EU PiG

EU PiG Innovation Group

Technical Report

Meat Quality

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Challenge: Organisational innovations in supply chains to create more added value

1. Introduction

Several initiatives have been developed in Europe and new initiatives are under development to innovate the organisation of the pork supply chain, creating more added value for pig farmers by meeting consumers' expectations for higher-quality pork production (eg organic, free-range, extensive pig farm systems). Compared to raw pork, as a commodity, more sustainable and/or tastier, certified and labelled pig meat can be offered to consumers who are willing to pay for it. These initiatives can be considered as efforts to differentiate the supply of pork on the market in order to obtain a higher market price able to cover the extra costs the chain actors are facing, when they have to comply with defined product specifications. The areas in which the differentiation strategies take place concern better animal welfare, higher environmental standards and pork with specific characteristics that enhance human health.

The pig sector is struggling with negative attitudes from citizens. This may be the result of conflicting attitudes towards pig husbandry of citizens and other stakeholders who have different interests and different perspectives with regards to pig husbandry. The pig sector tries to understand citizens' perspectives and include them in their production strategy, like the implementation of animal welfare measures, and in their communication to citizens and consumers (Bergstra et al., 2017).

Ethical meat production appears to have great market potential, especially when constant and reliable signalling and information is given to consumers. Above all, ethical meat should 'deliver' its value (ie hedonic, nutritional, social) to consumers, as with any other meat or food type, incorporating intrinsic qualities, that would justify superior experienced quality; only then, ethical process-based extrinsic quality cues (ie sustainable labels) will be able to fully deploy their market dynamism (Krystallis A, 2015).

Animal welfare is an important pillar of sustainability in meat production and is associated with other aspects of this concept, such as animal health, productivity, food safety, food quality and efficiency from a production cost perspective (Velarde et al., 2015).

Continued concern for animal welfare may be alleviated when welfare is monitored on farms. Retailers and governments have views of welfare that are derived from their relationships with producers, consumers, non-governmental organisations (NGOs) and scientists.

Many stakeholders emphasise the importance of communication in making a monitoring system work (Bracke et al., 2004).

Although the welfare of farm animals is increasingly being incorporated into notions of quality within the food chain, this is rarely an explicit component. Rather, it is bundled in with a number of related environmental, health and territorial 'goods' to create a composite construction of product quality that differentially conceals and makes visible the animal's life and its setting (Buller and Cesar, 2007).

Private standards are often more demanding than public minimum-quality standards like legislation and are subjected to regular monitoring by third-party certifiers, making it transparent to consumers that the products are of higher quality than required by the public standard. The most successful existing welfare-enhancing initiatives combine multiple goals with the use of multiple policy instruments (eg standard setting, labelling, information, research) and are developed in cooperation by multiple actors. Animal protection organisations in the north-western Member States of the EU often take the lead in the debate in society on animal welfare issues. The collaboration between NGOs, multiple retailers and actors in the production chain often creates the necessary conditions to promote animal welfare and environmental standards successfully on the market. At the overall EU level, the market for improved animal welfare or environmentally friendly products is considered to be a niche rather than mainstream, due to the state of development of the market, but in the north-western Member States, improved animal welfare and compliance with high environmental standards is prominent in the market, as consumers can choose from a wider assortment and different price-quality levels that focus specifically on animal welfare or cover a broader range of sustainability issues (Spoolder et al., 2011).

For welfare labelling to be viable, the market for livestock products produced at higher welfare standards has to be sufficiently segmented, with consumers having sufficiently distinct and behaviourally consistent preferences. Kehlbacher et al. (2012) found decreasing marginal 'willingness to pay' as animal welfare levels increase and that people's preferences for different levels of farm animal welfare are sufficiently differentiated, making the introduction of a labelling scheme in the form of a certified rating system appear feasible (Kehlbacher et al., 2012).

However, changing demands for intrinsic and extrinsic quality attributes of pork products impact the way supply chain management should be organised from the farmer down to the consumer (Trienekens and Wognum, 2013).

2. Methodology

In order to identify the top five best practices in the field of organisational innovations in supply chains across all the EU PiG regions, a series of criteria, aiming at measuring the effectiveness of the collected practices to match the specific challenge, were defined.

The following set of criteria was scored for each practice.

