Pig Farmers' Conferences 2008

Conference Proceedings

Fermoy, 20th October, 2008
Kilkenny, 21st October, 2008
Cavan, 22nd October, 2008

Published by Teagasc, Oak Park, Carlow.

The Two Tonne Sow !!

Seamas Clarke, Ballyhaise

The heaviest recorded adult pig weighed 1,157 kilos and was owned by Mr. Burford Butler in Jackson, Tennessee, USA back in 1933. It was a black and white Poland China bred boar. As a modern day pig producer your target is to efficiently produce the greatest amount of pig carcass per sow annually on your farm, not the heaviest single pig. But, we may have something to learn from Mr. Burford.

Sow feeding and meat output

Annual carcass output per sow varies greatly between herds and within herds. The national average carcass production per sow for the year 2007 was 1,677kg (Teagasc Pigsys). The top 25% of producers nationally produced 1,820kg carcass per sow. What's more, they did it by feeding only an extra 60 kg of sow feed per sow. What are these producers doing that you are missing out on?

One hundred and forty three kilos of carcass for 60 kg of sow feed!

Key factors involved in carcass output

- Litters per sow per year
- Born alive per litter
- Birth weight of litter
- Litter variation
- Mortalities
- Growth rates
- Slaughter weight

If you are producing less than 1,820 kg per sow per annum, it is time you investigated your areas of failure and righted them before the next 'pig crisis'. Remember that those producing 1,820kg today are targeting 2,000+ kg per sow per annum for next year. To reach the 2,000kg target you need to sell 25 pigs at 80kg but only 23.5 pigs at 85kg (Table 1).

Table 1. Sow output needed for 2,000kg sold per sow

Sale weight kg dead	**80**	**85**	80	85	**80**	**85**	80	85
Numbers sold/sow/yr	**25**	**23.5**	25	23.5	**25**	**23.5**	25	23.5
Litters per sow per annum	**2.4**		2.35		**2.3**		2.25	
No. Sold per litter	**10.4**	**9.8**	10.6	10.0	**10.9**	**10.2**	11.1	10.4

Three questions for you to consider

1. Where is your herd in terms of the 2,000 kg annual output per sow target?
2. Which pathway should you chose to improve your situation regarding carcass output?
3. What are the obstacles in your way to success?

At the 2006 Conference Dr. Peadar Lawlor, Teagasc, Moorepark discussed the factors limiting litter size. Sow feeding in lactation is critical to high output. Numbers of pigs born alive, farrowing rate and litters per sow per year can all be increased by increasing the intake of the sow during lactation.

The national sow feed usage figures show a difference of 60 kg /sow/annum between the average and the top 25% of producers (Table 2). The average usage of the top 25% selected on sow output is 80 kg per sow per year higher than the rest of the herds

Table 2. Annual sow feed level vs output

	National Average	***Top 25%***	***Lowest 75%***
Sow feed kg per sow per annum	1220	1280	1200
Adjusted for gilt feeding	1080	1140	1060
Born alive	11.53	12	11.32
Produced per year	22.5	24.3	21.6

Sow feed pathways

We are dealing with minute quantities of feed between the average and the top producers - slightly greater than 1 kg/sow/week; let us look at the annual breakdown between the two feeding regimes (Table 3).

Table 3. Sow feed usage difference

	High level	***Medium level***
Litters per sow per year	2.4	2.25
Suckling days (28 day weaning)	67	63
Lactating feed level kg/d [Avg]	6.8	6.3
Lactation diet fed per annum kg	456 (40%)	397 (37%)
Pregnancy days (115)	276	259
Empty (non-productive) days	22	43
Pregnancy diet, per annum @2.25 kg/d	671 (60%)	680 (63%)
Total sow diet feed per annum kg	1,127	1,077

The extra 59 kg lactating diet @ €280 per tonne increases sow feed cost by €16.50/year. The reduction in breeding feed usage of 9kg @ €265 per tonne is worth €2.39 giving an overall feed cost increase of €14.11 per sow per year (less than 1c/kg carcass produced).

The positives associated with high feed intake in lactation are

- Increased milk production / weaner quality
- Speedy returns to heat post weaning
- Good body condition at weaning, reducing the need to fatten pregnant females
- Welfare issues reduced e.g. shoulder sores / culled sows
- Increased pigs born alive in subsequent litters

Breeding programme

In order to maintain a stable herd most Irish pig producers operate a replacement rate of 50% approx/year. For those rearing their own replacements, this means a cohort of 12% of their commercial herd kept as breeding sows. These are the animals that influence the growth rate and future carcass quality of the pig farm. Greater attention to the past records of these animals is urgently required if we are to compete with other EU partners. Tables 4, 5 and 6 show where we need to position our breeding stock.

The genetic affect of the dam line herd influences days to slaughter, feed efficiency and carcass quality just as well as the boar used. Keep this in mind as you select your replacement gilts and your weekly sows for 'dam line AI'. Poorly shaped, thin or locomotivly disadvantaged sows should not be bred.

Poor eaters will be poor breeders and will produce similar progeny!

Table 4. Danish Boar performance [Bogildgard Test centre 2006]

Breed	***Number***	***ADG 30-100kg g/day***	***FCE***	***Lean meat %***
Duroc	1,568	1,006	2.30	59.9
Hampshire	1,018	885	2.41	62.0
Landrace	1,292	920	2.40	61.2
Yorkshire	1,289	928	2.34	61.2
Total	5,167			

Table 5. Danish Nucleus herds Results for boars 2006

Breed	Number	ADG 0 -30kg	ADG 30 – 100 kg	Age at slaughter	Lean meat %
Duroc	8,080	384	1,039	145	60.4
Hampshire	2,251	363	876	163	62.3
Landrace	18,713	382	978	151	62.2
Yorkshire	15,460	359	920	160	61.6
Total	44,504				

Table 6 Danish Nucleus herds Results for young sows 2006

Breed	Number	ADG 0 -30kg	ADG 30 – 100 kg	Days Birth / Slaughter	Lean meat %
Duroc	9,743	385	990	149	60.5
Hampshire	3,280	368	845	164.5	62.1
Landrace	23,144	384	935	153	62.1
Yorkshire	17,419	362	887	162	61.5
Total	53,586				

Management of weaned sow

An average weaning to first service interval target of 6 days or less is practical and achievable. Research shows a decrease of one pig when the weaning to service interval is extended from 4 to 10 days. Teagasc research at Moorepark shows an increase of 1.4 pigs per litter associated with reducing the weaning to service period by 5 days.

Late insemination has a negative effect on pregnancy. The natural uterine response after service is to remove non fertilizing sperm and bacteria introduced during service. The uterine contractions remove these unwanted products. Late insemination will interfere with this process.

Thirty percent of litter potential size is lost in the first 30 days post service. Stress is a factor in these losses. The days around fertilization, uterine entry, embryo spacing, maternal recognition of pregnancy and placental attachment of the embryos are crucial. Stress over this period from 2 / 3 day post service to day 20 post service will have a negative effect on the pregnancy. Mixing and moving are best avoided at this time.

Feeding levels during pregnancy

Gilts, post service, need special attention. Medium to high feed levels (over 30MJ DE / day) in the first 3 days post service may reduce litter size (Kongsted, 2005) by increasing embryonic mortality. Served gilts need to be penned and fed separately from unserved.

Feeding 28 MJ DE/day to all females for the first 12 days post service was recommended by Tokach et al. (1999). Thin sows at this stage are often the result of poor farrowing house management. Their condition can be improved by increased feeding levels post-mating but it is not advisable to exceed 3kg (40MJ DE)/day.

Birth weight : Slaughter weight relationship

Genetic selection for larger litters over the past decades has increased within-litter variation in piglet birth weight. There are strong indications that lower birth weights and lower carcass weights are linked. Low birth weight is correlated with increased mortality and lower growth rates. Dwyer et al. (1994) found that lighter pigs at birth have a lower number of muscle fibres which result in lower lean gain deposition rates and poorer FCE.

The breeding programme on many Irish pig farms does not take litter **quality** at birth into consideration when selecting replacements. The sire line is given the task of providing the carcass traits alone. Lower birth weight pigs have lower numbers of muscle fibres at birth, a less well developed skeletal system and grow slower, have lower lean meat and fatter carcasses than medium or high birth weight pig. A compensatory growth strategy does not overcome the negative impact of low birth weight on growth and carcass characteristics (Gondret et al., 2006). The differences in muscle fibre numbers and birth weight are believed to be due to malnutrition of the smaller littermates during foetal development. Unfortunately, a feed allowance above standard requirements in sows appears not to be very effective in stimulating muscle development and increasing birth weight. Placental development is also linked with litter development and birth weight.

Can we feed our sow to increase placenta size? Can we select sows with better placental development potential? Today's commercial pig farmer has a vast pool of breeding animals to select from. Use it effectively!

The growing pig

<u>The suckling period</u>

Having maximized birth weight and litter size you must focus on the growth potential of the pig and factors that enhance it. Creep feeding seems to have little effect on weaning weight (Kavanagh et al., 2002). Look at pre-weaning creep feeding as a process to stimulate the pig's digestive system to utilize dry food by modifying its digestive capacity and microbial flora. Recent Moorepark research found that pre-weaning nutrition was effective in increasing weaning weight, but the advantage gained was lost over the next 14 days post weaning.

<u>The weaned pig</u>

Whittemore et al. (1981) reported the consequence of low food intake in the first few days after weaning was the catabolism of fat reserves as the pig strives to balance its energy requirement for maintenance.

Low post weaning intakes are responsible for the reduction in the gut villous height which affects nutrient absorption. The resultant growth lag has serious consequences for pig performance over the growth period from weaning to slaughter. Tokach et al. (1992) found that daily gain in the first week post weaning was positively related to slaughter weight.

The first weeks feeding intake dictates the date of slaughter!

Provide the weaned pig with every opportunity to eat and drink. Inadequate feeder space, drinkers at incorrect heights, poor water flow all lead to low or <u>***no***</u> intakes in the first 24 hrs.

The benefits of heavy birth weights will be sacrificed unless a diet of high nutrient density is offered post weaning. Moorepark research demonstrates that the quantity of the high density diet given can be reduced, at least after day 10 post weaning, without adversely affecting lifetime performance. Edwards and Rooke (1999) reported that the litter of origin accounts for more than half of the variation in post weaning performance.

Remember the old adage, '**good breeding is half the feeding'**!

Slaughter weight

Slaughter weight is the final piece of the jigsaw we must examine when setting targets for carcass yield per sow. Growth rate, adequacy of space, diet quality, herd health are the fundamentals for successful pig finishing. Irish slaughter weights are lower than our EU partners/competitors. Over the past twenty years we have increased from 65 kg carcass weight to 75 kg. The Danes were at this weight 10 years ago. They are presently at 82 kg. There is room to catch up! Is there the time or the will?

But, we must not ignore the fact that we use entire males and boar taint increases with carcass weight.

In Summary

Our national sow herd has reduced to 145,000 sows in June 2008. We can make this slimmer herd produce a similar amount of meat as the 155,000 sow herd of 2005 by:

- Improving your gilt breeding / selection / culling
- Paying greater attention to farrowing house feeding levels
- Culling sows for poor production, poor litter quality at birth
- Paying greater attention to weaned pigs over the first 24 hours
- Reviewing your slaughter weight policy, especially if the breeding side of your business lets you down periodically

Keep in mind that your herd has many 2,000 kg carcass producing sows already. Why carry laggards? They all count when SI 378 [The Nitrates Regulations] rules are applied!

Back to Mr. Butler and his prize winning boar of 1,157 kg.

Weight rules, OK!

GM Feed Ingredients

Peadar Lawlor, Moorepark

What is a GMO?

Food and feed are generally derived from plants and animals which have been grown and bred by humans for millennia. Over time, these plants and animals have undergone substantial genetic changes as those individuals with the most desirable characteristics for food and feed were selected for breeding the next generation. The desirable characteristics were caused by naturally occurring variations in the genetic make-up of those individuals. In recent times, it has become possible to modify the genetic material of living cells and organisms using techniques of modern gene technology. Organisms, such as plants and animals, whose genetic material (DNA) has been altered in such way are called genetically modified organisms (GMOs) (Europa, 2008). The World Health Organisation (WHO) defines GMOs as those organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally (WHO, 2002). The technology is often called "modern biotechnology" or "gene technology", sometimes also "recombinant DNA technology" or "genetic engineering". It allows selected individual genes to be transferred from one organism into another and also between non-related species.

What is a GM food or feed?

The food and feed which contain or consist of such GMOs, or are produced from GMOs, are called genetically modified (GM) food or feed (Europa, 2008). Regulation (EC) 1829/2003 established 0.9% as base level for 'presence of GMO'. Therefore, in the EU, any food or feed containing more than 0.9% GMO is legally considered a GM food or Feed.

Global Picture

Animal feed accounts for a huge proportion of the world's harvest – estimates range from one third to nearly half of individual grains.

This year (2008) is the 13^{th} year in which GM crops were grown commercially in the world. Each year since 1996 farmers have planted more GM crops than in the previous year and in 2007, the land area planted to GM crops grew by 12%, or 12.3 million hectares. Worldwide, 114.3 million hectares were planted to GM crops in 2007 (Figure 1). Figure 2 shows how the global area planted to the most important GM crops has changed since 1996.

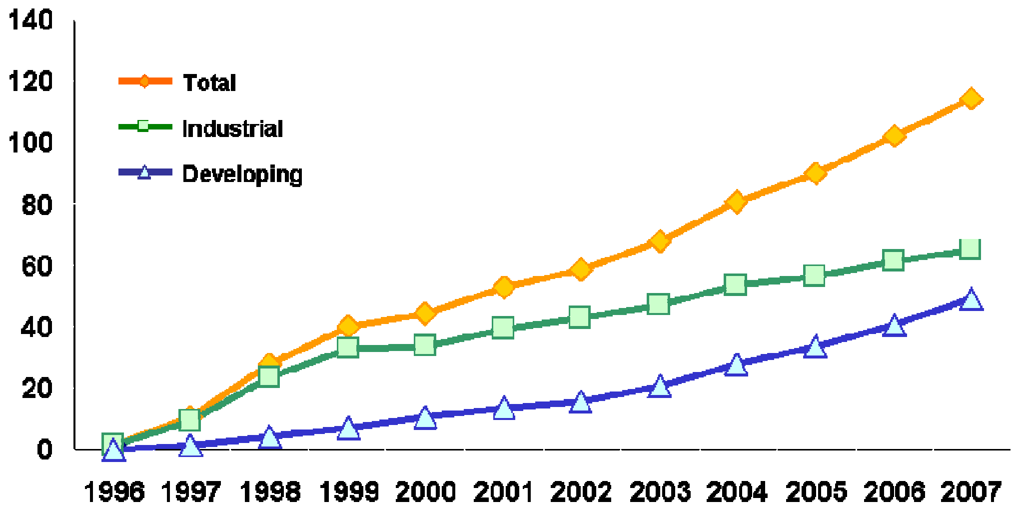


Figure 1. Global Area of Biotech Crops, 1996 to 2007: Industrial and Developing Countries (Million Hectares) (Source: James, 2008)

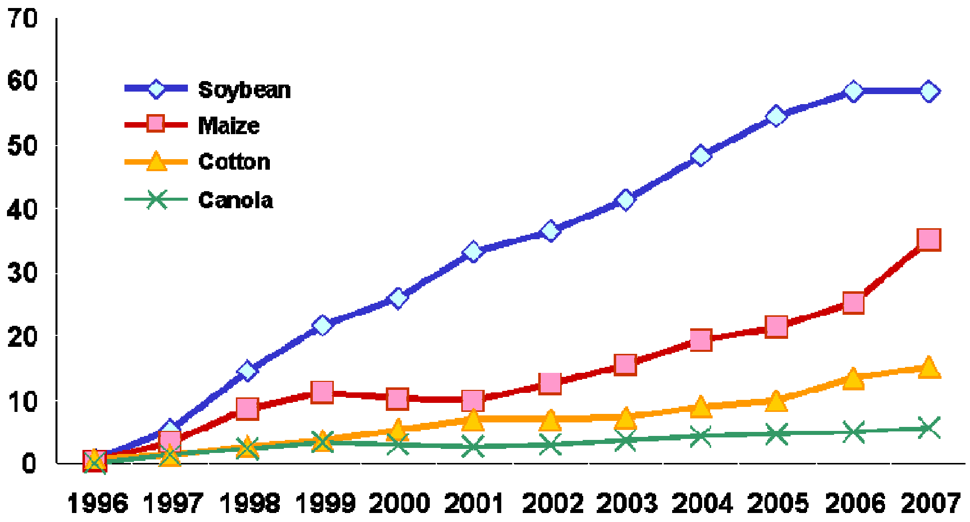


Figure 2. Global Area of Biotech Crops, 1996 to 2007: By Crop (Million Hectares) (Source: James, 2008)

If more than one gene from another organism has been transferred to a particular crop, the created GMO has stacked genes (or stacked traits), and is called a gene stacked event. Some new GM varieties contain two or three "stacked traits", which confer multiple benefits (Figure 3). For this reason, adoption growth is more precisely measured when expressed as "trait hectares", rather than hectares. Growth measured in "trait hectares" between 2006 (117.7 million) and 2007 (143.7 million) was 22%, or 26 million hectares. The unprecedented uptake of this technology is due to the substantial economic benefits to farmers worldwide (James 2008).

