Pig Farmer's Conferences 2009

Conference Proceedings

Cavan, 10th November, 2009

Clonmel, 11th November, 2009

Contents

Pig Production Research at Teagasc Moorepark

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The pig production research programme at Moorepark has been underway since 1969. The information generated has contributed enormously to the development of commercial pig production in Ireland. Some of the major achievements included (a) a long series of projects on sow nutrition, (b) development of simple diets which are still the benchmark against which other formulations are judged, (c) comparison of sire breeds / genotypes.

While some short-term experiments can be completed in a matter of months most research projects take two to four years and require four to ten separate experiments or tasks. Many of these long term projects will involve a graduate student who will be registered with an Irish or overseas university and complete a thesis for submission to the university for a Masters (18 to 24 months) or Doctor of Philosophy (36 to 48 months) degree.

What subjects are researched?

The steps in planning a research project are:

- Identify the problem
- Find out what is known already and what are the gaps in knowledge
- Decide if a research project has a reasonable chance of success
- Estimate resources required (staff, animals, special housing and/or equipment, laboratory services, special feeds)
- Identify any legal restrictions (animal welfare, food safety, biosecurity, danger to staff)
- Secure funding
- Link with university or other partners

Project selection

Selection of research projects to be undertaken is based on several criteria:

- Priorities identified by the Pig Industry Advisory Committee
- What is known already and what critical gaps exist in knowledge
- Probability of successful completion
- Likely return on investment
- Availability of funding
- Availability of resources (staff, animals, laboratory) with a reasonable timescale

Completing a project

The steps in completing a project include:

- Source funding
- Decision to proceed
- Recruit graduate student (if required)
- Update literature review
- Secure experimental license (if required)
- Draw up detailed protocols for one or more experiments
- Formulate and manufacture diets
- Allocate animals

- Monitor animals
- Collect samples (feed, faeces, tissue, carcass)
- Complete laboratory analysis
- Complete statistical analysis
- Write report

Overseas research

The resources available for pig research in Ireland are limited and form one small part of the jig-saw that is international pig production research. Findings from research abroad and reports already published are readily available in libraries. Access to this information is the foundation in planning what research needs to be done, and how it is to be done. While some overseas research can be directly applied to the Irish situation, this is not always true. Differences in genotype, sex, feed ingredients, slaughter weight, climate all influence how animals respond.

However, international linkages are an important factor in every research programme. These linkages can range from informal contact with researchers overseas to collaboration and sharing of tasks. Over the recent past research projects at Moorepark have involved collaboration with universities and institutes in several EU and non-EU European countries, universities in Australia and US. Collaboration sometimes involves staff or students spending time in another country to carry out tasks, attend courses or receive training.

Some projects can involve collaboration (funding, laboratory services, expertise) with commercial firms. In some cases the results may be confidential to the group funding the projects. Nevertheless, as well as generating welcome revenue, confidential contracts introduce staff to subjects and persons that might not normally come within their circle and provide information that can be used more widely.

Not all research work comes into the public domain. Attendance of staff and students at conferences and workshops at home and abroad is important in their training, career development and building up informal information networks. The confidence and insight gained from close links with research activity in Ireland and contact with researchers abroad is invaluable in their critical evaluation of published information.

Dissemination

Research is worthless unless the findings are applied by the end-user and unless they can be applied to economic advantage.

Dissemination of research findings takes several forms:

- Detailed reports (theses, peer-reviewed scientific papers, scientific conference presentations)
- Popular reports (users conferences, magazine and newspaper articles, workshops, end-of-project reports)
- Newsletters
- Technical brochures
- In-service briefings for Teagasc staff
- Informal contacts with end users

Current research

Moorepark research covers a number of areas:

- Nutrition and feeding
- Management
- Carcass composition and quality
- Reproduction
- Health and welfare
- Food safety
- Manure management
- Production costs

The returns from investment in agricultural R&D are well established:

- In the US a number of studies have shown a return of about 10 to 12 dollars per dollar invested in agricultural R&D.

- In Ireland, the pig breed evaluation programme carried out in 1993 to 1997 was estimated to have cost about €1.0 million to complete and yielded a gross return to pig producers of a €16.5 million over the following 12 years (Boyle et al., 2002).

- Examination of the output of the Irish pig industry over a five year period showed that users of the Teagasc PigSys benchmarking system (about 40% of the national herd) produced two pigs more per sow per year than did the non-using 60%. At current prices two extra pigs per sow per year is worth almost €90 in margin over feed cost and almost €50 in net profit.

- The loss of the ADAS pig service in the UK in the mid-1990s was a major contributory factor to the reduction of 50% in the UK sow herd since then. A similar drop in the Irish sow herd would spell the end of commercial pig production here.

Research funding

Funding of the Teagasc research programme is mainly from government resources supplemented by pig sales, contract research (EU, DAFF, commercial) and pig research levy (about 3% of total expenditure).

Recent and current projects are listed below.

For up-to-date information on Teagasc pig research visit www.teagasc.ie.

This website is currently being redesigned and this should be complete by December 2009.

Nutrition and feeding

Subject	Collaborations	Description
Amino acid nutrition of growing pigs	UCD; Eurolysine	1. Responses of growing pigs to level of lysine and assessment of the optimum level of lysine in different weight ranges 2. Do. with threonine 3. Do. with methionine
Feeding management and pig performance	UCD	1. Response of growing pigs to energy density in the diet 2. Effect of weaning age and amount of starter and link feed on performance to slaughter 3. Effect of weaning age on bacterial population and health
Bone development in pigs	UCD	1. Survey of bone condition in cull sows at slaughter 2. Effect of dietary phosphorus and crude protein on bone development in growing pigs 3. Compensation in bone development after feeding low P diets
Sorghum in pig feeds		1. Response of weaners and finishers to level of sorghum in the diet (Confidential contract)
Comparison of starter feed formulations		1. Comparison of commercial starter diets (Confidential contract)
Feed enzymes		1. Effect of dietary enzyme supplementation on pig performance (Confidential contract)
In-feed probiotics		1. Response of sows and growing pigs to probiotic supplementation (Confidential contract)
Seaweed extract	UCD	2. Effect of *Ascophyllum nodosum* extract on growth, nutrient digestibility, carcass and selected intestinal microflora populations of grower-finisher pigs

Carcass composition and quality

Subject	Collaborations	Description
Slaughter weight	UCC; Ashtown	1. Effect of slaughter weight (80 to 120kg live) on pig performance and carcass quality including eating quality 2. Effect of slaughter weight on androstenone and skatole in fat
Compensatory growth	UCC; EU	1. Effect of early stage restriction and compensatory growth on meat quality
Pregnancy feeding and muscle development		1. Effect of extra feed in mid-pregnancy on growth and muscle development in progeny
Dietary neutraceuticals	UCC	2. Effect of plant-derived neutraceuticals on pork quality

Management

Subject	Collaborations	Description
Body fatness in sows		1. Survey of fat depth in sows at different stages of pregnancy on farms
Body fatness in gilts		1. Effect of body fatness in gilts at first mating on subsequent prolificacy
Prediction of body weight in sows		1. Use of body measurements (length, height, girth) to predict body weight of sows
Feed intake of lactating sows		1. Comparison of wet and dry feeding systems for lactating sows 2. Effect of lactation feeding system on subsequent sow performance
Selling method		1. Effect of split-marketing or whole-group sale on pigmeat output
Slaughter weight and nutrient excretion	UCC; Ashtown	1. Effect of sex and slaughter weight on nitrogen excretion
High performance herds		1. Analysis of PIGSYS herds to identify design and management practices associated with high output 2. High growth rate herds – What do they do different ?
Birth weight		1. Effect of birth weight on growth potential and muscle development
Feeder space		2. Effect of providing an extra feeder in the pen on performance of weaned pigs
Modelling pig unit operation		1. Use of mathematical models to assist decision making on pig units

