Increasing per Sow Production

AND OTHER TECHNOLOGIES TO IMPROVE EFFICIENCY IN THE AUSTRALIAN PORK INDUSTRY

A report for

By SHAUN WELSH

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Sponsored by:

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Foreword

The following report aims to investigate how as Australian pork producers we can lift the output of our businesses. The specific topic that I have researched is improving per sow production with specific interest in lactation length.

This research is important as we compete in a global market and our domestic market is under pressure from rising imports. Many pork producers I hope will benefit from this research as it directly relates to on farm practices that can be readily implemented generally without huge outlays in capital.

A key findings of this report is that Artificial insemination will play a larger role in lifting production with more consistent production outcomes. Lactation length will need to be monitored as it will have a different value against performances for many farm operators, but the main thing is that producers are aware of this issue.

The most interesting finding of my research is that I believe that Australian producers have been disadvantaged by no access to porcine genetics since 1986. During this period other countries, especially in Europe have made enormous ground in genetic improvement of litter size compared to Australian industry averages.

It is essential that the importation of specific genetic material be reviewed and looked at more closely with increased competition from imported product.

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Abbreviations

PSY - Pigs Weaned per Sow per Year.

AI - Artificial Insemination

Executive Summary

The following report is about focusing on the reproductive efficiency of the modern Australian sow. It is about developing a greater understanding as farmers and managers of how we can best manage these animals to allow them to express their genetic potential. It is about understanding what factors influence or can influence positive improvement to sow output.

This research is extremely important in allowing farm businesses to maximise efficient production. It will also help some farmers and managers to better understand some of the physiological factors involved in successful reproductive outcomes. Australian pork production businesses now compete in a global market place as US, Canada and Denmark are the main competitors to our domestic processing pig market. These countries have different cost structures, different regulations – welfare, governmental, higher allowable slaughter weights and higher per sow production (PSY) and access to the worlds best genetics and large gene pools.

The import levels have grown in this market to the point of 75% of the product comes from one of the above mentioned countries. The remaining fresh meat market, which cannot be supplied by imports due to import restrictions, demands a smaller carcase.To lift the output of kg's carcase weight per sow there are two parts, grow the pigs bigger or sell more pigs per sow. I have focussed my report on improvements to the number of pigs sold per sow.

I hope to help the Australian industry in general to remain competitive now and into the future.

My key findings are that AI will play a bigger role in effective farm management and 100% AI will become the accepted norm with the correct protocols and implementation on a farm by farm basis. Lactation length will continue to be critical to having the numbers of piglets total born in subsequent litters to allow for efficient output. I believe that the optimal lactation length will be not less than 23 – 24 days and up to 26 days.

One of the last factors that kept recurring in comparisons between countries and Australian data is what percentage of the difference is genetic??. Australia has not had any importation of porcine genetic material since 1986. In this corresponding period in Denmark there has been a tremendous lift in total piglets born and the advent of the " Hyper-prolific " sow. I believe that there should be at least some research or discussion given to importation of specific genetics that may allow Australian producers to compete in their own domestic market against countries that have this genetic access.

Current Australian research should focus on comparing the modern Australian sow against the sows of its' competitors. The one way in which some form of comparison maybe achieved is to look more closely into average ovulation rates in commercial sows. This would allow for a comparison of "like with like ". It should allow these sows to be directly compared. If the sow does not have the corresponding number of viable eggs, there will not be sufficient piglets born allowing for acceptable percentage of loss.

In travelling the world and investigating the countries that pose the greatest threat to the viability of the Australian pig herd, I have found these countries very good producers with strong networks, efficient production and strong cultures of pig husbandry. Following are some recommendations for improving sow productivity.

Introduction

The timing of researching my study has coincided with some of the most adverse trading conditions that the Australian Pork Industry has faced in living memory. The continuing drought across eastern Australia has made feed grains scarce therefore almost doubling their value from historically high rates. A strong Australian currency against the US dollar, has allowed imports of product suitable to the processing sector to flood into the domestic Australian market. The fact that this product is available has had a negative effect on domestic pricing. This strong currency also presents problems of supplying export markets in Asia as the currency movements have eroded their buying power and therefore make it difficult for exporters to trade positively. These factors have played havoc in the seasonal pricing within the domestic market.