- **Excellence/Technical Quality**
  - Clarity of the practice being proposed
  - Soundness of the concept
  - Knowledge exchange potential from the proposed practice
  - Scientific and/or technical evidence supporting the proposed practice

- **Impact**
  - The extent to which the practice addressed the challenges pointed out by the RPIGs
  - Clear/obvious benefits/relevance to the industry
  - Impact on cost of production on farm and/or provide added value to the farming business or economy
  - The extent to which the proposed practice would result in enhanced technical expertise within the industry, eg commercial exploitation, generation of new skills and/or attracting new entrants in to the industry

- **Exploitation/Probability of Success**
  - The relevance of the practice to each Member State (MS) or pig producing region/system
  - Timeframes for uptake and realisation of benefits from implementation of the proposed practice are reasonable
  - Level of innovation according to the Technology Readiness Level (TRL)
  - The extent to which there are clear opportunities for the industry to implement the practice/innovation
  - Degree of development/adaptation of the practice to production systems of more than one MS

Scores had to be in the range of 0 – 5 (to the nearest full number). When an evaluator identified significant shortcomings, this was reflected by a lower score for the criterion concerned. The guidelines for scoring are shown below (no half scores could be used).

0	The practice cannot be assessed due to missing or incomplete information.
1 – Poor	The practice is inadequately described, or there are serious inherent weaknesses.
2 – Fair	The practice broadly addresses the criterion, but there are significant weaknesses.
3 – Good	The practice addresses the criterion well, but a number of shortcomings are present.
4 – Very Good	The practice addresses the criterion very well, but a small number of shortcomings are present.
5 – Excellent	The practice successfully addresses all relevant aspects of the criterion. Any shortcomings are minor.

The selection of the top five practices followed a procedure in six steps:

1. All members of the Thematic Group (TG) sent their scoring sheets to the TG leader
2. The TG members provided brief comments on the first 10 practices they had chosen as best practices, as these comments facilitated the discussion about the first five
3. The TG leader standardised all individual scores by calculating Z-scores
4. The first 10 practices were ranked according to the average Z-scores of all participants of the TG. All other lower-ranked practices were excluded.
5. The TG leader collected all the comments of the individual members of the TG for each of these 10 practices and sent them around to the TG.
6. In a dedicated meeting, the TG discussed the results and finally decided on the top five best practices for each challenge based on the comments provided by the group

3. Results and Discussion

3.1. Validation of top five practices

For the challenge ‘organisational innovations’, in total 42 practices have been collected in 10 Member States. Below, a summary is provided of the top five practices that have been selected by the Thematic Group with the methodology reported in section 2. The practices primarily cover strategies in the area of animal welfare and food safety.

Best practice, ‘Initiative Tierwohl’

The Animal Welfare Initiative ‘Tierwohl’ started in 2015 and has seen itself as the driver of this process. With the collaboration of partners from science and economy, the Animal Welfare Initiative has developed measurable criteria, which are exceeding legal requirements. Farmers who are voluntarily willing to put certain criteria into action will receive an animal welfare- remuneration, independent from the market price. This remuneration serves as a compensation for the execution of the criteria. The initiative is financed by all of the participating food retailers. Since 1 January 2015 they have been paying four cents in a fund for every sold kilogram of meat and sausage product from pork, chicken and turkey. In the period 2015 to 2017, payments of food retailers reached 85 million per year and these are expected to rise to 130 million per year in the period 2018 to 2020. In 2017, 2400 pig farmers participated in the initiative, including 16.6 million pigs per year.

www.initiative-tierwohl.de

Best practice, 'Chain director from producer to consumer'

Heihoef is the company name of an organisation of five pig farmers in the south of the Netherlands. Heihoef distinguishes itself as a chain director from production to the end consumer. It involves fixed partners: feed suppliers, veterinary services, slaughterhouses, meat processors, butcheries and retailers. To reach the consumer, Heihoef has developed two brands: Heyde Hoeve (with a focus on taste) and Hoevenaer (with a focus on taste and on animal welfare following the 'star-system' as developed by the Dutch organisation for animal welfare). Both brands are owned by the shareholders with different unique products, using taste as a distinguishing feature. To achieve an excellent taste, which is the most important unique selling asset, special feed and the Duroc breed are used. Currently five pig farmers produce 1,200 pigs a week, of which about 60% are sold under both brands. As sales are growing, Heihoef is growing too.