Health and welfare

Subject	Collaborations	Description
Supply of fibre and manipulable material to pregnant sows	QUB; Hillsborough	1. Effect of dietary fibre on welfare and behaviour of pregnant sows in groups and single stalls 2. Effect of manipulative material on welfare and behaviour of pregnant sows
Management of heavy slaughter pigs	QUB; Hillsborough	1. Behaviour of boar pigs in the weight range 80 to 120kg in mixed and single sex groups
Lameness in gilts		1. Assessment of gait in breeding gilts at entry to the herd as a predictor of later performance
Safety of GM feeds	WIT; EU	1. Development of bio-markers for the safety assessment of GM feed ingredients

Food safety

Subject	Collaborations	Description
Control of Salmonella	UCD; UCC	1. Survey of farm factors associated with Salmonella category 2. Effectiveness of on-farm controls for salmonella in pigs. 3. Effect of feed additives on Salmonella incidence in pigs 4. Effect of probiotic cultures on pigs challenged with Salmonella

Manure management

Subject	Collaborations	Description
Composition of pig manure	UCD	1. Survey of composition of manure samples from pig farms
Water use	UCD	1. Water use on pig farms 2. Effect of dietary protein and fibre on water intake of growing pigs
Separation of pig manure	UCD	1. Separation of pig manure into solid and liquid fractions
Energy generation from pig manure	UCG: UL; WIT; Hillsborough	1. Anaerobic digestion (AD) of pig manure to generate biogas
Composting of pig manure solid	UCG; UL; WIT	1. Composting of solid residue from AD (after separation) to generate solid fuel
Using reed beds to process manure	U. Edinburgh; WIT	1. Using reed beds to process the liquid residue from AD (after separation)
Costing of pig manure handling	UCD	1. Effect of composition, distance, transport method and processing on manure handling costs

research at Moorepark. Other pre and post-slaughter methods of controlling boar taint will also be briefly discussed.

Housing, management and feeding procedures to improve pig welfare and reduce boar taint

1. Social environment

Aggression is one of the main welfare problems associated with pig production. It is linked to boar taint because it causes an increase in plasma testosterone in entire male pigs which in turn increases androstenone levels (Andresen, 1976; Claus et al., 1994). Hence, mixing and other events that exacerbate fighting/aggression in pigs promotes sexual maturation and increases the boar taint compounds found in entire males. Dominant animals are the most aggressive and consequently have the highest levels of androstenone.

a. Single or mixed sex groups

Entire males are more aggressive than females and castrates. Even as piglets, males perform more play fighting than castrates or females. The highest levels of aggression and sexual behaviour are seen in single sex groups of entire males, intermediate levels in mixed sex groups and the lowest levels are seen in groups of females (Salmon and Edwards, 2006; Rydhmer et al., 2006; Boyle and Bjorklund, 2007). From this it appears that entire male pigs probably 'benefit' in terms of welfare from being reared in mixed sex groups as overall levels of aggression and sexual behaviour are lower than if they were housed in single sex groups. On the other hand, females probably fare better in single sex groups where they are spared the stresses of mounting and fighting caused by the males. This makes it difficult to recommend the optimal group gender composition from an animal welfare point of view.

The reduction in aggression and sexual behaviour seen in mixed sex groups would suggest that boar taint will also be reduced in such groups compared to single sex male groups. However, Hansen et al. (2005) reared entire male pigs mixed with 3 weeks older and 15 kg heavier female pigs (to ensure that females achieved higher ranks) but found no reduction in skatole and androstenone levels in the entire male pigs. Indeed, raising entire male pigs in mixed pens resulted in the increase of androstenone levels in pigs at 90 kg live weight. Another study showed that boars in mixed sex groups had higher fat androstenone levels and were more sexually mature than those in single sex groups (EFSA, 2004).

Salmon and Edwards (2006) compared single-sex groups of eight animals housed with or without visual and olfactory contact to neighbours of the opposite sex. They demonstrated that entire males were less sexually mature, indicated by testis weight at slaughter, and mounted each other less frequently when reared with contact to females, whereas female maturity was unaffected by these rearing conditions from 57 to 125 kg live weight. Irrespective of whether males had contact with females or not there was no effect on performance. As a consequence of being less sexually active, the males that had visual and olfactory contact with females also had reduced fat androstenone and skatole concentrations (Salmon and Edwards, 2006).

It appears that while the physical presence of females in the pen may have a stimulating effect on the boar taint compounds (Giersing et al., 2000) limiting contact with females to visual and olfactory contact has a suppressive effect.

Rearing entire male pigs

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Introduction

Boar taint is an unpleasant and often offensive smell and taste that emanates from the meat of entire male pigs when it is heated. The main contributors to boar taint are androstenone and skatole. Both compounds generate offensive off-odours and off-flavours in the meat. Androstenone has been described as urine-like, rancid, sweaty, ammonia, parsnip, silage and dirty while skatole is described as manure or faeces-like, mothball and musty. For these reasons boar tainted meat is considered to be defective and EU regulations (Council Directive 91/497/EEC, 1991) prohibit the sale of meat from entire male pigs of 80kg carcass weight (excluding head and limbs) or over unless an inspector has tested the meat for pronounced sexual odours and declared it not to have such odours. If the meat has been found to have such odours, it must be treated in accordance with the procedures laid down in Council Directive 77/99/EEC (i.e. heating, salting or drying).

In 2008, the mean carcass weight of pigs in Ireland was 76.6 kg (Table 1) and the liveweight at slaughter was for the first time more than 100kg at 100.8kg. Many carcasses are much heavier. The slaughter weight of pigs in Ireland is dictated largely by the minimum and maximum weight limits set by the main processors. Each processor has its own distinct range. However, processors will accept pigs heavier than their maximum declared weight from specific customers and in times of short supply. Allowing this increase in slaughter weight (without penalty) is quite profitable for the producer, since on a cost per kg dead weight basis, feed costs remain relatively unchanged while non feed costs are reduced. However, there is a risk of boar taint with these 'overweight' entire boars.

Table 1. Trends in pig carcass weight at (kg) slaughter in Ireland.

Year	1970	1980	1990	2000	2008*
Avg. wt. (kg)	64	66	66	72	76.6

Source FAOstat Database results and *PigSys 2009

Based on a growth rate of 776 g/day for finishers (PigSys 2008) each additional 1kg in liveweight at slaughter is equivalent to an additional 1.3 days on the pig's age at slaughter. It is this increase in age and the associated onset of puberty that increases the risk of boar taint occurring. The onset of puberty also increases the intensity of the sexual and aggressive behaviours performed by entire males. This means that entire male pigs are more susceptible to injury and social stress ultimately resulting in carcass damage. For example one study found that 15% of entire males had health problems involving lameness or injured legs or feet compared to only 6% of females (Rydhmer et al., 2006). However, females in mixed groups are also susceptible to sexual harassment by the males leading to leg problems and stress.

Housing and management protocols designed to reduce the negative welfare implications of rearing entire male pigs may also reduce boar taint. This has been the focus of recent

b. Split marketing

Owing to the penalties imposed by slaughter plants for pigs outside the desirable slaughter weight range, split-marketing i.e. removal (to slaughter) of the heaviest pigs in a pen 1 to 2 weeks early to allow lighter pigs to reach the required weight, is encouraged. Removal of pigs from a pen can cause a re-shuffling of the dominance hierarchy. This in turn could ignite aggression in much the same way as mixing pigs does. If this is the case then entire male pigs, being naturally more aggressive, would be expected to be more affected than castrates or females. Indeed the social order among male pigs appears to be less stable than among females.

In spite of these concerns, we found no effect on aggression in entire male or female pigs in an initial study of split marketing (Boyle and Bjorklund, 2007). However, there was a tendency for higher skin lesion scores in groups of entire males that were split marketed compared to males in pens that were not, which prompted us to repeat the experiment last year. In the recent experiment, split marketing had no effect on aggression, skin lesion scores, performance or carcass characteristics (Conte et al. unpublished findings). Given the lack of differences it is unlikely that we will find an effect of split marketing on boar taint. This will be confirmed when results of the laboratory analysis of boar taint compounds becomes available in the New Year.

