Pig Development Department

Teagasc Pig Farmers' Conference, 2022

Conference Proceedings

Hotel Kilmore, Co. Cavan, 18th October, 2022
Horse & Jockey Hotel, 19th October, 2022

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Agriculture and Food Development Authority

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Producing Pigmeat Sustainably

Gerard McCutcheon, Oak Park

World Population

Global demand for food continues to grow. It is hard to believe that the world population has risen from three billion in 1960 to over seven and a half billion at present. It continues to rise each year and is expected to hit eight billion by 2030. As the world population edges towards nine billion people by 2050 the challenge for the sector is to develop a "sustainable" and safe food chain in the production of pigmeat.

Sustainability

A useful definition of "sustainable" is "meeting the needs of today without compromising the ability of future generations to meet their own needs" (Bruntland Report, 1987). Future food production systems must be sustainable in terms of delivering a supply of safe, healthy food with low environmental impacts in terms of emissions and biodiversity. This will require a huge level of innovation and involve major improvements in efficiency and waste reduction and access to new types of technology.

Sustainability must be economic, social and environmental. Some people associate "sustainability" with the three Ps - profit, people and planet.

How sustainable is pigmeat production?

How can we assess whether pigmeat production in Ireland is sustainable? Our aim must be to demonstrate the environmental sustainability of the system used to produce pigmeat in Ireland, and, show that the sector is committed to improving this in the years ahead. We can do this by highlighting best practice on Demonstration and/or SignPost farms. There is a huge body of work in establishing best practices and communicating this to all pigmeat producers. Some areas to assess this process are listed below but it is expected that new areas will be added as we progress on this journey.

Suggested Indicators of Sustainability:

Economic Indicators:

- Profitability of the process over time,
- Production costs and prices received for pigmeat,
- The economic value of the sector to the national economy.

Environmental Indicators:

- Carbon footprint per kg of liveweight produced,
- Energy use per pig produced (kWh /pig produced),
- Emissions from production,
- Nutrients retained, excreted and recovered (mainly nitrogen and phosphorous and some trace minerals),
- Water use per pig produced.

Social Indicators:

- Employment value of pig farm to local community,
- Indirect value to local/ national economy,
- Antibiotic usage per kg of pigmeat produced,
- Improvements in animal healthcare and welfare in our production system.

Various models have been developed to measure the total carbon footprint of many production systems. For pig production these take account of the feed ingredients used, the transport of the feed, the pigs produced per sow per year and the various inputs (feed type and ingredients, energy inputs, manure storage and management etc) as well as the amount of pigmeat produced.

A model which has been developed by the Carbon Trust in the UK is currently being reviewed by Bord Bia to support the claims made by the Origin Green Programme. The proposed Carbon model will benchmark best practice at individual farm level alongside the overall national average figures for the sector .

The proposed Carbon model for the Irish pig sector was developed in collaboration between Bord Bia (who engaged The Carbon Trust to develop and validate the model) and the Teagasc Pig Development Department. It is proposed to pilot this model with a number of pig farms on a voluntary basis over the next 12 months.

Over the years many improvements have been achieved in terms of the "sustainability" credentials of pigmeat production. The on-going work on the Teagasc SignPost farms will help deliver the relevant messages to a much wider audience over the next few years. This will be an important part of communicating the pertinent messages on this journey of improvement.

Future Focus

The emphasis in the future should be a renewed focus on the use of organic fertiliser (in the form of pig slurry/manure) to replace chemical fertiliser in the growth of grass and various tillage crops. Podcasts, short videos and some news articles to disseminate the messages from these demonstrations have been developed and will continue to demonstate that pig manure/slurry can replace chemical fertiliser.

In collaboration with the Teagasc Tillage Specialists and relevant Advisors we have run a number of Demonstrations on farms to highlight this message. We would hope to repeat this in the future.

It is expected that the use of renewable energy sources and bioenergy to replace fossil fuels (directly and indirectly) on pig farms will continue to increase on pig farms as a result of the economic savings that can be achieved in energy/fuel costs.

There are still challenges to be dealt with but we must focus on improving efficiency at all stages of the food supply chain while not compromising food quality.

Efficiency Improvements over the years

It is important to recognise the achievements of the past and build upon those achievements. It is useful to look at 1990 as a base year (because it is a reference year in terms of the Kyoto Agreement which is often cited in relation to green-house gas emission targets) and compare current productivity and input usage.

Irish pig producers produced 1350kg of pigmeat per sow in 1990 (with an FCE from weaning to sale of 2.45). This figure has improved to 2,549 kg of pig carcase weight/sow in 2021 and an average FCE of 2.39 from weaning to sale. This was achieved by increased output/sow/year (i.e. 21.9 up to 28.1 pigs produced/sow/year) and increased slaughter weights (82 kg liveweight in 1990 up to 118.4kg

liveweight in 2021). While the drop in FCE weaning to sale is very small (2.45 to 2.39) it is very significant particularly when you factor in the rise in sale weight (as the FCE increases as the pigs get heavier).

The output of pigmeat produced per sow has increased greatly between 1990 and 2021 as shown above. During this time there has also been a strong focus on reducing inputs, in particular reducing feed usage per kg of pigmeat produced along with achieving greater efficiency in the use of other inputs (such as energy, healthcare products, etc). This is evident in the crude protein levels in diets used in 1990 compared to the reduced levels used today which has resulted in reduced excretion of surplus organic nitrogen in the pig manure.

Also the level of phosphorus (P) excreted by pigs has greatly reduced from a figure of 26kg/sow plus progeny / annum in the early 1990s to a current level of 17 kg/sow plus progeny/annum. This was achieved through more accurate formulation of diets on a digestible P rather than a total P basis, and by the use of phytase enzyme to improve the digestibility of plant bound P in the feed ingredients.

All of the changes through the years have improved the sustainability of the production process. There is room for further progress and new technologies and innovations should further enhance the "sustainability" credentials of the sector.

Denmark – Current & Future Perspectives

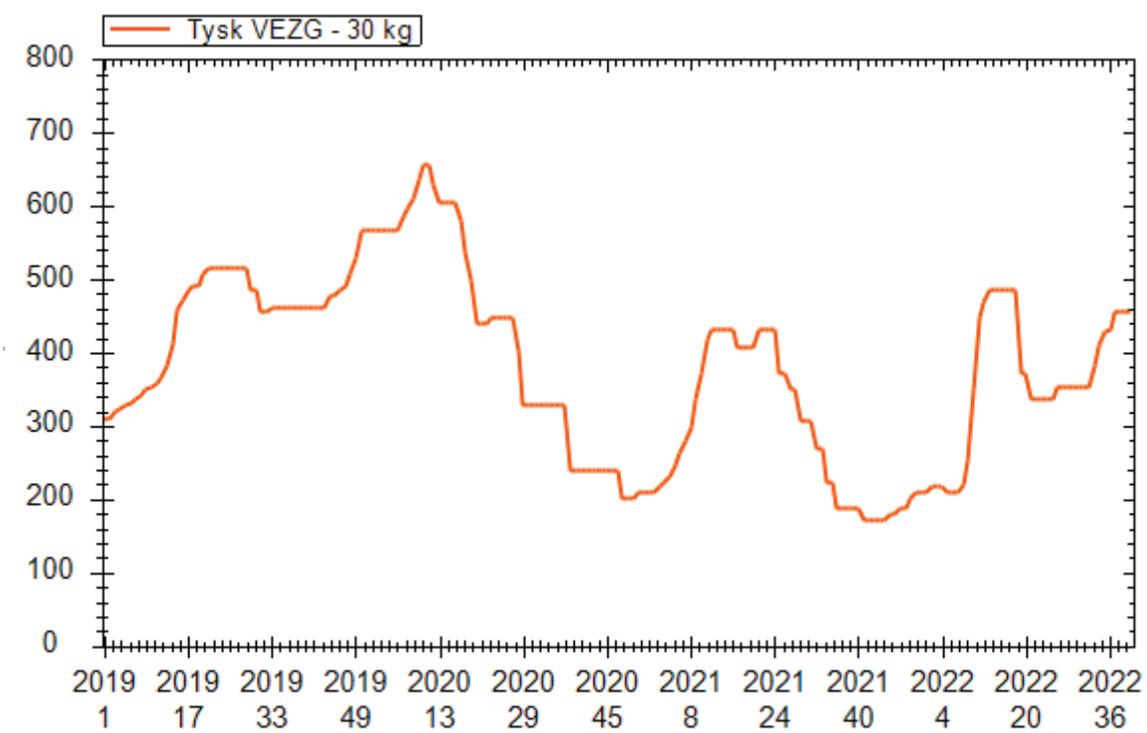
Jens Sorensen, Danvet

African Swine Fever

African Swine Fever (ASF) is a big challenge in Eastern and Central Europe. The disease was introduced from Russia & Belarus to the EU in 2014. An outbreak in domestic pigs is followed by economic losses due to depopulation of infected farms and restrictions in movement of domestic pigs in infected areas. The price of pig meat is therefore negatively affected by the imposed restrictions in export e.g. Chinese import ban. Recently this has been a major challenge in Germany, when Germany was infected by ASF in September 2020.

It is also a challenge for the Danish pig sector as previously 14 million weaner/grower pigs were exported in 2021, 6.5 million to Germany and another 6.5 million to Poland. Obviously the demand for Danish growers declined when the pigmeat price in Germany and Poland was much lower. This reduced demand is best illustrated in the price reduction of Danish growers (Fig.1).

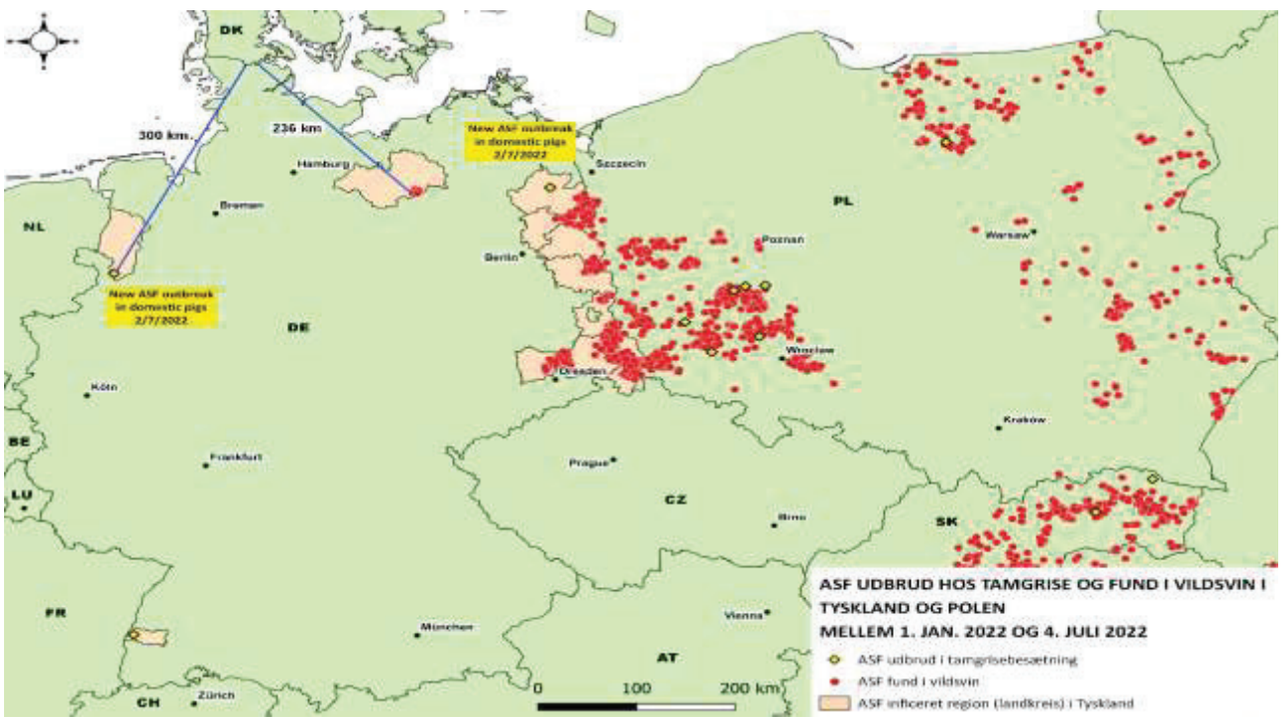
Fig. 1: Weekly Price of Danish growers at 30kgs (Kr. 100 kr=13€)



An ASF outbreak in Denmark would have a major impact on Danish production, and on the export of pigs and pig meat. An estimated 17 million pigs are slaughtered annually in Denmark but less than

15% of this pigmeat is consumed domestically. In addition, a further 14 million growers are exported. An outbreak of ASF in Denmark and resultant ban on exports would therefore have a severe effect on the Danish Pig Industry. As a result the industry is taking comprehensive action to keep this disease out of Danish territory. A map (Fig.2.) illustrates the ASF outbreaks in Poland and Germany from January 2022 until July 4th 2022. The yellow boxes highlights domestic pig herd infections and the red dots highlights cases of infected wild boars. There is only 236 km between Danish border and nearest outbreak in Germany.