The industry is facing a major shake up which many producers will not survive. The loss of significant numbers in the Australian sow herd in the traditonally profitable season leading up to Christmas will result in a very different industry to the one we know today.

The pig industry is sensitive to feed prices as it represents 60 – 70 percent of the cost of production, and increased grain prices have significantly increased this percentage of feed costs. There is little that can be done to protect a pork business from these extreme trading conditions. However a productive unit that is producing above average kilograms carcass weight per sow per year is the unit that will survive.

Output in kilograms carcase weight per individual sow is very important as it helps spread the fixed costs over a larger number of kilograms and therefore helps to lower the cost of production.

This statement is very true and sounds very easy, however this is not the case and there are many other factors that influence the outcome of efficient pork production.

OBJECTIVES

This leads to my primary focus of my area of study of improving per sow productivity. There are many areas of potential improvement to this measurement but I will place particular emphasis on the increase in lactation length and its effect on subsequent litter size. There will also be many other factors that I will address in an overall production system that will improve output in the business.

I also plan to compare systems in the countries that are direct competitors in our domestic market. The comparisons from the individual systems should highlight the differences between performances and allow some factoring for some of the individual difference for example in climate, welfare and legislation etc.

Questions that I hope to answers are:

Why do they have superior production to that of the Australian herd?.

What management techniques can be transferred to Australian production systems?

It is also important to understand our competitors and their strengths and weaknesses and to be aware of this when marketing our products.

It will be an issue of increasing the knowledge of the modern sow and how we can help her to perform better and realise a better outcome for the people that manage and own these animals.

COMPARING PRODUCTION SYSTEMS

It is important to compare the Australian production against that of our world competitors. It is this benchmarking and measuring that will allow Australian farmers to set goals to go about improving the financial returns of their businesses.

The following table gives some comparisons in Australian dollar equivalents. The most striking figures in the table is kilograms of carcase weight produced per sow. It highlights where Australia sits in average production in world terms and also shows the potential production that other countries are able to produce. The two main factors are average carcase weight of which Australian producers are 16 percent lighter and a lower number of pigs weaned per sow.
These 2 variables result in a difference in output of between 390 – 603 kg per sow. This figure is enormous in terms of reducing cost of production.

Table 1 Business Indicators and Costs for Selected EU Countries, the USA and Canada (2006)

Indicator/Country	*Denmark*	*USA**	*NL**	*Australia+*	*Canada**
COP ($Aus/kg carcass weight)	2.07	1.52	1.98	2.35	1.41
Pigs weaned/sow/year	25.9	22.3	25.1	21.1	21.8
Pigs sold/sow/year	24.0	20.7	23.9	20.2	21.9
Carcass weight (kg)	80.5	91.9	88.4	75	90
Carcass/sow/year (kg)	1935	1905	2118	1515	1971
Feed cost ($Aus/tonne)	265	216	275	302	208
Average Diet DE (MJ/kg)	14	14.8	14.2	13.3	12.8
Diet cost (Cents/MJ DE)	1.89	1.45	1.9	2.27	1.63
HFC (Carcass weight basis)	3.75	4.03	3.56	4.13	3.84
HFC (MJ DE/kg carcass weight)	52.5	59.6	50.6	54.9	49.2

NL The Netherlands

*** based on British Pig Executive -2006 Pig Cost of Production in Selected Countries (December 2007), + based on Australian Pork Limited's Australian Pork Annual (2006).**

Lactation Length & Subsequent Litter Performance

It has been widely recognized that increasing lactation length will positively affect subsequent litter size. (eg. number of pigs total born / born alive). The research has indicated approximately 0.1 pigs for every day increase over 21 days in lactation length. This figure of .1 maybe very conservative in the farm that I manage I have seen in some instances this figure maybe .3 - .4.