Nevertheless, there are contradictory reports on the effects of split marketing. At least two studies reported an increase in aggression and consequently a reduction in the welfare of pigs in pens that were split marketed particularly among entire males (Rydhmer et al., 2006; Fredriksen and Hexeberg, 2008). No implications for boar taint were reported in either of these studies. Differences between the Scandinavian studies and those conducted at Moorepark could be attributable to the different feeding systems (dry vs. wet) and group sizes employed. This suggests that research on the effects of split marketing on the behaviour, performance and meat quality of entire male pigs needs to be considered across a range of housing environments and feeding arrangements.

c. Littermate groups/birth to slaughter

Mixing of unacquainted pigs is usually followed by fighting (especially during the initial hours) until a new rank order is established in the group (Petherick and Blackshaw, 1987; Moore et al., 1994). According to Fredriksen et al. (2004) mixing exacerbates sexual maturation of entire male pigs compared to rearing them in sibling groups in farrow-to-finish (FTF) pens. The reason is that fighting and mating behaviour cause an increase in plasma testosterone, which also results in a concurrent increase in androstenone (Andresen, 1976; Claus et al., 1994). Fredriksen et al. (2004, 2006) showed that keeping littermates together in stable groups was successful in delaying puberty and reducing the levels of androstenone in fat. They also showed that aggressive behaviour and skin lesions in entire male pigs were reduced in the FTF-system thereby improving animal welfare (Fredrisksen et al., 2008).

In true FTF or 'birth to slaughter' systems litters of pigs are kept together from birth to slaughter, including transport and pre-slaughter lairage. Such systems are rare and require costly changes to housing. Nevertheless aspects of FTF systems could be adapted by conventional herds where attempts could be made to keep siblings together and avoid re-

mixing of pigs from different litters. The benefits to animal welfare and boar taint are likely to be considerable.

2. *Physical environment*
Most research to determine housing and environmental requirements for finishing pigs is based on castrated and female pigs. Because of increased aggressiveness and activity levels it is likely that rearing environments and handling facilities for entire males should contain more resources (i.e. space including space at feeders/troughs, drinkers, environmental enrichment devices) than normally provided for female and castrated pigs. Indeed it is likely that specifications need to be redefined for entire males. If castration is banned in the EU and rearing entire male pigs becomes more common a considerable amount of new research on the housing requirements of entire male pigs will be required.

a. Flooring
One of the two main boar taint compounds, skatole, can to a large extent be controlled by feeding and by keeping pigs clean. The latter explains why pigs on slatted flooring have lower skatole levels than those on solid concrete flooring (Bonneau, 1998). This may lead to extensive use of slatted floors which are not conducive to pig welfare. Concrete slatted flooring is the major risk factor for lameness in finishing pigs (KilBride et al., 2009) and mounting behaviour performed by entire males means that both they and the females they harass are at an increased risk of lameness on fully slatted floors.

Although mounting is actually increased in straw bedded systems because pigs are more active on straw (Morisson et al., 2003) lameness is much lower in such systems (Scott et al., 2006). This is because straw protects the feet from the concrete which is abrasive and injurious particularly for pigs fighting or mounting on its surface. Nevertheless, poorer hygiene in straw bedded systems (Scott et al., 2006) would likely aggravate skatole levels. Clearly there is a need for research on ways to improve the underfoot conditions for entire male pigs while at the same time not affecting skatole levels.

b. Environmental enrichment
Tail biting is also significantly reduced on straw bedding (Scott et al., 2006). Male pigs perform more of this behavioural vice than castrates or females and this could be aggravated by potentially tighter limitations on tail docking by the EU in the future. The main reason that straw bedding reduces tail biting is because it occupies the pigs behaviourally. This is also the reason why pigs in highly enriched pens (i.e. large space allowance, rooting substrates) perform less aggressive behaviour (Beattie et al. 2000). However, enrichment provided to pigs prior to weaning also reduces aggression in the fattening stages even if no enrichment is provided during fattening (Chaloupkova et al., 2007). This indicates that enrichment during early development has a positive influence on pigs' cognitive abilities making them less aggressive in later life. Interestingly there are similar findings for humans where children coming from deprived backgrounds are more aggressive as adults.

Ultimately environmental enrichment is a very promising tool to reduce the problems associated with rearing entire male pigs. Remember that anything which reduces aggression among entire male pigs is also likely to reduce production of the compounds responsible for boar taint. In any case current EU legislation requires that pigs of all ages are provided with

substrates to manipulate. At last year's Pig Conference examples of different enrichment sources and the pros and cons of each were discussed.

c. Space allowance and group size

There is a strong relationship between aggression and space allowance (Courboulay, 2005). Given that entire males are naturally more aggressive than castrates and female pigs they may require higher space allowances. Current space allowances as laid down in legislation were derived using castrates and females and may be inadequate for heavy entire male pigs.

The optimal group size for pens of entire male pigs or mixed sex pens is unknown. Currently there is interest in large group sizes as a means of reducing housing costs and simplifying some aspects of management. Group size does not influence overall performance (Augspurger, 2000; Schmolke et al., 2003). However, when group size increases growth performance decreases (Weatherup et al., 1998).

3. *Nutritional and diet composition effects*

Allen et al., (2001) found the lowest incidence of boar taint when boars were mixed with gilts on fully-slatted floors and fed a reduced protein diet containing virginiamycin (not permitted in the EU for use in pig feed since 2000), using a wet feeding system. This production system was also the most efficient in terms of growth rate and feed conversion efficiency.

Hansen et al., (2008) found that feeding fermentable fibre rich feedstuffs such as 10% dried chicory root or 25% Blue lupin in the diet of pigs lowered skatole levels. The level of skatole in entire males was most effectively reduced after feeding for 14 days with both feedstuffs tested. Other ingredients such as potato starch and sugar beet pulp may have similar benefits. A high availability of energy in the hindgut due to feeding these ingredients stimulates the proliferation of bacteria that use tryptophan for protein synthesis to the detriment of those bacteria that degrade it to skatole.

4. Slaughter management

a. Optimum slaughter weight

Even using modern genotypes (highly selected for lean tissue growth rate) boars still grow more efficiently and will thus be more profitable than castrates. However, increasing slaughter weight reduces the lean meat content in the carcass and causes FCR to deteriorate. Nonetheless, heavier pigs will still be more profitable since non-feed and sow feed costs per pig are spread over a greater carcass weight. Producers will thus continue to increase pig weight at slaughter up to the maximum permissible. This trend is likely to increase the incidence of boar taint.

With entire males skatole levels increased between 80 and 100kg and then dropped at 120kg. Androstenone concentration in the backfat of entire males increased with each sequential increase in slaughter weight. Conversely, the indole concentration in the backfat of entire males dropped with each sequential increase in slaughter weight. Androstenone levels were above the cut off levels for detection by a trained sensory panel (0.5 to 1.0 mg/kg) at each of the weight categories examined. Skatole levels were only above the cut off point for detection (0.20 to 0.25 mg/kg) by a trained sensory panel (Bonneau and Prunier, 2005) for entire males slaughtered at 100kg. However skatole levels can be manipulated by diet (Hansen et

al., 2005) and management (Allen et al., 2001) and may not be as important as androstenone which is to a large extent genetically determined having very high estimates for heritability ranging from 0.25 to 0.87 (Bonneau and Prunier, 2005).