Fig.2. Outbreak of ASF cases between Jan 2022 – 4th July 2022



Denmark is a peninsula connected to Germany by only 67 km of border. We have no import of live pigs and we have built a fence along this border to keep out wild boars (Fig.3.). We used to have a very small wild boar population but this is now eradicated by intensive hunting.

Fig. 3. Border Fence along border between Germany and Denmark**.**

Another potential ASF high risk is swill feeding. It is very important to enforce the ban on swill to stop ASF from spreading. Information is made available to inform farm workers and the general public never to give pigs food intended for humans. This food must always be disposed-off in sealed food waste containers. Additionally 24 hours of quarantine must be observed before entering stables after being abroad.

Hunting wild boars is very popular and information campaigns have been made for hunters: Cleaning and disinfecting clothes and gear after wild boar hunting, leaving offal on the hunting site and keeping hunting trophies, hunting dogs and meat out of contact with domestic pigs.

The 14 million pigs exported every year by truck is a risk. To make sure trucks entering Denmark are clean, all trucks must go for washing and disinfection at the border. Clean and disinfected trucks receive a certificate. The certificate, and truck, must be checked prior to loading pigs at the Danish farm site. Trucks entering from ASF infected areas are required to have 48 hours quarantine after cleaning and disinfection.

Imported feed to Denmark (grain, corn and soybeans) from areas with ASF infected wild boar population is a problem yet to be solved. US studies show that ASF contaminated feed will be infective for more than one month. To avoid ASF infection in domestic pigs from feed, the feed must be heated or kept in quarantine. Fortunately the volume of feed imports into Denmark from ASF infected areas, is quiet low. The main feed ingredient that is imported is soybeans with1 million tons imported annually from South America.

PRRS

Porcine Respiratory and Reproductive Syndrome was introduced in Denmark in 1992, and has since been a challenge to Danish Pig Farms, just like it is in pig production worldwide. In 1996 a national eradication program was launched in Denmark for the industry. The main idea in this program was to eradicate PRRS-1 (European Strain PRRS) using PRRS-2 (US-strain PRRS) live vaccine. The program was a disaster as the use of the PRRS-2 live vaccine introduced PRRS-2 in Denmark, therefore instead of eradicating PRRS we ended up having two PRRS strains instead of one!

Since then we have been trying to handle PRRS by vaccination and AI /AU production, but it is still a very harmful disease.

In 2019 a new PRRS-1 variant was introduced into a boar stud and semen at PRRS risk was sent to 700 sow farms, with 39 of these farms becoming PRRS-1 infected. The 5 month post infection production data from 13 of these farms, showed 5 pigs less weaned per litter

This year a PRRS reduction plan has been launched by the industry. The focus is to minimize the number of farms being PRRS positive by ensuring PRRS negative farms stay negative. All pig farms must be tested once a year and from July 2025 all pigs slaughtered in Danish abattoirs will have a price reduction if they are PRRS-positive. The price differential will motivate action to convert PRRS positive farms to negative status by either total or partial depopulation. An individual program for each farm must be designed and worked out in cooperation with neighboring farms.

License to produce

Overall antibiotic consumption in Danish pig production, at farm level, has been monitored for almost two decades. Since 2010 consumption at farm level above a specified number of antibiotic doses per animal, triggered a fine (“yellow card”) of €1,000 and a mandatory herd visit by a state veterinarian. From 2009 until 2021 the number of doses per pig produced was reduced by 39% driven by the “yellow card” system.

Use of high doses of Zinc oxide in weaner diets, was used in most Danish nurseries until July 2022, until it came to an end due to an EU ban. Unfortunately this will increase antibiotic consumption post weaning on most farms, despite efforts to avoid post weaning diarrhea by including; extra organic acid in feed or water, lower protein level in diets, more digestible ingredients like milk powder and blood plasma, and more focus on the shorter interval between feeding weaned pigs.

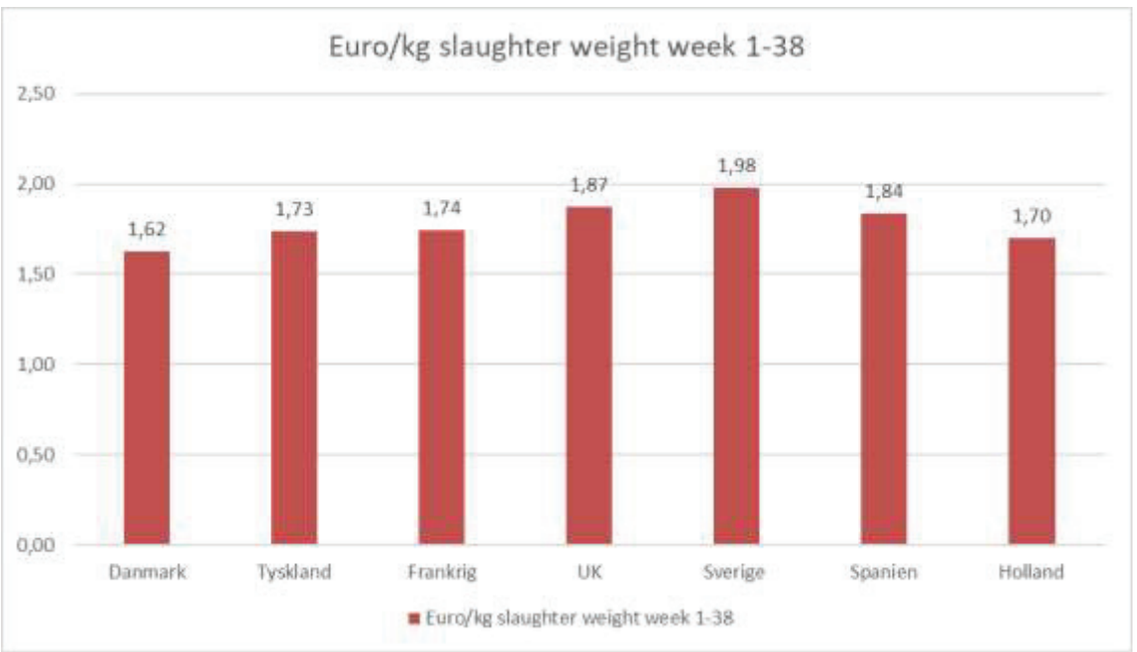
There will continue to be very high focus on animal welfare in public and media. In pig production topics like tail docking, castration and overall piglet and sow mortality, are very much in focus. Breeding programs in DanBreed and Danish Genetics have significantly increased the number of pigs

born and pigs weaned per sow over the last 25 years. The negative side effect of this increase is the higher number of still born and lower birth weight piglets. Therefore the number of total dead piglets out of farrowing room have increased. Breeding programs have now made more focus on litter weight gain, and more herds are increasing their lactation days. We are stilling looking into the higher number of live born piglets to see if action will be necessary.

Economic

The current financial status of Danish pig production is quite bad. The ASF outbreak in Germany in autumn 2020 affected export of meat and the price of pigmeat and led to a lower price for imported Danish grower pigs. The Danish pigmeat price was also affected by a sudden reduction of export to the Chinese market in summer 2021. This resulted in increased sales onto the EU market, a market already low in demand for pigmeat. In 2022 we are facing a pig price which is amongst the very lowest in Europe (Fig.4). Adding an increase in energy cost and feed cost due to the Russian/Ukraine war, has led to a decrease in total number of pigs and sows of 8-9 % from Q2 2021 to Q2 2022. The exchange rate between pig meat and feed is low. The focus in Danish pig production is on feed efficiency and now recently also on energy efficiency. A decrease in pigmeat production in EU-27 is necessary to improve the situation and make it possible to reach a break-even price.

Fig.4 Pig Meat Price to-date 2022 c/kg



The Labor cost is very high in Denmark and that is making the abattoir-cost high and therefore the abattoir less competitive. Conversely Danish pig production is competitive when compared to

Germany and The Netherlands, therefore I think our piglet export will increase in the coming years and our domestic pig meat production will decline. I do not see the current 8-10 % drop in sow numbers as being permanent.

Future challenges to manage will be ‘loose lactation’ and ‘intact tails’. Intact tails could be made as a volunteer program, giving the farmers taking part a better meat price. The loose lactation is starting to become an issue. It is estimated that 20,000 sows are now on farms which have loose lactation.

Environmental, Social, Governance (ESG) is an issue for getting a better price for pigmeat. Danish Crown, the largest Danish abattoir, have big focus on carbon emission in their abattoir and on-farm low feed FCE. Finishing farms receive a small bonus when they provide data on their feed consumption to Danish Crown.

Succession in pig farms is quite seldom. Increasing herd size/farm size will make external investors more necessary, especially when the banks are less willing to take risk in pig farms.

The demand for labor has been increasing, but we are still getting employees from Eastern Europe, Ukraine and Asia. We expect in the future that a big part of the labor force in Danish pig industry will continue to be coming from abroad.

Adopting Best Practices

Emer McCrum, Ballyhaise & Ciarán Carroll, Moorepark

Since our last in person Pig Conference in 2019, performance and output on Irish farms has continued to advance. In the last three years, national average figures indicate that born alive has increased by 1 pig per litter, pigs produced is up 1.2 per sow per year while FCR weaning to sale tightened by 0.04 in the same period. This is considerable progress achieved in a relatively short space of time and is testament to the hard work and dedication of pig farmers and staff across the country. Now ask yourself - what did you do differently? What changes have you implemented on farm in the last three years to support this progress? In order to maintain progression into the future, what changes will you make to support the modern pig, capable of superior prolificacy and growth rates? You need to ensure you are in a position to optimise and effectively manage performance improvement in order to keep pace with progress. This can be difficult however especially given the challenging financial situation in the last 14 months.

The purpose of this paper is to highlight a number of relatively low cost but high impact best practices that can be implemented on farm to maintain and support improved performance. The strategies discussed are centred on areas where relatively simple changes will yield quantifiable results to support progression into the future.

1. Pain Relief for Postpartum Sows

As discussed above, increasing litter sizes in the past decade has improved sow output but this has presented challenges for pig producers. One such challenge is in the area of colostrum intake, which as we know is essential for the lifetime performance of the piglet. Colostrum yield per sow has not increased in line with litter sizes, yet it remains critical that each piglet consumes sufficient colostrum (200g+) from the limited pool available. Adequate colostrum intake should help increase pre-weaning growth, weaning weight and subsequent lifetime performance.

The PigNutriStrat project at Moorepark recently looked at strategies to ensure all pigs in the litter received sufficient colostrum intake. One such strategy involved administering Meloxicam (Loxicom® Injection, Norbrook, Ireland) to sows as soon as possible after the placenta was delivered. The idea was that administration of pain relief would facilitate greater suckling by the piglets. The results show that administering pain relief to the sows increased piglet colostrum intake by ~18g (Figure 1).