Heihoef exploits a twofold business model. By developing products for the end consumer with added value, Heihoef creates better margins for the pig farmer (+4% compared with conventional pig farming margins); by organising the complete supply chain, Heihoef manages to create more efficiency and reduce its costs, thus achieving a higher margin for the farmer of an additional 4%.

The producers reinvest part of this margin back into the company to be used for product development and marketing. Each brand supplies a different market channel: Heyde Hoeve is for the quality butchers (focus primarily on taste) and Hoevenaer is for large retailers (focus on animal welfare and taste).

www.heihoef.nl

Best practice, 'Heart pig'

According to this quality scheme, tail docking is not performed in the pig herd. The pigs have more space than normal and thereby acquire the welfare brand 'Heart pig', which provides an extra 1.3 DKK (about €0.17) per kilogram at slaughter for the pig farmer.

There are specific requirements for acquiring the brand 'Heart pig': sows need to be kept in a loose housing system for the entire production cycle (except a few days at farrowing) and all animals must have access to straw. Moreover, pigs must not be tail docked and more space per pig must be provided to rearing and slaughter pigs.

Management procedures contribute to facilitate the handling of pigs without tail docking, as well as the use of straw and more space per pig. It is evident that the effect of enrichment material is best when the material is newly introduced into the pen. The advantage of using straw racks compared with straw on the floor is the accessibility of straw all the time and not just in the short period of time after applying straw on the floor.
The farmer receives an extra 1.30 DKK per kilo at slaughter, which matches the extra costs in the production line (according to calculations performed by SEGES www.seges.dk).

Best practice, 'Friberne' market concept

Frievar is an organisation of primary pig farmers. Frievar buys the animal feed and sells the pigs for slaughtering (collective purchasing and selling policy).

To optimise the feed and genetics, Frievar can produce a uniform, high quality pig. Also, Frievar performs good management and health by using the same veterinary and feed/management adviser for all the farms. 80% of the feed originates from Europe (60% from the types of grain). The soy used meets the FEFAC criteria of sustainability. The daily roughage contains plant products, like oak bark, juniper and chestnuts. This gives a special taste to the meat. Because of a higher cost of production, Friberne/Frievar meat is produced for a more affluent segment of consumers.

Best practice, 'Finnish national quality system'

The Finnish national quality system is based on an animal health and welfare register. This quality system is approved following EU regulation 2010/C341/01 by EVIRA (National food safety authority) and audited and certified according to ISO 9001 standard quality management system by an external organisation, eg Bureau Veritas or Inspecta:

- Animal health and food safety cut-off values for sustainable production
- Labelling meat packages with Laatuvastuu brand

Its advantages are related to:

- Using a national quality system as criteria for public food acquisitions
- Promoting consumer knowledge and quality awareness regarding animal health, food safety and sustainable production-defending pricing of domestic pork

www.ett.fi

3.2. Cost-benefit analysis of the EU PiG Ambassador

To produce under the brand name ‘Heart Pig’ in Denmark, a series of conditions have to be met. The most important features are not to perform tail docking, to keep sows in a loose house system for the entire cycle, to allow pigs to have continuous access to straw and to allocate more space to the pigs in all phases of breeding and fattening.

The costs and benefits of this system have been analysed, taking into account the changes in technical performance parameters, the extra labour time and the investments needed to comply with the system. According to calculations with the Interpig model, the extra space allowance of 10% in all phases of the pig farms first of all generates higher fixed costs related to depreciation and interests inherent to the investments needed. A second relevant effect is a higher feed consumption of sows due to their movement in loose house systems and more use of energy to heat to larger pens (33 kWh/sow). In the breeding phase, a slightly higher pre-weaning mortality may be expected (+2.5%) and higher sow mortality (+1.5%), which requires an extra recruitment of gilts.

The continuous access to straw implies the endowment of all pens with straw racks and the purchase of significant quantities of straw (160 kg/sow/year and 21 gr/pig /day). The labour time necessary to provide extra straw increases by more than 30%.

Based on these assumptions, the production costs of farms adhering to the brand ‘Heart Pig’ rise from € 141/kg up to € 1.52/kg slaughter weight, which corresponds to an increase of 7.9%.

Challenge: Reducing boar taint

1. Introduction

Stopping castration is a new welfare and environmental challenge for European pig production. In 2010, representatives of several actors (farmers, meat industry, retailers, scientists, veterinarians and non-governmental organisations) of the European pig sector endorsed the European Declaration on alternatives to surgical castration of pigs. It is a voluntary initiative aimed at stopping surgical castration of male pigs by 1 January 2018. At the end of 2017 the entire male production, after a strong increase from 2009 to 2016, is stable and reached 36 % of the marketed male pig carcasses in Europe (Nancy de Briyne et.al, 2016).