Table 2. The effect of slaughter weight on pig performance and carcass quality (Lawlor et al., 2005)

Target slaughter weight, kg	80	100	120	SE	F-test
Weaning weight, kg	8.4	8.8	8.6	0.17	NS
Weaning to slaughter, d	105[a]	128[b]	150[c]	1.8	**
Daily feed intake, g/day	1541[a]	1772[b]	1965[c]	21.0	**
Daily gain, g/day	717[a]	735[ab]	748[b]	9.6	*
Feed conversion ratio, g/g	2.15[a]	2.43[b]	2.64[c]	0.043	**
Slaughter weight, kg	83.9[a]	102.0[b]	119.7[c]	0.58	**
Carcass lean meat, g/kg	568[a]	557[ab]	549[b]	0.39	**

[abc] *Means with different subscripts within rows are significantly different (P<0.05).*

It is interesting to note that the cut off levels for both skatole and androstenone for detection by a trained sensory panel were estimated using panels in continental Europe and Scandinavia where castration of male pigs is the norm. For this reason consumer sensitivity to boar taint may be higher than that in Ireland and the United Kingdom where the production of pork from entire male pigs has been almost exclusively practiced since the 70's. The incidence of boars with a taint detectible by trained sensitive consumers was found to be as low as 8% in Ireland (Allen et al., 2001). For this reason the cut off level of 0.5 to 1.0ppm for androstenone may greatly overestimate the likelihood of boar taint being detected by Irish consumers. However we must remember that c.40% of Irish pigmeat is exported to countries where consumers might be more sensitive to boar taint. In addition, even among Irish consumers where the frequency of boar taint is relatively low, market share for pigmeat is likely to have been lost due to the presence of a small percentage of sensitive consumers.

The trend towards increasing slaughter weight in Ireland must be considered carefully due to its link with the increase in compounds responsible for boar taint and in particular androstenone. Castration of pigs is likely to be banned for animal welfare reasons by the EC in the near future and should not be considered as a long term remedy for boar taint.

Table 3. Effect of liveweight at slaughter on skatole, androstenone and indole levels in the backfat of entire male pigs (Lawlor et al., 2005).

Live weight at Slaughter, kg	Compound		
	Skatole (ppm)	Androstenone (ppm)	Indole (ppm)
80	0.16	0.61	0.26
100	0.33	1.04	0.11
120	0.18	1.14	0.05

b. Feed withdrawal

To reduce skatole development it is often recommended that feed be withheld from entire males from 26 hours prior to slaughter. However, this extended fasting period is contrary to

good management and animal welfare practices. Furthermore, modern pigs have large appetites and hunger could cause mounting and aggression to escalate. Further investigation of the implications of feed withdrawal on welfare and skatole levels in entire male pigs is required.

c. Transport and lairage

It is very common for pigs from one pen to be slaughtered over a period of several weeks so as to provide the optimal price to the producer because of narrow weight ranges and. This makes it very hard to avoid the mixing of pigs during transport and lairage, and represents another welfare challenge for entire male pig production.

Other pre-slaughter methods of reducing boar taint

1. Genetics

In a comparison of breeds, Allen et al., (2001) found that the Large White breed had the lowest incidence of boar taint and the hybrids had the highest. The report recommended that consideration should be given by the breeding companies to screening boars for taint, particularly among the hybrids, Landrace and Duroc breeds.

There is presently no available technique enabling the production of boar taint free pigs. Although skatole and androstenone are known to be genetically determined, there is still a long way to go before selection of boar taint free lines of pigs can be achieved. It is known now that the genetic determinant of skatole levels is linked to the capacity of the animal to degrade it. More basic knowledge on the key enzymes/genes governing skatole degradation in the pig is still necessary to identify reliable genetic markers which could be used for selection.

Whether the genetic determination of androstenone levels is mostly linked to testicular production, or peripheral degradation, or both, is presently not known. More basic knowledge on the key enzymes/genes governing androstenone levels in the pig, without negatively affecting sexual development or performance, is still necessary to identify reliable genetic markers which could be used for selection.

Genetic markers for boar taint (androstenone in particular) are currently being investigated and it is likely that in the future that marker assisted selection may be utilised to produce entire male pigs with a greatly reduced incidence of boar taint. However, this technology is not yet available.

2. Immunocastration

Normal testes function starts and is driven by gonadotropin releasing factor (GnRF) produced by the hypothalamus. As part of normal function the testes produce steroids, such as testosterone and androstenone, and hence taint builds up in the fat tissue.

Improvac™ is a vaccine against GnRF. It is not a "hormone" and none of the constituents of the vaccine have any hormonal activity. It just stimulates the pig's immune system to produce specific antibodies against GnRF. These natural antibodies inhibit GnRF activity,

thus temporarily inhibiting testes function and as a consequence the production of all taint compounds. Taint compounds that have already accumulated at the time of vaccination are rapidly metabolised and eliminated, allowing the pig to be presented for slaughter with improved meat quality.

In practice 2 doses of Improvac™ must be given, at an interval of at least 4 weeks. The first dose has no physiological effect but is essential to prime the immune system. The second dose is effectively the "immunocastrating" dose and is essential to control boar taint. The first dose is generally given 6 weeks prior to slaughter and the second 4 weeks later at 2 weeks prior to slaughter.

Immunocastration has been commonly used on Australian pig farms with great success for the past decade. Improvac™ is also authorised for use in the EU but uptake of the technology is low there due to an unwillingness of multiples to accept pigmeat produced in this way.

3. Sexing of sperm
Sperm sorting to produce only female offspring would be a very good solution for the control of boar taint from entire male pigs in the long term. However, it is not currently feasible in commercial conditions in pigs.

Post-mortem control of boar taint

1. On-line detection
There is as yet no reliable rapid and inexpensive test for the online detection of boar taint, however, many groups worldwide are working on developing such a test.

2. Meat processing
Processing of tainted pigmeat in itself can reduce the proportion of the androstenone stored in the fat. Furthermore, during processing, tainted product can be mixed with untainted meat as a means of diluting the concentration of malodourous compounds. In addition spices used in for example sausage making can also mask the unpleasant odours and flavours associated with tainted pigmeat leaving it acceptable for the consumer.

Conclusion

If the production of entire male pigs is to remain an economically viable production system in this country it is absolutely necessary that we control the frequency of boar tainted carcasses. The cost of removing unacceptable carcasses from the food chain is prohibitively high and could have detrimental implications for the reputation of our industry at home and abroad. However, it is equally important that the negative welfare implications associated with the production of entire male pigs are controlled. In the majority of cases these issues do not come into conflict. However, considerably more research on optimal production systems for entire male pigs are required.

Gilt Culling Rate – A Case Study

Ciarán Carroll & Michael McKeon

In a 1996 survey of Irish herds Laura Boyle found that over 30% of sows are culled before their third parity. The same survey found that 4% were culled before they were even served and 15% were lost in their first parity. Michael Martin found similarly disturbing figures in 2001 (Teagasc PigSys data) when he reported that 13% of gilts introduced onto a unit are removed before they even have one litter. The interim period has shown little evidence that things have changed.

Reproductive failure and locomotor problems are the main causes of culling in gilts and first parity sows, accounting for 56% and 20% respectively, of all removals in these parities. A 2008 study on a large Irish pig unit found that 32% of gilts were lame by the time they were served.

The key to optimising gilt performance requires greater focus on gilt housing, gilt selection, oestrus stimulation and service management.

Case Study

To highlight the issue of gilt management we took a case study of a 500 sow integrated pig unit which has been experiencing problems with sow performance, particularly young sows. The problem manifested itself through a high culling rate (25%) between gilt service and second parity. Further investigation identified two main reasons for the high culling rate:

1. Poor fertility (repeating) before 1st parity 12%
2. Poor performance from weaning 1st parity to weaning 2nd parity 13%

The case study outlines the problems, their causes, and the recommendations given to help solve them

1. Poor Fertility

A high repeat rate after gilt service was a recurring problem on the unit. Many of these gilts repeated a second time and were then culled. A walk through the unit and discussion with the farm owner and his staff identified the following reasons.

(a) Inadequate housing: the gilt accommodation was poor in terms of house temperatures, lighting and floor area allowed per gilt. While poor or harsh accommodation has been thought to improve gilt performance via a "hardening off" effect in the past, research shows that inappropriate stress via poor housing will have a detrimental effect on gilt performance.

Advice:

- Seal doors (to prevent draughts) and improve insulation
- Broken lights need to be replaced and dirty ones need to be cleaned.
- Lights will be put on a timer switch to provide 16 hours of light (300 lux) per day.
- Stocking rates in the gilt area will be reduced to allow 1.4m^2 (15ft^2) per gilt.