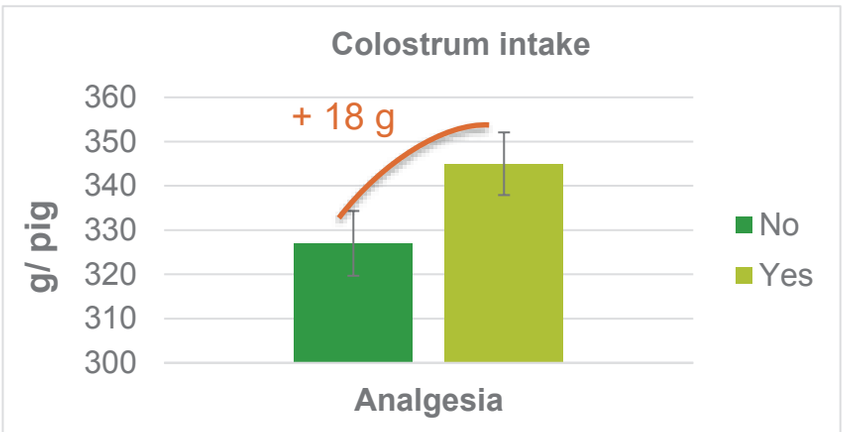


Figure 1. Effect of analgesia (pain relief) on average colostrum intake

While this increase in colostrum intake at first glance does not look to be a major effect, it was sufficient to lead to an increase in average piglet weaning weight of 350g at ~26 days (Figure 2).

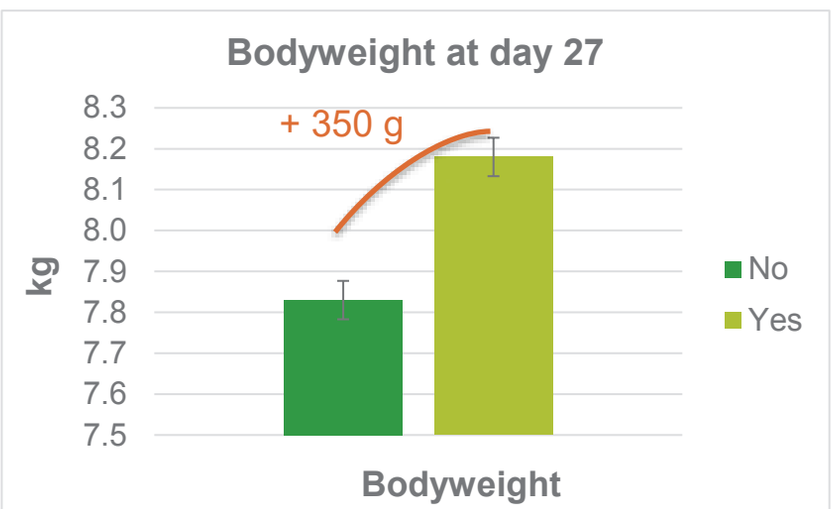


Figure 2. Effect of analgesia (pain relief) in sows on average piglet weaning weight

This study also recorded the number of clinically sick piglets identified per litter during the trial. Researchers found that on sows administered with pain relief, the number of clinical cases reduced by ~65%, which significantly reduced the need to treat suckling piglets with both anti-inflammatories (by ~55%) and antibiotics (by ~50%). Make sure to consult with your vet.

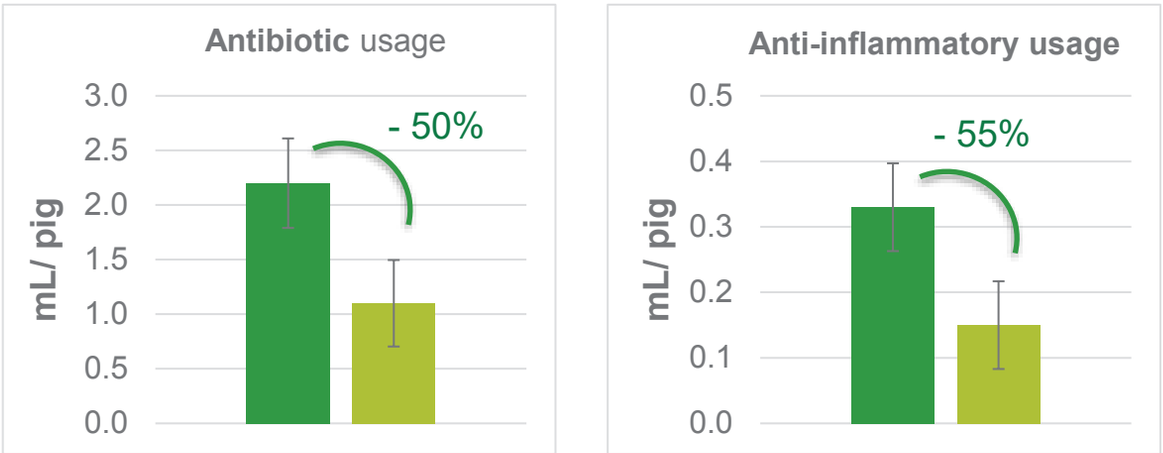


Figure 3. Effect of pain relief in sows on the volume of antibiotics and anti-inflammatories administered per piglet

We can conclude that administering pain relief to sows as soon as possible after delivery of the placenta will increase colostrum intake and weaning weight in piglets. It will also reduce the number of clinical cases of disease identified per litter thereby reducing the need to use injectable antibiotics and anti-inflammatories. At a time when farms are dealing with higher numbers born alive, the administration of pain relief to sows and gilts can help to ensure optimal management and performance of larger litters.

2. Gilts

Gilt development and management is critical in the reproductive performance of the sow herd as future reproductive success is directly linked to a strong gilt breeding policy. The average replacement rate nationally has increased by almost 3% since 2019 equating to an additional 4,000 gilts required per year. While this may equate to just 18 additional animals per year on an average 600 sow unit, there are hidden costs associated with a high replacement rate. Aside from the direct rearing costs, disproportionately young herds are exposed to lower gilt litter sizes with poorer performing pigs and mortality twice that of other parities from birth to sale, which subsequently reduces the number of pigs produced/sow/year. A low average herd age also increases the risk of herd health destabilisation as a result of the lower immunity in gilt offspring. Gilts do not breakeven in the herd until the 3rd parity and yet currently in Ireland 13% of gilts are culled before the 1st litter and 32% are culled by the 3rd litter. 32% of sows therefore do not cover rearing costs. It is therefore extremely important to keep an eye on your annual replacement rate and if it is higher than recommended, investigate the factors that may be contributing to this.

Strategies to improve sow longevity must be targeted at replacement animals. Gilts must be managed, housed, and fed appropriately during the developmental phase to improve retention and reduce involuntary removals.

2.1 Rearing conditions

Research conducted on Irish farms found that lameness is a substantial contributor to the premature culling of sows and young sows in particular are more susceptible. Lameness may also be an underlying factor in other involuntary removals as sows culled for poor body condition or reproductive failure can often be lame. The GILTLIFE project at Moorepark found that rearing gilts in single sex pens from weaning to service benefitted the welfare and subsequent performance of the animals. Gilts reared in single sex pens tended to grow faster than mixed sex pens, possibly due to experiencing less stress as gilts reared with entire male pigs were exposed to higher levels of activity, more aggression and sexual mounting compared to gilts reared in female-only pens. Gilts reared in single sex pens therefore had lower body lesion scores and less hoof damage, probably as a result of less physical interaction taking place. In addition, sows reared in female only pens had fewer piglets born dead, which could have a positive effect on lifetime performance.

It is worth investigating if it is possible to sex pigs or separate replacement females at weaning to improve welfare and subsequent performance. Research has found that the earlier gilts are managed separate to males, the larger the reduction in lameness. With that said if separation at weaning is not possible, investigate whether there is opportunity later in the rearing phase to house gilts in single sex pens. Rearing gilts in female-only pens reduces their exposure to behaviours that can injure hooves and therefore increase the likelihood of culling for lameness in later life.

2.2 Nutrition

When examining strategies to improve sow longevity, it is impossible to ignore gilt nutrition. A gilt nutritional program should be tailored to meet the nutrient demands for adequate protein growth, target bone and reproductive tract development and avoid over conditioning upon entry to the sow herd. Inappropriate nutrition during the developmental phase can contribute to the problem of lameness in replacement gilts. Diets specifically for the developing gilt are formulated around the nutritional requirement for bone development and fat deposition. This includes a higher energy to lysine ratio plus higher Calcium and Phosphorus levels in addition to the vitamin and mineral premix containing zinc, copper and manganese.

The *Limb Health in Pigs* project in Moorepark trialled ad libitum feeding of a developer diet from 70kg to ~130kg compared to feeding a finisher ration over the same period. Gilts fed ad libitum developer

had reduced lameness and reduced claw damage without any negative impact on the target age at service compared to gilts fed finisher ration. The project found that over 90% of the gilts fed finisher were affected by claw lesions at the time of service. The GILTLIFE project investigated the effects of mineral supplementation (Copper, Zinc and Manganese) during rearing and found mineral supplementation increased bone mineral density.

As finisher diets are formulated for fast growth rates and high lean meat deposition, higher average daily gain in gilts fed this diet is associated with an increased incidence of culling for lameness. In addition, feeding finisher diets can cause gilts to become over conditioned at service which impacts subsequent performance as discussed in more detail below. The benefits associated feeding gilt developer over finisher feed from 60-70kg translates into improved longevity, welfare and productivity of the breeding herd. A recommended gilt feeding programme arising from this research is as follows:

- From 60kg commencing feeding gilt developer diet
- 13.5 MJ DE per kg, 0.8% lysine, 1% calcium, 0.8% phosphorus, 300ppm biotin
- Feed Level: 2kg per day at 60kg rising to 3kg per day at 100kg
- Target weight gain of 5kg per week

2.3 Age at service

Recent Danish research found that the target age at service for gilts is 34 to 38 weeks of age (238 to 266 days). After this point, the frame of the animal becomes too large and there is an increased incidence of leg problems. Older gilts also risk becoming too fat which is associated with a reduction in farrowing house intakes. In addition, the research found that the high service age resulted in 23% of the sows from the group culled before second litter service. This corresponded to a larger analysis of 33 Danish herds which found sow longevity reduced with increasing age at first service. 34 weeks is the minimum age as if served prior to this, the frame of the animal is too small and the gilt will struggle to achieve sufficient intakes in the farrowing house. This results in excessive condition loss, which can lead to a reduction in the numbers and quality of pigs weaned, a reduction in subsequent born alive and an increase in the weaning to service interval. Working within these targets will optimise the performance of the gilt in her first lactation and beyond.

2.4 Condition at farrowing

In order to ensure optimum first litter performance it is recommended to body condition score gilts prior to farrowing. Each week score the condition of the gilts (1 to 5) prior to transfer to the farrowing

house and mark the number on the animals back. Once finished add up the numbers and divide by the number of gilts to get your weekly average and record this information. 3 to 3.2 is the target body condition for gilts prior to farrowing and if results outside of this range are detected, gilt management should be revised. As discussed above, gilts that are too fat will struggle to achieve the necessary farrowing house intakes whereas thin gilts will grapple with the demands of rearing her litter. Such stresses on first litter sows can contribute to early removal and an increased replacement rate. A five-minute weekly check-up on body condition however will highlight if problems exist here and the practices outlined above should be reviewed to rectify condition.

3. Staff

Your staff are your best asset and keeping them happy is key to the future success and profitability of your unit. Job satisfaction as opposed to money can often be the main career motivator for many people. In numerous employee surveys, criteria such as good communication with co-workers, being treated with respect, a feeling of accomplishment in a role and doing interesting work ranked higher than pay in job standards most valued by employees. This is good news for employers as such criteria add little or no cost to a business. Job satisfaction leads to higher production and performance on farms, in addition to reduced staff turnover.