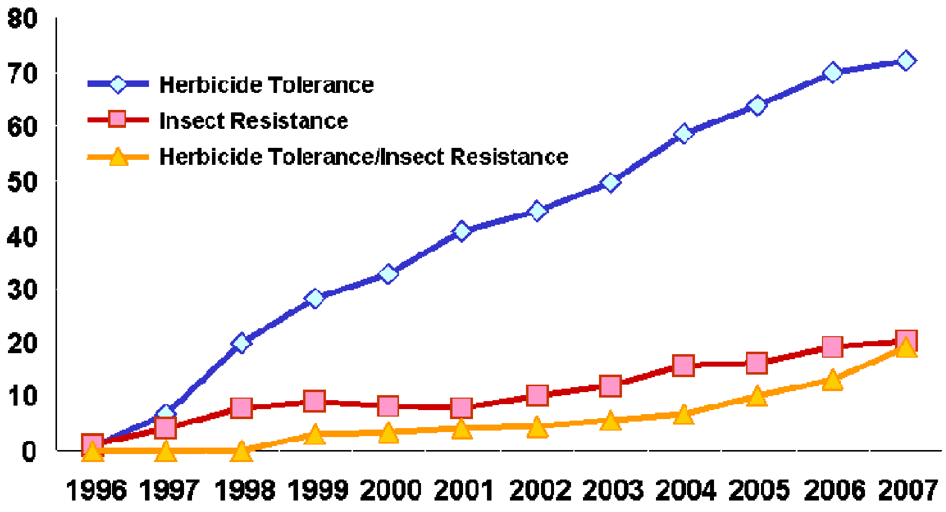


Figure 3. Global Area of Biotech Crops, 1996 to 2007: By trait (Million Hectares) (Source: James, 2008)

Twenty three countries grew GM crops (12 developing countries and 11 industrial countries) in 2007. In order of area grown they were, USA, Argentina, Brazil, Canada, India, China, Paraguay, South Africa, Uruguay, Philippines, Australia, Spain, Mexico, Colombia, Chile, France, Honduras, Czech Republic, Portugal, Germany, Slovakia, Romania and Poland. The first eight of these countries grew more than 1 million hectares each. The USA grew 57.7 million hectares (50% of global biotech area) spurred by a growing market for ethanol with the biotech maize area increasing by a substantial 40%. The accumulated area of GM crops grown worldwide between 1996 and 2007 was 690 million hectares (1.7 billion acres), with a 67-fold increase during this period, making it the fastest adopted crop technology in recent history (Figure 4; James 2008).

Notably, 63% of biotech maize, 78% of biotech cotton, and 37% of all biotech crops in the USA in 2007 were stacked products containing two or three traits that delivered multiple benefits. Stacked products are now used in USA, Canada, the Philippines, Australia, Mexico, South Africa, Honduras, Chile, Colombia, and Argentina, with more countries expected to adopt stacked traits in the future (James 2008).

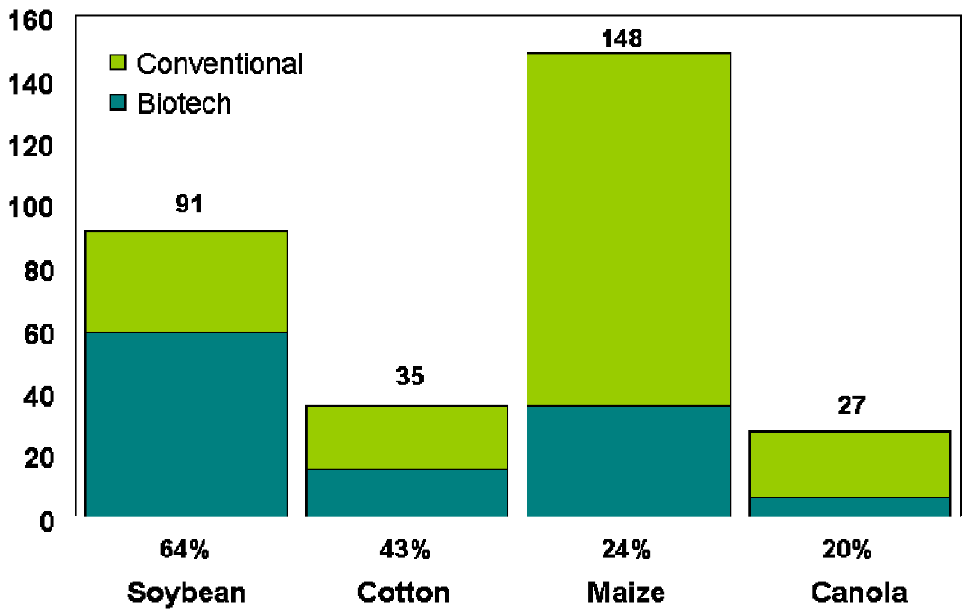


Figure 4. Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares) 2007

Ireland and GM crops

Currently no genetically modified (GM) crops are cultivated in Ireland. However, it is probable that in the near future, Irish farmers will be afforded the choice of whether or not they wish to grow specific GM crops (Teagasc, 2008)

Sourcing our imports of feed ingredients is becoming more difficult and expensive due to factors such as weather, freight, currency, energy debate, GM influence, funds activity and a global tightening of wheat stocks. Ireland relies more on imports of animal feed ingredients than any other country in the European Union. We are 52% reliant on imports while the UK are only 36% dependent, France 19% dependent, and Germany 26% dependent (Hughes, 2008). In particular we do not have enough land to be self-sufficient in the protein supplements required for animal feeds. The high protein content in pig diets is achieved by using imported GM soybean and GM maize products (corn gluten feed, distillers dried grain), which are primarily sourced from the US, Brazil and Argentina. All GM feed distributed in Ireland has been authorised by the European Commission as safe for consumption. Since 2005, over 3.4 million tonnes of GM feed ingredients (Table 1) has been imported to offset the deficit in domestic feed supplies.

The decrease in maize imports in 2007 (Table 1) arose because of the difficulty in sourcing GM maize authorised by the European Commission on the global markets. To compensate for the shortage of GM maize feed, an increased tonnage of authorized GM soya was imported in the same period (Hughes, 2008).

Table 1. Imports of GM ingredients into Ireland between '05 and '07 (Hughes, 2008).

Year	Maize (t)	Soya (t)
2005	640,135	549,293
2006	781,823	454,828
2007	395,525	607,367

Cost of substituting imported GM feed with a non-GM equivalent?

Declaring Ireland a GM-free country has been raised by some as a mechanism to enhance the export potential of the Irish food industry. It is important to note that EU law prohibits the imposition of a national ban on GM crops/feed unless scientific research can support a ban based on health/environmental fears (Teagasc, 2008).

The only way that Ireland could adopt a GM-free position would be to do so based on a voluntary decision by the agricultural sector. Thorne et al. (2005) investigated the financial impact of such a 'voluntary ban' on the Irish dairy and beef sectors. Their study concluded that a decision not to use GM animal feed would cost the dairy sector an additional €17.7 million pa. while the beef sector would face an additional cost of up to €18.6 million pa.

This Teagasc research concurs with conclusions from a report by the European Commisssion's Directorate General of the Agriculture and Rural Development which states that countries such as Ireland in particular would experience significant economic consequences in trying to replace current GM maize products with non-GM material (European commission, Directorate-general for agriculture and rural development, 2007). This report stated that corn gluten feed is particularly imported by some Member States with direct sea access (Spain, UK, Portugal, Netherlands and Ireland) and to replace this product with other non-GM sources would be associated with increased transportation costs of up to €60 per tonne (European Commission 2007).

It is very difficult to accurately predict the financial impact of a GM free Ireland on the Irish pig industry. Soyabean, maize and rapeseed would be the ingredients of most concern in this regard. Pig diets are formulated on a least cost basis and if one ingredient becomes expensive the formulation is altered to incorporate a cheaper alternative. In addition to the GM situation, factors such as weather, freight, currency, energy debate, funds activity and a global tightening of wheat stocks will all impact on ingredient supply and price thus influencing the ingredient composition of pig diets. Today the additional cost of formulating a GM free pig diet would increase for the following reasons:

1. Cost of sourcing similar non-GM Ingredients
2. Cost of substituting GM ingredients with alternative protein and energy products.
3. While GM maize by-products are not used to a great extent in pig diets, the effect of using more wheat and barley as substitutes in ruminant diets would make such cereals scarcer thus increasing their cost of inclusion in GM free pig diets.

Below is an estimate of the cost of formulating a GM free composite pig feed on 4th September 2008. At that time GM free soya was available at a premium of €40/tonne. All the maize being imported at the time was GM free from France with no premium over GM maize. All the rapeseed being imported was also GM free.

Table 2. Estimated Cost of Substituting Conventional for GM Ingredients on Irish Pig Industry (September 4th 2008).

Feed intake (inc. sow) per pig (Kg)	278	(PIGSYS 2007)	
No of sows in Republic	153070	(Teagasc Pig Herd Survey 2007)	
No. pigs produced/sow/year	22.5	(PIGSYS 2007)	
Total pig feed required (tonne)	957453		
Inclusion of GM ingredients	**(%)**	**Cost of Non GM (€)**	**Cost /t diet**
Soya	20	40	8.00
maize products	8	0	0.00
Rapeseed	3	0	0.00
Soya oil	1	100	1.00
Additional cost / tonne diet (€)	9.00		
Additional cost to pig Industry (million €)	8.6		
Additional cost per pig (€)	2.50		

If we were to feed non-GM pig diets based on prices on ingredient prices on 4th September 2008 the cost of feeding a pig would increase by €2.50 and the total cost to the pig industry would amount to in excess of €8.6m/ annum (Table 2).

If, and this is likely in the future, cheaper GM maize and maize by-products are available on the world market, the European commission Directorate-general for agriculture and rural development (2007) predict that the additional cost of non GM maize products could be as high as €60/tonne. Although, the likelihood in Ireland is that alternative feed ingredients would be used instead of maize or maize by-products to formulate a GM-free diet, the likelihood is that these alternatives would similarly increase in price. Table 3 shows a scenario where the full €60/t premium for non-GM maize and maize by-products is absorbed. In this case the cost of feeding a pig would increase by €3.84 and the total cost to the pig industry would amount to in excess of €13.2m/annum (Table 3).

Table 3. Estimated cost of substituting conventional for GM ingredients on Irish Pig Industry (September 4th 2008 – with access to cheaper GM maize products).

Feed intake (inc. sow) per pig (Kg)	278	(PIGSYS 2007)	
No of sows in Republic	153070	(Teagasc Pig Herd Survey 2007)	
No. pigs produced/sow/year	22.5	(PIGSYS 2007)	
Total pig feed required (tonne)	957453		
Inclusion of GM ingredients	(%)	Cost of Non GM (€)	Cost /t diet
Soya	20	40	8.00
maize products	8	60	4.80
Rapeseed	3	0	0.00
Soya oil	1	100	1.00
Additional cost / tonne diet (€)	13.80		
Additional cost to pig Industry (million €)	13.2		
Additional cost per pig (€)	3.84		

It is highly unlikely that the Irish pig industry could survive in a GM free Ireland in the absence of a premium being paid for GM free pig-meat. The history of recovering such premiums from the market place has not been a positive one.

Safety assessment of GM animal feed

It is important to note that all imported GM animal feed is regulated and verified as safe for consumption by the European Food Safety Authority (EFSA) prior to its inclusion in the food chain. This comprehensive regulatory process takes approximately 2 years with authorisation granted only after the completion of a full scientific risk assessment of the GM crop material.

Critical to this process is the input gathered from the relevant food safety agencies of each member state (e.g. Food Safety Authority of Ireland), as each scientific risk assessment conducts a comparative anlaysis between the GM feed and an equivalent non-GM feed.

Specifically, this examines the GM feed for:

1. potential for allergenicity
2. nutritional composition
3. potential for toxicity from ingesting
4. influence of processing on the properties
5. potential for long-term nutritional impact
6. possibility for unintended effects due to the genetic modification

At the end of this process the EFSA Scientific Committee provides an opinion to the European Commission as to the safety of the GM animal feed in question. The European Commission prepares its decision on whether to grant or refuse authorisation. If they propose to grant authorisation, the official recommendation of approval is disseminated to representatives of the Member States for consideration (Teagasc, 2008). See Appendix 1 for a schematic of how the EU authorisation process for GM crops works.

Delays in authorisation by EU

Sourcing our imports is becoming more difficult for the reasons already referred to. All of these factors contributed to increasing the price of animal feeds in 2007/2008. The delay in the authorisation of GM events by the EU and the EU's policy of zero tolerance of unauthorised GM material has further contributed to the massive price inflation in animal feeds witnessed by the agricultural sector in the past year.

A political decision was taken by the Irish Government in 2007 to abstain in a key vote on authorising the importation of the GM maize variety 'Herculex'. This was contrary to the EFSA opinion that 'Herculex' was as safe as non-GM maize. As Herculex failed to secure EU approval, European feed importers were forced to pay inflated prices for scarce supplies of non-GM material on the global market. Consequently, feed costs for the farmer also increased (Teagasc, 2008). Herculex was eventually authorized by the EU Commission in October 2007. The approval process took 33 months. However, other crops have been grown and harvested which are not yet authorized in the EU. Therefore, the lengthy EU authorization process is likely to again limit the import of maize and maize products and push up the price of non-GM and authorized GM maize and maize by-products and substitute alternatives in the medium term.

In September 2008 authorization for 10 years was given by the EU Commission to market foods, food ingredients and feed containing, consisting or produced by "A2704-12 soybean". Soybean is of particular interest to Europe's livestock and feed manufacturing industries since we depend heavily on imported soy products as a source of protein-rich and high-quality feed. This approval also followed on from an inconclusive debate by EU farm ministers in July of this year.

Summary

Genetic engineering is a tool employed by plant breeders which allows for much faster genetic improvement than achievable with traditional plant breeding technologies. It is mainly used to confer herbicide resistance or insect resistance or both to a crop. The use of genetically modified crops is the fastest adopted crop technology in recent history. The Irish feed industry is highly reliant on imported feed ingredients, particularly soya and maize by products as a source of protein. As the area of GM crops increases year on year it becomes increasingly difficult and more expensive to access non GM alternatives. It can take up to 33 months to get a GM crop authorized in the EU which means that these crops are generally harvested before EU authorization is received. The delay in the authorization process results in a premium being paid by the Industry for authorized GM alternatives or non GM alternatives. If Ireland were to adopt a GM free position it could prove disastrous for the pig-meat sector.

Acknowledgements

I would like to acknowledge the assistance of Deirdre Webb, Director IGFA, Lower Main Street, Abbeyleix, Co Laois and Dr. Karina Pierce, School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin 4 for providing information from which the cost of a GM free Ireland to the Irish pig industry was calculated.

References

Thorne, F.S., Hanarahan, K. and Mullins, E. 2005. The economic evaluation of a GM free country: an Irish case study. RERC Working Paper Series 05-WP-RE-08. http://www.agresearch.teagasc.ie/rerc/downloads/workingpapers/05wpre08.pdf Accessed on 8/9/08.