(b) Served gilts kept in the same pen as unserved gilts: gilts were being fed ad lib in order to "flush feed" them thereby increasing ovulation rates and subsequent litter size. However the served gilts being kept in the same pens were being over fed. This resulted in increased embryo deaths and a higher number of repeats due to lost litters.

Advice:

- Served gilts will now be moved to separate pens and fed 2kg of a dry sow diet for the first 30 days after service.

(c) Movement after service: served gilts were being moved to the dry sow house at two weeks post service to make room for new gilts coming into the system. This movement caused stress which again resulted in increased embryo deaths and a higher number of repeats.

Advice:

- The movement of served gilts to separate pens, as described above, will remove this problem.

(d) Poor oestrus stimulation system in place: there was an inadequate oestrus stimulation programme in place. This entailed limited boar exposure time and when it did occur it was only fence exposure (ie through the pen

bars) with an old, disinterested boar. There was also no recording of oestrus dates. Therefore, the stock person was never sure what oestrus number gilts were being served on. An accumulation of these problems resulted in gilts being served too young and small. It also resulted in some over fat (and too old) gilts being retained in the gilt pool.

Advice:

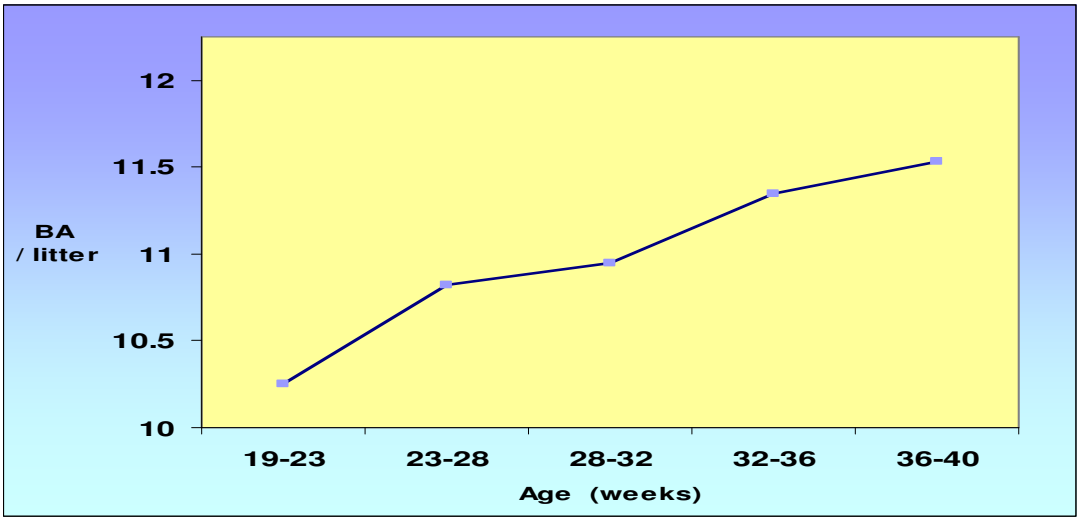
- Move gilts weekly into dedicated oestrus stimulation area
- Boar exposure 20-60 minutes per day
- Either move gilts into exposure pen or allow boar into gilt pen
- Keep young, vigorous, 'chatty' boars in stimulation area
- Supervise stimulation and tag on 1st standing heat

2. Poor Performance from 1st weaning to 2nd weaning

Many gilts and young sows were culled as 'hang backs' and even when they were served they repeated or had very small litters. Further discussions identified two main reasons for this.

(a) Gilts Served too young at service: There was a shortage of replacement gilts, therefore many gilts were served at 28 – 30 weeks old. Ensuring gilts are not served too young is critical to their lifespan in the herd. Research shows that mature gilts with more backfat at service are more productive (see Table 1).

Table 1. Age at First Service and Litter Size



(*Alberta Pig Company, 2000)*

Advice:

- Calculate gilts require for service each week
- Serve sufficient number of replacements to achieve this target
- Examine if gilts are been lost in system
- Don't serve any gilt under 32 weeks old

(b) Poor control over weight of gilts

There was a large variation in gilt weights in service pool. Many gilts were too light at service due to their young age. These gilts lack necessary body reserves to sustain body condition through several parities. Table 2 below identifies a target weight at first service of 130kg to 150kg to maximise number of pigs born alive.

Table 2. Gilt Weight at Mating and Subsequent Born Alive (Litters 1-5)

Gilt Wt at Mating (kg)	Born alive (litters 1-5)
<120	**51**
120 – 130	**59**
130 – 140	**60**
140 – 150	**63**
150 – 160	**51**
> 160	**54**

Challinor et al (1996)

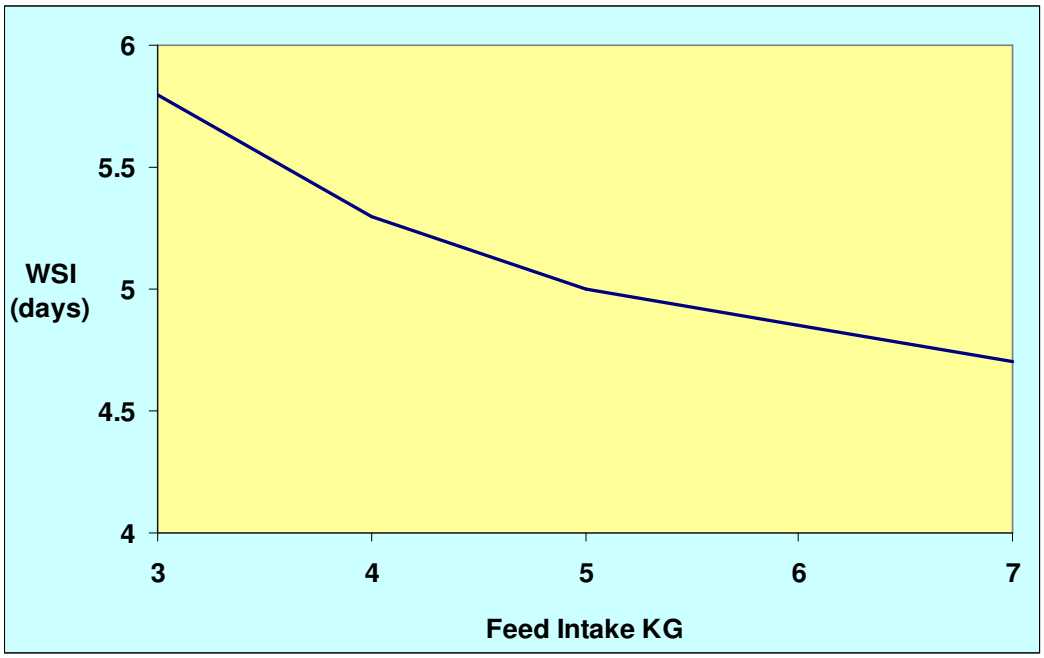
There was also a significant number of gilts over 160 kgs that had never cycled. If a gilt has not cycled by 130 kgs then they need to be targeted.

Advice:

- Target weight at service 135-150kg
- 220 to 230 days old
- Backfat cover 18mm at the P2 site – can be difficult to achieve with the modern genotype
- Change management regime for gilts failing to cycle by 130 kgs

(b) Low intakes in farrowing: analysis of the farrowing house feeding identified poor intakes by gilts, ranging from 2.5 kg to 4kg per day. This resulted in a significant amount of shoulder lesions, a slow return to heat after weaning (increased weaning to service interval). Table 3 shows the effect of increasing feed intake on the weaning to service interval.