Staff who feel valued by their employer and who feel they are contributing positively to a unit are more satisfied. One key strategy to improve this is to share information with staff. Such information can include:

- ePM PigSys Herd Performance Reports
- Infographics
- Newsletters
- Skills videos

Available on the Teagasc website

One of the most important aspects of managing a pig unit is ensuring that staff are aware of what performance is expected and whether the unit is hitting these targets. If you and your staff get a good handle on the week-to-week targets, the rest will fall into place. A target board is a great way to keep track of weekly targets on farm. Each week the unit manager can update the weekly performance on the board by using a black marker if targets are reached, and a red marker if results are below target. This system gives all staff an immediate picture of how the unit is performing and has the benefit of making the target board more visual. It is a good idea to locate the target board in high traffic areas such as the canteen or office where the results will generate discussion.

Regular 'roundtable' sessions can be used to go over different topics with all staff. It is an opportunity for staff to share ideas in order to improve farm performance. The manager should use this time to go over production records (e.g. Teagasc ePM PigSys Herd Performance Reports) with staff to let them know how the farm is doing, both physically and financially. It also enables new goals to be set for the farm and this information can subsequently be fed into the target board. Open discussion in roundtable meetings allows for two-way communication between staff and management which is also important for job satisfaction. This is a great opportunity to ask for staff input – what are the problem areas on the farm, what are the causes, what targets would they set, how will they go about achieving them? It is important to act on good suggestions in so far as possible as employees like a manager willing to listen to their ideas.

In the case of new staff members, take time each week to walk together through their section until you have established the employee feels competent in carrying out their duties. While walking, draw attention to the pigs in their care in addition to the buildings and equipment. This is a great opportunity to share your own knowledge and answer any questions, which is a valuable support network for the staff member as they adjust to their new role. Investing this time in your employees demonstrates your interest in and commitment to their long-term success in the role.

References

Arnaud, E. & Lawlor, P. (2022) 'Administering pain relief to sows after farrowing increased piglet weaning weight and reduced the need for medicinal treatment of suckling piglets', *Teagasc Pig Newsletter*, March 2022, p.4

Hartnett, P., Boyle, L. & O'Driscoll, K. (2020) 'The effect of group composition and mineral supplementation during rearing on the behavior and welfare of replacement gilts', *Translation Animal Science*, 4(2), pp. 1038- 1050.

Quinn, A., Green, L., Lawlor, P. & Boyle, L. (2015) 'The effect of feeding a diet formulated for developing gilts between 70kg and~ 140kg on lameness indicators and carcass traits', *Livestock Science,* 174, pp. 87-95

Bruun, T., Bache, J. & Amdi, C (2021) 'The effects of long- or short-term increased feed allowance prior to first service on litter size in gilts', *Translation Animal Science*, 5 (1)

An Extreme 14 Months in the Irish Pig Sector – the Learnings So Far

Michael McKeon, Moorepark

1. Introduction

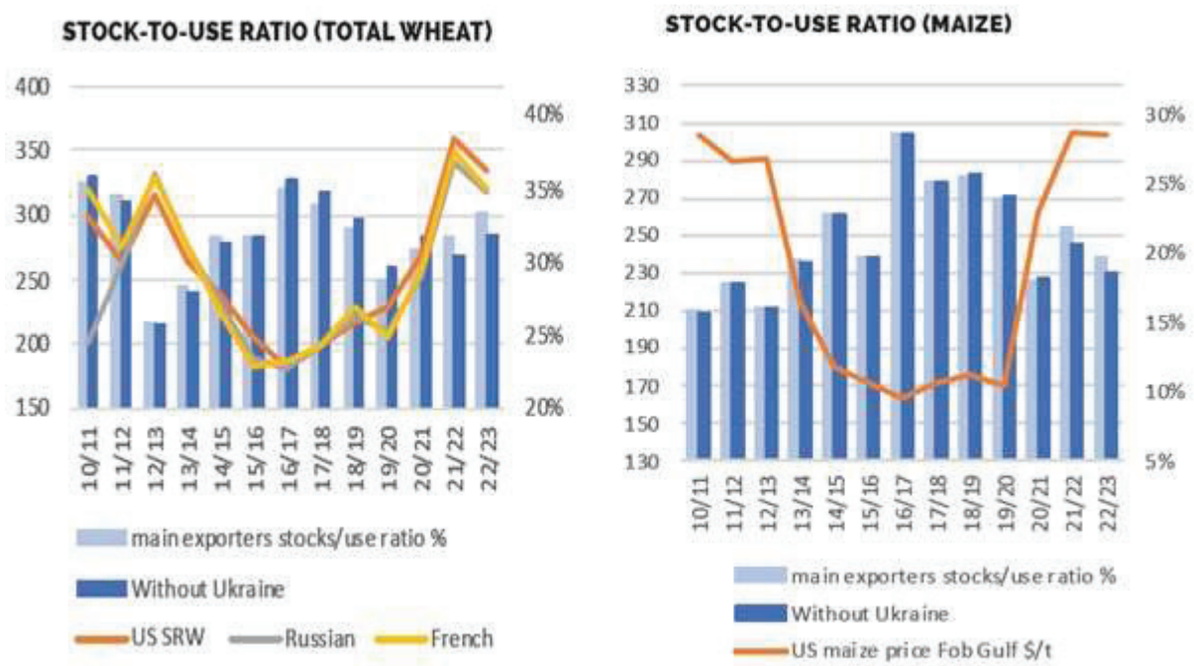
The Irish pig sector is well used to volatility and price fluctuations from year to year but even for seasoned pig producers the last 14 months have been one of the most difficult in living memory. It began with rising feed prices from August 2021, then difficulty getting pigs slaughtered due to logistical problems in N. Ireland, followed by historic high pig feed price spike when Russia invaded Ukraine. Then just when producers were getting acclimatised to the new stratospheric feed cost norm, energy prices escalated by 200-300% on the back of Russia restricting gas exports to the EU. Once in a lifetime is definitely enough to be experiencing the severe trepidations of the past year!

This paper will attempt to quantify and frame this year's volatility against the 30 years financial database that the Teagasc Pig Development Department has accumulated, and then suggest strategies to mitigate the risk of future volatility.

2. Feed Ingredients

The problem all started for Irish & European pig producers with feed ingredient costs. Feed constitutes 70-75% of the cost of producing a pig depending on relative feed ingredient prices, therefore an escalation of feed ingredient costs will have a significant effect on pig production costs and profitability. The Irish pig sector imports virtually all its protein feed source (soybeans) and approximately 60% (500,000 tonnes) of its cereal requirements. Therefore it is very exposed to the volatility of the International feed ingredient market. Since harvest 2020 feed ingredient costs had been increasing in a gradual upward curve due initially to a poor wheat harvest in US & France and then by poor maize harvests. This led to lower stocks in the major exporting countries and therefore an increase in international prices (Fig 1).

Fig.1: Major wheat and maize exporters; stocks & price

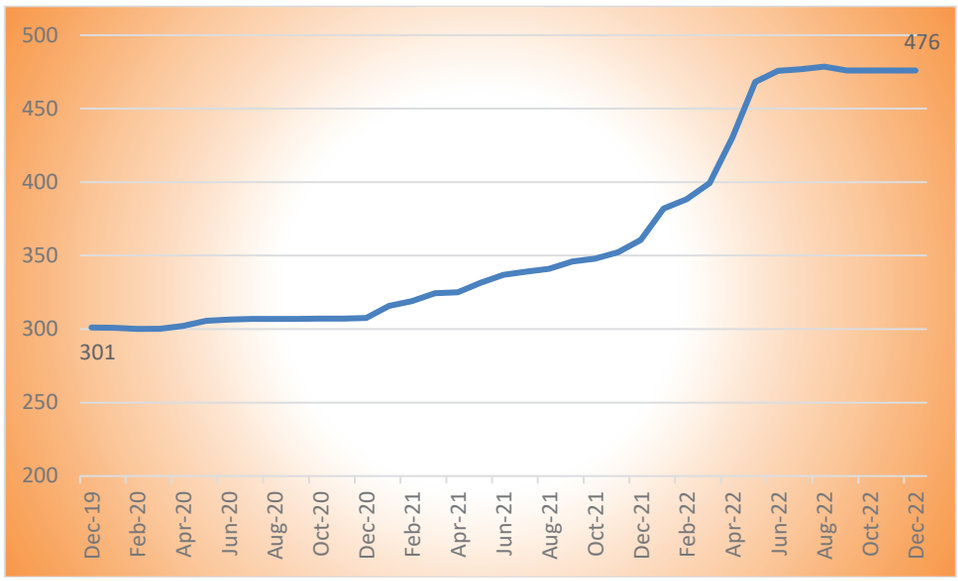


The Ukraine war subsequently shocked the market with resultant feed ingredient prices spiking to historic highs. An accompanying paper in this conference will deal with the feed ingredient market in greater detail.

2.1 Feed Cost

The rise in international feed ingredients obviously increased the Irish composite pig feed price. The rate of increase (Fig.2) from €301 in December 2019 to €476 in Dec 2022 (forecast) is a rise of 58%, with the majority of this rise (62% of total) occurring from October 2021 to Jul 2022. The pig producer's feed credit days only rose marginally during this period, with an estimated increase of 14-21 days, to give an estimated total average credit days of 105 days per pig unit. However, the total feed credit per average 600 sow pig unit, in cash terms, has increased by an estimated €300,000. Similarly the total feed credit extended by the five principal pig feed mills to the pig sector has increased from an estimated €76m in 2020 to €119m in 2022 (+€43m).

Fig. 2 Irish Composite Pig Feed Cost (€/tonne)

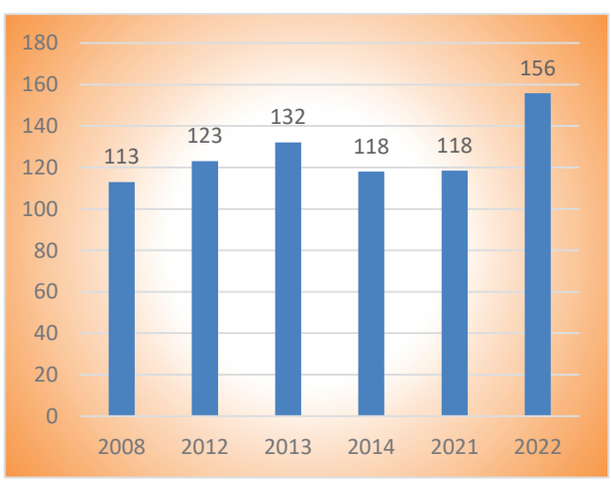


Source: Teagasc PDD

When the 2022 feed cost is compared to previous historic high cost periods (Fig.3), unsurprisingly we see that it's at an historic high of 156 cent per kg dead wt. (c/kg dwt), with 2013 being the previous highest feed cost at 132 c/kg dwt.

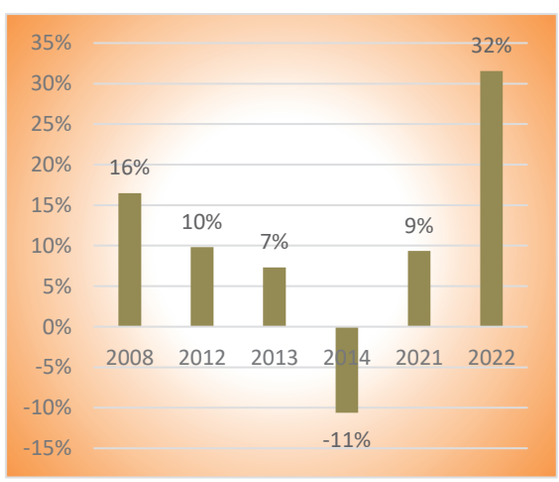
The high feed cost in 2022 was further exacerbated by the rapid rate of the rise. Traditionally there is a lag phase of 6-8 months between a pig feed price rise and corresponding pig price rises. If feed cost rises modestly then this puts a moderate strain on cashflow/profitability, however a rapid feed cost rise, as per 2022 (Fig. 4), placed a severe strain on cashflow. The 2022 rate of feed cost increase year-on-year (YOY) was 32%, which was double the next highest rate (16%) in 2008.