Teagasc. 2008. www.gmoinfo.ie Accessed on 22/08/8.

European commission, Directorate-general for agriculture and rural development. 2007. Economic impact of unapproved GMOs on EU feed imports and livestock production. http://ec.europa.eu/agriculture/envir/gmo/economic_impactGMOs_en.pdf Accessed on 22/08/8.

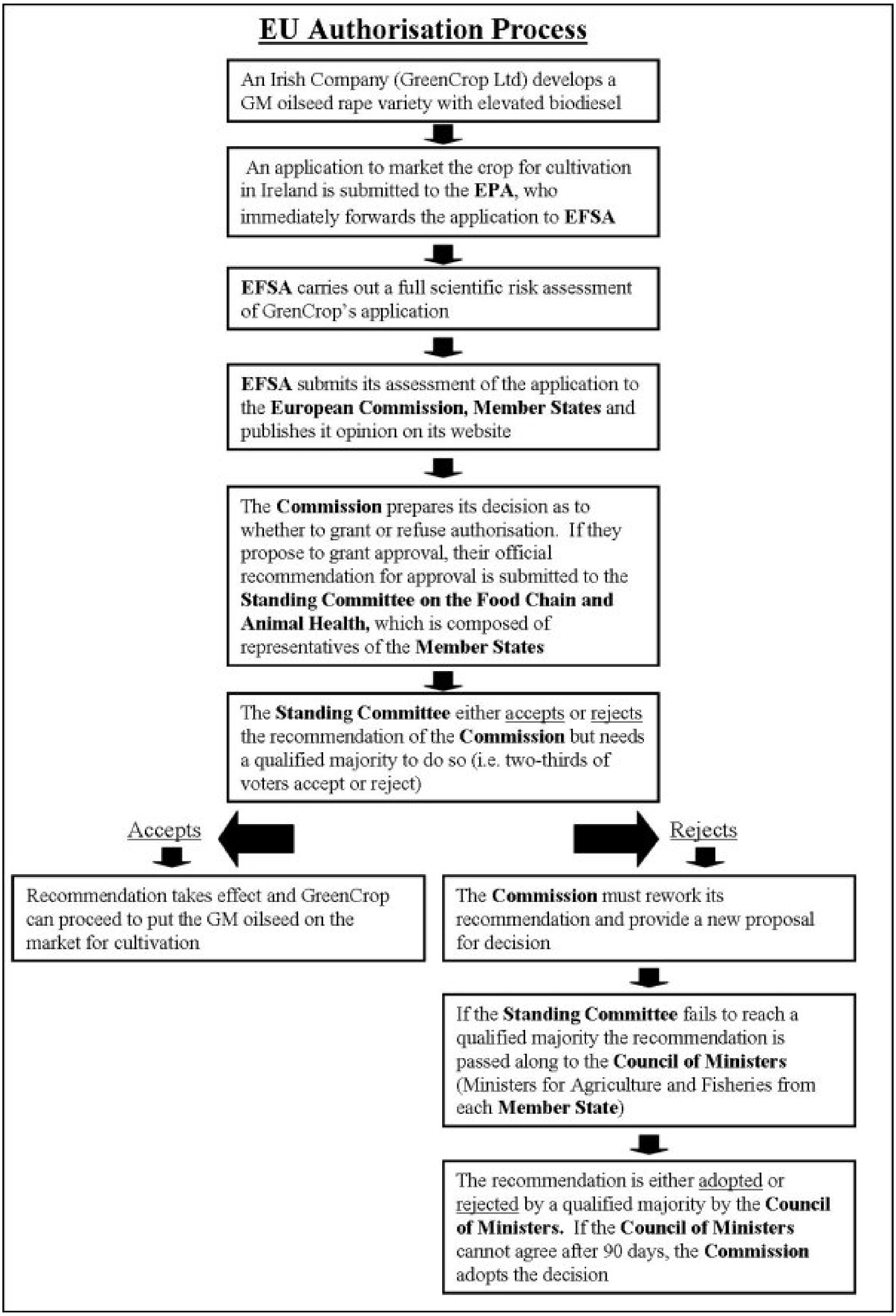
Europa, 2008. GM Food & Feed. http://ec.europa.eu/food/food/biotechnology/gmfood/index_en.htm Accessed on 3rd September 2008.

WHO, 2002. Biotechnology (GM foods): 20 questions on genetically modified foods. (Available at: http://www.who.int/foodsafety/publications/biotech/20questions/en/index.html Accessed on 22/08/8.

Regulation (EC) no 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed Official Journal of the European Union. pp23.

Hughes, R. 2008. Developments in feed grain markets. In proceedings: Teagasc National Tillage Conference. Wednesday, 30 January, 2008, The Dolmen Hotel, Carlow. p13-22.

Appendix 1. Schematic of EU authorisation Process for GM crops (Teagasc 2008)



Pig Welfare: Tesco Pork Standards, National Legislation and meeting requirements for both

Laura Boyle, Teagasc, Moorepark

Introduction

The premium offered by Tesco for pigs produced according to their Pork Standards (PS) (Tesco Pork Standards, Revised - March 2008) is a potentially attractive source of additional income for producers. However, the animal welfare requirements of the Tesco PS are in several instances stricter and more comprehensive than current National Legislation (laid down in S.I. No. 14 of 2008 European Communities [Welfare of Farmed Animals] Regulations) with which all pig producers must comply. This paper has two aims: (1) to highlight the main differences between the Tesco PS and Irish National Legislation and (2) to focus on one of the most contentious issues common to both, namely the requirement for environmental enrichment in the form of manipulable substrates.

Differences between Tesco PS and Irish National Legislation

Note to the reader: This list is by no means all-inclusive and anyone who is interested further should review the aforementioned documents in detail.

<u>Sow housing</u>

The biggest constraint to producers wishing to avail of the Tesco premium is the requirement that all pigmeat supplied to Tesco stores must come from sows that are stall and tether free, i.e. loose housed. As housing sows in stalls is still permissible under Irish/EU law until January 2013 (and beyond that for the first four weeks of pregnancy), although tethers are obviously banned since 2006, the majority of Irish sows are still housed individually. Over the next four years many producers will simply convert existing stalls to make them free access.

The floor area that must be available to sows and gilts when kept in any kind of group housing is the same for both the Tesco PS and S.I. No. 14. But under the Tesco PS the internal area of the free-access stall cannot count towards the area of the pen in free-access stall systems while it can be included under Irish law. This is an important difference as it effectively increases the amount of space required for each sow in group systems compared to what is required under Irish National Legislation.

High-fibre diets

Staying with the pregnant sow, Tesco PS on the feeding of high fibre diets are similar to the legislation outlined in S.I. No. 14 in that 'All dry sows must be given a sufficient quantity of bulky or high fibre food as well as high energy food to satisfy their hunger and need to chew'. However the Tesco PS are more comprehensive because they suggest a level of dietary crude fibre that should be fed in order to comply with this requirement (i.e. 18%). They also give examples of ways in which this level of crude fibre can be achieved in the diet for example by adding 'fibre to the normal ration e.g. sugar beet pulp, silage or by supplying *ad libitum* access to palatable fibre e.g. daily provision of clean, fresh straw or hay'. For information on the results of a Teagasc research programme on high fibre feeding for pregnant sows see last years Pig Conference Proceedings (Boyle, 2007).

Water

Water provision is referred to in two schedules of S.I. No. 14 of 2008. Under Schedule 1 **'Conditions under which an animal should be kept'** it states that 'An animal must have permanent access to a suitable water supply or be able to satisfy its fluid intake needs by other means'. From the underlined section it could be surmised that 'a suitable water supply' is not required for suckling pigs which can theoretically satisfy their fluid requirements by milk and wet fed pigs which can theoretically satisfy their fluid requirements from the diet. However, in Schedule 3 **'Specific provisions for various categories of pigs'** it states that 'All pigs over 2 weeks of age shall have permanent access to a sufficient quantity of fresh water'. It is likely that this statement supersedes the previous one but there is undoubtedly some ambiguity. Notwithstanding this, there are sound physiological reasons as to why all classes of pigs should indeed have continuous access to fresh water. Indeed there is no ambiguity on the issue of water provision in the Tesco PS i.e. 'All animals must have continuous access to a sufficient quantity of clean drinking water so that they are able to satisfy their fluid intake'. They go on to specify that 'In wet feeding systems for weaned pigs there must be a separate supply of water with at least one additional drinker in each pen….' Specific guidelines regarding space allowances at troughs used to supply water and the number of nipples/[mini] bowls to be provided to restricted and *ad lib* fed pigs are also provided.

Tail docking and teeth clipping

Similar to S.I. No. 14, the Tesco PS does not advocate routine teeth clipping and tail docking of piglets. The procedures may only be carried out where there is evidence on the farm that injuries to pigs have occurred or are likely to occur as a result of not tail docking or teeth clipping. However, the Tesco PS goes one step further and require that in order for a producer to conduct tail docking or teeth clipping a veterinary surgeon must confirm in writing that the practices are necessary and acceptable. Furthermore, the necessity of these practices must be regularly reviewed and reported on in the quarterly veterinary site visit reports. Another important difference is that while tail docking and teeth clipping can be carried out on piglets up to 7 days of age under Irish legislation, under the Tesco PS, veterinary 'approved' tail docking and teeth clipping can only be carried out on piglets under 72 hours old.

Hospital pens

The topic of hospital pens is important and it has been covered extensively at previous Teagasc pig conferences (see Carroll, 2007), in the Teagasc Pig Newsletter (Vol. 9, No. 5, 2006) and in Today's Farm (Boyle 2006, Vol. 17, No. 6. pgs. 21-22). Nevertheless there is only a cursory mention of hospital pens in S.I. No. 14 under Schedule 1 **Conditions under which an animal should be kept** and in Schedule 3 Part 1 **Conditions for the rearing or fattening of calves and pigs** where it is stated that 'Where necessary, a sick or injured animal shall be isolated in suitable accommodation with, where appropriate, dry, comfortable bedding'. The words 'where necessary' and 'where appropriate' clearly leave this statement open to all kinds of interpretations.

The Tesco PS states that *hospital pens must meet the following criteria:*

1) *The area must be dry, draught free and bedded and sheltered from direct sunlight when in use*
2) *The area must provide adequate space for veterinary access, carcass removal and easy cleaning*
3) *Good artificial lighting must be provided*
4) *Provision must be made to provide food and water*
5) *Isolation facilities ,must be available for those animals suspected of having a disease, which is contagious to other animals or [hu]man[s]*
6) *The siting of hospital pens should be such that animals are within sight and sound of other animals*
7) *The number of pens provided must be sufficient to cope with the needs of the system. This must be addressed via the Animal Health and Welfare Plan.*

There are also specific guidelines on the treatment of sick or injured pigs, on-farm humane destruction and casualty slaughter.

Environmental enrichment

Both Irish national legislation and the Tesco PS require that all classes of pigs be provided with some form of environmental enrichment in the form of manipulable substrates. Both documents list material such as 'straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such which does not adversely affect the health of the animals'. A common criticism of the list provided in the EU Directive on which S.I. No. 14 is based, is that given their incompatibility with liquid manure many of the materials cannot be employed in fully slatted systems. Furthermore, the list leaves too much room for interpretation meaning that it is not clear for example whether metal chains, ropes, rubber toys or plastic balls are sufficient materials. In the Tesco PS however, the guidelines are more explicit as they go on to say that 'On slatted systems *[sic]*, chains are not acceptable as manipulation activity *[sic]*. Toys are acceptable which provide a reward'.

Interestingly the results of a comprehensive Dutch study that aimed to determine what exactly are suitable enriching materials for pigs yielded conclusions that are broadly in line with the Tesco PS (Bracke et al., 2006). These authors reviewed 54 experiments and containing 200 statistically significant and welfare relevant findings related to environmental enrichment. Using sophisticated data modelling techniques they then devised scores to represent the enrichment value of a range of material classes based on the findings of the 54 experiments (Table 1).

Table 1 Enrichment value of a range of material classes for pigs

Material class	**Enrichment value**
Metal objects	0.3
Mineral block	0.5
Rubber and plastic	0.7
Rope and cloth	0.8
Roughage (e.g. hay)	0.8
Wood	0.9
Substrates (e.g. compost, earth, sawdust, peat)	1.0
Straw	1.1
Compound enrichment (mixture of substrates)	1.3

Clearly metal objects, which mainly consisted of chains, show very few significant welfare benefits. In line with Tesco, the Department for Environment, Food and Rural Affairs (Defra) in the UK and their equivalent in the Netherlands, do not accept metal chains as manipulable materials for pigs. Rubber, rope, wood, roughage and substrates have more benefits than metal objects, but less than straw and compound objects. Bracke et al. (2006) concluded that in addition to the materials listed in the EU Directive, rope may also qualify as a suitable material and that rubber objects may also provide suitable enrichment for pigs. However, the same authors went on to evaluate an additional 64 enriching materials (Bracke et al., 2007) and found that materials such as straw provided at an absolute minimum, a heavy plastic ball, a chain, a rubber hose cross, a hanging car tire and a bucket all generated scores of ≤ 1.5. Materials that generated scores of 5, the minimum of what pig welfare experts considered as acceptable enrichment, included: compost provided in a food dispenser, straw pellets (loose or from a plastic dispenser) and straw in a metal basket or rack.

These results are not surprising when you consider that pigs show a clear preference for substances that are destructible and ingestible (Van de Weerd *et al.*, 2003; Tuyttens, 2005). Specifically the characteristics of objects used most intensively by growing pigs are that they are 'ingestible', 'odorous', 'chewable', 'deformable' and 'destructible' (Van de Weerd et al., 2006). Such materials stimulate foraging and exploratory behaviours and are therefore most effective at sustaining pigs' interest. This explains why for example, in a study by Scott et al. (2006) with fully slatted systems, unmolassed sugar beet pulp being ingestible, chewable and destructible was used more than Bite-Rite toys which are only truly qualified as chewable.

Environmental enrichment options

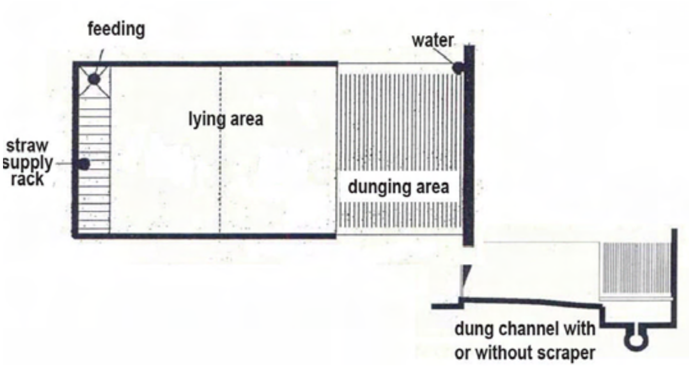
Even though Irish National Legislation and the EU Directive on which it was based require that environmental enrichment be provided to *all* classes of pigs (including boars and suckling piglets) the following focuses on a few of the options for weaned and growing/fattening pigs although some could also be used for dry sows.

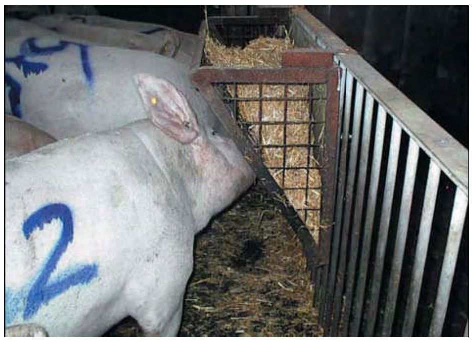
Straw - The Gold Standard

Straw provided as deep bedding is the best outlet for the rooting and chewing activities that are part of the foraging and exploratory behavioural repertoire of pigs. When given the opportunity pigs will spend up to 25% of their time interacting with it (Edwards et al., 2004; Beattie et al., 2000; Jensen et al., 1993). For this reason straw bedded pens are used as a positive control in studies of environmental enrichment for pigs. Few studies have found an enriching substrate that provides a comparable level of occupation to that of straw bedding. Nevertheless in studies where access to straw was restricted such as in part-slatted straw-flow systems (Figure 1) or where it was provided in racks to pigs in fully slatted systems (Figure 2) the level of straw manipulation was higher compared to 'toys' such as the Bite Rite toy (Figure 3) or a feed dispenser (Van de Weerd et al., 2005; 2006). This suggests that where its use is feasible, even small amounts of straw will yield the best possible returns in terms of reducing the adverse behaviours that lead to vices such as tail biting and generally in improving pig welfare.

