AUSTRALIAN Pork

Pigs to Pork

Issue 10 Autumn 2019 Research and Innovation

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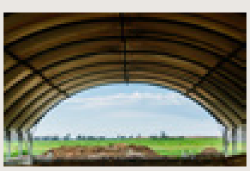

APL Membership: for information call Rachel Blake on 02 6270 8807 or visit the APL website at www.australianpork.com.au/members.

2019 Science and Innovation Award recipient

APL's Rachael Bryant, the Hon David Littleproud MP, 2019 Science and Innovation Award winner Anne Watt, and APL CEO Andrew Spencer

APL is pleased to announce Dr Anne Watt as their recipient of the 2019 APL-sponsored Science and Innovation Award.

During her PhD, Anne was involved in the discovery of a new bacteria that causes respiratory disease in Australian pigs. Her Science and Innovation Award project will examine the presence of the new *Glaesserella* species, as well other bacteria, in the lungs of pigs.

Through her project, she hopes to answer questions including *Is this new species common?* and *How can it be treated?* so that her work can help Australian pig producers manage respiratory disease in their herds.

The Autumn 2019 edition of Pigs to Pork highlights the results of a recent Physi-Trace study using fresh pork, an update on ongoing studies into gilt vs sow progeny, the outcomes of a recently completed study that looked at trends in environmental impacts from the pork industry, the risks associated with the importation of fresh pork, and a biosecurity reminder.

Accurately tracing fresh pork to pro perty of origin using Physi-Trace™

The Australian pork industry's traceability system can determine farm of origin for unpackaged fresh pork and determine whether processed ham and bacon is Australian or not. Physi-Trace™ does this by identifying trace elements of a sample and comparing them with known reference samples.

Processors currently involved in Physi-Trace™ slaughter around 70% of Australia's pigs. Samples are collected by processors according to an agreed sampling plan, and used to fill the reference database. Four abattoirs collected 3269 samples this quarter.

In February, as part of APL's Physi-Trace™ project, a controlled traceback was conducted for fresh pork. Three unknown samples were selected at random (APL-1, APL-2, and APL-3) and provided for analysis. In addition, eighty pork meat reference samples were provided through the Physi-Trace™ program, representing approximately ten samples from eight different farms. These farms were represented by tattoos, and for the purpose of this report, will be referred to as Groups 1, 2, 3, 4, 5, 6, 7, and 8.

Statistical analysis was conducted to identify the origin of the three unknown samples. Linear discriminant analysis (LDA) was explored to narrow things down.

LDA is a method used to demonstrate the extent to which an observation (in this case, APL-1, APL-2, and APL-3) belongs to a particular group (in this case, one of the eight Groups of reference samples). Though LDA plots appear two dimensional, they also explore other dimensions to find the best match between an observation and group.

Firstly, all eight tattoo reference groups were clearly distinguished from each other using LDA analysis (see Figure 1).

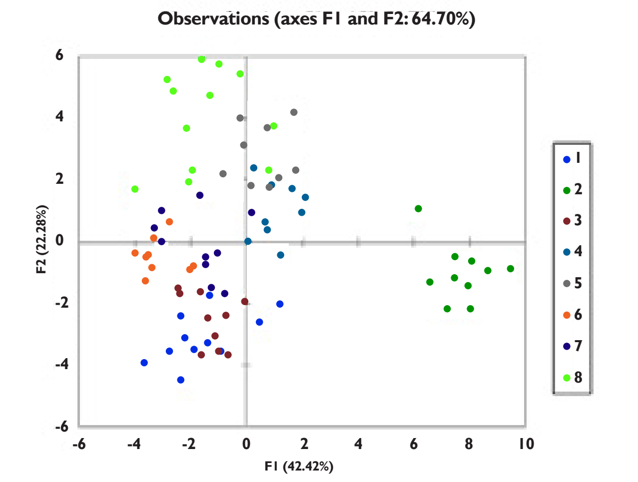

Figure 1 LDA plot of the eight reference groups (1, 2, 3, 4, 5, 6, 7, and 8).

The unknown samples on the plot were included (see circled dots on Figure 2). Using the plot, a prediction was run to determine the probability of the unknowns fitting within one of the sample groups.

The predictions fit within a 95% confidence interval; it was found that APL-1 had a probability of 1.00 of fitting within Group 3, APL-2 had a probability of 0.997 of fitting within Group 4, and APL-3 had a probability of 0.972 fitting within Group 6.