Fig.3: Annualised Irish composite pig feed cost c/kg



Source: Teagasc PDD

Fig.4: Rate of feed cost change YOY %



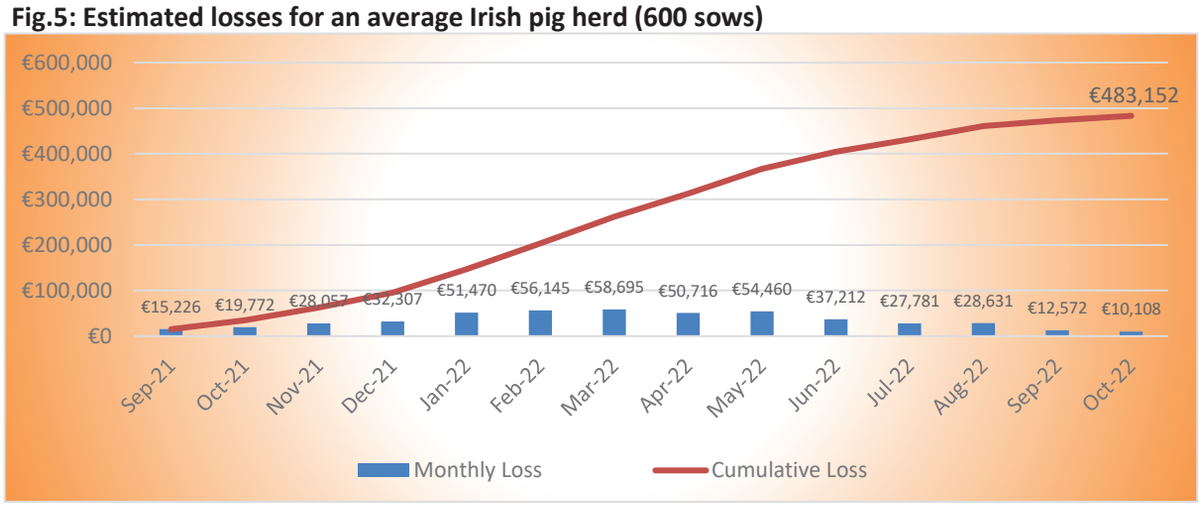
Source: Teagasc PDD

3. Financial Loss

The rapid spike in feed cost and the lag in pig price movement has resulted in Irish pig producers suffering unprecedented losses. Irish pig producers are currently (October 2022) entering their 14th month of consecutive losses, albeit the size of the current average monthly loss has decreased to €10,108 when compared to €58,696 earlier in the year (Fig.5). For producers to reach profitability will require a drop in feed cost or an increase in the pig price. The latter appears the more likely as the supply of slaughter pigs declines due to the contraction of the EU sow herd.

In Ireland the national sow herd has contracted by an estimated 12,000 sows (145,000 to 133,000) which will result in a reduction of 6,500 slaughter pigs per week from early 2023. Across the EU, the sow herd reduction is conservatively estimated to be at least 550,000 sows, which would equate approximately to a 6% reduction in the total EU herd.

Fig.5: Estimated losses for an average Irish pig herd (600 sows)



Source: Teagasc PDD

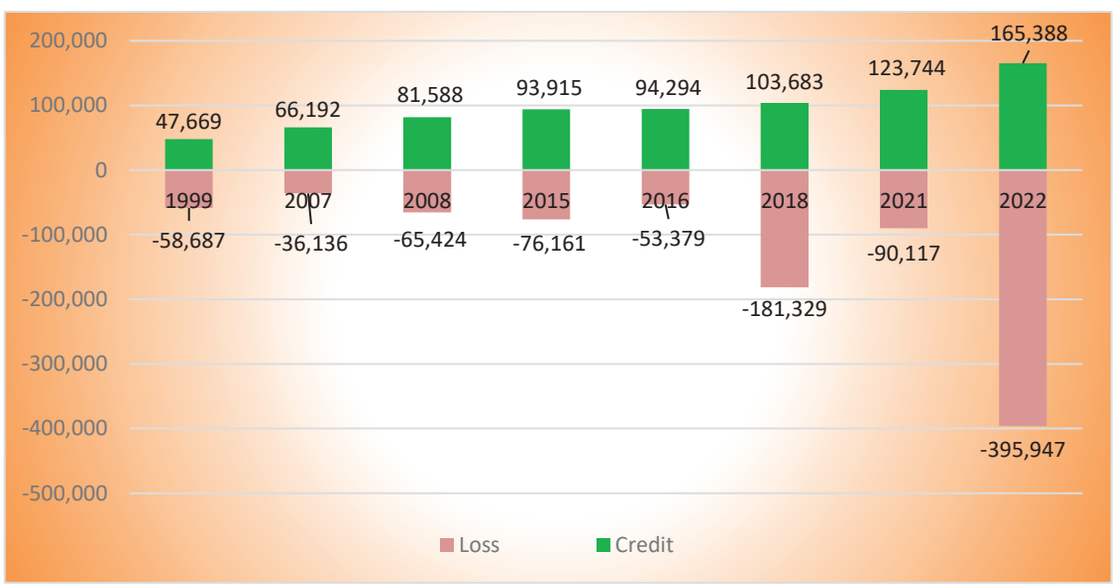
4. Volatility

An analysis of the pig sector data in recent years highlights an increasing level of volatility in input costs and pig price with a resultant increase in profitability volatility. Traditionally in the 1970s & 1980s pig producers would use feed credit to absorb this volatility. In times of low profitability feed credit would extend, by agreement with the miller, by a further 4-6 weeks and then when profitability returned the credit terms would be brought back to the norm. However, in more recent years this practice has diminished because as pig units got larger the financial risk to the feed mill became greater. Teagasc Pig Department would previously have advocated maintaining the equivalent of one months feed credit as a cashflow reserve. This sum would be invested into the business during a

financial down-turn and restored in better times. However, an analysis of the volatility in more recent years demonstrates that this is no longer sufficient to meet the vagaries of today's market place.

Figure 6 shows the years of lowest annual profitability over the last 30 years, with the respective estimated loss for an average sow unit (red bar) and the estimated value of one months feed credit based on the feed usage & feed cost per tonne in the respective years (green bar). The graph illustrates that until recent years, if an average producer had set aside a sum the equivalent of one month's feed credit (1 months feed credit fund) then they would have been able to fund their losses when required. Unfortunately in the last number of years this would not have been sufficient, illustrating that volatility has increased.

Fig.6: Effectiveness of 'one months feed credit fund' to cover annual losses in specific years



Source: Teagasc PDD

The rate of volatility can be further examined by illustrating the rate of variance from a 10 year income average. In figure 7 a 10 year rolling average income for an average size pig unit is calculated and then each respective year, whether profitable or not, is estimated as a percentage variance from this figure.

This illustrates that the volatility, whether the year was profitable or loss-making, has increased over the last seven years. While no pig producer will ever complain about volatility when profits are much higher, the inverse lows make it much harder to forecast cashflow requirements and to accurately budget for capital investments.

So what options/tools could be utilised by the Irish pig sector to reduce these annual fluctuations / volatility and maintain a more determinable income?

Fig.7: Annual Income fluctuations illustrated by % variance from a rolling 10 year average

5. Tools to reduce volatility

A number of tools are outlined below. Some of these tools would require legislative / tax changes, others EU approval and some simply require getting the requisite sector stakeholders aligned to a common purpose of reducing sector volatility.

5.1 Margin Over Feed Contracts (MOFC):

In this scenario the pig price is based on the average feed price plus a premium to cover all non-feed costs and profit. The pig price would rise with any increases in feed prices thereby negating the volatility of the biggest input cost, namely feed. This would give greater stability to producers to forecast their incomes and also incentivise them to perform better as greater efficiencies would reduce their non-feed costs and therefore allow them to keep a bigger share of the premium as profit. From the pig processers view point the MOFC gives them greater certainty of supply as the pig supply is contracted rather than on the current system of weekly spot price supply. In this scenario the processer would offlay the risk of feed price increases & therefore higher input costs by hedging the feed price. If feed prices rise then the higher cost of the pigmeat would be off-set by selling the feed position. This system is used commonly in some other European countries and North America but is rarely used here.

5.2 Hedging:

The pig producer would hedge feed ingredients to insulate against sudden feed prices. This would be particularly attractive to home-millers but would also apply to composite feed purchasers as ultimately the feed ingredients volatility would be passed on by the mills to the end user/pig producer. The time span for hedging could be months or even years in certain situations. If feed ingredient prices

rise then the producer gains by selling their position, if feed prices remain unchanged then the producer sells his position at no gain but has experienced price certainty & 'peace of mind' for the cost of the premium. There are however a number of limitations to this system. Firstly, it requires a reasonable technical knowledge of the markets and how they operate – your broker would help in this regard. It also requires a large trade volume to open an account (in excess of 30,000 tonnes per year), however your composite feed supplier could possibly open an account on your behalf. Another limitation is that the premium you pay for a position will vary considerably (e.g. €10-€45/tonne) depending on how volatile the market outlook is. Therefore you may be paying a premium when the market outlook is very stable and this is adding to your feed cost, inversely when you really need to hedge the cost then it may be too prohibitively expensive to purchase a position.

5.3 Crop / Revenue Insurance:

This system has been in operation in the U.S. for over 50 years. The federal states provide an insurance policy to reduce the risk of the crop farmer by reimbursing them for a loss if it occurs. Originally it was based on the yield of the crop but in more recent years it is based on the revenue of the crop, i.e. the crop yield may be fine but the price of the crop has plummeted thereby reducing revenue. There are different options for the amount of the crop / revenue that one can insure and the insurance is higher in areas where the risk is higher. Insurance is not available in some very high risk areas, e.g. if the county is prone to severe drought every year.

As the system is backed by the federal government and is a 'not for profit' venture the premiums are relatively modest and it allows producers to financially forecast/plan with greater certainty. An Irish system to insure 'pig revenue' would be more complicated than for crop yield and presumably would have to pass E.U. authorisation.

5.4 Levy Funding:

If producers paid a statutory levy on a 'per pig sold' then this fund would accumulate over time and become an 'emergency fund' to be withdrawn during periods of negative profitability. The periods of low profitability could be determined by independent analysis – e.g. Teagasc Pig Development Department. As the fund would be based on the number of pigs sold per producer, the sum available for withdrawal would therefore be larger on a pro-rota basis for the larger producers. The advantage of this system is that it would allow pig producers to pay into the fund during high profitability and would negate the requirement to seek bank funding during downturns. A further extension of this scenario could be that the fund is used as 'collateral' to drawdown low interest loans to allow pig

producers to undertake capital investment. The funder of these low interest loans could perhaps be the National Treasury Management Agency (NTMA).

However, there are a number of limitations to this funding:

- If the 'rainy day fund' is required to fund the full losses and assuming this fund would be required every four years, then the size of the required levy would be substantial. If the 'rainy day fund' required was a '1.25 months feed credit' fund (one month would be insufficient) then the levy required would be €2.43 per pig (~ 2.7c/kg dwt).
- To make the system manageable a statutory levy would be required. Some pig producers may not agree to a statutory levy for this purpose.
- If the fund was to be used to facilitate low interest loans by the NTMA or other parties, then this system would require an oversight infrastructure – formation of a management board, independent auditors etc.
- As the industry is split between home-milling & composite feed purchasers, at times one of the parties may be loss making while the other sector remains marginally profitable e.g. home-millers had high feed costs in October 2021 but the composite feed cost didn't rise until January 2022.