In my travels to the US, Denmark, Holland and Ireland I have seen many farms with differing levels of production, herd sizes, management styles and infrastructure. Such contrasts have been where I have visited a family farming operation with 35,000 sows with many sites in the US and to 600 sow family operated farm in Denmark. Both of these farms have very good production figures with relationship to pigs weaned per sow per year (PSY).These two units operated very similarly in the breeds of sow that were used being predominantly an F1 sow of Landrace and Large White breeds. Artificial Insemination programs ran along similar lines. However the major difference was lactation length. In the US herds a weaning age of 18 – 22 days was very normal but in Denmark 28 – 35 days is a very strict standard. There is some legislation preventing sows being weaned prior to 28 days unless there is a good reason such as the sow is sick etc.

However both of these systems had farms that produced from 25 to 30 PSY as a very standard form of production. It has made comparing this to the Australian industry a little more difficult but it maybe gives the producer some choices in how it is achieved.

To explain some of the factors that influence the productivity of the sow I have broken it down into several parts that I have found to be important and applicable to the Australian Industry. These areas of focus are not new to the Australian industry but there maybe reason to focus more or slightly change management in these key areas.

Genetic Advantage – Breeding Company Alignment

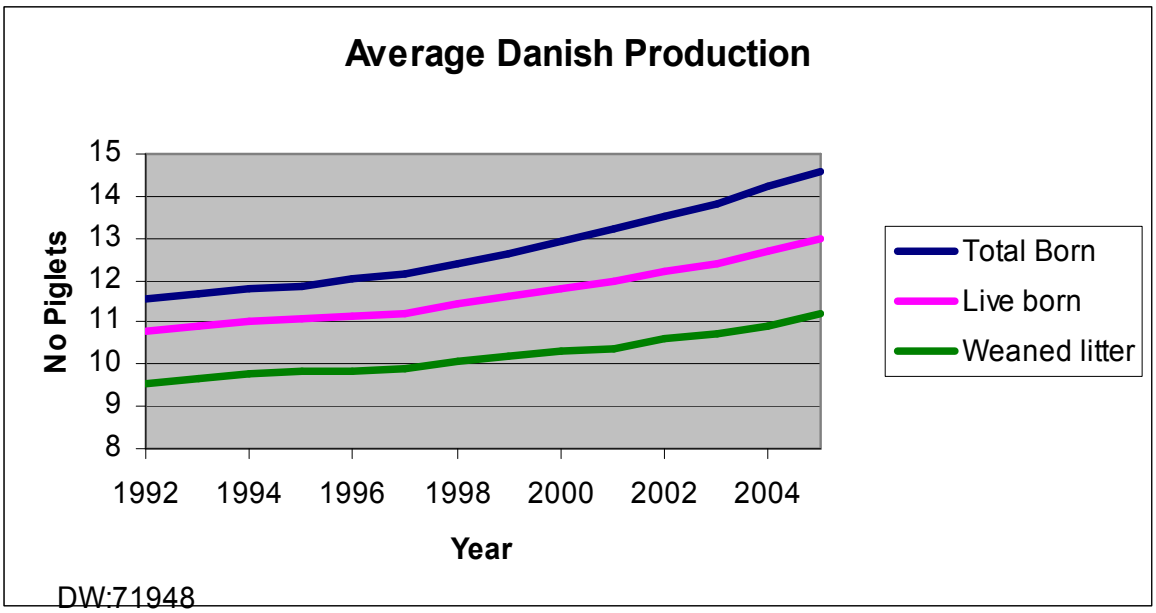
The one factor that has been common between all of the high PSY producing herds that I have visited or come in contact with have a strong relationship with superior genetics.

In essence a pork producer needs to be able to take advantage of available genetic improvement from these large companies. These companies have tremendous resources available to keep developing lines and products suitable to market requirements, whilst supplying efficient genetics that provide reliable production outcomes.

With the above being said, it is the producer's responsibility to manage the animals to express their genetic potential into efficient production and a positive financial outcome for the farm business.