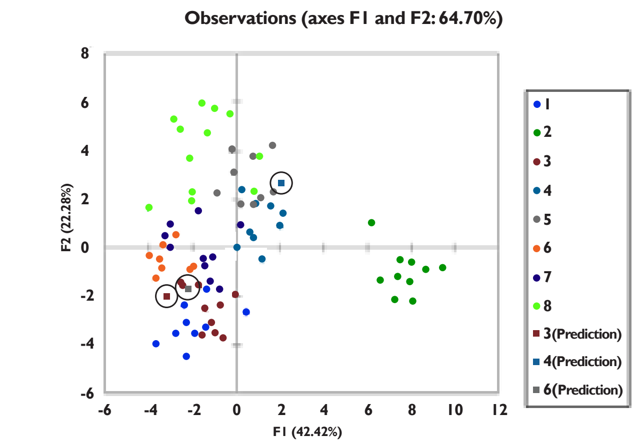

Figure 2 LDA plot of the eight reference groups (1, 2, 3, 4, 5, 6, 7, and 8) and the unknowns; APL-1 is 3(Prediction), APL-2 is 4(Prediction), and APL-3 is 6(Prediction). Prediction points have been circled.

Importantly, when the unknowns' tattoos were revealed, they matched the groups that had been predicted by the LDA plots.

One of Physi-Trace's™ Key Performance Indicators is that 95% of fresh pork should be able to be traced back to its property of origin (or tattoo) within 7 business days. In this study, the time taken to trace the three unknowns (APL-1, APL-2, and APL-3) to their property of origin was 6 days.

This study successfully demonstrated both the capability of Physi-Trace™ to correctly identify unknown samples of fresh pork (with farm-level precision), and its ability to do so within 7 business days.

This demonstration of Physi-Trace's™ ability to accurately identify the property of origin of unknown Australian fresh pork samples highlights its potential as an effective traceability tool to support the Australian pork industry.

For more information please contact Dr Heather Channon at heather.channon@australianpork.com.au or on 0423 056 045

Gilt versus sow progeny – why do they differ in their performance?

Jessica Craig from Rivalea, Australia, is currently completing a PhD through Murdoch University. The aim is to understand the early development of gilt progeny in order to improve their lifetime growth and survival, as well as the reproductive performance of replacement breeders selected from gilt litters.

Piglets that are born to first litter sows (gilts), often referred to as gilt progeny, are known to be slow growing and have higher rates of mortality and morbidity than piglets born to sows in subsequent parities (sow progeny). Hence, gilt progeny are often thought of as an area of significant loss of productivity.

Jessica's initial studies quantified the differences in performance (reproductive and growth) between gilt progeny and sow progeny. It was found that gilt progeny were born, weaned, and sold lighter than sow progeny, and that a large proportion of the difference in performance in the weaner and grower-finisher stages was a consequence of gilt progeny performance in the farrowing house. Additionally, gilt progeny were 1 day older, on average, at first mating than sow progeny. When compared to sow progeny, an additional 4% failed to return to oestrus after their first observed standing heat; as a consequence, they did not have their first mating by 270 days (38 weeks) of age.

Jessica's studies also found that, as a management strategy, segregated rearing of gilt progeny and sow progeny was unsuccessful in reducing pathogen transmission between the two groups. Several studies were conducted to further identify and understand any underlying physiological factors that may affect gilt progeny performance in early life. These studies compared compositions of colostrum and milk between gilts and sows; organ, tissue and gastrointestinal development around birth and weaning; and absorption of immunoglobulin G (IgG) between gilt progeny and sow progeny. Colostrum and milk concentrations of macronutrients and IgG were similar between gilts and sows. However, gilt progeny had lower levels of IgG in their blood after colostrum ingestion, suggesting that their ability to absorb the IgGs in colostrum were compromised compared to that of sow progeny.

Furthermore, the development of gilt progeny was different to that of sow progeny, particularly, at birth and similar to that of intra-uterine growth restricted piglets (IUGR) which indicates that gilt progeny are already at a disadvantage before they are even born.

Finally, in a large commercial experiment, Jessica fed medium chain fatty acids and/or conjugated linoleic acid (CLA) to gilts in lactation in order to try and improve colostrum intake and energy levels in neonatal gilt progeny. However, this was largely unsuccessful in improving gilt progeny performance. CLA did improve pre-weaning survival rates of both gilt progeny and sow progeny.

The substantial work undertaken as part of Jessica's PhD has shown that gilt progeny represent a significant loss of production in commercial systems and focusing on improving their performance in the pre-weaning period will be crucial to improving their lifetime profitability.