5.5 Farm Management Deposits (FMD)

This system is run by the Australian Department of Agriculture and has been in operation for over 20 years. It currently contains over $6 billion in savings and in general is well-liked by the Australian farming community. The aim of the system is to help famers deal more effectively with fluctuations in cashflow. It is "*designed to increase the self-reliance of Australian primary producers by helping them manage their financial risk and meet their business costs in low-income years by building up cash reserves*". The system allows agricultural producers to set aside pre-tax income which they can then draw-down in later years. The money is only taxed as income in the year that it is withdrawn. There is currently a limit on the amount that can be deposited – currently its $800,000 but is reviewed upwards every couple of years. The scheme is only open to primary producers and to qualify you can't have an off-farm income in excess of $100,000. Practically all banks and financial institutions offer the deposit facility so the process is very simple as it only requires opening a specific account in your local bank and completing a 4-page application form.

The money can be withdrawn as required by the producer after an initial 12 month period. The deduction claimed for an FMD in the financial year cannot exceed the primary producer's taxable primary production income for that year, i.e. can't be bigger than your taxable income for that year.

This scheme has a lot to offer the Irish pig producer:

- Very easy to set-up and simple to operate
- No oversight structures required
- Scheme is self-financing in a tax efficient manner
- Easy access to funds when required

6. Conclusion

The last 12 months have (& still are) the most difficult experienced in the pig sector in living memory. The data suggests that the sector has experienced higher levels of volatility in recent years, which places greater strain on the cashflow of producers. The sector needs to address how this volatility can be reduced if the sector wants to grow in the future. Some of the possible tools have being outlined here but there may be more possibilities. The sector needs to have a discussion now on what is the most feasible way to address this issue as any fund / system will take a number of years to 'bed-in' and to build-up sufficient funding in preparation for the next financial challenge.

Grain & Oilseed Market Outlook

Philip Lynch & James Nolan, IAWS

Global grain markets remain supported at multi-year highs against a weakening global macro economic outlook. The Russian/Ukrainian conflict delivered an unprecedented shock to the global grain supply system. In recent times, the successful operation of an export grain corridor has reopened some supply from the Black Sea to the world however markets remain very sensitive to further escalation of the conflict which, could once again shut off grain export flows from the region.

Another key factor for the market to consider is multi-decade high inflation and central bank efforts to control this across major economies. Interest rate policy is the most effective solution according to most monetary policy experts however the cure for inflation could very well be poison for the health of the global economy. Central Banks effectively seek to use interest rate policy to dampen economic demand and it is a very delicate operation, even impossible, to raise rates without causing a sharp economic slowdown. The duration and severity of a global recession is open for debate but the big question for global grain and oilseed markets is to what extent this can harm demand for grains in the short to medium term.

Of course the disruption caused by the Russia/Ukraine conflict hasn't been confined to grain & oilseed markets. The current energy crisis is caused mainly by supply side issues rather than demand. Years of underinvestment in fossil fuel supply infrastructure and the trend towards various ESG objectives amongst policymakers of major economies has been an underlying threat for some time. The Russia/Ukraine conflict has pushed the situation to full crisis mode given the importance of Russia as a natural gas and crude oil supplier to the global market. This is having major ramifications for fertiliser production and cost, which in turn significantly drives up the cost of cereal production globally. As a consequence, 2023 grain prices may well stay supported longer than many consider appropriate.

Let's take a closer look at the global grain supply and demand picture. If we look at the five years prior to the conflict, combined Russia and Ukraine account for 29% of global wheat , 32% of barley and 17% of corn exports. Ukraine on its own accounts for 15% of global grain exports hence the closure of Black Sea export infrastructure caused a massive shock to world grain supplies. Ukrainian corn exports have declined by approximately 30% season to date, with production 38% lower. Wheat production

estimates at 19.5mmt are significantly below last season's total of 33mmt. Growers faced obvious challenges applying adequate inputs during the growing season. As a consequence yields dropped to average 2.88t/ha compared to 4.53t/ha last year. Total Ukrainian wheat exports are currently running 59% from 20/21 levels.

The Ukrainian conflict initially caused a severe rally in grain values with MATIF wheat gaining 52% or €152/mt in a matter of weeks. The world needed to readjust to the sudden new supply landscape. However, as crops in major exporting regions such as the EU navigated the growing season and other supply routes were developed, prices have drifted back from those initial highs. However, we remain over €100/mt from harvest 2021 grain prices.

If we look at the global corn picture, the loss of Ukrainian production is estimated at 12mmt versus last year. However, Brazil delivered a record corn crop in the summer of 126mmt which is an increase of a massive 29mmt on the 2021 crop. Ideal harvest weather conditions allowed early harvest flow of this corn to the world market and this helped fill much of the gap created by a loss of Ukrainian corn. However, the world cannot afford an indefinite loss of Ukrainian corn supply given its prominence on the global market. The outlook for next year is very uncertain and this continues to support prices.

On a global level, wheat stocks remain at multi-year lows and we can recall wheat values have been on a firm footing since harvest 2021. Ukraine wheat production has declined to 20mmt this season compared to 33mt last season. However, Russian wheat production is a record this year with a total output of just over 90mmt compared to 75mmt last year and the previous record of 85mmt in 2020. It must be stated that this wheat really exists on paper as normal export flows from Russia have been hindered. The market can't factor this supply into pricing exercises to the same extent as would normally be the case therefore this crop hasn't been able to weigh on wheat values. Of course, the outlook for production costs going into 2023 around the globe, particularly in Europe continues to impact the market's opinion on fair value for grains next year. If as widely expected, energy remains at punitive levels, fertiliser and other costs will continue to climb which can support forward grain prices.

2022 delivered one of the worst South American droughts on record, wiping 35mmt off soybean production potential across Brazil, Argentina & Paraguay. This sparked a price rally in soymeal which was in motion before the conflict started in Ukraine. The Black Sea region is a significant supplier of

global sunseed and sunoil supply however in terms of soymeal, there is no clear supply issue from this region. Chinese soybean import demand dropped considerably this year to 91mmt compared to early season estimates of 99mmt. For almost a decade, growing Chinese soybean import demand has been a permanent bullish driver in the soybean market. The US$ remains extremely at multi-decade highs versus most major currencies and this in itself is particularly troublesome for local soymeal values. The US soybean is currently being harvested and yields appear disappointing. The projection for the 22/23 year is for a stocks:use in the US of just 4.5% or a 9 year low. This has potential to further support soymeal prices around current levels.

In summary, we expect supply side issues to dominate the narrative in coming months and this can lend support to grain and soya values despite obvious economic headwinds blowing at this time. Cereal production costs and relatively tight global stocks situations leave little room for a weather threat to 2023 crops. As geopolitics and government policies remain very difficult to predict, price volatility will remain at elevated levels.

Impact of improved hygiene: Farrowing accommodation and liquid feeding systems

Peadar Lawlor[1], Keely Halpin[1,2], James Cullen[1,2], Florence Viard[1,3], John O'Doherty and Gillian Gardiner[2]

[1]Teagasc, Moorepark, [2]South East Technological University, Waterford and [3]University College Dublin, Dublin

Summary

Measures taken to increase internal biosecurity in pig production have previously been shown to increase pig growth, reduce mortality (Laanen et al., 2013) and reduce antibiotic usage (Postma et al., 2017). However, there are many factors associated with internal biosecurity and the impact of proper implementation of individual measures such as cleaning and disinfection routines is not always clear or evident. Furthermore, implementing cleaning and disinfection routines correctly takes time and there is always the temptation to take short cuts or, in the worst case, avoid altogether, particularly where labour and space on a pig unit are limited. Here we look at the importance of hygiene routines in two very different but critically important areas on the unit; farrowing accommodation and liquid feeding systems.

Our work shows that implementing an effective hygiene routine (optimised cleaning and disinfection) in farrowing accommodation reduced the number of clinical cases recorded per litter, leading to a reduction in the volume of antibiotics and anti-inflammatories that needed to be administered to piglets up to weaning. As a consequence of this, average piglet weight at weaning was also significantly increased.

Cleaning and disinfection routines are seldom, if ever, performed on liquid feeding systems. However, we know that feed efficiency is poorer for liquid-fed than dry-fed pigs (at least by 0.10 of an FCE unit; O'Meara et al., 2020) and much of this difference is believed to be due to the loss of energy and amino acids from liquid feed due to microbial fermentation. The feeding equipment itself, which includes the mixing tanks and feed pipelines, contains biofilms that harbour bacteria and fungi which can contaminate the feed, thereby increasing fermentation losses. Although it did not completely remove the biofilm present, the hygiene routine implemented on the feeding system between batches of pigs, greatly disrupted it and reduced *E. coli*, *Enterobacteriaceae* and mould counts to below detectable levels in swabs from the inside of pipelines. However, this improved hygiene of the mixing tank and

pipes did not improve the microbial quality of the liquid feed, most likely due to the high microbial load within the feed itself. Nonetheless, the improvement in system hygiene now provides us with the opportunity to improve feed quality through dietary acidification or even by introduction of beneficial microbes (e.g. homofermentative inoculants; produce only lactic acid as an end product of fermentation) to the feeding system/feed so that they dominate the microbial populations within the feeding system.

1. Farrowing Accommodation Hygiene

Introduction

There is concern that high use of antibiotics in pig production can promote the spread of antibiotic resistance (AMR) from animals to humans. Hence, the current drive to reduce on-farm antibiotic usage. Furthermore, therapeutic levels of in-feed zinc oxide have been banned in the EU since June 2022. A multifaceted approach will now be required to maintain post-weaning piglet health and growth. We believe that implementing an optimised cleaning and disinfection routine in farrowing rooms to provide a hygienic environment for piglets to be born into, should be part of that strategy.

Study

As part of the PigNutriStrat project we recently tested an optimal cleaning and disinfection routine and compared it with a sub-optimal routine. The optimal routine was as follows:

1. Pre-soaking of pens with water overnight (18 hr).
2. Detergent application (Blast Off; Biolink Ltd, Hull, UK) with a contact time of 20 min. Thorough washing of pens with cold water. Pens allowed to dry overnight, with a blow heater used to speed up the process.
3. Application of a chlorocresol-based disinfectant (Interkokask®; Interhygiene GmbH, Cuxhaven, Germany).
4. Pens allowed to dry for 6 days (note that 3 days drying produces equivalent results), with a blow heater used for the first 24 hr.
5. Sows were washed with cold water and disinfected (Virkon S; Lanxess, Köln, Germany) before they entered the farrowing crates.

The sub-optimal routine consisted of:

1. Thoroughly washing pens with cold water and allowing pens to dry overnight (≤18 hr) before introducing sows.
2. Sows were not washed or disinfected before entering the farrowing crates.

To determine the efficacy of the optimal cleaning and disinfection routine we took swabs from various locations in the farrowing pens. From these, we obtained total bacterial counts and *Enterobacteriaeace* counts per cm^2 of each area swabbed. *Enterobacteriaeace* are a group of bacteria that act as indicators of faecal contamination. An example of the results obtained can be seen in Figure 1, where total bacterial counts are displayed for the floor area behind the sow before washing and again at entry of the sows to the farrowing pens. It can be seen that after using the optimal cleaning and disinfection routine, the total bacterial count decreased by more than 400,000-fold in this area of the pen, while it decreased only ~30-fold using the sub-optimal regime. This trend was consistently observed for each area of the pen swabbed, both for total bacterial and *Enterobacteriaeace* counts.