Danish pig producers have access to a genetic bank that is owned and operated on behalf of the Danish producers. The Co-operative has its own breeding company and research department that its objective is to provide practical research into improving profitability to the producers in relation to sow reproductive efficiency, farrowing house management, weaner management etc. This research is important for Danish producers to maintain competitive advantages, as they export 90% of the 25 – 26 million pigs produced each year. It has been this joint approach that has allowed litter size in Denmark to increase dramatically over the last 15 years. The Danish litter size has moved from around 11 to over 13.0 average born alive.

Graph 1 Avg Danish Production – Source Flemming Thorup Danskesvineproduktion



PIC North America has been very successful as well in providing genetic material to the progressive swine producers. PIC has a very impressive breeding program that has been developed that requires a lot of very impressive data of the physical pigs being recorded. There has been a lot of data at the slaughter houses collected in relation to loin depth, pH, meat colour, lean meat % etc. This along with physical performance data of growth rates, back fat, reproductive efficiency etc is used in their PICtraq program. This program has allowed a tremendous amount of data to be generated about their animals and it has allowed superior animals to be retained for longer periods.

The US systems and objectives also run along slightly different lines as with larger units and a substantial amount of vertical integration with the packers. It is this integration at a processing level that has had a great amount of influence on the carcase qualities of the slaughter pigs via their respective genetics.

Recording Systems
You can't manage what you don't measure

Accurate recording systems of your pork production enterprise are a must. The level of most producers that I visited was very thorough. It is important that all areas of the business are recorded accurately. The US producers had very comprehensive production and financial records available to key people. It is these records that allow management to make the business more profitable and also to reduce unnecessary wastage of resources. The producers in US have also taken this information to the next level especially in some of the interpretation of the raw data.

The number of PSY is a very important and universal measure of herd productivity but maybe not an overall measure of efficiency. High PSY production may be one thing but the efficient production is a true measure of profitability.

Some of the new benchmarking figures are

Total Born	13
Born Alive	12
Weaned	11

(These figures relate to US with Lactation length of 18 – 22 days)

One new measurement is the weight of pigs weaned per sow per year. A typical value is 365 lbs (165 kg). This measure allows some value to be placed on the pig and its subsequent performance for the next 18 to 25 weeks in the growing phase of the business. The relationship between piglet weights at weaning has a direct correlation with post-weaning mortality, weight at slaughter or time to optimum slaughter weight. So this measure allows some quality parameters to be also assigned to the PSY.

One of the major factors that can affect a high producing herd is sow longevity. As a sow gets pushed harder to produce more she becomes susceptible to not fulfilling her potential by her life being cut short by structural problems, reproductive issues, disease etc. Therefore a value of 55 piglets to be weaned in a sow lifetime has been arrived at, to again put some quality behind a total production system. This will allow a positive value on bringing in replacement gilts to the herd to make sure that they have been inducted and grown correctly to be ready to form a productive part of the herd for several litters.

This leads to the final part of this section in that, whilst there are gains to be made in improving production by increasing pigs born alive etc, I feel there are many opportunities to improve output by reducing wastage. Areas that are focused on in the countries that I have visited so far are:-

1. Stillbirths
2. Pre-Weaning Mortality
3. Post-Weaning Mortality
4. Reproductive Wastage
5. Improper Gilt Management
6. Disease management

There are possibly better returns in retrieving some of this missed opportunity and therefore boosting production, reducing costs and having a positive outcome for your business.

Artificial Insemination – Implementing 100 % services

I believe that Artificial insemination will be a key driver for delivering reliable production especially in the mating / reproductive area.

AI however can be a doubled edged sword as far as production is concerned. The protocols for the correct techniques for successful AI need to be implemented otherwise the system will not deliver the required results. A failure of the system due to a lack of management is poor management. I have witnessed large farms that have in excess of 4000 sows implement 100% AI with amazing results. There have not been any farms that I have visited that have operated at less than 100 % AI. There are many factors that will influence the success of such a program. I will outline some of the important factors that I have seen in the difference between US and Europe and Australia.