Figure 1 Straw Flow System

Figure 2 Straw provided in a rack

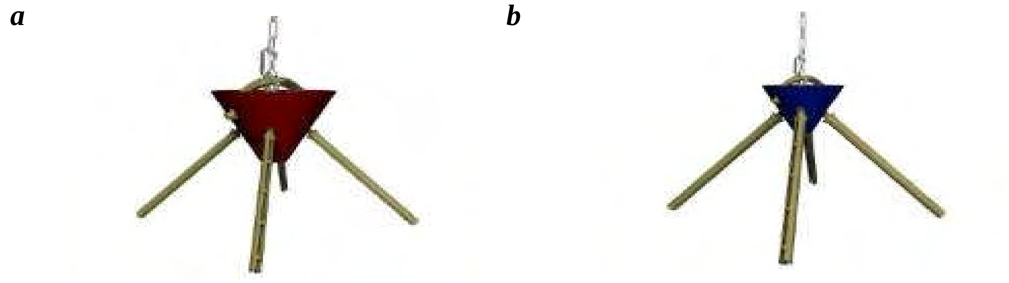




BiteRite toys®

These plastic toys are commercially available from Ikadan (ikadan@ikadansystem.com) and consist of a 'hanger', four chew sticks and a hanging chain. The cost of these toys is considerable (red €22.50 and blue €29.50 each; both models comes in boxes of 10 sets) and this does not include the cost of replacing the chew sticks. Even though the manufacturers claim that these toys reduce aggression and tail biting, this is not supported by research and rubber hose/piping toys as described below are probably a cheaper alternative although equally minimally advantageous in terms of improving pig welfare.

Figure 3 BiteRite® toys for a) weaners and b) fatteners

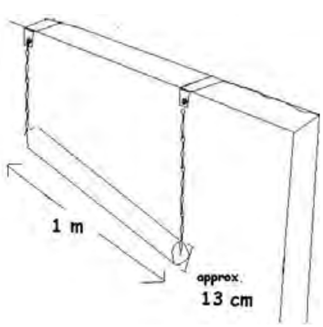


'Helicopter' toys

As the name suggests these toys are imitations of the rotor blades of a helicopter! Like the Bite Rite® they are suspended from the ceiling but unlike the BiteRite® they are much cheaper. The toys are typically constructed out of rigid plastic piping such as the alkathene water piping that is found on most pig farms and suspended by a chain. They are deemed as acceptable by Tesco and several Irish producers are currently using them. Typically these and BiteRite® toys provide less than 12% of the occupation time provided by straw bedding. Nevertheless they will be used to some extent by the pigs suggesting a definite value.

The nibbling beam

The nibbling beam is under intensive research in Switzerland as a viable enriching device for most classes of pigs. It consists of a beam or log of about 1m in length and 13 cm diameter suspended from the pen partition at either end by chains. The log is suspended diagonally so that the pigs do not have immediate access to the entire beam and can only access the upper section as they get bigger. Provided a soft wood is used the pigs are at no risk of acquiring splinters and apparently they chew the wood into a soft pulp that poses no risk to the manure system.



Environmental enrichment - why bother?

Undoubtedly environmental enrichment is a contentious issue. Unfortunately it is one that we have to contend with sooner rather than later. The Veterinary Inspectors (VI) charged with inspecting pig units in this country are themselves frequently inspected/evaluated by the FAO. The FAO visit Ireland on Country Profile Welfare Missions to evaluate levels of compliance with EU legislation.

Developing an economic and practical option for each individual unit is essential and will certainly require some innovative thinking. However, in addition to being economic and practical the enriching device or material chosen should also be functional! This means that the pigs should be seen to use it and it should sustain their interest in the long term. For this to happen the pigs need to be able to access the device or material in the first place. This is impossible if the device is too high, if there are not enough of the devices for the number of pigs in the pen or if there is simply not enough room for the pigs to access an enriching material. Ultimately there is some possibility of a return on investment through a reduction in tailbiting and aggression if the enriching device or material is actually used by the pigs!

BPEX

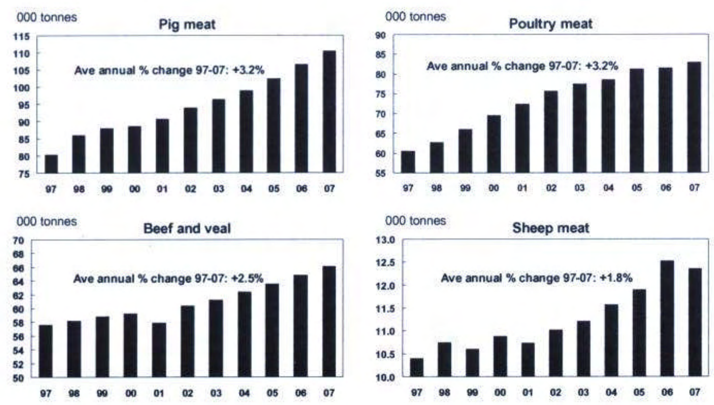
Pigmeat and Feed Market Outlook

2008 Pig Conference
Teagasc

Andrew Knowles
BPEX Strategy Co-ordinator

BPEX

Global Meat Consumption Trends



BPEX

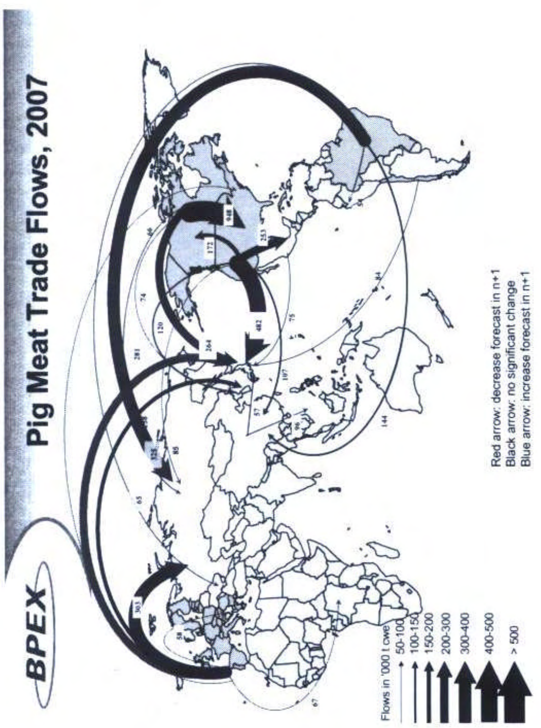
Global Overview (1)

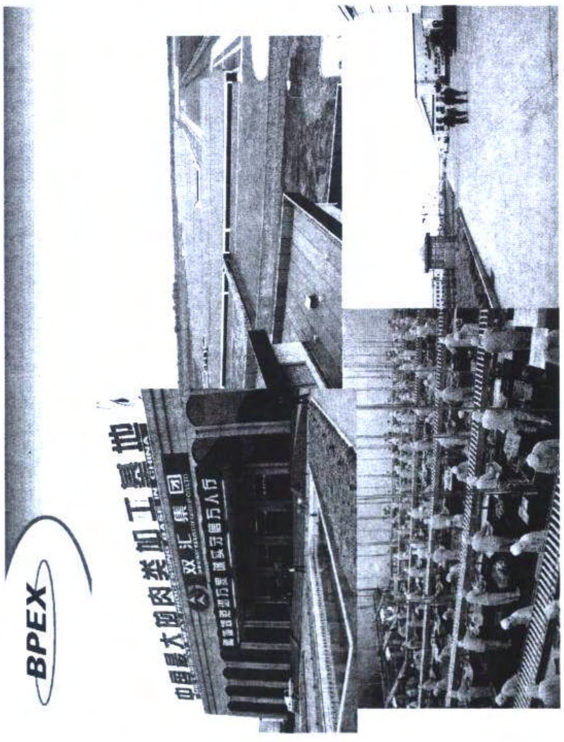
- World pigmeat production/consumption = 110m tonnes
- Pigmeat is world's most popular meat, followed by
  - Poultry meat 83m tonnes
  - Beef and veal 66m tonnes
  - Sheep meat 12m tonnes
- Largest producer/consumer = China = 55m tonnes (50% of world production)
- World pig meat consumption is growing by 3% a year

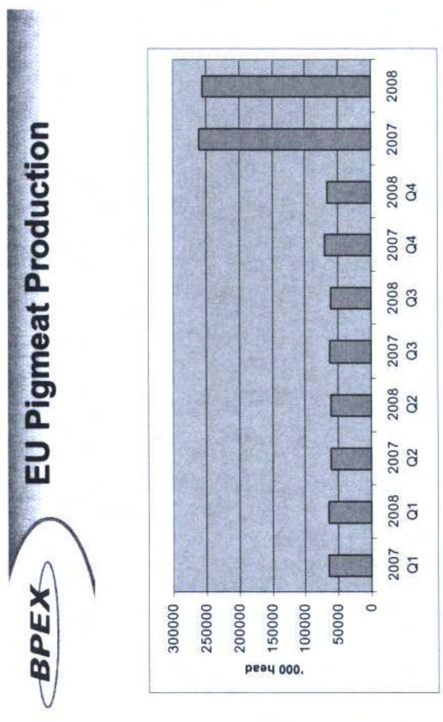
BPEX

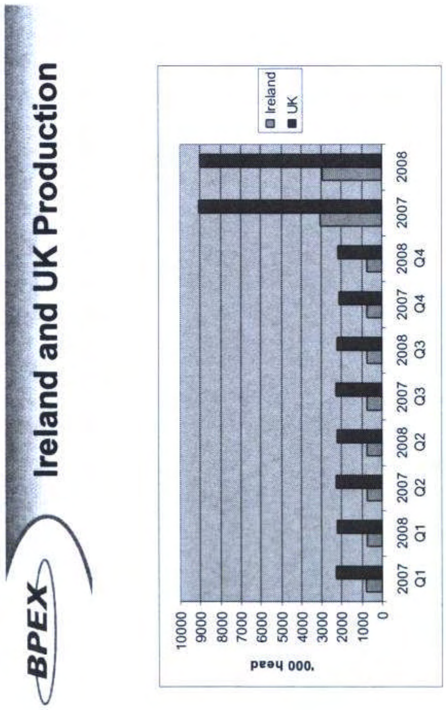
Global Overview (2)

- Consumption is growing most rapidly in the Far East
- Consumption has become fairly static in Europe
- World exports = 5.3m tonnes in 2008 = 5% of world production
- Largest exporters are United States, Canada and the EU
  - All roughly 1.3m tonnes in 2007. However..
  - United States only one growing at present
- Largest importer = Japan = approx 1.1m tonnes


BPEX
Pig Meat Trade Flows, 2007
Red arrow: decrease forecast in n+1
Black arrow: no significant change
Blue arrow: increase forecast in n+1
Flows in '000 t cwe
50-100
100-150
150-200
200-300
300-400
400-500
> 500

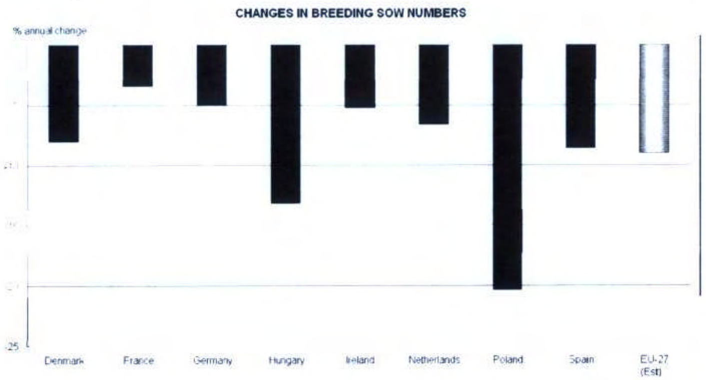

BPEX


BPEX
EU Pigmeat Production
'000 head
300000
250000
200000
150000
100000
50000
0
2007 Q1
2008 Q1
2007 Q2
2008 Q2
2007 Q3
2008 Q3
2007 Q4
2008 Q4
2007
2008


BPEX
Ireland and UK Production
'000 head
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
2007 Q1
2008 Q1
2007 Q2
2008 Q2
2007 Q3
2008 Q3
2007 Q4
2008 Q4
2007
2008
Ireland
UK

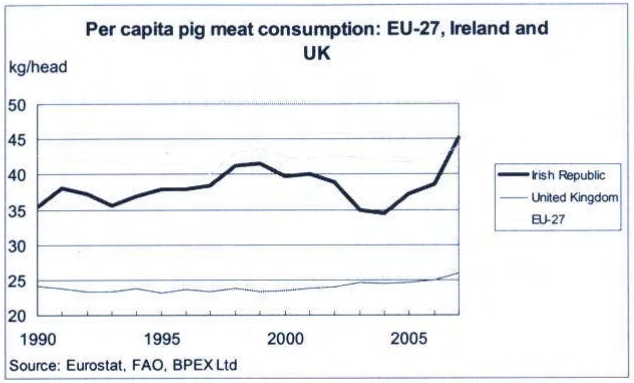
BPEX

EU Production forecasts – Breeding herd



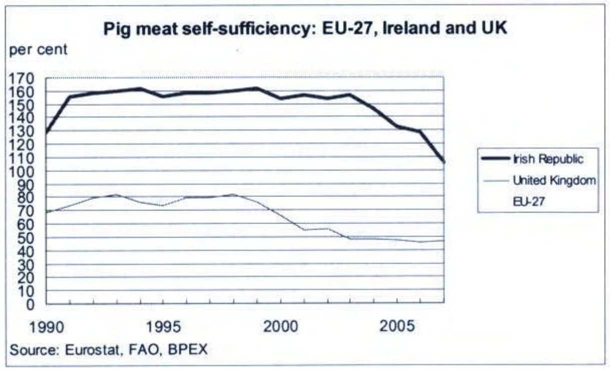
BPEX

Pig Meat Consumption



BPEX

Self-Sufficiency

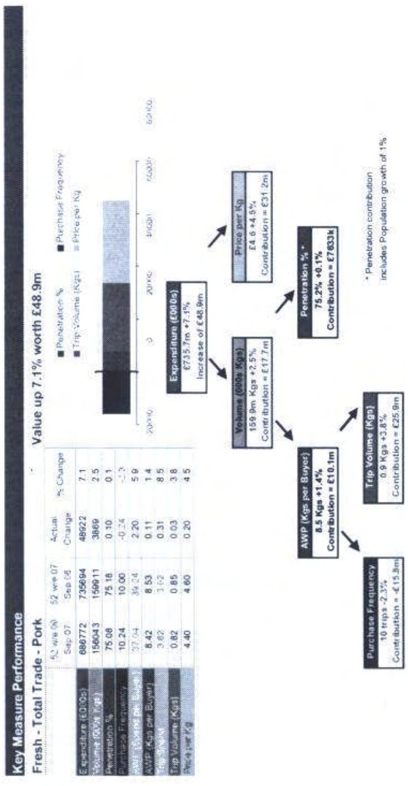


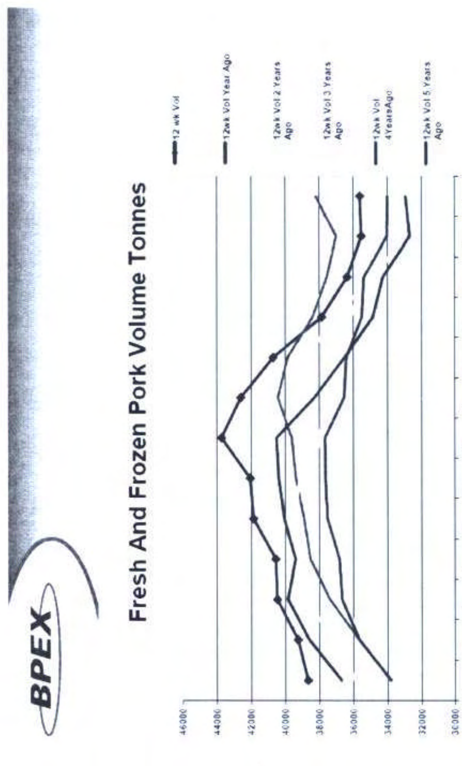
BPEX

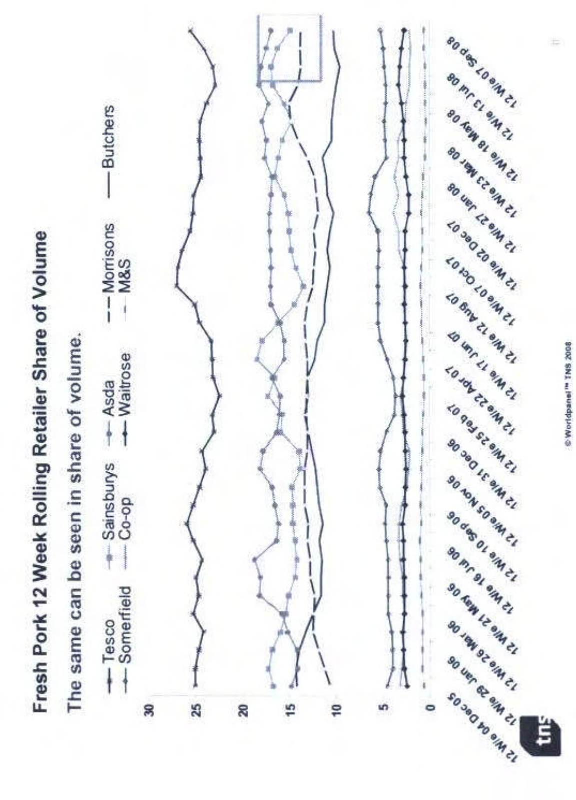
Supply

- TODAY
  - Feed prices increasing
  - Costs of production increasing
  - Finished pig prices increasing
  - Reduced clean pig kill
  - Plus
    - Continued negative net producer margins
- TOMORROW
  - Increased sow slaughterings
  - Decreased breeding herd
  - Plus
    - Carcase imbalance