At the moment the major risk of producing entire males is to detect boar taint on parts of the pig carcases at consumer level (fresh meat in particular), especially if the sorting method at abattoir level is not efficient (Haugen, 2013). A majority of abattoirs which slaughter male carcases identify the level of boar taint in the fat tissue using humans' sense of smell (heat the pig backfat and smell the odour with very well-trained people, the 'human nosers'). In the majority of cases, the tainted male carcases are cheaper in the European market and the boar tainted meat and fat are oriented towards the low-cost pork processing industry (Engesser et al., 2017). Reducing boar tainted percentage is an important economic challenge for the pig food chain in Europe and in the world pig market.

The main identified compounds responsible for the odours of boars are two molecules: the skatole produced at the intestine level and the androstenone produced by the testes. These two compounds are stored in pig fat tissue (Bonneau & Chevillon, 2012).

Reducing boar taint at farm level is an important challenge for pig producers to meet the societal demand on reducing pain and suffering during and after castration. Analgesia and/or anaesthesia could be alternatives to reduce pain and suffering around castration when castration is maintained (Fontanesi, 2016,). The use of immune vaccination Improvac can reduce the development of the testes, but its use is not popular at moment at the farm level (two injections during the fattening period and the cost). Vaccination against gonadotropin-releasing-hormone(GnRH) may represent, however, a valid alternative to surgical castration. It significantly diminishes the size of the testes and causes the suppression of testosterone and androstenone. Moreover, it also causes a reduction of skatole levels in the fat. Low concentrations of androstenone and skatole (0.27 ± 0.08 and 0.04 ± 0.01 respectively) prove the efficiency of immunocastration.

For traditional production or high added value products (heavy slaughtering weight, slow growing lines or local breeds which reach sexual maturity before they reach a heavy weight), the alternative of producing only entire males is not compatible with the aim of high-quality meat standards and the necessary fat content of such products. Vaccination against boar taint could be a solution for these specific production systems to avoid castration.

In entire male production, the major strategy to reduce the percentage of boar-tainted carcases for a pig farmer is the choice of the male and female genetics, particularly addressed to reduce androstenone levels. The use of genetic markers was identified as a promising solution (Zamaratskaia and Squires, 2009). Some genetic companies in Europe have started to select some pure breeds with very low levels of boar taint and develop a selection of boars used in insemination with very low levels of androstenone. Predicting fat androstenone content using a rapid and cheap method applied to live pigs is needed for efficient genetic selection against boar taint (Prunier et al., 2016).

The second strategy to reduce boar taint is the management of boars at farm level (final weight, sexing or not sexing, clean pigs, surface, environmental parameters) and, in particular, feeding to reduce the skatole level by means of better tailoring the nutritional requirements of the needs of the pigs, especially for finishing pigs (Squires and Bonneau, 2014). Also, the incorporation of fibre in the diet or the replacement of yeast with casein, reduces the backfat level of skatole.

Finally, mention should be made of the production of entire males to reduce castration. This production system needs to fulfil some specifications at farm level, such as specific selected genetics, maximum final weight, management in finishing pen, specific feeding to reduce skatole level in the fat tissue (Backus et al., 2016). Nutritional effects on boar taint were recently reviewed by Urbanova et al. (2016).

To be cost-effective, extra costs to reduce boar taint have to be counterbalanced by a reduction of some expenses and/or by higher prices.

In France in 2016, for example, the producers of entire males received €3.8/kg of cold carcase weight more than the producers of castrated males. This resulted from a 2.1 higher lean meat percentage (LMP). The main contribution to the estimated LMP came from the lower fatness (about 4 mm at the splitline) of entire males (Daumas, 2017). A meta-analysis of 43 studies showed the same difference (4mm) at the P2 site, ie the fat thickness at the last rib at 6.5cm off the midline (Trefan et al., 2012).

The feed conversion ratio is lower for entire males, which reduces both the production costs and the environmental impact. The advantage was assessed to 14% by Quiniou et al. (2010) compared with castrates fed *ad libitum*. Gathering several studies, Quiniou (2013) concluded an average of 12%. In a context of a very high feeding cost, Aubry (2014) quantified the decrease of feeding costs at €3.9 /sold slaughter pig.