There has been a longer history of AI and its implementation in these countries with a lot of consistent research. The high producing herds that have 100 % AI have a very solid routine that has developed with research. Nearly all of the farms that I visited had the same basic routines of:

1. Intensive heat checking once per day
2. Insemination 24 hours apart
3. 2.2 Average inseminations per sow
4. Sows inseminated in stalls
5. Constant boar exposure whilst inseminating
6. Sows stalled post weaning until mated
7. Semen used prior to 3 days of age

One difference also that exists is the large number of independent privately owned and operated boar studs. This second tier of breeding especially in US has allowed a new level of service and quality of product. The respective boar studs have access to the latest indexed boars that are supplied by their respective breeding company. These studs have the opportunity to purchase boars of above average indexes, which has the ability to give them a marketing advantage over their peers. This competition also has provided better semen quality as most operations use large amounts of semen and rely on a quality product.

One of the most important parts of this technology is the transport of the semen from the boar stud direct to the farm therefore maximizing the quality of the semen and its ability to achieve the desired results on farm.

Also I have noted that operator technique is important but I feel that the breeding barns have been setup to provide results far better than would be achieved in Australia. The positioning of boars and the crated females has had a major bearing on the success of the breeding plus the regulated exposure at the time of insemination to a boar.

The number and timing of inseminations appears to be approximately 2 inseminations 24 hours apart. The first insemination is at the first sign of standing oestrus and the next 24 hours later. The physical heat checking is only done once per day, but is done very thoroughly.

The life of a dose of semen is 5 – 7 days but most semen is used before or on day 3. There has been research done that has shown the levels of acrosin (the covering of the head of the sperm) starts to break down after 3 days and its ability to fertilize the eggs may decline. Therefore it may also affect reproductive levels as Total Born and Farrowing rate detrimentally.

Gilt Management and Induction into the herd

This area is one of the most important parts of a successful high PSY producing herd. I also think that it the most important factor in having longevity in the sow herd. If a gilt is developed correctly she will be a productive animal for a long period of time. This longevity is a very good measure of efficient production. I will not dwell for too long on gilt development as there are minimum guidelines that must be adhered to and they are:

- 210 days age minimum
- 130 – 140 kg in weight.
- mated at 3rd but definitely not before 2nd oestrus.

Farrowing House Ventilation & Environment for Production

One of the major differences between Australia and the other countries that I have visited has been the investment in ventilation and environment control of their barns especially the farrowing house. Admittedly their climate will experience far colder winters than we will ever experience, and this has necessitated superior buildings for maintaining constant temperatures suitable to pig production. I believe that Australian pig producers must find ways to better control wild fluctuations / seasonal changes in temperature that limit production or prevent economic benefits. The farrowing houses had constant temperatures of 18 degrees Celsius. The other factor that I thought was very good was that the air quality was perfect especially in Danish farrowing houses and there was also no draughts to chill little piglets.

This ventilation system and its benefit to a farrowing house can not be underestimated in a high producing sow herd. The environment for the sows is perfect. It allows sows to have high feed intakes to produce sufficient milk for a large litter. The piglets have their own creep area with heating supplied by a heat lamp for the first week then turned off. The reason the lamps can be turned off is that the ventilation system has no draught. This draught is very critical in chilling piglets and predisposing them to scours, overlaying especially in the first few days of life.

The Economics of Increasing PSY – What's it worth $?

It is now time to calculate what returns maybe available for increasing sow production in an average pork production system. If the Australian average PSY is around 20 then it should not be too difficult to increase this by 2 pigs weaned per litter.

Assumptions:

That the increased progeny will be housed at contract grow out rates of 80 cents per pig / week.

The average feed costs for the exercise will be $ 350 tonne as fed.

Feed conversion will be 2.4.

Slaughter weight will be 76 kilograms.

Bacon price will be $ 2.60 /kg

Therefore 76 DWT x $ 2.60 = $ 197.60 Gross income.