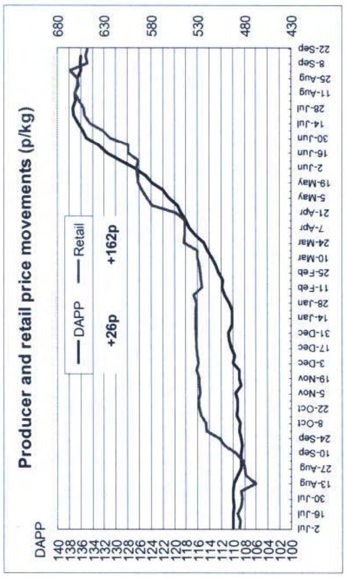

DAILY EXPRESS
Outrage as Muslims with several wives claim extra benefits
PRICE OF FOOD SOARS TO ALL-TIME RECORD
Weekly shopping bill goes up by £15
Daily Mail
FREE MILLS & BOON DVD
FOOD INFLATION SOARS TO 19%
Food prices increasing at fastest pace ever


Key Measure Performance
Fresh - Total Trade - Pork
Value up 7.1% worth £48.9m


BPEX
Fresh And Frozen Pork Volume Tonnes


Fresh Pork 12 Week Rolling Retailer Share of Volume
The same can be seen in share of volume.
Tesco
Somerfield
Sainsburys
Co-op
Asda
Waitrose
Morrisons
M&S
Butchers

BPEX



BPEX

Net Producer Margins in the UK

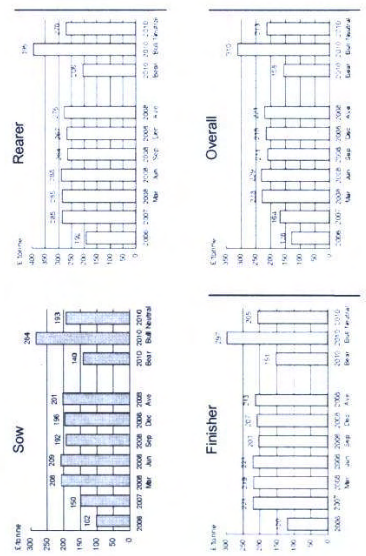
BPEX

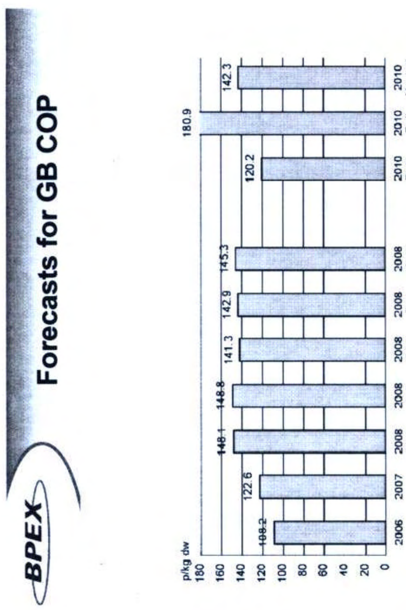
EU 27 Wheat Supply and Demand

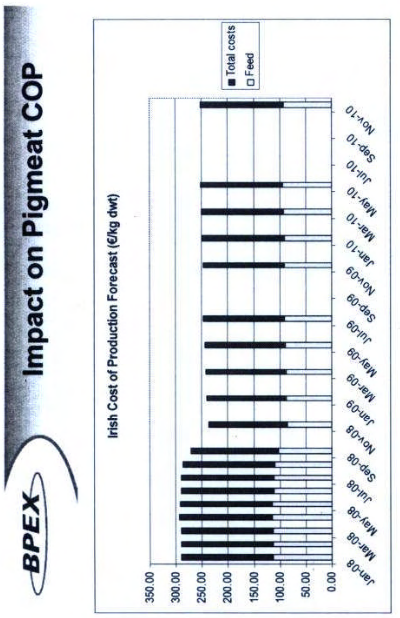
	2006/07	2007/08	2008/09	% change
Opening stocks	17.9	12.5	10.6	-15.2
Production	**117.2**	**111.7**	**137.6**	**23.2**
Imports	3.2	4.8	5.2	8.3
Domestic use	**115.3**	**109.3**	**123.7**	**13.2**
of which feed	53.9	48.1	59.2	23.1
human & industrial	54.7	54.4	57.5	5.7
Exports	10.4	9.2	15.4	67.7
Closing stocks	**12.5**	**10.6**	**14.3**	**34.9**

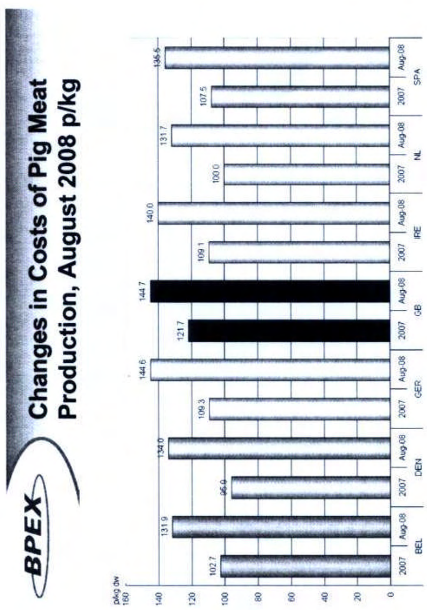
BPEX

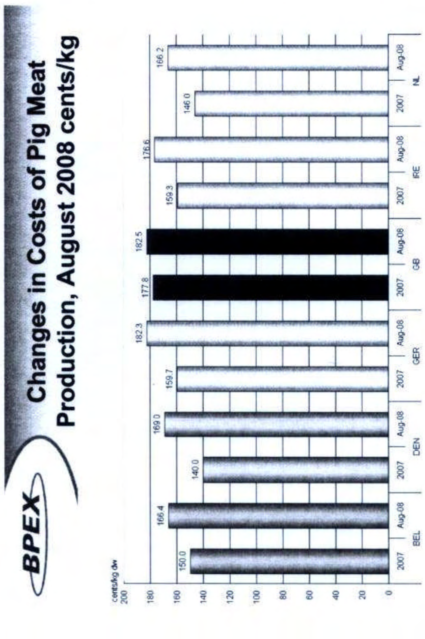
Forecasts for Feed Prices




BPEX
Forecasts for GB COP
p/kg dw
108.2
122.6
148.1
148.8
141.3
142.9
145.3
120.2
180.9
142.3
2006
2007
2008 Mar
2008 Jun
2008 Sep
2008 Dec
2008 Ave
2010 Bear
2010 Bull
2010 Neutral

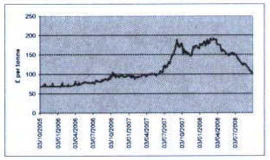

BPEX
Impact on Pigmeat COP
Irish Cost of Production Forecast (€/kg dwt)
Total costs
Feed
Jan-08
Mar-08
May-08
Jul-08
Sep-08
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
Jul-10
Sep-10
Nov-10


BPEX
Changes in Costs of Pig Meat Production, August 2008 p/kg
p/kg dw
102.7
131.9
95.9
134.0
109.3
144.6
121.7
144.7
109.1
140.0
100.0
131.7
107.5
135.5
BEL
DEN
GER
GB
IRE
NL
SPA

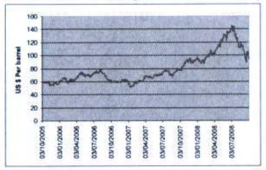

BPEX
Changes in Costs of Pig Meat Production, August 2008 cents/kg
cents/kg dw
150.0
166.4
140.0
169.0
159.7
182.3
177.8
182.5
159.3
176.6
146.0
166.2
BEL
DEN
GER
GB
IRE
NL

Commodity Volatility

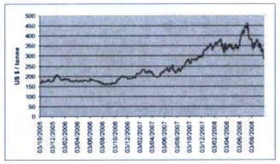
Wheat



Soya



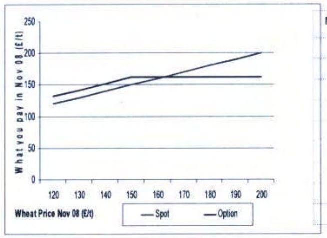
IPE Brent Crude Oil



Managing the Risk – Protect don't Predict

There are risk strategies that farmers can take, for example:

- Don't wait until the end of your contract to negotiate the next contract
- Buy a % of feed at different times, 25% of their feed every 3 months
- Use options?



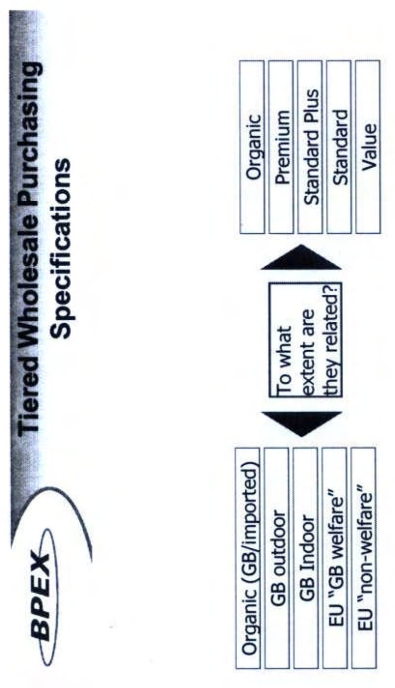
Nov Wheat Price	Spot	Option	Difference
120	60000	66000	-6000
130	65000	71000	-6000
140	70000	76000	-6000
150	75000	81000	-6000
160	80000	81000	-1000
170	85000	81000	4000
180	90000	81000	9000
190	95000	81000	14000
200	100000	81000	19000

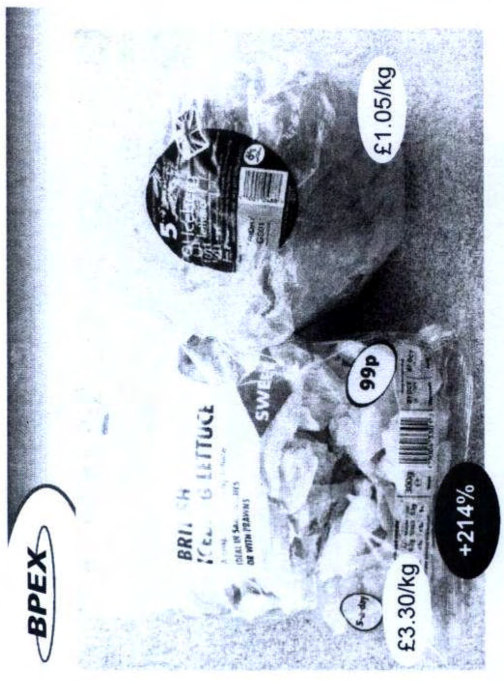
Retailer Tiering

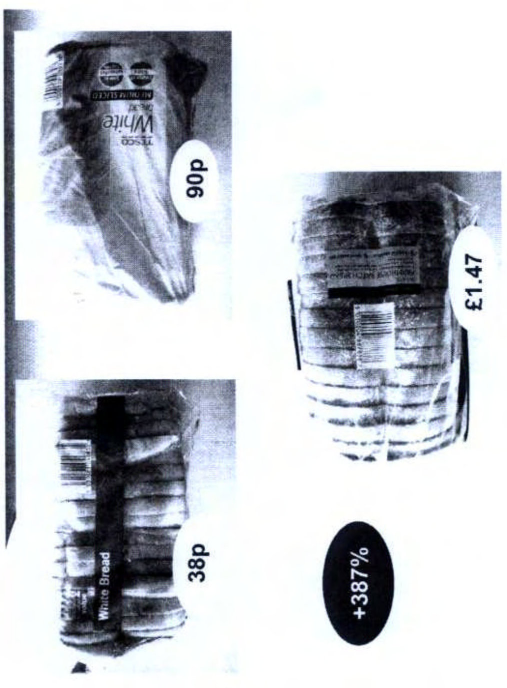
Tiering	Tesco	JS	Asda	Morrisons
Premium/ Super Premium	Finest	Taste the Difference/ TTD Jamie Oliver	Extra Special	The Best
Healthy	Healthy Living	Be Good to Yourself	Healthy Eating	Good for You
Organic	Organic	So Organic	Organics	Organic
Standard Plus	Specially Selected/ Willow Farm (for Chicken)			
Standard	Standard	Standard	Standard	Standard
Value	Value	Basics	Smart price	Fresh Choice

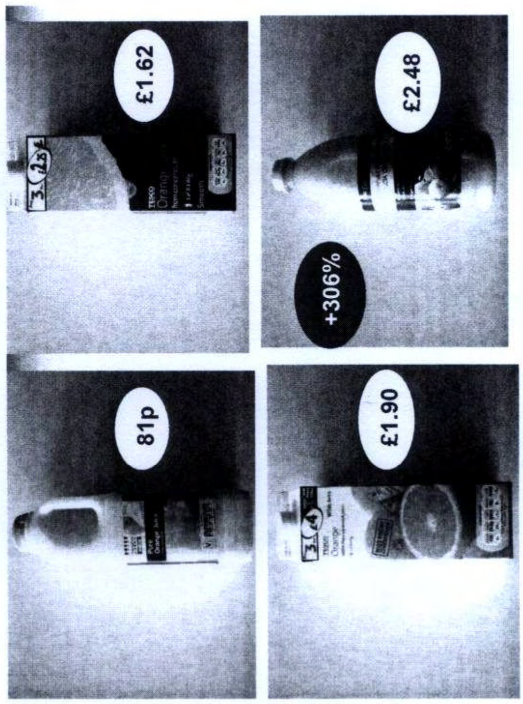
Fresh Pork Retailer Tiering (2)

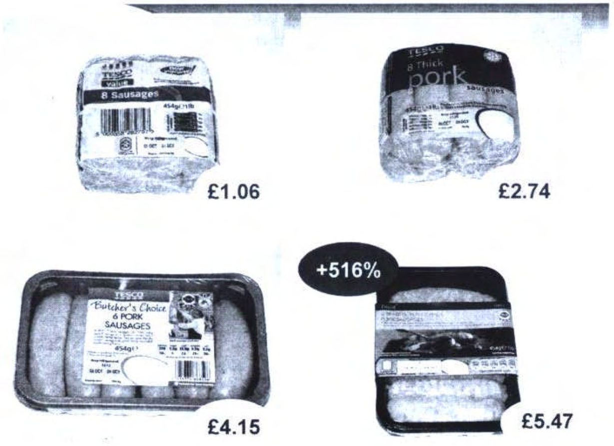
	Tesco	JS	Asda	Morrisons
Premium	Outdoor, extra matured, hand cut British QSM	Outdoor British QSM	Outdoor, extra matured British QSM	Outdoor British QSM
Standard Plus	Outdoor bred	-		
Standard British	British QSM	British QSM	British QSM	British QSM
Standard Imported	Dutch, Danish UK equivalent welfare	Dutch, Danish or German UK equivalent (?)	German, French UK equivalent(?)	German, Dutch, French, Irish UK equivalent(?)
Value – British	British QSM		British	
Value – Imported	Polish UK equivalent welfare (?)	Dutch, Danish or German UK equivalent(?)	French UK equivalent (?)	German, Dutch, French, Irish UK equivalent(?)