2. Methodology

In order to identify the top five best practices to reduce boar taint across all the EU PiG regions, a series of criteria aiming at measuring the effectiveness of the collected practices to match the specific challenge were defined.

The following set of criteria have been scored for each practice.

- **Excellence/Technical Quality**
  - Clarity of the practice being proposed
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- **Exploitation/Probability of Success**
  - The relevance of the practice to each Member State (MS) or pig-producing region/system
  - Timeframes for uptake and realisation of benefits from implementation of the proposed practice are reasonable
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6. In a dedicated meeting the TG discussed the results and finally decided on the top five best practices for each challenge based on the comments provided by the group

3. Results and Discussion

3.1. Validation of top five practices

For the challenge ‘reducing boar taint’, in total 15 practices have been collected in nine Member States. Below, a summary is provided of the top five practices that have been selected by the thematic group via the methodology reported in section 2. The practices cover strategies in the field of genetics and animal nutrition or a combination of both in order to reduce boar taint.

Best practice, ‘Male fatteners without boar taint’

The aim of the studies EN-Z-EMA and Strat-E-Ger was to find out how fattening of uncastrated male piglets can work in practice. The first key point in the studies was the possibility of reducing boar taint in the breeding programme through a selection of terminal line boars. The second was the evaluation of a human nose scoring system and its limits.

Boar taint is determined by the key elements androstenone and skatole. Both of these substances have high heritability and these traits can therefore be included in a breeding value calculation. Breeding values with high securities include pedigree information, genomic information (33 SNPs are significantly associated with boar taint) and the information of a performance test based on neck tissue probes. If a group of the 25% best AI boars in relation to their breeding values of boar taint is chosen, the risk of boar taint for male fatteners is nearby zero.

Costs of the boar taint testing and the following calculation for breeding values are passed on via the semen tubes of the positive selected AI boars. Piglet producers and fattening farms have the advantage of being able to stop castration and to reduce the linked labour costs. Simultaneously, fattening traits like daily gain and feed conversion improve.

Piglet producers in the whole EU can buy semen of positive selected

boars. www.gfs-topgenetik.de

Best practice, 'Genetic selection for low boar taint levels'

Since 2016, there have been boars in the market that have a progeny with lower sexual odour, that fulfil requirements to avoid surgical castration. This project started with the selection of candidate boars, located in different boar studs. These boars were used as parents for different slaughter pigs, kept in different farms, and evaluated for their performance and, also, for their content of androsterone and skatole after slaughtering. Afterwards, a DNA evaluation (60,000 loci) was carried out, in order to correlate boar taint levels and genomics results. More precisely, the relation between different DNA markers and androstenone and skatole levels was studied. This information was used to develop a new Estimated Breeding Value, achieved by genomics, for androsterone and skatole, and a new selection index is used now. All the animals that have a value above 100 points in this selection index have a lower risk of having boar taint.

Genotyping has a cost; however, entire males are more efficient than castrated animals: they need less feed to produce more meat. Castration takes time for producers and producing entire males saves this time. Avoiding castration pain generates a welfare benefit. Finally, pigs that suffer inguinal hernias cannot be castrated.

Best practice, 'Correct amino acid composition'

This herd purchases 30 kg pigs and feeds them for slaughter. They experience high daily weight gain due to the detailed and optimised feeds, which results in a low discard rate when producing intact males. The herd has been promoted by the slaughterhouses as one of the herds experiencing the lowest discard rate due to skatole and androsterone. Daily weight gain is approximately 1050 – 1100 grams per day from 30kg until slaughter. This results in a low age at slaughter and thus a reduced level of androsterone since the pigs have not reached puberty before slaughter. Additionally, the levels of amino acids are optimised to the pigs in relation to the exact needs for the pigs. This results in optimal utilisation of the amino acids in the feed and results in lower production of skatole in the intestines.

There are extra costs due to a demand of vaccination against PCV-2 for purchased 30 kg pigs (9 DKK), as well as the high genetic (2 DKK) and health status of delivered pigs (highest status of SPF) (extra costs unknown). Extra costs are linked to the higher quality of the pigs. Normally, the extra costs linked to higher health status will pay off from better productivity. The better balanced amino acid composition does imply more labour costs and costs to feed advisers. They do not consider the extra costs as part of the goal to reduce the discard rate for intact boars. Extra costs are covered by the better daily weight gain and lean meat percentage.