Less $ 41.60 for accommodation and Feed at 100 kg LWT x 2.4 = 240 kg feed.

240 kg X 35 cents per kg = $ 84 per pig Net Costs

Net margin over costs = $ 72 per pig sold.

2 PSY increase for a 700 sow herd would be $ 144 x 700 sows = $ 100,800.

$100,800 is a very impressive figure that in many cases may be just an adjustment to management techniques on farm.

Lactation Length, Ovulation Rate & Timing of Insemination

One interesting conclusion or observation after a discussion with Dr Nicoline Soede at the Wageningen University, Netherlands with regards to lactation length and subsequent litter performance has been the scientific documentation that a sow weaned before 21 days will have on average a lower litter size than sows weaned above 21 days. Sows weaned prior to 21 days also will have a lower LH response. She will also have smaller follicles and will have a higher embryonic mortality as a result of this shorter lactation length.

This could explain the lower litter sizes in the US, that the lower lactation length has resulted in lower numbers total born, but still quite satisfactory. Also their Insemination programs normally do not delay insemination as they inseminate at the start of standing oestrus. Normally a sow will ovulate two thirds through standing oestrus. And therefore optimally it is required to inseminate 24 hours and 0 hours prior to ovulation. Sows in the US are normally inseminated on average 2.1 – 2.2 inseminations per mating. So this would indicate that the sows have a shorter standing oestrus and therefore will ovulate earlier and by not delaying insemination they are and or should be inseminating optimally as far as ovulation is concerned. This differs to the Europeans that wean at 28 days and delay the first insemination until 24 hours post signs of first standing heat. Therefore the sows will have a longer standing oestrus and ovulate later in the cycle.

So as we can see that there are many variations to the systems and protocols of various pork production enterprises and the one size fits all approach will not suit as an approach to highly productive breeding barns needs to be more exact. It is certainly a very important aspect of a successful insemination program and therefore a farm by farm oestrus length will need to be performed on a regular basis. This length of standing oestrus will determine more accurately the optimal timing of insemination.

This would then bring me to the next point of ovulation rate. It is widely recognized that European sows, especially Danish and Dutch, have increased their total litter size and subsequently their pigs born alive over the past 10 – 12 years very markedly. This has been a result of increasing the ovulation rate of their breeding sows. It is not uncommon for standard F1 sows (Landrace x Large White) to have 25 eggs (oocytes). This is one area that I feel that Australian pig producers have been left behind in the quest for increasing production from a limited genetic base.

High PSY – The Conclusion

In comparison between the leading countries with high average PSY and Australia it is important to also allow for differences. Some of the main differences will lie in their climate. The extreme cold of winter and the relative mild summers have some advantages to high producing pigs but the extra investment in superior insulated buildings with top quality ventilation adds to initial construction costs and also running costs of heating plus the ventilation and control. So these enterprises will require superior levels of production to maintain margin over costs.

The other major difference that has been evident is genetic advantage. Many times I have compared overseas systems directly with my Australian experiences and there are some explainable differences but there is also some evidence that would support improved and or superior genetics. Lets also keep in mind that US has approximately 6.1 million sows, Denmark and Holland around 1.1 – 1.2 millions sows each and Australian production sits around 300,000 – 350,000 sows. There has been no importation of porcine genetic material since 1986.

What can Australian Farmers do to improve PSY?. It is all about expressing genetic potential. There are a lot of pigs that are farmed in Australia that do not go any where near fulfilling their production potential for a variety of reasons. As an operator or manager the systems and protocols must allow for the maximum efficient production from animals.

This maximizing of potential will involve some key management areas and some of the most important ones that I have outlined earlier are as follows.

Gilt Development. If this is not done correctly the long term production and profitability of the sow herd will not happen. The following standards are minimum's and must be adhered to as not to compromise these replacement animals potential production. They are as follows:-

1. Do Not Mate before Minimum 210 days of age.
2. Minimum 130 kg liveweight.
3. Mated on 3rd oestrus.
4. Fed on a specialist Gilt Developer diet.