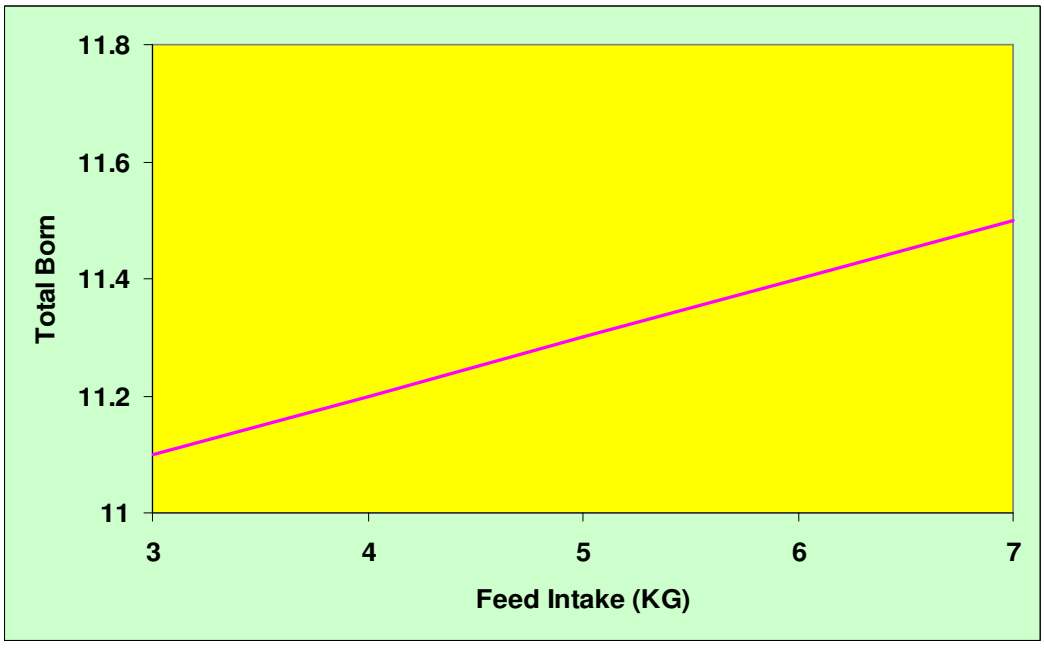
Table 3. Effect of feed intake on weaning to oestrus interval



Kotetsu et al (1996)

Increased the lactation feed intake has also been shown to be highly correlated with an increased litter size in the subsequent litter

Table 4. Effect of feed intake on subsequent litter size



Kotetsu et al (1996)

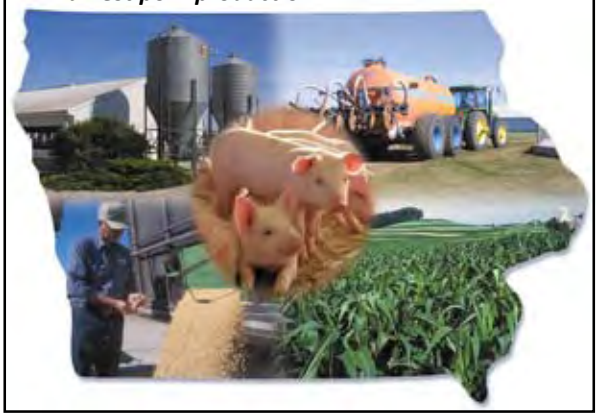
Advice:

- Avoid over-fat gilts at farrowing – don't overfeed in gestation
- Increase feed frequency to 3 times per day
- Supplement 1st parity lactation with weaner feed / soyabeans
- Keep the water:feed ratio low to increase feed intake but ensure free access to water is available

Summary Guidelines Recommended for the Unit

- Improve housing: insulation, lighting (16 hours per day, 300 lux) and floor space (1.4m^2 per gilt)
- Served gilts should be separated from un-served gilts immediately
- After service reduce feed levels to about 25MJ DE (2kg) per day
- Implement a new Oestrus Stimulation System: good boar exposure and record oestrus dates
- Target weight at service 135-150kg, age 220 to 230 days old and backfat cover 18mm at the P2 site
- Serve on 2nd or 3rd heat to avail of increased ovulation rates
- Serve twice, less than 24 hours apart
- Cull gilts not served before 250 days/155kg
- Focus on improving lactation feed intakes

Midwest pork production



Midwest Production (IA)

Can't talk pigs without mentioning:

- Corn
  - 251 bil bu = 114 mil mt (11.58 mt/ha)
  - 34 % fed to livestock (24 % to ethanol)
- Soybeans
  - 496 mil bu = .23 mil mt (3.43 mt/ha)
  - 25 % fed to livestock
- Manure value

Midwest Production Overview

- Multi-site
- Ownership structure
- Supply networks
- Contract finishing
- Natural vent / Tunnel vent / Filtration

Midwest Production: Structure

- Commodity production
- Niche based production

- Farrowing
- Farrrow to finish
- Finishing
- Wean to finish

- Contract grower

- Allied business

Midwest Production: Farrowing

- Shortage of weaned pigs in Iowa
  - 17.8% of US breeding herd, 1.09 mil (Jun '08)
  - 29.5% of US market hogs, 18.01 mil (Jun '08)
- >8 million feeder pigs imported
- Requires highly skilled management
- An economic generator

Midwest Production: Finishing

- Capitalizes on feed availability
- Capitalizes on slaughter capacity
- Works well for crop farmer of part-time farmer
- Flexibility in risk and ownership structure
  - purchase (Fdr budget Feb'07.XLS)
  - custom grower (contract production)
    - numerous arrangements available

Midwest Production: 'Niche Markets'

- Based on:
  - production system (pasture reared)
  - eating quality (Berkshire, Duroc)
  - health perceptions (no subtherapeutics)
  - diet (organic)
  - a story (family farm)
- Demand in this area grows as the affluence of the consumer grows

Midwest finishing model

- 2400 pigs, 20 – 122 kg
  - 2,4 turns = 5760 pigs/ year (140 days / group)
  - Consume 1290 mt food / yr
  - Corn production from ~129 ha; soybeans from ~ 80 ha
- Manure value
  - 8,6 kg N, 5,9 kg P_2O_5, 4,5 kg K_2O / space /yr
  - =20,7 mt /yr N, 13,1 mt P, 10,9 mt K ($43,826 in Iowa)
  - Meets nutrient needs for 100 ha corn /yr (185kg N /ha)

24 pigs (20-122 kg) will fertilize 1 hectare of corn producing 10,4 mt

Midwest Production: Contract Finishing

- Numerous source options available
  - Sow farm co-ops
  - Local independent producers
  - Grain co-ops
  - Integrators
- Wean-to-finish, nursery, or finish
- Constructions costs are high
  - Tunnel vent or natural vent
- Manure is of great value *(>$5/pig)*

Midwest Production: Contract Finishing

The Arrangements

- Basic Contract
  - Own the barn; provide labor, utilities, maintenance; receive rent & manure
- Owner Contract
  - Own the barn; provide utilities & maintenance; receive rent & manure; pig owner manages pigs
- Sale / Manure Contract
  - Sell the land; investor builds; you receive manure
- Sale / Management & Manure Contract
  - Sell the land; investor builds; you receive manure & caretaker wages

Midwest Production: Contract Finishing

Cashflow example

- 2400 hd feeder to finish on ~2 acres
- $220/space construction cost
- 7.5% interest; $20,000 down
- Utilities:$1.50/hd ($8640/yr)
- Tax & Ins.: $7560/yr
- Own labor
- Paid $38/space ($91,200/yr)

Midwest Production: Contract Finishing

Words of Advice

- Understand your contract
- Read through it
  - whether written or verbal
- Length of contract & terms
- Payment terms
- Repair & maintenance

Midwest Production: Contract Finishing

Words of Advice

- Know your contractor/ supplier of pigs
  - Financial history
  - Herd health history
  - Trust
  - Employee retention / job satisfaction
  - Accessibility of regional field person & vet service
  - Pigflow & space allotment
  - Type of facility required & cost
  - Other: genetics, feed, MMP assistance, lending assistance, long term plans
- Manure Value

Midwest Production: Contract Finishing

Words of Advice

- Know what is required of you
  - Daily care
  - Variable costs/Utilities; LP gas
  - Vaccinations/treatments
  - Rendering
  - Insurance
  - Feed ordering
  - Biosecurity; washing; loading, unloading
  - Liability for deathloss or pig shortage
  - Manure management

