) to pork from female pigs or castrated pigs.

Market acceptance

Swine producers do not operate in isolation: they are at one end of a supply chain that ends with the consumer. In some cases, and increasingly in some markets, they are part of a vertically integrated system, but the end of that chain is still the consumer.

In some markets, those consumers are becoming increasingly concerned about how their food is produced and are making purchase decisions based on those concerns. This is one factor that has prompted the search for more animal friendly alternatives to piglet castration.

A reduction in feed consumption and waste (slurry/manure) production means that Improvac has the potential to contribute to a more sustainable form of production compared to castration – a factor which is becoming increasingly important for both consumers and the industry. This aspect is currently being assessed in an ongoing global study by the Italian company Life Cycle Engineering, as project co-ordinator Gian Luca Baldo explains:

"We are currently undertaking a life cycle assessment (LCA) of Improvac for EPD purposes – the international system for assessing the environmental performance of products according to the ISO 14025 Standard. So far, the results for Improvac look promising – including a reduction in carbon footprint from cradle to gate."

Consumer research has been conducted among European consumers to gauge their reaction to physical castration, with and without anaesthesia, and to the use of Improvac. The overwhelming majority of people who took part in these studies (over 5,300 from seven countries) said that immunisation was an acceptable method of boar taint control and found it a preferable method compared with physical castration.

Vaccination – the animal friendly alternative to castration.

Conclusion

Improvac offers producers the opportunity to raise intact males and produce quality pork without the risk of boar taint or the inconvenience of boar-like behaviour. In markets that castrate, it offers a more welfare friendly and acceptable alternative to physical castration that has the added economic benefits of reducing the amount of feed required and waste produced for every kg of liveweight. In non-castrating markets it offers the opportunity to raise heavier and thus more profitable pigs without compromising meat quality, environmental or welfare standards.

This is a unique form of technology with a novel mode of action. For the producer, the idea of replacing physical castration with immunisation can be a difficult concept to rationalise. Likewise, the mode of action of Improvac can be equally difficult to understand. The veterinarian is a key source of information and advice on this innovative swine management option: a source that can help the producer improve the profitability of his or her business. ■