BPEX
Tiered Wholesale Purchasing Specifications
Organic (GB/imported)
GB outdoor
GB Indoor
EU "GB welfare"
EU "non-welfare"
To what extent are they related?
Organic
Premium
Standard Plus
Standard
Value

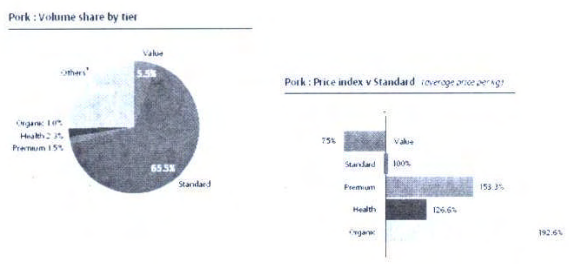

BPEX
£3.30/kg
+214%
99p
£1.05/kg


38p
White Bread
90p
£1.47
+387%


81p
£1.62
£1.90
£2.48
+306%



Retailer Tiering



Conclusions

- Global demand strong and still growing
- EU consumption relatively static
- EU production due to decline in 2008-10 due to herd contractions in 2007-08 following feed crisis
- If supply and demand theory applies then firming of EU prices in Q4 2008 and 2009
- Volatility in feed inputs the norm
- Need to get clever on protecting ourselves from the norm to avoid yoyo in COP

Pig production Research and Development in Teagasc

Brendan Lynch, Moorepark

B L Conf 2008 research 1

Teagasc pig services

- Research
- Advice
- Training

B L Conf 2008 research 2

Pig research programme – resources

- Four research scientists (1 contract)
- Four research technicians (1 contract)
- Six stockpersons
- Six graduate students
- 275 sow herd
- Ashtown Food Research Centre – meat
- Johnstown Castle – environment

B L Conf 2008 research 3

Research programme – collaborations

- Third level colleges (UCD, UCC, UL, QUB, WIT)
- Foreign universities (Royal Vet College, Purdue, Vienna)
- Other institutes (Hillsborough; INRA France)

B L Conf 2008 research 4

Research programme – what we do

- Nutrition and management
- Sow nutrition
- Health and welfare
- Food safety
- Environment
- Economics
- Contract

B L Conf 2008 research 5

Research projects 2006/2008

- Amino acid nutrition of growing pigs
- Feed intake of lactating sows *
- Feed intake in pregnancy and muscle growth
- Backfat in breeding gilts *
- Salmonella control
- P nutrition and bone strength *
- Manure processing *
- Energy from pig manure
- Behaviour of boar pigs
- Safety of novel feeds

* Research levy

B L Conf 2008 research 6

1

Contract research (may be confidential)

- Enzymes in feeds
- Probiotics
- Acids to replace zinc
- Starter feed formulations
- Feed additives
- New ingredients in feeds
- Using pigs to study human foods

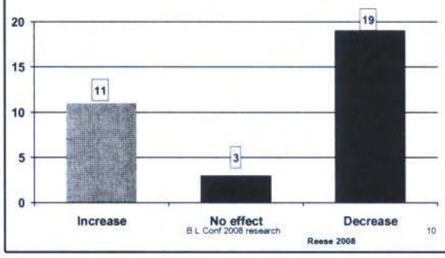
Teagasc pig programme – deciding priorites

- Current industry issues
- Input from Teagasc staff
- Input from pig industry advisory committee
- Prospects of success
- Available funding
- Available pigs, staff, houses

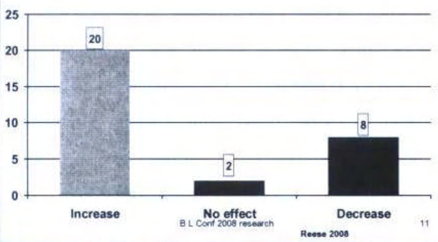
Is repetition of research a waste of resources ?

- *That has been done before !*
- *We know the answer !*
- *Often the answer is not clear*

Effect of dietary fibre on energy intake in pregnancy (no. trials)



Effect of fibre in pregnancy diet on energy intake in next lactation (no. trials)



Why do we get different results from apparently the same trial ?

- *Example may be explained by:*
  - *Type of fibre*
  - *Genotype*
  - *Feeding system*
  - *Feeding level*
  - *Body condition*
  - *Random variation*

2

Getting results to the industry

- Advisory committee
- Informal contacts
- Newsletter
- Conferences
- Local meetings
- Newspapers and magazines
- Radio & TV

Teagasc advisory service to pig producers

- PIGSYS
- Farm visits
- Objective business and technology advice
- Benchmarking herd performance
- Financial advice
- Planning assistance

Users of best technology reap the rewards !

- PigSys herds - 22.2 pigs/sow/yr (5 yr ave)
- National ave. - 20.7 pigs/sow/yr (5 yr ave)
- Value to the average 450 sow herd c. €25,000/yr

Training for the pig industry

- Shortage of skilled staff
- No training courses in agricultural colleges
- Need to train new entrants
- Upskilling of existing staff

New Training Initiative Proposed

- For existing staff
- Two year course
- Twenty one-day workshops
- Learn skills on unit
- FETAC qualification
- Will count towards more advanced qualifications
- Start Feb 2009 (if sufficient interest)

Training - What if staff leave ?

- *"The only thing worse than training an employee and having him leave, is not training him and having him stay"*

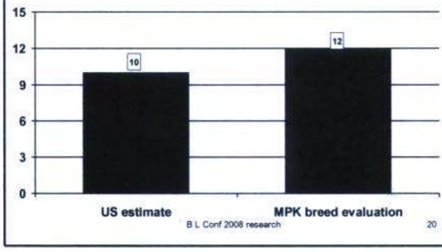
— Zig Ziglar, American author

Why invest in R&D

- "To-days investment in research drives tomorrow's growth in productivity"
  - *Fuglie and Heisey. (2007). USDA Economic Brief 10*

B L Conf 2008 research 19

Investment in R&D yields > 10:1 return



B L Conf 2008 research 20

How much should we spend on R&D?

- Developed world spent 2.4% of GAO in 2000 on publicly-funded agricultural R&D (Pardley et al, 2006)
- Ireland - Teagasc pig service 0.6%

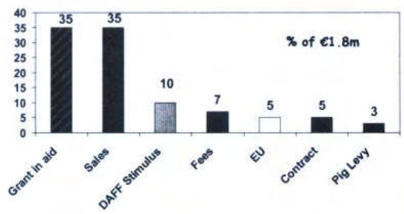
B L Conf 2008 research 21

Teagasc pig programme: Who pays?

- DAFF grant in aid
- EU Framework
- DAFF Stimulus and FIRM
- Pig sales
- Advisory fees
- Private firms
- Pig levy

B L Conf 2008 research 22

Sources of funding Teagasc Pig R&D programme 2008



B L Conf 2008 research 23

Worldwide - who pays?

- Government share of funds is falling
- Governments funding more "basic research"
- Industry is expected to pay bigger share for "near-market" research
- Examples:
  - Denmark
  - Australia
  - NZ
  - France
  - US
  - Canada

B L Conf 2008 research 24

4

Example: US Pork Industry Board

- Checkoff \$0.40 per \$100 sales (about €0.40 per pig)
- Budget 2007 \$60 million
- Spent on
  - US Pork Centre of Excellence €12 mill.
  - Promotion
  - Training
  - Advice

B L Conf 2008 research 25

Irish Pig Research Levy

- Current contribution 8.4c/pig
- Potential yield €250,000
- Teagasc share 2000-2007 = €47,000/yr (c. 20% of potential)

B L Conf 2008 research 26

New industry-funded research proposal

- Contribution 25c/pig
  - Potential yield €800,000
  - Agreed enhanced R&D programme
  - Upgrade research facilities
  - More applied research
  - More farm-based studies
  - Enhanced advisory/training service to contributors

B L Conf 2008 research 27

Basic or near-market research?

- "Near market" has immediate application e.g.
  - What lysine level to feed
  - What feeder / drinker to use
  - How much manure is produced
- Some near market research can be carried out on farms

B L Conf 2008 research 28

What is basic research ?

- "Basic research" has a long term objective e.g. several years
- Explains
  - How biological systems work
- Outputs of basic research
  - Scientific papers
  - Theses

B L Conf 2008 research 29

What is near-market research

- Putting knowledge to work
- Applies basic research to everyday problems
- Answers to-days questions
- Output of "Near market" research
  - Technical information
  - A basis for management decisions
  - Tips to improve productivity
  - Makes or saves money now

B L Conf 2008 research 30

5

Farm trials - how useful ?

- Advantages
  - Results apply to own unit
- Disadvantages
  - Can staff devote time to it ?
  - Would time be better spent elsewhere?
  - Is design right ?
  - Is interpretation correct ?
  - Is trial big enough ?
  - Can something else explain the difference?

B L Conf 2008 research 31

Where does Irish pig R& D go from here ?

- What does the industry need?
- What does the industry want?
- Industry must invest more and do so soon
- Otherwise there is danger of scale-down and slow death
- Then it will be too late …….

B L Conf 2008 research 32

Reports show concern about the decline of applied R&D

- Governments feel users should pay for near market research
- Increasing unit size in commercial agriculture
- In thriving economies, agriculture is smaller share of GDP/GNP
- Will 7,000 jobs in Irish pig industry be more appreciated in 2009?

B L Conf 2008 research 33

"The need for a new vision for UK agricultural R&D" - Report by Leaver 2008

- "The impact of government research policy on agricultural R&D has been a major erosion of infrastructure and expertise"
- "The loss of applied R&D removes an important element of innovation and the ability to exploit advances in basic scientific knowledge into practice"

Report for Commercial Farmers Group by David Leaver

B L Conf 2008 research 34

"R&D decline is a threat to future" - Tim Rymer, JSR Genetics

- "Current levels of R&D in agriculture give it the appearance of another sunset industry in the UK destined to go the same way as mining, textiles and manufacturing"

Weekly Tribune August 18, 2008

B L Conf 2008 research 35

Conclusions

- R&D spending is an investment in the future
- Industry must invest more in near-market research
- Rate of return on investment is high - over 10:1
- Technology transfer is critical to gaining this return
- Research is worthwhile only if results are used

B L Conf 2008 research 36

6

Pig Manure –
An Asset to be Managed

Gerard McCutcheon and Brendan Lynch

What does manure transport cost you?

Transport cost depends on:

- Distance
- Type of vehicle
- Size of load
- Volume to be transported
- Turnaround time

For tractor and vacuum tank assume:

- Load size - 2600 gal (11.8m³)
- Loading time - 6 minutes
- Travel speed 20 to 25 km/hour
- Return speed 5km/hour faster
- Cost €40/hour
- Spreading time is twice loading time

Tractor and Tanker to Transport Manure

The further you go the more expensive ...

Distance Km (miles)	Transport Cost €/m³
10 (6.2)	3.71
20 (12.5)	5.93
30 (18.6)	7.99

Tractor and Tanker to Transport Manure

Value of pig manure nutrients at current prices

	4.2kg N	0.8kg P	1.9 kg K
% Available	40	100	100
€/kg	1.21	3.99	1.32
Value	2.03	3.19	2.51

Composition as in SI 378

Total = €7.73/m³ or €35 /1000 gallons

Above 30 km (18.8 miles) the cost of transport exceeds the value of nutrients

Tractor and Tanker to Transport Manure

Example: Truck (27 m³ or 5940 gallons)

Loading time 15 minutes

Travel speed 45 to 55 km/hour

Return speed 5 km faster

Hire cost of truck €72/hour

Unloading time is equal to loading time

Add cost of spreading €2 per m³

Truck to Transport Manure

Distance km (Miles)	Haulage Cost (€/M³)
30 (18.6)	6.21
40 (25)	7.00
50 (31.3)	7.73

* Value = €7.73/m³

Truck toTransport Manure

		Distance above which transport cost exceeds nutrient value	
Dry Matter %	Value €/M3	Tractor and tanker	Truck + tractor spreader
3	5.40	9 miles	16 miles
4	7.19	16 miles	25 miles
5	8.99	25 miles	31 miles
6	10.79	31 miles	63 miles

Separation into solid and liquid fractions

Decanter Centrifuge for 500 sow unit producing 10,000 m³ manure/year

Manure Separation

Cost of Centrifuge	=	€125,000
Storage shed for solid	=	€100,000
Liquid Storage (6 mths)	=	€270,000
		€495,000
Depreciation cost	=	€3.10/m³
Interest Cost	=	€1.97/m3
		€5.07/m3

Manure Separation

Cost of Manure Separation	€/M³
Investment Cost	5.07
ESB	1.50
Labour	1.00
Chemicals	2.00
Repair & Maintenance	0.38
Sub Total	9.95

Total Cost of Separation	
Sub-tot. carried fwd.	9.95
Transport	
Solid (100km)	2.25
Liquid (5km)	2.70
Sub Total	4.95

Overall Total €14.90/M³ treated

Overall Total €14.90/M³ treated

= Transport cost of untreated manure with truck c. 150km (94m)

Conclusion

- Treatment of manure has high costs
- Needs to be properly assessed

Summary

- Pig Manure – Associated Costs
- Aim to reduce volume on site
- Reduce water getting into pig manure
- Examine
  - Water: meal ratios
  - Leaking pipes, nipples
  - Roof water etc

Appendix 1: Pig Manure Separation

Various types of separator are available to separate pig manure in the form of slurry into two fractions:

1. Solids with a dry matter content of about 30% (range 15 to 35%)
2. Liquid with a dry matter content of about 1%

The actual composition of both the solid and liquid fractions will depend on the type of separator used. The decanter centrifuge is considered to give the highest degree of separation among conventional manure separators. Most of the Phosphorus (P) from the manure will be separated into the solids material (80-85%) whereas only about 20% of the Nitrogen will be in the solids and about 80% will be in the liquid.

To obtain really good separation it is necessary to add chemicals in a water-solution thereby adding to the cost and also adding 10 to 20% to the volume.

500 sow unit producing 10,000 m^3 pig manure per year at 4.3% solids

Separation Scenario : Install a decanter centrifuge with ancillary facilities

Cost Item	Details	Cost per m³ €
Decanter Centrifuge	Cost €125,000	
	Depreciated over 10 years	1.25
	Average interest @7% Repayment €139 per year per €1,000 loan	0.50
Operating Cost	Electricity	1.50
Labour		1.00
Chemicals	Conditioner and Flocculent	2.00
Repairs and maintenance	€3,000 per year = 3% of initial cost	0.38
Transport of solid fraction	100 km Includes loading but not spreading	 2.25
Spreading of liquid fraction	Average distance 5km	2.70
Additional Storage facilities	Solids fraction € 240per m^2 covered shed 11 months storage: 30kg manure dry matter per m^3 100kg per m3 at 30% dry matter 1000 tonnes capacity $0.77m^3$ per tonne 1.8m high :$428m^2$ →Total cost €100,000 Depreciation 20 years Interest 10 year loan @7%	 0.50 0.39
	Liquid fraction €40-75 per m^3 €60 per m^3 : 20 years 50% storage Total cost €270,000 Depreciation Interest 10 year loan @7%	 1.35 1.08
TOTAL		**14.90**

Appendix 2. Factors affecting manure DM:

Low manure DM content is caused by dilution with water. This may be as a result of extraneous water being diverted into the slurry storage or other factors that may be controlled by the pig unit manager. Good management of storage tanks and building equipment is crucial. E.g. water nipples should be repaired promptly.. Clean roof water should be diverted to a soak hole/ open drain away from any source of pollution rather than into manure tanks.