Management strategies to improve lifetime performance of gilt progeny should, therefore, target growth in late gestation to improve birth weights and prenatal development, as well as throughout lactation in order to increase gilt progeny weaning weights. Jessica is looking to continue her work on improving gilt progeny performance through targeted management protocols. She currently has an APL funded project extending her work on CLA inclusion in late gestation and lactation in order to determine the optimal inclusion level and duration of feeding to improve gilt progeny growth and survival. Furthermore, Danni Wijesiriwardana from the University of Melbourne is also completing a PhD in the area of gilt progeny management and is due to complete this work in the next 6 months.

Watch this space for further updates from both Jessica's and Danni's ongoing work in this area. If you have any questions in the meantime, please contact Dr Rebecca Athorn at rebecca.athorn@australianpork.com.au.

Trends in environmental impact from the pork industry

A recent study conducted for Australian Pork Limited by Integrity Ag & Environment has shown that ongoing changes and improvements in production efficiency have resulted in large gains in environmental performance.

Using a life cycle assessment (LCA) approach with a 'cradle-to-farm gate' boundary, the changes in greenhouse gas (GHG) emission intensity and key resource use efficiency indicators (fresh water consumption, water stress, fossil fuel energy demand and land occupation) were determined at decade intervals between 1980 and 2010. Results for 2020 were projected from trends identified between 1980 and 2017 data.

Impacts were reported per kilogram of pork (live weight – LW) produced in each decade.

The analysis showed that since 1980 there has been:
- 44% improvement to feed conversion ratio (FCR)
- 69% lower greenhouse gas (GHG) emissions from 10.6 to 3.3 carbon dioxide equivalent (CO2-e) per kg LW
- 80% lower water consumption from 441 L/kg LW to a projected 90 L/kg LW
- 58% lower fossil energy use from 34 MJ/kg LW in 1980 to a projected 14 MJ/kg LW
- 63% lower land occupation from 31m2 kg LW to a projected 11 m2 kg LW

Australian pork production has changed dramatically over the last 40 years. Improvements have been driven by:
- Herd productivity
- Changes in housing, manure management and technology use
- Improved feed production systems such as cropping systems for feed grains

Improved feed conversion ratios led to lower feed requirements and reduced manure production and was also partly associated with reduced feed wastage. In addition, improvements in feed grain production systems resulted in lower impacts per tonne of feed grain produced. This was related to reduced tillage, higher yields and a decrease in the proportion of irrigation water used for grain production.

Herd Productivity

Between 1980 and 2020 (projected) herd productivity improvements included increases in:
- Number of pigs born alive
- Pigs weaned and pigs slaughtered per sow
- Average carcass weight of pigs sold
- Average daily gain in growing pigs
- Reduction in feed wastage via better feeding systems
- Reductions in herd feed conversion ratios (FCR)

Housing and manure management systems (MMS)

Between 1980 and 2020 (projected), the major changes to housing and MMS included:
- Introduction of deep litter in late 1990s
- Reduction of conventional systems in 2000 as a result of deep litter introduction
- Outdoor production has remained fairly stable at around 10%
- Increasing use of covered ponds

GHG emissions

Between 1980 and 2020 (projected) manure management systems (MMS) were the largest emission source. However, emissions from the MMS declined over the analysis period and this decline of GHG emissions is reflected in changes to lower emission intensity systems such as deep litter housing and anaerobic digesters or covered ponds and in response to reduced flows of manure and feed waste to the MMS per kg of pork. Lower emissions were also associated with:
- Improved feed formulations which have led to lower predicted manure excretion rates
- Decreased feed wastage due to improved feeding systems and feed management
- Decreased tillage to reduce soil carbon loss

Energy use

Fossil fuel energy reduction was primarily associated with feed grain production:
- More efficient use of feed led to better FCR and herd improvements
- Decrease in tillage
- Improvements in engine and machinery efficiency

Water consumption

Water consumption reduction was primarily associated with feed grain production. There were:
- Significant reductions in crop irrigation
- FCR improvements reduced weight of feed per pig

Piggery water consumption reduced as a result of efficiency gains from:
- Increased water recycling (flushing)
- Water management improvements

The Department of Agriculture and Water Resources has indicated that Australia's climate is changing, and the impacts of climate change can be seen in the differences we are experiencing in rainfall, temperature and extreme weather events. Climate-smart agriculture – which aims to boost farm productivity, adapt to climate change and reduce emissions – is gaining momentum. The findings of this study demonstrate that the pork industry is benchmarking best practice in climate smart agriculture.