Best practice, 'Inulin in pig feed'

The full PhD thesis can be found at the AHDB pork website: 'Factors Affecting Boar Taint in Pigs' by Dario Zammerini. Faster growth of more than 0.7 kg per day significantly increased concentrations of both taint compounds, giving no support to the view that the older, slowest-growing pigs are likely to be more tainted. An effective way to reduce skatole levels in the fat is the use of diets rich in fibre or in fermentable carbohydrates. In this study, feeding chicory, *Cichorium intybus L.*, a source of a fermentable carbohydrate known as inulin, had a significant effect in reducing skatole levels in the fat. Chicory fed at the level of 9% for two weeks was successful in reducing skatole to a level well below the threshold for this compound at 0.2 microgram per gram with only one pig with a skatole value over the threshold and 55% with levels typical of castrated pigs.

Inulin is an expensive compound to feed to pigs, which apparently is the reason why this has not been taken up more widely within the industry. Conversations with nutritionists will provide an up-to-date cost of this feed.

Any farm that has the ability to include inulin via chicory in feed, and where it is cost-effective to produce inulin, may adopt this practice.

Best practice, 'Certification 'INO' of terminal boars for the improvement of meat quality'

To reduce the boar taint risk, Nucleus offers a range of INO-labelled terminal boars. This process was developed in collaboration with INRA. Fat tissue samples and blood samples were taken from young Piétrain boars. The levels of androstenone and skatole were measured in fatty tissues and plasma oestradiol and testosterone were used. Different models were then tested to determine the best prediction equation for androstenone in fatty tissue from blood tests (Prunier et al., 2016). The equation chosen takes into account the testosterone and oestradiol plasma levels measured at 150 days of age. Since April 2016, all candidate boars are harvested at 150 days and their androstenone levels are predicted. This estimate makes it possible to exclude animals at high risk of producing odorous derivatives. Today, all terminal boars marketed by Nucleus are labeled INO.

The implementation of this labelling necessitates equipping the breeding farms of terminal boars with centrifuges and consumables. The realisation of fixed-age harvests requires a strong mobilisation of the technical teams (visits to breeding farms, transport of samples to the laboratory) and training in the use of new equipment (centrifuge, micropipette). The utilisation of this process is in the order of € 110,000 per year for Nucleus. It should also be noted that blood sampling is much less invasive for animals than a biopsy and blood dosing is less expensive than an analysis of odorous compounds in fatty tissues. The use of INO Nucleus boars reduces by 35% the proportion of degraded odorous butchered pigs, for which the loss to the farmer can be as much as 15 to 20% of the price of the carcase.

3.2. Cost-benefit analysis of the EU PiG Ambassador

One of the biggest problems for farms, that raise uncastrated male pigs is the significant presence of boar taint of the carcasses at slaughter. The possibility of reducing boar taint in the breeding programme through a selection of terminal line boars has been successfully explored by Gfs- Topgenetik in Germany. The boar registered in the herd book of the 'German Genetic' breeding organisation belongs to the Westfleisch boar pool of Gfs. His progenies have been intensively tested, so his suitability for use in the boar fattening is proven. After insemination and farrowing the male and female piglets are raised together in the rearing period, but are finished in separate groups. The additional costs of the semen of these tested boars are €1.10. Without the odour tested sires 3.5% of the carcases show the significant presence of boar taint, but using the Gfs odour tested sires only 0.75% of the carcasses have to be discarded. Boars with conspicuous odours will suffer lower prices than boars without boar taint. In the table below, the benefits are shown of using odour-tested sires with three classes of price reduction and assuming the slaughtering of 2,250 boars. Without the use of odour-tested sires, 79 boars will show boar taint, with a loss ranging from €1,580 up to €6,320 . Using the Gfs odour-tested sires, only 17 boars will present boar taint and the losses will be limited up to a maximum of €1,360. The extra costs of using these sires are €990.

Costs and benefits of using Gfs odour tested sires

	Additional costs for semen	Number of boars with conspicuous odours	Deductions per boar with conspicuous odours (€)		
			20%	40%	80%
Without use of odour tested sires	0	79 (3.5%)	-1,580	-3,160	-6,320
Use of odour tested sires	990	17 (0.75%)	-340	-680	-1,360
Difference			1,240	2,480	4,960

Source: Gfs Topgenetik

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