Midwest Environment

- #1 odor – not regulated in Iowa
- USA has highest # lawyers per capita
- Just because its not regulated, doesn't mean you can't be sued
- Adds to cost of production
- Bigger scale production is a target

Midwest Environment

- #1 odor – not regulated in Iowa
- Water quality, N & P
- Air quality, NH_3, H_2S, PM_{10}
  - Clean Air Act
  - awaiting National Air Emission study, EPA
- Carbon trading

Midwest Environment

- Manure Management Plan
  - Regulated on N & P uptake of the crop
  - P-Index calculation
    - Erosion factor (slope & tillage)
    - Soil P load
    - Crop uptake
  - Annual update and filing
- Construction permits
  - Separation distances
  - Concrete standards

Midwest Environment

- Proactive siting
- Vegetative buffers
  - "Green Farmstead Partner"
- Neighbor visits
- "Doing Things Right"
- Coalition to Support Iowa's Farmers
  - www.supportfarmers.com

USA Welfare

- On The Horizon
- Iowa- no regulation other than "willful acts of abuse"
- HSUS, animal rights and vegetarian groups active and well funded
- Several states by legislation or 'voluntarily' abandoning gestation stalls
- Several farms [corporate] transitioning to 'loose' gestation
- Looking to EU for experience (DK, UK, …)
- Hopeful for practical research and science based vs. emotional based discussion
- Niche production comments, +/-
- Site Assessments and certifications

Midwest Herd Health

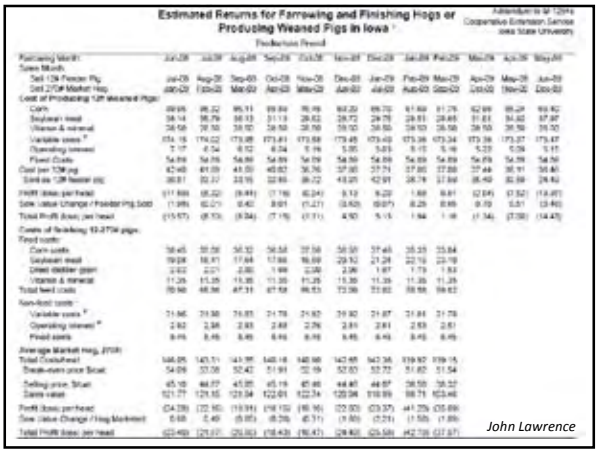
- *Great season fluctuations in temperature & humidity*
- PRRS
  - costly & troublesome
  - farm/system eradication efforts
  - industry surveillance & eradication efforts
  - filtration
- H1N1 & SIV's
  - Much education to staff
  - Vaccination of staff
  - Vaccination of herds

Midwest Herd Health

- PCV2
  - Widespread, but PCVAD not
- ISU swine disease trends
  - http://vetmed.iastate.edu/vdpam/disease-topics/swine-disease-trends

Midwest Cost of Production (IA)

- Feed costs
  - feed price, feed usage, feed conversion, pigs marketed per sow per year
- Non-feed costs
  - Labor, fixed (facilities, etc), variable (insurance, utilities, supplies, repairs, taxes, etc), professional fees (management, accounting), labor, vet/med, breeding/genetic costs, death losses, trucking, …


Estimated Returns for Farrowing and Finishing Hogs or Producing Weaned Pigs in Iowa

John Lawrence

Midwest Profitability

John Lawrence
Shane Ellis

Role of Extension

- Transfer of research based knowledge to industry
- Iowa State University [a 1862 land-grant university]
  - education, research, extension
- Outreach or "Extension" traditionally funded by public tax
  - Now service based fees
  - Grant support

Role of Extension

"To promote efficient pork production technologies in Iowa, maintain Iowa's pork industry leadership and strengthen rural development efforts"

- Mission of the Iowa Pork Industry Center (IPIC)

Role of Extension
Pork Industry Work Areas

- Environment
- Nutrition
- Genetics
- Reproduction
- Health
- Economics
- Meat quality
- Harvest, processing
- Animal well-being
- Youth programs
- Niche markets
- Independent farms
- Corporate farms
- Peer group support
- Quality systems
- COOL, ID, traceability
- Record systems
- Real Time Ultrasound

Staff Development

- Significant Hispanic workforce
- No education required
- 'voluntary' Pork Quality Assurance Plus required for market access; high participation
- Industry funded education tools and programs
  - PQA Plus, TQA certification
  - Conferences
  - DVD's
  - Pork Information Gateway (P.I.G.) and www. resources

Staff Development

- We have a lot to achieve in staff personal development, job satisfaction and working environment [rest, facility, team building, safety]
- People are the greatest asset to any business
- Modern pork production is unique in its work environment, promotion process, longevity and 'ownership'

Teagasc Pig Conference 2009

Bench-marking: The financial implications

Michael A Martin
Specialist Pig Development Officer

Profitability in pig production is determined not alone by minimising the costs of production but also by maximising the amount of pig meat sold and the price obtained. There are wide differences in the technical performance of recorded herds. More worryingly, there are substantial differences between the average performance of PigSys recorded herds and those herds whose performance data is not routinely analysed using the Teagasc PigSys system.

National Sow Productivity

Most of the data required to calculate the average number of pigs produced per sow per year in Ireland is available from various sources. A few minor gaps in the data can be reasonably estimated. Taking the 5 years 2004-2008 combined the average number of pigs produced per sow per year is calculated at **21.1** (Table 1)

Table 1: Number of pigs produced per sow per year 2004-2008

	Source	No.
Closing Stocks Dec 2008 m	CSO	1.605
Slaughtered at Licensed Export Plants m	DAFF	13.023
Live Slaughter Pig Exports m	DARDNI	2.399
Other Live Exports m	Estimate	0.35
Slaughtered at Local Authority Abattoirs m	Estimate	0.2
Opening Stocks Dec 2003 m	CSO	1.732
Number Pigs Produced m		15.845
Average Herd Size (Dec + June)	CSO	150,000
No. Pigs Produced per Sow per Year		21.1

In early 2009 the Teagasc Pig Development Unit determined that the number of sows/served gilts in commercial herds was 148,700. This included the appropriate allowance of about 10,000 sows for herds that had been de-stocked in early 2009. Based on these numbers, adjusted for de-stocked herds, and producing 21.1 pigs per sow per year, the average number of pigs for disposal in 2009 would be 2.92 million head. This equates to 56,300 pigs per week. Actual disposals per week to date in 2009 are 57,120 and are shown in Table 2

Table 2: Average pig disposals per week 2009 (39 weeks)

Production per week	57,120
Of which (2009)	
Licensed Export plants	45,095
Exports to Northern Ireland	9,025
Other Slaughter Plants (estimated)	1,000
Other Live Exports (estimated)	2,000

These figures confirm that the average number currently only slightly exceeds 21.1 pigs produced per sow per year (21.4).

Recorded Herds

For comparison purposes, the average number of pigs produced in recorded herds is summarised for the same period 2004-2008 (Table 3)

Table 3: Average sow productivity in PigSys recorded herds 2004-2008

Year	Sows	No. Pigs Produced per Sow per Year
2004	54,992	21.9
2005	47,430	21.9
2006	46,125	22.2
2007	52,689	22.5
2008	49,308	23.4
Average	50,109	22.4

Combining the information in Table 1 and Table 3 we can calculate that the average number of pigs produced per sow per year in herds not participating in PigSys benchmarking is only 20.5 (Table 4)

Table 4: Average sow productivity in pig herds 2004-8

All herds	150,000	21.1
PigSys recorded herds	50,000	22.4
Non PigSys recorded herds	100,000	20.5

The differences between herds are even greater,

Top 25% of Herds

The top 25% of PigSys recorded herds selected on the number of pigs produced per sow per year produce significantly more pigs per sow than the average for all recorded herds. In 2008, this Top 25% of herds produced, on average, 25.4 pigs per sow per year. All of these herds produced more than 24 pigs per sow.
The average over the 5 years 2004-8 is 24.5 pigs per sow per year. This is 2.1 pigs more than the average for all recorded herds and 4 pigs per sow higher than the average of all unrecorded herds.