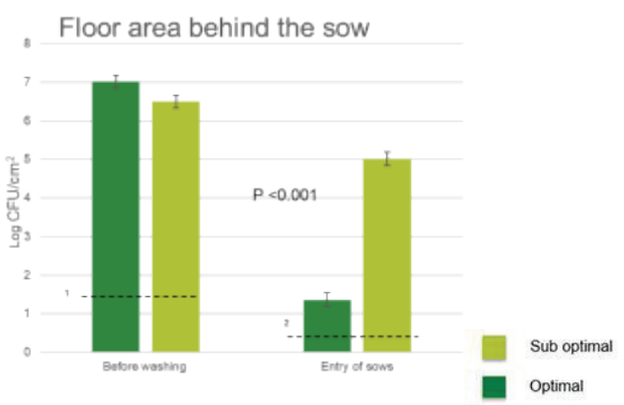


Figure 1. Total bacterial counts on the floor area behind the sow in Log CFU/cm²

[1] Detection limit before washing (1.4 Log CFU/cm²). [2] Detection limit after washing (0.4 Log CFU/cm²)

As a result of implementing the optimised cleaning and disinfection routine in the farrowing rooms we found that the number of clinical cases per litter was reduced by 86% (Figure 2).

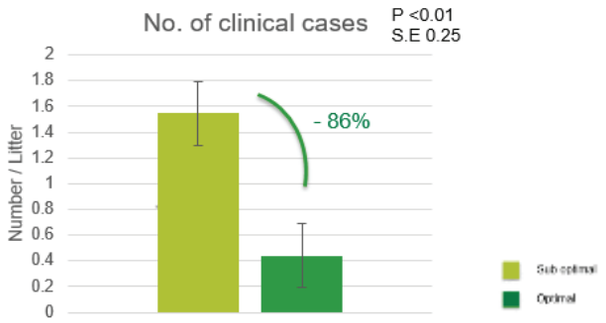


Figure 2. Effect of the optimal cleaning and disinfection routine on the number of clinical cases recorded per litter.

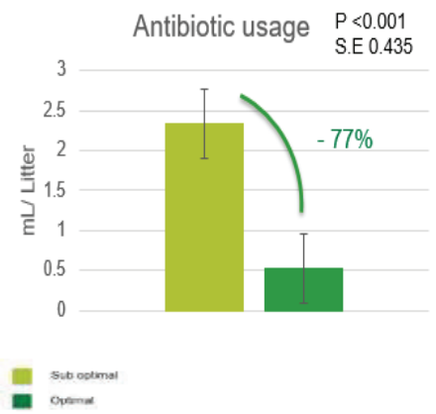


Figure 3. Effect of the optimal cleaning and disinfection routine on antibiotic usage in mL/litter

As a result of this, the volume of antibiotics and anti-inflammatories administered per litter was reduced by 77% and 75%, respectively (Figure 3 and Figure 4)

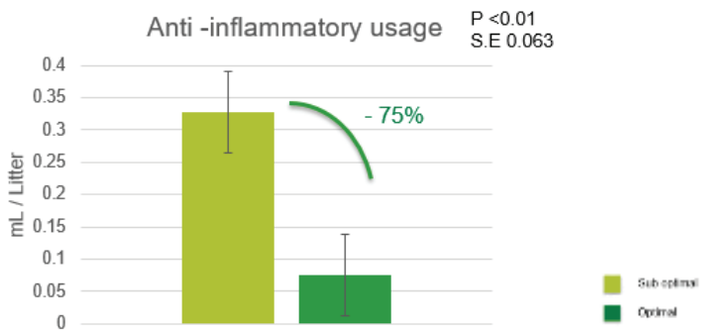


Figure 4. Effect of the optimal cleaning and disinfection routine on anti-inflammatory usage in mL/litter

Not only did the optimised cleaning and disinfection routine reduce the need to use antibiotics and anti-inflammatories, it also increased piglet weaning weight. Pigs were weaned at ~28 days and on average piglets were 320g heavier at weaning for the optimised cleaning and disinfection routine (Figure 5).

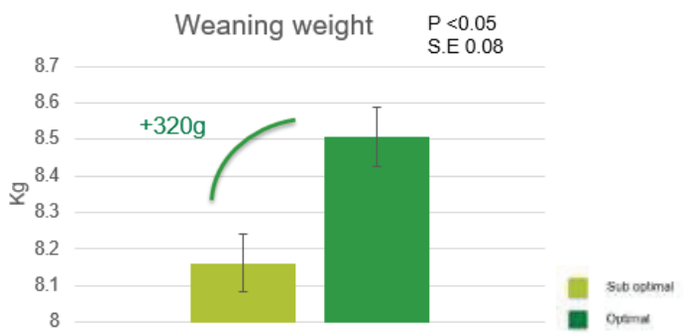


Figure 5. Effect of the optimal cleaning and disinfection routine on weaning weight (Kg)

In summary, implementing the optimised cleaning and disinfection routine described above reduced the number of clinical cases recorded per litter, leading to a reduction in the volume of antibiotics and anti-inflammatories that needed to be administered per litter. As a consequence, piglet weaning weight was also significantly increased.

Implications: It might be considered that the sub-optimal hygiene routine implemented here was quite basic. However, when compared with the routine on the Moorepark unit, at the time, it yielded similar numbers for clinical cases and volume of antibiotics and anti-inflammatories administered per litter. Therefore, we believe it to be a good representation of the effect of current on-farm hygiene routines. Implementation of the optimised cleaning and disinfection routine certainly takes more labour, but particularly more time. Implementing it will necessitate there being sufficient accommodation to allow it to be implemented correctly. However, the results speak for themselves with regard to its potential to reduce antibiotic use and its benefit in increasing piglet weaning weight.

2. Liquid Feeding System Hygiene

Introduction

There is no standard protocol for maintenance of liquid feeding system hygiene. This is despite the fact that poor hygiene in these systems is linked with the growth of undesirable bacteria and fungi (yeasts and moulds) that reduce the nutritional quality of the feed and may even be pathogenic. Feed conversion efficiency is at least 0.1 of an FCE unit poorer with liquid feeding compared to dry feeding (O'Meara et al, 2020) and much of this difference is thought to be due to losses of amino acids and energy from the liquid feed as it is fermented by microbes in the feeding system. As a first step towards improving feed efficiency in liquid-fed finisher pigs we performed a study to determine the effect of introducing an effective sanitisation programme on the hygiene of the liquid feeding system itself, as well as and on the microbial quality of the liquid feed.

Study

As part of the WetFeed-2 project we recently tested an optimal hygiene routine for liquid feeding systems and compared the resultant microbial counts (mixing tank, pipelines and feed) during a 10-week grow-finisher feeding study with those obtained before the routine was implemented and before the batch of pigs was introduced.

The optimal routine was as follows:

1. Remove pigs and wash pens and troughs.
2. Intensive washing and scrubbing of mixing tank and rinse.
3. **Alkali wash** (Avalksan Gold Standard CF Chlorine Free at 0.9 % inclusion) of tank with circulation of pipeline for 10 min every 2 hr for 16 hr. Feed out to troughs. Rinse tank with water and feed out to troughs.
4. **Initial acid rinse** (Interpronutri Plus BE [Formic (60%), Propionic (15%) and Benzoic (2.5%) at 6 L/T of water inclusion] with circulation of pipeline for 10 min every hour for 4 hr. Feed out to troughs and wash troughs.
5. **Daily Maintenance acid rinse** of tank and pipes with Interpronutri Plus BE (3 L/T of water inclusion) with circulation of pipeline for 10 min every hour for 6 hr at night. Rinse residue makes up part of wet mix in first feed split of each day.
6. Introduce new batch of pigs.
7. Continue maintenance rinse of tank and pipes with Interpronutri Plus BE as above daily for 10 weeks.

To determine the efficacy of this sanitisation routine we took baseline samples before the previous batch of pigs were sold prior to starting the hygiene protocol. Following this, samples were taken at day 1, 3 and 7 post-cleaning as well as every week thereafter until the end of the study at 10 weeks when pigs were sold. Samples of feed were taken from the mixing tank and troughs (fresh and residual from the latter) for microbiology, as well as ATP, pH and temperature measurements and chemical analysis. Additionally, swabs were taken from the mixing tank and inside the pipeline for microbiological analysis and from the pipeline for microscopy.

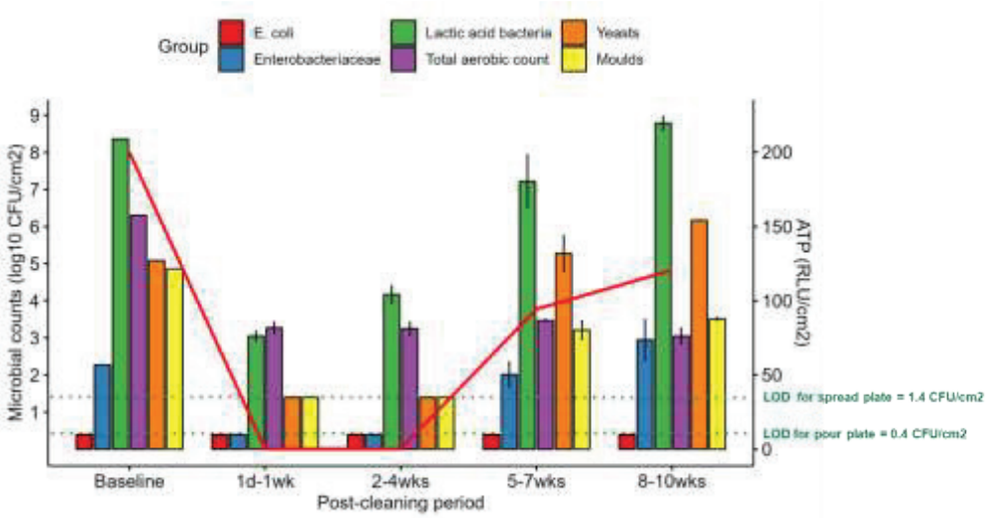


Figure 6. Effect of the feeding system hygiene routine on ATP levels and microbial counts on mixing tank surface

Initially post-cleaning, *Enterobacteriaceae* and yeast and mould counts on the mixing tank surface declined to become undetectable. However, ~5 weeks post-cleaning counts began to return to levels found at the baseline sampling point (Figure 6). Readings obtained from the ATP luminometer provide information on total surface contamination (from microbes, feed and faeces) and these mirrored very closely the microbial counts. This is a method that could be easily used on commercial units to obtain immediate results regarding the efficacy of sanitisation of surfaces after hygiene protocols have been implemented.

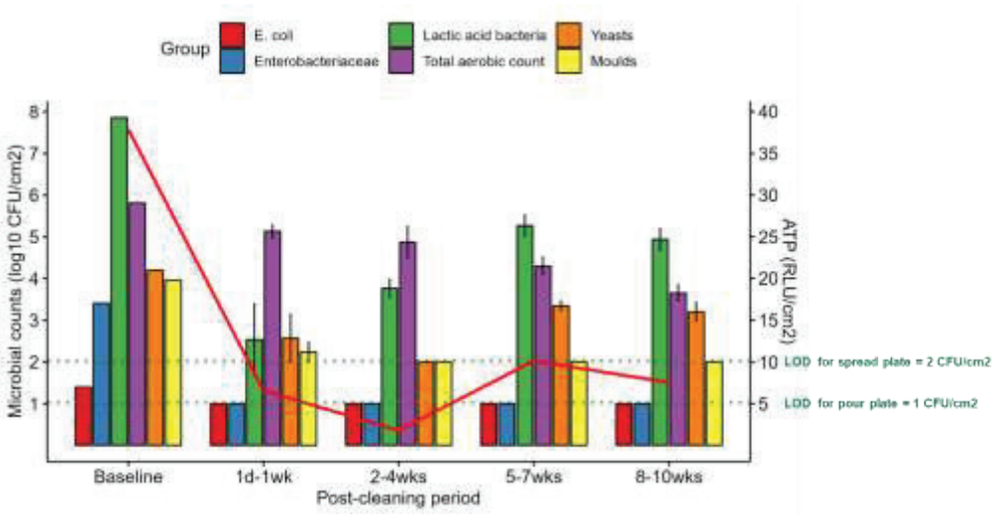


Figure 7. Effect of the feeding system hygiene routine on ATP levels and microbial counts on pipeline surface

Similarly, although microscopy demonstrated that the hygiene routine implemented did not completely remove the biofilm present on the internal surface of the pipelines between batches of pigs, it greatly disrupted it and reduced *E. coli*, *Enterobacteraceae,* and mould counts to below detectable levels in the pipelines (Figure 7).