If the above minimums are met the herd is on the way to fulfil productive potential.

Artificial Insemination

Artificial Insemination of sows within Australia is not a new management practice, however the importance in high producing herds must not be underestimated. The way AI is seen within Australia needs to change. Predominantly AI is used in conjunction with natural service, but all of the farms visited that had high PSY had implemented 100 % AI. So as Australian farmers, the management and implementation of AI must move to professional application of this service.

1. sows stalled for insemination
2. intense boar exposure at heat checking
3. intense boar exposure at insemination
4. avg 2.2 inseminations per service
5. direct to farm delivery of semen
6. correct semen handling procedures
7. Semen used prior to day 3 for best results.

If semen is used from a commercial boar/ AI stud a successful transport service to the farm is a very important procedure in the success of any program.

Investment in First Class Facilities.

This has been highlighted in many farm visits. The farms with the best production had the best facilities. Above average producers have invested heavily in first rate buildings with superb fitout and in particular European production have great ventilation systems. Good facilities will also help attract the best people to manage the enterprise. The business of pork production is a continuous production flow system, so the initial capital expense is important, as a bad design can be an opportunity lost every day and or the production can be compromised each and every day.

Individual farm timing of Ovulation

Timing of insemination is one of the most critical procedures in highly effective and successful mating of a sow. Therefore it is important to have the first insemination at 24 hours pre ovulation and at ovulation. This sounds quite easy however a sow will on average ovulate 2/3 of the way through standing oestrus. The difficultly is that it is a retrospective look at ovulation by the time you know how long the sow was on standing heat for it is too late because you should have inseminated her 48 and 24 hours earlier.
So to get a better snapshot of when ovulation will occur, it is necessary to record for individual animals how long they are in standing heat for. Once a profile is developed for a particular farm then a specific AI program can be implemented with a reasonable amount of science behind it. It would be also necessary to do a profile in summer and winter to take into account variation. Also it is advisable to keep an eye on lactation length as it may vary with increased farrowings etc. which will have a bearing on strength and length of standing oestrus.

Lactation length

I now come to what I personally view as a very important or under-rated effect of pork production. Over many years there has been a push to wean earlier to get better utilization of farrowing crates as they are expensive capital costs, also as a disease break weaning in an all in all out system as to provide a clean break in the cycle. There has also been a belief in over mating for the available crates to operate at 110% production as to maintain throughput of the other progeny buildings.

These are all valid reasons and people can argue the importance to their particular system. However from a production point of view in relation to Total Pigs Born and Born Alive and Farrowing rate, a longer lactation length with all things being equal, the more days plus 25 lactation length the better.

The main reason for this is that a sow requires a certain time, around 21 days post farrowing to prepare the uterus for the next pregnancy.
I believe that there is no right or wrong lactation length but the manger and / or owner must be aware of the limits that weaning sows and piglets earlier can have on potential production and it is this awareness that I believe is important.

WASTAGE????

The final part of this report is reducing reproductive and production wastage. There is as much to be gained by not allowing actual production to be lost as there is in improving potential production.

1. reducing stillbirths – will increase piglets born alive
2. reducing pre weaning mortality – increase pigs weaned
3. better AI and procedures – will increase farrowing rate
4. Increasing farrowing rate – increased Litters per sow per year
5. All of the above combined will result in higher PSY????

How can this be achieved??? All of the above will be achieved by improvements to management, investment in infrastructure and uptake of relevant technology. The extremely challenging times will be here for the foreseeable future. With pork production being price sensitive to feed grains as a major input cost of around 70% Cost of Production and world demand for grain is very strong. Only producers that are willing to invest heavily in their businesses to maximize their efficient production will be available to take advantage of future supply and demand issues.

Plain English Compendium Summary

Project Title:	
Nuffield Australia Project No.:	
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Objectives	Increasing Per Sow Production and other technologies to improve efficiency in the Australian Pork Industry.
Background	Increase sow output and to investigate lactation length and its role in improving subsequent litter size.
Research	
Outcomes	
Implications	
Publications	