Water to meal ratios should be reduced wherever possible. Research work showed that the water to meal ratio (2:1, vs 3:1, vs 4:1) had a significant effect on the dry matter content of manure (O'Connell – Motherway, 1997) while it did not appear to affect pig performance. Measurements at Hillsborough (1993) showed a water consumption of 1.9 litres/kg of feed eaten when the only supply is the nipple in the single-space feeder. The popularity of these feeders grew in Holland because they minimise water spillage and reduced manure production. O'Connell – Motherway (1997) calculated that if pig producers reduced the water: feed ratio 3:1 to 2:1 there would be approximately a 40% reduction in the volume of manure produced and a 45% increase in the DM content.

Other factors which affect the dry matter content would include such factors as nutrient digestibilities in the pig rations, collection of roof water, protein levels, salt levels in the diet and the level or power washing on the unit. All of these factors can be influenced by good management in order to keep the dilution of slurry minimum.

Table 1: Effect of manure dry matter content on volume and value per m^3.

Dry Matter Content %	Volume Produced per sow per year (m^3)	Value €/m^3
3	28.73	5.40
4	21.55	7.19
5	17.24	8.99
6	14.36	10.79

Based on 21 pigs sold/sow/year at a carcase weight of 75kg and carcase FCE of 3.7

Conclusion:

It makes sense to reduce the volumes of pig manure being produced in Irish pig farms. In Holland they aim for a manure with DM content of 10-12%. In Ireland we need to start to focus on improving our overall management in order to improve the overall quality and reduce the volumes being produced. Low quality pig manure is of little value.

Time to Review

Ciaran Carroll, Teagasc Moorepark

How well will you use the information you receive here today? The aim of this conference is to provide clear, relevant and practical information which you can use to improve the profitability of your unit. Each paper has a "take home" message. Sometimes the message can be missed, lost or just ignored. With this in mind I propose to review some of the papers from the last few pig conferences. The aim is to refresh your memory and refocus your thoughts on messages that you may have missed or ignored the first time. The areas which will be covered include:

- Gilt Management for Sow Longevity
- Controlling Manure Volumes
- Mycotoxins in Feed
- Keeping Accurate Records

Gilt Management for Sow Longevity

This subject has been discussed at several conferences. While the message has been received and acted upon by some, many units could do better. Boyle (1996) reported that 32% of sows are culled before they reach their third parity. Martin (2001) presented the further worrying statistic that 13% of gilts were removed before they had even one litter. To cover replacement costs they must survive three to four parities. How do we ensure that they do?

- Establish and implement a "Gilt Rearing" programme on your unit
- This will ensure a continuous supply from an adequate gilt pool (12-15% of herd size)
- Use only dam lines
- Select from large litters with a history of low born dead
- Avoid selecting from litters with a high boar:gilt ratio and litters that have been cross-fostered as this can delay the age of puberty
- Select from sows with a good temperament, ample milk production and which wean heavy litters
- Select gilts of good comformation, structural soundness, good movement, even toes and a good underline (6 well spaced functional nipples per side)
- Provide adequate space ($1.4m^2$) and light (300 lux for 16 hours per day)

- Feed a gilt diet (13.5 MJDE/kg, 0.75% lysine). Target a P2 backfat of 17mm at breeding (about 145-155 days of age)
- Cull gilts with suspect legs and conformation, and slow responders
- Induce early puberty (boar stimulation) as these gilts will be more fertile
- Use a mature boar with good libido and provide nose-to-nose contact. Twice per day exposure of 10-15 minutes for small groups of 8-10 gilts up to 30 minutes for larger groups up to 20 gilts.
- Feed boars prior to exposure. Use of a vasectomised boar will increase conception rate and litter size
- Where gilts have been restrict fed to slow down growth they should be flush fed for two weeks prior to breeding
- Serve on second heat
- Reduce feed levels to 1.8 to 2kg per day from service until 12 days post service. Target P2 backfat of 19mm at farrowing

Controlling Manure Volumes

The cost of storing and transporting pig manure has increased significantly over the last few years. This has forced us to think of ways to reduce these costs. Reducing the volume produced is the aim. Controlling and reducing the use of water on our unit is one such way of achieving this. It will also increase the dry matter content of the manure which will increase it's fertiliser value. In the current climate of rising chemical fertiliser prices it makes even more sense to do so. Pig manure (4.3% D.M.) has a fertiliser value of €7.70 per m^3 (€35 per 1000 gallons) at present. How can we reduce manure volumes?

- Water Intake: the greater the intake, the greater the volume of manure produced. Focus on reducing the volume of water fed to pigs (while obviously safe guarding the welfare of the pig). Pay particular attention to finisher pigs as they have the greatest influence on manure volume produced. Can water:meal ratios be reduced on your unit?
- Wet Feed Systems: mono (screw) pumps can pump a thicker mix than centrifugal pumps. Consider the length of the feed circuit, the number of bends and the type of trough used (long troughs require a more dilute mix)
- Dry Feeding: wet/dry feeders reduce water disappearance. Waste is also reduced by 10-15%
- Drinkers: be selective. Bowl drinkers are generally better. They have shown a 15% reduction in water use and a 30% reduction in water waste compared to bite drinkers

- Water Leakage: early detection and repair is essential. A 0.5 litre per minute leak results in 720 litres per day or $5m^3$ (1,100 gallons) per week. Use a water meter to detect leaks and monitor use.
- Washing: pre-soaking pens can reduce washing time by 40%. Operate pre-soaking sprinklers on a timer switch to reduce water use.

Myctoxins

Mycotoxins are toxic metabolites of fungi growing on cereal grains that are produced during growth, harvest, transport or storage. They affect 25% of world crops and can result in increased disease, reduced productivity and reproductive performance and incur worldwide losses of over €100 million per year. Tillage specialists have reported a high level of fusarium mould on cereals this year.

With the wet harvest that we've had, this is a year when increased problems could occur. Prevention is better than cure.

- Purchase good quality ingredients from a reputable supplier
- Clean grain and store at low moisture content (14%)
- Use a mould inhibitor or mycotoxin adsorbent
- Cool feed before storage when pelleted
- Empty bins regularly (at least twice per year). Work from the top of the bin downwards, powerwash and allow to drip-dry. Ensure the bin is completely dry before putting new feed in
- Examine feed for signs of mould and infestations: musty smell, rise in temperature, feed flowing unevenly

Keeping Accurate Records

We use records to measure herd performance, highlight problems (which allows prompt action) and to quantify production costs. They are useful when planning expansions or renovations, or when implementing management changes on a unit. As many of us have seen over the last 18 months records can prove invaluable when putting together a cash flow to try secure funding from your lending agency.

To get the complete picture we must know our true production costs. This requires recording all non-feed costs. While there have been improvements in this since it was discussed at the 2006 conference (see table below) there is still room for improvement.

Number and Percentage of units recording various items on PigSys

Item	% Units Recording Data 2005 (out of Total 85)	% Units Recording Data 2007 (out of Total 77)	% Improvement
Productivity Data	100	100	0
Feed Costs	88	85	-3
Common Costs			
Healthcare	58	70	12
Heat/Power/Light	61	71	10
Transport	47	44	-3
A.I.	74	76	2
Manure	47	55	8
Miscellaneous	59	65	6
Labour/Management	55	53	-2
Repair	59	67	8
Phone/Office	46	46	0
Environment	21	30	9
Insurance	40	65	25
Stock Depreciation	55	87	32
Herd Specific Costs			
Interest	25	24	-1
Building Depreciation	46	43	-3

This table shows an improvement in the percentage units recording non-feed costs from 49.5% in 2005 to 57% in 2007. However, it still indicates that 43% of units recording still don't know their true production costs. The benefits are evident. O'Connell (2006) showed and accumulated saving of almost €53,000 for a 500 sow integrated unit keeping accurate regular PigSys Analysis records.

Take Home Message

This is just a brief summary of some recent conference papers. Consider the points raised on each topic and see whether or not they have been applied on your unit. If not, why not? Now is a good time to refresh and refocus!

Going for Growth Rate

Michael A. Martin, Specialist Pig Development Officer, Athenry

Measuring Growth Rate

In the absence of the routine and accurate weighing of pigs at transfer between the different growth stages one single measure of growth from weaning to sale is the only reasonably reliable indicator of pig performance. In 2007 in PigSys recorded herds the Average Daily Gain from Weaning to Sale was 620g (Table 1).

Table 1: Growing Pig Performance in PigSys Recorded Herds 2007

	All Herds	***Top 25% of Herds***
Number of Herds	70	18
Average Weaning Weight kg	6.9	7
Average Live Weight at Sale kg	98.6	102.8
Daily feed intake g	1487	1544
Average Daily Gain g	620	668
Feed Conversion	2.41	2.31

Source: Teagasc PigSys Report 2007

The growth rates in 2007 were substantially higher than for the previous decade. During this period the average was a consistent 594g per day despite increasing sale weights.

The average Growth Rate for all of these herds conceals wide differences between herds. This is illustrated by comparing the average of all herds with the average of the top 25% herds selected on the basis of growth rate (Table 1). This means that from 7kg pigs in the Top 25% herds reach 100 kg in 139 days compared to 150 days for the average of all herds.

International Comparison

Comparing growth rates for pigs in Ireland with that reported for other countries (Table 2) is complicated by differences in slaughter weights.

Slaughter weights in continental Europe are 17-22 kg higher than in Ireland with the exception of Denmark which is about 7-8 kg higher. However, all of these countries use castrates rather than entire males. Castrates will grow more slowly than entire males over the same weight range.

Table 2: Pig Growth Rates in Different Countries 2006

Country	*Growth Rate Weaning to Sale g*	*Average Live Weight at Sale kg*
Ireland	600	97.4
Great Britain	595	98.2
Denmark	690	105.3
France	673	115.5
Netherlands	629	114.2
Germany	647	119.0
Sweden	736	115.6

Source: From InterPig 2006

Financial

The benefits of increased growth rates are maximised when the producer is allowed to take pigs to heavier weights. An improvement of 25g per day in growth rate from weaning to sale over a 140 day growing period amounts to 3.5 kg higher live weight at sale. This would be expected to translate into an extra 2.8kg dead weight based on a kill out of 80% on the added live weight. The additional cost associated with this extra weight is the cost of feed. Based on a Feed Conversion of 3.0 for this extra weight an extra 10.5 kg of feed is required per pig (Table 3).

On units where an increase in the average live weight at sale is not possible due to the level of penalty imposed on overweight pigs the benefit of increased growth rate is, primarily, in the reduction in the number of pigs on the unit. An increase from 620 to 645 of 25 g per day from 7 to 100 kg reduces the number of days from 150 to 144. This means a reduction of 37 pigs on the unit per 100 sows. This results in about €4,200 less tied up in stock on the unit – reduced working capital.

Growth Rate and Feed Conversion

Sometimes, when reference is made to the benefits of improved growth rates, this is taken to mean improved Feed Conversion Efficiency as well.

The effect of improved growth rates on Feed Conversion will be determined by the combined effect of a number of different factors:

1. Reduced maintenance requirement. The pig spends fewer days on the unit and as a result the maintenance requirement is a lower proportion of the total feed used

2. Composition of the extra growth (the ratio of lean to fat deposited). About 15MJ of Digestible Energy are required per kg of lean tissue growth while 50 MJ DE are required per kg of fat tissue

The overall effect of increased growth rate on Feed Conversion is likely to be slightly very beneficial. An improvement of 10% in growth rate can be expected to result in a 7-8% improvement in feed efficiency. However, this is not to be confused with a situation where growth rate is improved without any increase in daily feed allowance.

Table 3: Calculating the Financial Benefit of Increased Growth Rate

Factor	Assumptions	Kg	€
Increased Growth Rate g/day	25		
Number of Days	140		
Increased Live Weight kg		3.5	
Kill Out %	80		
Increased Dead Weight kg		2.8	
Finisher Price per kg Dead c	150		
Value of Extra Weight €			4.20
Feed Conversion on Extra Weight	3.2		
Extra feed Per Pig kg		11.2	
Feed Price per Tonne €	250		
Additional feed cost per pig €			2.80
Margin Over Feed per Pig €			1.40

Table 4: Comparison of Pig Performance 7-100kg

Daily Feed Intake g	1500	1500
Average Daily Gain g	600	625
Feed Conversion	2.5	2.4
Feed per Pig kg	232.5	223.2

Based on a feed price of €250 per tonne this improvement in Feed Conversion reduces the feed cost by €2.33 per pig

Growth Rate Variation

The average growth rate for a unit conceals often very wide variation between the growth rates of the different pigs. Differences in birth weights between pigs are likely to have increased by weaning and to increase still further by the time pigs reach slaughter weight.

A high level of variation in growth rates within a unit is likely to be a major contributory factor to depressing the overall average growth rate. This variation in weight within a group of pigs can be expressed as the **Standard Deviation** or as the **Coefficient of Variation.**

Table 5: Measured Variation in a Group of Pigs of the Same Age

Number of Pigs	632
Live Weights kg	
Average	103.72
Minimum	74.4
Maximum	124.9
Weight Variation kg	
Range	50.5
Standard Deviation	8.31
Coefficient of Variation %	8.02

Source: Patience et al 2004

Standard Deviation: This is a measure of the spread in live weights. The greater the variation in weight of a group of pigs, the larger will be the standard variation.
About two thirds (68.3%) of pigs weighed in Table 5 were between 95.4 and 112.0 kg (432 pigs).

Coefficient of Variation: This is calculated by dividing the Standard Deviation by the Average or Mean and multiplying by 100.

In Table 5 this is (8.31/103.72*100) = 8.02%

A Coefficient of Variation of less than about 12% at slaughter weight is considered to be acceptable. This would translate to over two thirds of pigs at about 165 days of age falling within the weight range 88-112 kg

The wide range in acceptable pig slaughter weights in Irish slaughter plants means that growth rate variation has been less of an issue than it would be where pigs are sold to a narrower weight specification (Table 6)

Table 6: Weight Specification at Irish Pig Slaughter Plants

	Minimum	Maximum 1	Maximum 2
Dead Weight kg	55	85	90
Approximate Kill Out %	74	76	76.3
Live Weight kg	75	112	118

Reducing the weight specification range would mean that the slow growing pigs would spend longer on the unit and therefore be older at slaughter. The inevitable consequence of this is an increase in boar taint and especially in taint due to androstenone. Alternatively, the number of slow growing pigs and the extent of this reduced growth needs to be minimised.

Reasons for Low Growth Rate Pigs

Average Daily Feed Intake is a key factor influencing Average Daily Gain. When growth rates are below target the reason why all or particularly some pigs have reduced feed intakes and low growth rates need to be investigated.

There are genetic differences between pigs which explain some of the variation seen in growth rates. Differences in birth weights are important. The smallest 20% of pigs at birth grow significantly more slowly after weaning and are responsible for a majority of the variation in pig weight at various ages after weaning (Schinckel et al 2004).

A variety of environmental and management factors exert a major influence. Among the factors to be considered are:

1. Pig Health: Chronic stimulation of the pigs' immune system depresses both daily feed intake and daily gain (Table 7).

2. Stocking Rate: This is defined as the unobstructed floor area per pig. The optimum floor area per pig in terms of pig performance (Table 8) must not be confused with the minimum floor area requirements set down in for welfare purposes (European Communities (Welfare of Farmed Animals) Regulations 2008). While group size

among other factors need to be taken into account the following guidelines are proposed

Table 7: Impact of chronic immune stimulation on pig performance 6-113 kg live weight

Immune Stimulation	Low	High
Daily Feed Intake g	2296	2066
Average Daily Gain g	850	677
Feed Conversion	2.70	3.05

Source: Stahly 1998

Table 8: Recommended Floor Area per Pig

Pig Weight kg	M^2	Ft^2
15	0.2	2.15
35	0.325	3.5
60	0.55	6
100	0.75	8

3. Feed Access: In the absence of ad libitum feeding some degree of feed restriction will apply. Within a pen this will be greater for pigs at the lower end of the social order. Even with ad libitum feeding there may be too many pigs per feeder place resulting in reduced intake by some of the lower ranking pigs. The rate of feed flow from the feeder needs to be adjusted so that the pig's feed intake is not restricted.