Microbial counts in feed samples were similar to those obtained at baseline at all sampling time points during the study, indicating that the hygiene routine used alone did not impact feed microbial quality.

Implications

The improved hygiene of the mixing tank and pipes did not on its own improve the microbial quality of the liquid feed, most likely due to the high microbial load in the feed itself. However, the improvement in system hygiene (particularly in the pipelines) now provides us with the opportunity to improve feed microbial quality through dietary acidification or even by introduction of beneficial microbes (e.g. homofermentative inoculants) to the feeding system/feed so that they dominate the microbial populations within the feeding system. Improved hygiene of the system reduces the risk that feed and water introduced to the system will be seeded with potentially harmful spoilage/pathogenic microbes from the system itself.

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Energy Options: short, medium and long term

Louise Clarke, Ballyhaise

Energy is a resource that must be used efficiently and effectively. It makes no sense to waste it. Energy prices have risen quite significantly in the last number of months and there is concern that it will become an even more significant cost in the future. Pig farms, like all businesses can spend a considerable amount of money on energy. Pig farms are energy intensive and data from the 2021 National Pig Herd Performance Report showed that the energy cost (heat, power and light) was €6.43 per pig produced (or €180 per sow per year based upon 28.1 pigs produced per sow per year). This Profit Monitor data covers approximately 43 per cent of the national pig herd. Typically, this meant that an average 600 sow integrated pig unit spent approximately €108,000 on energy cost in 2021. Today this price has further sky rocketed as current energy costs are quotes at 45c+ per kWh used versus approximately 25c KWh in 2021. For energy-intensive businesses like pig farms, these cost can be crippling.

In 2012, a Teagasc survey on 23 pig farms show a huge variation in the energy usage ranging from 18 up to 45kWh per pig produced with an average figure of 28kWh per pig produced. These audits for 23 farms included over 20,000 sows. The high variation from one farm to another suggests that a greater emphasis needs to be put on energy efficiency.

Where is the energy used?

For most pig units the biggest energy requirements are used to:

I. Heat the farrowing and first stage weaner houses,
II. Ventilation systems and fans,
III. Lighting pig buildings,
IV. Feed delivery and mixing,
V. Power-washing,
VI. Manure pumps to mix and agitate slurry tanks.

Short term steps in trying to reduce your overall energy costs:

Monitor the energy usage on your farm. This will provide the basis of good energy management. Do regular meter readings; do not just rely on utility bills. Carry out an energy audit of your farm. Energy

audits will not only tell you where the energy is being used but it can also highlight areas where potential savings can be made. SEAI's Support Scheme for Energy Audits (SSEA) offers financial support for small and medium enterprises (SMEs) to get an Energy Audit. The application and approval process is quick and easy, and in most cases, the financial support provided by SEAI will cover the entire cost of the Energy Audit. Support is issued in the form of a Voucher, which is awarded to the Applicant (the SME), who will then use it to "pay" the Auditor once the audit is complete. The Auditor will claim the cost of the Voucher from SEAI.

Benchmark your performance with industry standards. Do you know how much energy it takes to produce a pig of your farm? Research shows that there is a huge variation in energy usage on pigs farms with a range of 18 to 45kWh per pig produced. Based on today's energy cost that can equate to a substantial difference of approximately €170,000 as seen below. This difference highlights that greater emphasis needs to be placed on energy efficiency on pig farms. If we can minimise the amount of energy needed by being more energy efficient that is better because a kWh that does not need to be used is one that does not need to be produced. This will also be a positive from a carbon footprint point of view and from the country's energy statistics and reduced greenhouse gas emissions.

Table 1: Energy cost per pig produced

	18kWh/pig produced	**45kWh/pig produced**
Total kWh used/year	303,480	758,700
Daytime requirement (kWh)	202,320	505,800
Night-time requirement(kWh)	101,160	252,900
Daytime rate* 44c	97,033	242,582
Night-time rate* 16.6c	18,303	45,759
Total €	115,336	288,341
Difference €	**173,005**	

*Calculation based on a 600-sow unit producing 28.1 pigs/sow/year, including VAT

Understanding your electricity bill:

Understanding all of the terms on your energy bill is important in order to know how to improve your energy efficiency and reduce your bills. Two terms that producers should familiarise themselves with and understand are MIC and Wattless Charges:

- Maximum Import Capacity (MIC) is the upper limit on the total electrical demand you can place on the network system, so it should be high enough to meet the requirements of your business and is measured in kilovolt-amps (kVA). If your MIC is too high or too low for your needs it will cost you money:
  - If the MIC is too high, you may be paying for more capacity than you actually require.
  - If the MIC is too low, you may incur an 'Excess Capacity' charge

  As a general guideline electrical providers would suggest that your MIC should be set at 5% above your highest electrical load in the past year. We strongly advise you to study your energy bill over a period and if you find your MIC is too high or too low we recommend that you discuss your MIC requirements with your energy provider to determine the correct MIC for your unit.

- Wattless Charges

  On large commercial pig farms, there are likely to be items of electrical equipment that require wattless energy to operate. Wattless energy is measured separately from your general units, and if you exceed a certain limit, during certain periods it may give rise to a separate charge. Electric power consists of two components: active power and reactive power. Active power is recorded on your normal electricity meter, and appears on your bill as general day and night units. Reactive power is also recorded by your normal meter, but will only affect you if you are a large industrial or commercial business user. This is because certain equipment common to industrial or other large businesses - such as motors or fluorescent lights (e.g. in an industrial premises) that need reactive power in order to operate. Again, it is important that you study your energy bill and see if there is an excess wattles charge regularly occurring on your bill. If so, you should contact your electrical contractor to fit power factor correction equipment. This will reduce the amount of reactive power you consume and help to avoid wattless charges on your bills.

Medium term steps in trying to reduce your overall energy costs:

Maintenance, repairs and cleaning is an essential part of reducing wasted energy. Check the accuracy of controls on your farm, check that sensors are correctly positioned and kept clean (dust, cobwebs & fly dung will contribute to incorrect sensor reading). Use the information obtained from control systems to see how the system is performing. It is critical to check if the ventilation system is working in tandem with the heating system throughout the whole unit. The ventilation system may control house temperature at a massive cost to the heat supply system if the two systems are not working in tandem with each other.

Insulation of pig buildings

The provision of heat in buildings is very wasteful if there is a poor level of insulation in the building. The walls and ceilings should be insulated to achieve suitable U values. Check the insulation to see if it has been damaged by pests. The temperature fluctuation in the pig house should also be checked by using maximum-minimum thermometers to monitor if house temperatures vary considerably between day and night-time. Is it worth replacing poorly insulated doors?

Lighting

We all know the importance of lighting throughout the different stages of production. The LED (light emitting diodes) is the latest technology in lighting and has come on leaps and bounds in the last ten years. It's really a very commercial technology available to producers today. The light fittings are more expensive to install but last much longer and are more efficient from an energy use perspective. They do not heat and use less energy as a result. They are well worth considering in new buildings because of their lower energy requirements.

Farrowing house tips: Accurate heat control is a requirement in the farrowing house for the survival of newly born piglets.

- The ideal is to have a farrowing room temperature of 24°C once the first piglet is born in the room. This should be reduced to 20°C -21^{0}C when the youngest piglet in the room is over 48 hours old.
- Pig producers may use shredded paper to supplement the heat source at farrowing rather than an infra-red bulb.
- If the average gestation period is 115 days, it is not necessary to heat up the creep area until day 113 of gestation.

- Poor temperature control can lead to unnecessary overheating of pads resulting in wasted heat production and wasted ventilation energy. This applies particularly in the first two weeks after farrowing.

Weaner and finisher accommodation tips: Ventilation and feeding systems are the main users of energy in the weaner and finisher section of a pig farm.

- First stage weaners also require a source of heat. The aim is to have newly weaned pigs kept at 28°C to 29°C initially, with a reduction of approximately 2°C in room temperature each week thereafter. However, with heavy weaning weights there may be some scope to reduce these temperatures.
- Implement dual temperature zones in houses by installing covered creep areas in weaner houses. This means that only the small area under the covered creep needs to reach 20-30^{0}C, the temperature in the rest of the room can be reduced to 24°C.
- Make sure controls are properly calibrated and set to the correct temperature
- Re-insulate buildings if necessary and seal buildings to stop draughts
- With wet feeding and slurry pumping systems, choose pumps that give the best flow to energy characteristics.

On farm generators

A generator is a practical investment for all farmers. With the electricity networks set to come under more pressure this winter and an increased risk of blackouts due to electricity grid being overloaded and unable to cope with demand there is more of an interest in having your own generator on farm. There is a range of different sized generators available and the load the generator will be asked to run should determine what size of generator you buy or lease. Standby generators are the most common type of generators used on pig farms. These are diesel or gas powered generators with their own engines. In most cases, these generators are wired to automatically kick in in the event that power goes down. The downside to these generators are they are more expensive to install and a direct fuel supply is needed for them to work. However, with the crippling cost of energy now some units that are coming out of contract are using their generators as the main source of energy supply particularly during daytime rates. Speak to your Teagasc adviser to calculate the cost of running your generator to replace daytime electricity usage. However, if you are using a generator you must inform the ESB to ensure the safety of the ESB network. Most modern generators can be programmed to turn on and run for an hour or so at regular intervals. Also, it is important that generators should be tested a few times a month when not in use.

Long term steps in trying to reduce your overall energy costs:

Heat pumps:

A number of units have installed air-source heat pumps (otherwise known as air-to-heat pumps) to heat the heat pads in farrowing units. These systems extract heat from ambient air and use it to heat water via heat exchange systems. This can be ideal to heat water to temperatures of 55°C. The capital costs of these systems can be high, but they are effective in reducing fuel costs.

Solar PV:

Solar photovoltaic (PV) cells work on the principle that energy in the sun is converted to electricity. PV cells are used to convert solar radiation into direct current (DC) electricity. This DC electricity is then inverted to alternating current (AC) electricity for use in buildings or export to the grid. When light shines on the PV cell, an electric field is created across the silicon conducting layers, which causes electricity to flow. Solar PV is a well-proven technology and has been around for years. There is the potential to store excess energy in a battery or export it to the national grid. The technology is predictable as well in terms of the output for kW installed. Generally, solar PV will generate 20 to 50% of the farms annual requirement. It is very difficult to put in a system on pig farms that would generate 100% of the farms requirements. You would need to look into requirement around planning restrictions; roof space, etc will determine how big you can go. Once you have bought your solar PV panels, the maintenance and operating costs are small. Pig farms will require robust panel because of their environment and producers should enquire about product and performance warranties.

Funding available

- TAMS (PPIS)
    - 40% grant aid on an investment ceiling up to €80,000
    - 100% of electricity to be used on farm
    - On farm Solar PV survey required
    - Maximum size for grant aid is 62Kw (larger at own cost)
    - Potential new scheme in 2023

- Better Energy Communities (SEAI)
    - up to 25%
    - pig farmers could become part of a local community project
    - https://www.seai.ie/grants/community-grants/

- EXEED Funding (SEAI)
    - Excellence in Energy Efficient Design (EXEED)
    - funding of up to 50% (70% for pre-investment support)
    - https://www.seai.ie/business-and-public-sector/business-grants-and-supports/exeed-certified-grant/

Conclusion

Energy is a resource that must be used efficiently and effectively. The large variation from one farm to another suggests that a greater emphasis needs to be put on energy efficiency. A lot of the savings are greatly influenced by management which is the most important aspect of energy efficiency.

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