How much more profitable are these high productivity herds?

Financial Benefit of Higher Sow Productivity

Each extra pig sold per sow per year increases profitability significantly and especially so when overall profitability is good.

From the value of the extra pig sold must be deducted the additional costs associated with that pig. These include feed, housing, healthcare, energy, transport and manure costs. Other costs are largely unaffected and include labour, AI, insurance, repairs, stock depreciation and environmental charges.

On an integrated each extra pig produced per sow per year will add about **€43.50** to Margin over Feed (Table 5)

Table 5: Effect of one extra pig produced per sow per year on Margin over Feed Costs

Item	**Details**		**€ per pig**
Sale Price	76 kg	135c per kg	102.60
Feed Costs	Kg per pig	€ per tonne	
Lactating Sow	20	232	4.64
Creep	3	792	2.38
Link	5	508	2.54
Weaner	42	267	11.21
Finisher	180	213	38.34
Total			59.10
Margin over Feed			**43.50**

If sale weights are to be maintained additional housing is required for weaners and finishers and there are also increases in some of the other production costs.

Table 6: Effect of one extra pig produced per sow per year on Net Profit

			€ per pig
Margin Over Feed			**43.50**
Extra Housing	Places per 100 sows	Cost per place €	
	17 weaner	200	
	25 finisher	350	
	Cost of extra housing €		
	Building Depreciation	8.80	
	Interest Cost	3.95	12.75
Healthcare	Vaccinations		2.00
Energy	Ventilation		1.00
Transport			2.00
Manure	$1m^3$	€56 per $25m^3$	2.25
Total Other Costs			20.00
Net Profit			**23.50**

Each extra pig produced per sow per year will increase the Margin over Feed by about €43.50 and will increase Net Profit by at least €23.50 based on current pig and feed prices. The difference between the Margin over Feed and the Net Profit is due mainly to the cost of the extra housing required to maintain sale weights

These equate to an increase in pig price or a reduction in production costs of about 2.5c and 1.5c per kg dead respectively.

Table 7: Financial Effect of Increased Sow Productivity

Herds	Pigs per Sow per Year	Increase per Sow €	
		Margin Over Feed	Net Profit
Non PigSys	20.5	-	-
Average PigSys	22.4	83	45
Top 25% PigSys	24.5	174	96

The Growing Pig

No less important than sow productivity is the performance of pigs from weaning to sale including feed conversion efficiency, growth rate and kill out. Unfortunately, the information is not readily available to compare key pig performance parameters in PigSys recorded herds with those in non-participating herds. The performance of pigs from weaning to slaughter in herds participating in PigSys in 2008 is shown in Table 5.

Table 8: Average Pig Performance from Weaning to Sale in PigSys Recorded Herds in 2008

Average Weaning Weight kg	7.0
Average Live Weight at Sale kg	100.8
Average Dead Weight kg	76.6
Kill Out %	76.0
Daily Feed Intake g	1534
Average Daily Gain g	622
Feed Conversion	2.47

Within the group of about 80 herds for which the data can be analysed for 2008 the top 25% of herds selected on the basis of Feed Conversion Weaning to Sale performed significantly better than the average of all the herds (Table 6).

Table 9: Average Pig Performance from Weaning to Sale in All and Top 25% PigSys Recorded Herds Selected on Feed Conversion (2008)

	Average	Top 25%
Average Weaning Weight kg	7.0	6.9
Average Live Weight at Sale kg	100.8	100.1
Average Dead Weight kg	76.6	75.9
Kill Out %	76.0	75.8
Daily Feed Intake g	1534	1485
Average Daily Gain g	622	645
Feed Conversion	2.47	2.30
Average Feed Price per tonne €	286.26	283.90

The superior feed efficiency amounts to a saving of 15.9 kg feed per pig. Based on a finisher feed price per tonne of € 213 (October 2009) this amounts to €3.39 per pig. But the financial implications do not end there. The pigs in the Top 25% herds grow 23 g per day faster. This means over a 150 day growing period from weaning the pigs would be 3.45 kg heavier live or about 2.76 kg dead. If the additional weight is gained at a feed conversion of 3.0 and finisher feed costs €213 per tonne the feed cost of the extra gain is €2.20, Based on a price of 135c per kg dead, the value of the added weight is €3.73. The benefit to the producer is €1.53 (€3.73 less €2.20).
The overall financial advantage of the better performance is €4.92 per pig produced. This equates to an increase in pig price or a reduction in production costs of 6.5c per kg on a 76 kg dead weight pig.

Achieving Improved Herd Performance
There are five key steps to improving herd performance**.**

1. Record analysis and bench-marking
2. Identify sub-standard performance / problems accurately
3. Prepare action plan
4. Implement action plan
5. Monitor progress and adjust action plan accordingly

Action plans very often require investment e.g. housing, equipment, vaccinations, repairs, etc. This means the action plan must have a solid financial basis and justification. Your unit needs a business plan because your unit is a BUSINESS.

Summary

1. There is considerable scope for most herds to significantly increase sow productivity.
2. Each extra pig produced will generate a Net Profit of about €23.50 or a Margin Over Feed Costs of €43.50
3. An improvement of 0.1 in Feed Conversion Weaning to Sale is worth €2 per pig.
4. An improvement of 25 g per day in Growth Rate Weaning to Sale is worth €1.66 per pig.
5. The Top 25% of PigSys recorded herds selected on Feed Conversion Weaning to Sale are €4.92 per pig (6.5c per kg dead) better off the average of recorded herds.

Survival of the Fittest!

How much is required to cover your current cash outgoings?

S. Clarke & G. McCutcheon

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Golden Rule of Business

- **Never run out of money!**

Sources of Funding

- **Pig sales**
- **Own capital reserves**
- **Extra bank loans**
- **Extended over-draft facility**
- **Feed credit extension**

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Credit Problems

- Bank restrictions
- Slower payment for pigs
- Less credit available
- Reduced price for pigs
- High feed prices still being paid

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Is Ryanair Competitive?

Do Tesco stores monitor their costs and spending? Would shareholders invest if costs not known?

Non-feed costs 2008

Cost	c	Cost	c
Healthcare	5.3	Repairs	2.4
Energy	4.7	Phone/Office	0.8
Transport	1.1	Environment	0.6
A I	1.5	Insurance	0.7
Manure	2.6	Stock Deprec.	0.2
Labour/Manage.	15.0	Miscellaneous	2.1

Total = 37c

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Herd Specific Costs

Not incurred on all units and vary substantially between units

Year	Cost per kg Dead c
2004	7.1
2005	6.5
2006	6.6
2007	8.5
2008	9.3

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What are Herd Specific Costs?

1. Interest: The interest only part of payments to lending institutions. Capital repayments not included
2. Building Depreciation: Not a cash payment
3. Interest + Capital Repayments are cash payments
4. How much per kg dead is required to pay bank?

Estimated Cost of Production October 2009

Cost	Per kg Dead c
Purchased compound feed	88.6
Common	37.0
Herd Specific	9.3
Total	134.9

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Cash Payments per kg dead October 2009 – 3 months credit

Cost	Per kg Dead c
Purchased Compound Feed	95.0
Non feed costs	37.0
Bank Payments	6.3
Total	138.3

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Average Cost of Production

- Average costs are from "better" herds – Are of little use to YOUR business
- Large variations exist between units
- Critical that each unit calculate its costs
- Ensure that calculations are standardised
- Serious risk that some costs may be understated

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The future –what lies ahead?

- What are <u>your</u> production costs?
- How much do you need per kg to cover outgoings?
- Do you know how many pigs you will have for sale in the next 6 months ?
- Up dating the cost of production
- Can this be improved?

PDU Teagasc

Teagasc Services to the Pig Industry

Teagasc provides a range of services to the pig industry in research, advice and training, as well as confidential consultancy on all aspects of pig production, meat processing, feed manufacture, economics and marketing. Contact numbers are as follows

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DD = Direct Dial; S = Switchboard; M = Mobile.			

Notes