4. Regrouping: Fighting is associated with the mixing of pigs from different pens as a new social or "peck " order is established and a consequent1al reduction occurs in pig performance. Once the social order is established the more dominant pigs will have priority in regard to essential requirements such as feed, water and lying space. Avoid mixing pigs.

5. Recovery Pens: Individual pigs that fail to thrive and do not respond immediately to the appropriate veterinary treatment must be moved promptly to suitable recovery pens and receive special feeding and attention. Terminally ill and severely injured pigs must be euthanased humanely.

6. Diet: If feed quality is below standard a negative effect on growth can be expected. However, the use of higher specification diets in an attempt to improve growth rates can only be justified if it is cost-beneficial to do so.

Growth Rate Targets

A well managed herd with a reasonably good health status should be capable of achieving the following targets (Table 9).

Table 9: <u>Minimum</u> Pig Growth Rate Targets

<table>
<tr><th rowspan="2">Stage</th><th rowspan="2">Age – days</th><th rowspan="2">Weight Kg</th><th colspan="3">Average Daily Gain g</th></tr>
<tr><th>Stage</th><th>Combined</th><th>Overall</th></tr>
<tr><td>Weaning</td><td>26</td><td>7.5</td><td rowspan="2">350</td><td rowspan="3">490</td><td rowspan="4">650</td></tr>
<tr><td>First Stage</td><td>52</td><td>16.6</td></tr>
<tr><td>Second Stage</td><td>80</td><td>34</td><td>620</td></tr>
<tr><td>Finisher</td><td>168</td><td>100</td><td>750</td><td></td></tr>
</table>

Conclusion

Growth rate is a very important factor in improving pig profitability especially when there is scope to take pigs to a heavier slaughter weight. A high growth rate is closely associated with good feed efficiency. There is considerable potential on many units to improve growth rates by dealing effectively with the slow growing pigs. The challenge is to minimise if not eliminate these as they significantly overall average growth rates. Managing the unit to do this will bring substantial financial rewards.

Antibiotics – the what, why, which !

Michael McKeon, Teagasc Tullamore

Antibiotics play an important role in the treatment of bacterial infection in humans and animals. It is important that antibiotics are used in the correct way to ensure that they continue to be effective in the years to come. In today's pig industry, producers must be aware as to what exactly they are treating their animals with and what they are treating their animals for.

A good understanding of what they are, how they work, where and when one uses them and why they are used will ensure that they produce the greatest therapeutic and financial benefit.

What's an antibiotic?

An antibiotic is an antimicrobial that can be defined as a compound which inhibits the growth or kills microorganisms. Antimicrobials can be produced by fungi or bacteria (e.g. Streptomyces) or produced synthetically e.g. Sulfas, Quinolones.

Antibiotic tabs inhibiting bacterial growth on agar plate

Antibiotics are generally grouped together according to their mode of action and their spectrum of activity. There are five different modes of actions:

1. Inhibition of ribosomal protein synthesis
2. Inhibition of DNA replication
3. Alteration of metabolism
4. Disruption of cell membrane function
5. Disruption of cell wall synthesis

In addition, antibiotics may have either a broad or narrow spectrum of activity. A **broad spectrum antibiotic** is effective against gram positive and gram negative bacteria whereas a **narrow spectrum** one is only active against a limited or specific type of bacteria. The table below shows the antibiotic class for some commonly used commercial antibiotics.

Table 1. Antibiotic class for some commonly used antibiotics

Commercial name	Antibiotic class	Mode of action =Interferes with
Aivlosin	Macrolides	Ribosomal protein synthesis
Alamycin	Tetracyclines	Ribosomal protein synthesis
Baytril	Quinolones	DNA replication
Betamox	Penicillin	Cell wall synthesis
Bimoxyl	Penicillin	Cell wall synthesis
Devomycin	Aminoglycosides	Ribosomal protein synthesis
Crystapen	Penicillin	Cell wall synthesis
CTC	Tetracyclines	Ribosomal protein synthesis
Depocillin	Penicillin	Cell wall synthesis
Engemycin	Tetracyclines	Ribosomal protein synthesis
Enroxil	Quinolones	DNA replication
Excenel	Cephalosporins	Cell wall synthesis
Hostamox	Penicillin	Cell wall synthesis
Lincocin	Lincosamides	Riibosomal protein synthesis
Marbocyl	Quinolones	DNA replication
Naxcel	Cephalosporins	Cell wall synthesis
Noribritten	Penicillin	Cell wall synthesis
Norodine	Sulfas	Cell metabolism
Nuflor	Chloramphenicol	Ribosomal protein synthesis
Pen V	Penicillin	Cell wall synthesis
Potencil	Penicillin	Cell wall synthesis
Spectram	Spectinomycin	Ribosomal protein synthesis
Streptomycin	Aminoglycosides	Ribosomal protein synthesis
Sulfoprim	Sulfas	Cell metabolism
Tiamutin	Tiamulin	Metabolism
Tetroxy	Tetracyclines	Ribosomal protein synthesis
Tylan	Macrolides	Ribosomal protein synthesis
Tyloject	Macrolides	Ribosomal protein synthesis
Ultrapen	Penicillin	Cell wall synthesis

Why worry about use?

How antibiotics are used is important as their misuse can lead to an increased risk of antibiotic resistance. This increased resistance can affect humans and animals in the future by reducing the arsenal of antibiotics we have available to fight diseases. The most high profile form of antibiotic resistance is **MRSA** where the **Staphylococcus aureus** bacterium has now developed resistance to methicillin (penicillin). Salmonella is another disease that has developed resistance and is currently resistant to five different antibiotics. It is estimated that bacteria resistance increases the human healthcare cost in the US by $4 billion per year.

Picture of a bacterium

There are many ways of inducing resistance but the most common is the sub- therapeutic use of antibiotics. This is the use of antibiotics at lower levels than that prescribed for disease treatment which puts a selective pressure on the bacteria to either develop resistance or perish. The Darwin principle of 'survival of the fittest' applies to bacteria as well as animals. Over a period of time resistant bacteria emerge and can completely dominate the gut microflora since they can survive the antibiotics. The animal then becomes a potent source of transmission of resistant bacteria to other animals in the group.

The US National Pork board has recently launched a 'Take Care' program for producers on how to use antibiotics responsibly. A copy is available free on their website www.porkboard.org.

Which antibiotic to use?

The correct selection of an antibiotic will maximize its efficiency and the cost effectiveness of its use. A number of factors are important in its selection:

1. Appropriate diagnosis
2. Medication duration
3. Medication form
4. Cost benefit analysis

1. Appropriate diagnosis

It is important that a proper diagnosis is undertaken in consultation with and making effective use of veterinary advice. This should include an analysis of performance records to indicate the extent of the mortality or the deterioration in average daily gain or feed conversion efficiency. The pigs on the unit should be examined for clinical signs especially in the hospital / recovery pens. A post-mortem slaughterhouse examination will give a lung score and allow an examination of the hearts, liver etc on a large number of pigs. This is a most valuable tool in gauging the overall health of the herd and is relatively inexpensive in the context of overall healthcare costs. In the case of younger pigs suffering from scour, undertaking culture and sensitivity testing can indicate which antibiotics may prove most effective in controlling the outbreak.

This photograph shows a sensitivity analysis been undertaken on a culture plate using antibiotic tabs.

2. Medication duration

Antibiotics should not be used to replace good management but rather as a supplement to management when appropriate. The medication use on a unit should be reviewed continuously to ensure that the most effective product is been used to treat the condition especially for units with a chronic disease challenge.

3. Medication form: Feed vs Water

Traditionally in Ireland the principal way of using antibiotics was either as an in-feed medication or injectable. This has been changing in recent years due to the pressure of eliminating any medication residues in the milling industry. It is becoming increasingly difficult and expensive for commercial mills to include in-feed medication in diets. This has led to increased use of water medication over the last number of years following the lead of the poultry industry and the US pig industry.

Water medicator

A review by the USDA of antibiotic use is shown in the table below and indicates the high use of water medication for pigs in the weaner and finisher stages.

Table 2. USDA survey of US antibiotics usage on pig units *

	Sows	Boars	Piglets	Weaners	Finishers
In-feed	38.8	30.7	8.7	94.9	86.4
In –water	2.7	0.5	2.6	76.2	65.7
Oral	4.7	3.1	41.5	5.1	5.2
Injection	35.6	21.2	85.6	76.4	68.4

* % of herds using each mode of delivery (Mathews, K.H., 2001)

The option of whether to use water medication needs to be taken carefully as there are a number of pro's and con's. The biggest draw back is that the water medication version of a commercial product is usually much more expensive compared to the in-feed version. There may also be more wastage of the product depending on the water system been used. It is generally more suited to a bowl drinker system as nipple drinkers may use up to 20% more product due to wastage.

The advantage of the water medication system is that it is easier to incorporate medication into water compared to meal and it allows greater flexibility of use. Also, even ill pigs will generally drink water but they can refuse to eat thereby missing the target audience when using in-feed medication

Table 3 below shows some antibiotics that may be available for water medication here.

Table 3. Commercial water soluble medication that may be available

Amoxinsol	Lincocin Sol
Apralan Sol	Linco-Spectin
CTC	Nuflor Liquid
Colisour	Tylan Sol

As in the case of in- feed medication, withdrawal times and the recording of medication use also apply to water medication.

4. Cost: benefit analysis

The planning and review of any medication program should be discussed in full with the veterinary practitioner to try and find the optimum program to suit the disease challenges of the unit. After the initial period of a disease outbreak it should be reviewed to see if it is possible to partially step down the program or to substitute some of the newer, more potent antibiotics with less expensive ones in order to maintain reasonable performance at a reasonable cost.

It may also be possible to use a pulse medicated program on some units where medication is used every second load or for the first week after transfer when the disease challenge is highest and the pigs immune status is lowest.

How to administer correctly

How the antibiotics are administered is directly related to the effectiveness of the treatment. The points below highlight the main areas of concern.

1. Hygiene
2. Dosage
3. Injection sites
4. Needle sizes and types
5. Withdrawal Period
6. Remedies register

1. Hygiene

It is important when using any antibiotics that they are administered as hygienically as possible irrespective of the form of delivery.

- Syringes: Ideally ensure that it is a new disposable syringe with a new disposable needle. If this is not possible then ensure that it has been cleaned and sterilized in the best possible manner. Many units use a syringe and then reuse it many days later with a simple precursory rinse. By doing this there is a good risk that the new antibiotic will be inactivated and a high risk that you are injecting fresh microbial disease into the animal. Not ideal treatment for an animal which is already ill!

- Wet Feed System: Ensure that the mixing tank is cleaned regularly. When mixing tanks are infrequently or rarely cleaned a build up of stale feed and mould will occur. This buildup will fall in to the tank and may at minimum put the pigs off the feed or could inactivate the antibiotics in the feed. Tanks should be cleaned three to four times per year.

- Water medication: Before any water medication is used the pipe work and water tanks needs to be flushed out with chlorine and then rinsed out again to remove residues. This can be done by opening the end of a line until the tank is flushed out. If water medication is used regularly then a build up of silica will occur in the lines which must be flushed to remove any contamination effects. Always get the water quality analyzed before beginning water medication.

2. Dosage:

When using any medication and especially antibiotics it is important to get the dosage rate right. Too low a dose will be ineffective, increase the medication duration and increase the risk of resistance. Too high a dose is a waste of money and may cause an ill animal to die from organ failure and anaphylactic shock.

3. Injection sites:

Different antibiotics will have different injection sites depending on whether they are **intra muscular (into the muscle)** or **subcutaneous (under the skin)**. For an injectable drug to work effectively it must be placed in the correct tissue location. The label will state whether the drug is subcutaneous or intramuscular.

4. Needle size and gauge:

The table below shows the recommended needle size and gauges for the different age groups of pigs depending on whether the injection is intra-muscular or subcutaneous.

Table 4. Recommended needle sizes and gauges for different ages of pigs

	Intra – muscular			**Subcutaneous**		
	Gauge	Length inches	Length mm)	Gauge	Length inches	Length mm
Piglet	18-20	5/8 or ½	16-13	-	-	-
Weaner	16-18	5/8 or ¾	16-19	16-18	½	13
Finisher	16	1	25	16	¾	19
Sow / Boar	14-16	1-1.5	25 – 38	14-16	1	25

5. Withdrawal Period:

The withdrawal period is the time required for the pig to excrete all antibiotic residues from its body. The withdrawal period will vary between antibiotics, generally ranging from 2 – 28 days depending on the product. Your veterinary practitioner can supply you with a table of antibiotic withdrawal times.

Farrowing rooms and hospital pens are the principal areas of risk for mistakenly sending to slaughter pigs that have not observed the correct withdrawal times. The withdrawal period should be used as an indication only and it is prudent to extend this period by a number of days as sick pigs and older sows can take longer to excrete all residues.

Long ago, antibiotic residues in slaughter animals was a particular area of concern for the Irish pig industry due to the high number of residues being discovered. This is an area that has greatly improved over the last number of years as the table below shows and it is something that the Irish pig producers and the Department of Agriculture can be justifiably proud of.

Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Positives %	0.7	0.5	0.4	0.3	0.1	0.1	0.01
Number of samples	53,205	57,985	49,434	32,981	24,924	9,042	11,125

Table 5. Dept. of Agriculture antibiotic residues in slaughter pigs 2001-2007

6. Remedies register:

The use of all antibiotics must be recorded. The information required has changed with the introduction of the Animal Remedies legislation (SI 786 2007, Schedule 7). This new legislation now requires the following information to be recorded.

- **Incoming / purchasing details**

Quantity	Authorized name of remedy	Date of receipt	Name & address of supplier

- **Administration / outgoing details**

Date of administration	Authorized name and quantity of remedy	Identity of animal (ear tag/ Pen No.)	Date of expiry of withdrawal period	Name of administrator	Name of prescribing vet	Quantities of unused or expired remedies returned

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

Teagasc Headquarters, Oak Park, Carlow. Phone 059-9170200, Fax 059-9170239.

Name	Phone No.	Fax No.	E-Mail
Dr. Brendan Lynch, Moorepark Research Centre, Fermoy, Co. Cork.	025-42259 (DD) 025-42222 (S) 087-246 63 86 (M)	025-42340	Brendan.Lynch@teagasc.ie
Dr. Peadar Lawlor, Moorepark Research Centre, Fermoy, Co. Cork.	025-42217 (DD) 025-42222 (S) 086-8214674 (M)	025-42340	Peadar.Lawlor@teagasc.ie
Dr. Laura Boyle, Moorepark Research Centre, Fermoy, Co. Cork.	025-42389 (DD) 025-42222 (S)	025-42340	*Laura.Boyle@teagasc.ie*
Mr. Seamas Clarke, Teagasc, Ballyhaise, Cavan.	049-4338121 087-258 09 48 (M)	049-4338540	seamas.clarke@teagasc.ie
Mr. Michael Martin, Teagasc, Mellows Campus, Athenry, Co. Galway.	091-84 52 30 (DD) 091-84 52 00 (S) 087-273 59 56 (M	091-844296	Michael.Martin@teagasc.ie
Mr. Ciarán Carroll, Moorepark Research Centre, Fermoy, Co. Cork.	025-42388 (DD) 025-42244 (S) 087-246 29 25 (M)	025-42384	*Ciaran.Carroll@teagasc.ie*
Mr. Ger McCutcheon, Teagasc, Oak Park, Carlow.	059-9183503 (DD) 059-9170200 (S) 087-830 39 69 (M)	059-9183430	*gerard.mccutcheon@teagasc.ie*
Mr. Michael McKeon, Teagasc, Tullamore, Co. Offaly.	057-9329434 (DD) 057-9721405 (S) 087-67 39 178 (M)	057-9721659	*Michael.McKeon@teagasc.ie*
DD = Direct Dial; S = Switchboard; M = Mobile.			

Notes