APL considers that further research and development opportunities are identified as:
- Biogas and closed loop technologies
- Improving reuse opportunities for spent bedding
- Increased utilisation of food waste that is treated into optimised and controlled diet formulations under the supervision of nutritionists
- Nutrient recovery and improved effluent use

For further information please refer to the APL Project 2017/2212 Trends in Environmental impacts from the pork industry or contact Denise Woods, Manager Environment – Research and Innovation at denise.woods@australianpork.com.au or on (02) 6270 8826.

Key results:

- Improvements in herd and system efficiency has led to improved feed conversion ratios.
- The introduction of deep litter housing and covered ponds in Australian piggeries contributed to reducing environmental impacts.
- Reduced tillage, higher grain yields and a decrease in the proportion of irrigation water used for grain production improved the efficiency of the feed grain production systems resulting in lower impacts per kg of feed grain produced.

Lessons learned – the risk of exotic disease incursion through the importation of fresh pork

In 2014, New Zealand made changes to their Import Health Standards (IHS) to allow 'consumer-ready cuts' (fresh meat in pieces of up to 3kg with major lymph nodes removed) to be imported into New Zealand. The changed import standards have resulted in a significant increase in the amount of fresh pork imported into New Zealand (Figure 1).

At the time, APL commissioned a study to identify the biosecurity implications for the Australian pork industry if Australia were to follow New Zealand's lead and allow the importation of fresh pork products. Australia's Pork Biosecurity Import Risk Assessment (Pork BIRA) considers that porcine reproductive and respiratory syndrome (PRRS) was and remains, one of the highest priority threats to Australia's pork industry. While the study looked specifically at how changes to the import standards might affect the likelihood of the introduction of PRRS, the findings can be applied to other exotic diseases, including the current threat of African Swine Fever (ASF).

The 2014 changes to New Zealand's IHS have the real potential to put the country's biosecurity at risk, as countries that are positive for various exotic diseases (including PRRS) are able to import fresh pork into New Zealand. Based on the amount of fresh pork now imported into New Zealand, it has been predicted that the risk of PRRS being introduced into New Zealand has increased from a mean value of approximately once in twelve-hundred years, to once in less than a hundred years as a result (figures given in personal communication).

It is well known that pork and pork products contaminated with diseases are a known pathway of infection through swill feeding to pigs, including ASF outbreaks across Europe, Russia and China. APL strongly supports the Australian Government's approach to protecting border biosecurity, for the pork industry through the robust science-based pork protocols.

Risk and response planning for an exotic swine disease incursion through the importation of fresh pork (APL Project 2017/2213).

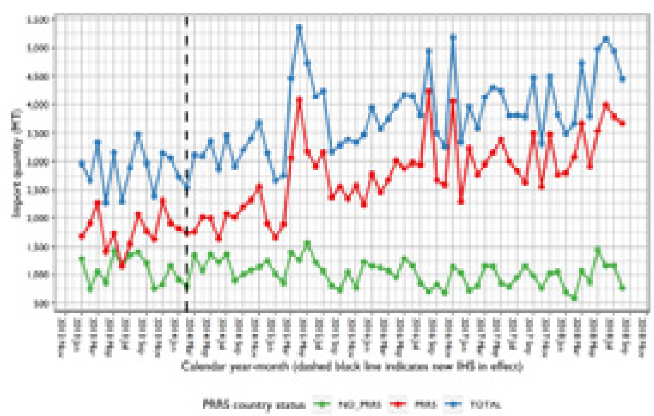

Figure 1. Volume of pork imported into NZ per month, stratified by PRRS status of country of origin.

Prevention is better than cure – prevent exotic disease entering your farm

Dr Trish Holyoake presented a webinar addressing ways small holders can increase their biosecurity and reduce the risk of exotic disease incursions the webinar is now available on the APL website at http://australianpork.com.au/industry-focus/biosecurity/.

African swine fever (ASF) poses a potential disease risk for Australian pig producers. Whether you own one pig or many, good biosecurity at the farm level is one of the easiest ways you can protect your animals.

Swill feeding is illegal. It is food scraps or food waste that contains or has been in contact with meat or meat products.

For questions about exotic diseases and biosecurity, please contact Dr Lechelle van Breda at lechelle.vanbreda@australianpork.com.au or on 02 6270 8816.

Take home messages:

- Do not feed swill feed to pigs
- Don't allow employees to bring any type of pork products on-farm
- Control what visitors feed your pigs
- Prevent feral pigs having contact with your pigs
- Quarantine new pigs
- If you see something unusual call your veterinarian or the Emergency Animal Disease Hotline on **1800 675 888**
- Biosecurity, Biosecurity, Biosecurity