Australian Government
Department of Agriculture and Water Resources

AUSTRALIAN Pork™

Investigating the proportion of gilt progeny which enter the breeding herd – SunPork Solutions.

Final Report
APL Project 2015/062

June 2016

SunPork Solutions
Mr Robert Hewitt
PO Box 5950
MANLY QLD 4179

Acknowledgements

This project is supported by funding from Australian Pork Limited and the Department of Agriculture and Water Resources. Consultation has been undertaken with Rivalea (Australia) Pty Ltd to ensure the two reports in this APL project are comparable.

Executive Summary

Progeny born to gilts are recognised as a having a significant impact on the efficiency of pig production. When compared to progeny of multiparous sows, the progeny of gilts are lighter at birth and weaning, have reduced lifetime growth rates and have a greater susceptibility to disease. These factors all contribute to substantial impacts on progeny feed efficiency and the overall feed efficiency of the herd. This project builds on this impact and looks to assess the impact of selected gilts born to first parity sows on the overall reproductive efficiency of commercial herds.

This project sets out to benchmark gilt progeny performance within the breeding herd. Performance of selected gilts born to first litter sows will be reviewed in the herd against selected gilts born to multi parity sows. Reproductive outcomes will be investigated including removal rates & cause, reproductive performance and longevity in the breeding herd.

Performance records from a total of 5,755 gilts that successfully farrowed in the GGP breeding herd of SunPork Farms Tong Park Piggery, Warra, Queensland over the 10 year period from 1st January 2006 to the 31st December 2015 were included in this study. There were a total of 1,034 breeders from gilt litters that farrowed their first litter during this period and 4,721 breeders from sow litters.

Data for this analysis was mined from the herd recording system, with any gilt that entered the herd and successfully farrowed her first litter during this period being included, thus the data consists of sows that have completed their time in the herd and those that are still active. Owing to the nature of the herd and how data was recorded, apart from pedigree information there was no information available for all gilts included in the study prior to entering the herd as a ready to mate sow. Records available for analysis included; pedigree information - dam ID, dam parity and date of birth, age at first mating, reproductive data – gestation length, total born, pigs born alive, stillborns, mummified piglets, number weaned, lactation length and wean to oestrus interval, and removal information – age and parity at removal, reason for removal.

This analysis showed that there appears to be little cause for concern for reduced reproductive performance from selecting breeding stock from gilt litters when compared to breeding stock selected from sow litters. Whilst this dataset couldn't investigate patterns of performance prior to the gilts entering the breeding herd, the known reduction in health and performance of gilt progeny did not impact their reproductive performance.

Breeders from gilt litters were just over one day older at first mating than those from sows. Given known performance differences in growth of lighter weight progeny from gilts this small difference in age was not unexpected, in fact the lack of age difference would tend to indicate that the weight of breeders from gilts at first mating would be expected to be lower, this may be associated with some of the other observed effects.

In the first parity, breeders selected from gilts had a higher rate of stillborn piglets than those breeders selected from sows. The reason for this is unclear, however, it may be a result of the potentially small size of breeders from gilts, as larger uteruses have been associated with a higher number of live births, or, the lower birth weight of gilt progeny is associated with lower number of muscle fibres, which may be reflected in a lower contractile ability of the uterus in progeny of gilts.

The observed increased length of the wean to oestrus interval may also be a reflection of potentially reduced body size, and thus a lower level of body reserves available for mobilisation during lactation, with lower losses in lactation being associated with a reduced probability of an extended weaning to oestrus interval, which has been observed in previous studies.

The lack of difference in reasons for removals and the percentage retained in the herd at subsequent parities is somewhat of a surprise, given the health and performance issues experienced by gilt progeny. Although not investigated here, there may be some degree of self-selection occurring in breeders from first parity dams, with poorer performing animals in the growing phase not being considered for selection.

The results of this study suggest there does not appear to be a requirement for breeders to only be selected from sow litters, with little reproductive performance differences being observed between breeders of differing dam parities.

Table of Contents

List of Tables

List of Figures

1. Background to Research

Progeny born to primiparous sows (gilts) are recognised as having a significant impact on the overall efficiency of pig production. When compared to the progeny from multiparous sows, the progeny of gilts are lighter at birth and weaning (Hendrix et al. 1978), have reduced lifetime growth rates (Rehfeldt and Kuhn, 2006) and have a greater susceptibility to disease (Miller *et al.*, 2012). These factors all contribute to a substantial impact on progeny feed efficiency and the overall feed efficiency of the herd.

These impacts have been recognised by APL SG3 and they have committed to a core program of research aimed at improving the performance of gilt progeny. Professor John Pluske is leading APL project 2014/461 'Optimising the progeny of first-litter sows in the Australian herd'. The first experiments within this project are designed to benchmark the performance of progeny of gilts, sows and comingled groups to determine differences in performance as well as the impact that gilt progeny have on the performance of sow progeny.

This project builds on these benchmarking studies, assessing the impact of selected gilts born to first parity sows on the overall reproductive efficiency of commercial herds. There will be two herds of distinct genotypes investigated in this project, Rivalea (Australia) Pty Ltd and SunPork Farms, to which this report pertains. If substantial differences in reproductive performance are identified, recommendations will enable producers to limit the negative effects of gilt progeny within the breeding herd.

2. Objectives of the Research Project

This project sets out to;

- Benchmark gilt progeny performance within the breeding herd. Performance of selected gilts born to first litter sows will be reviewed in the herd against selected gilts born to multi parity sows. Reproductive outcomes will be investigated including removal rates & cause, reproductive performance and longevity in the breeding herd.
- In the event of differences in reproductive efficiency between gilt and sow progeny entering the breeding herd, an economic evaluation will be conducted to determine the impacts on HFC.

3. Introductory Technical Information

There is a dearth of research looking at the effects of dam parity on subsequent reproductive performance. The data generated from this two herd investigation will provide recommendations as to the selection of breeder gilts and whether a balance needs to be struck between any poorer reproductive performance associated with breeder from gilts and increases in genetic lag associated with selection from sows.

4. Research Methodology

4.1 Animals

Performance records from a total of 5,755 gilts (PIC Australia Pty Ltd) that successfully farrowed in the GGP breeding herd of SunPork Farms Tong Park Piggery, Warra, Queensland over the 10 year period from 1st January 2006 to the 31st December 2015 were included in this study. There were a total of 1,034 breeders from gilt litters that farrowed their first litter during this period and 4,721 breeders from sow litters, ranging from parity 2 through to parity 7.

4.2 Data Collection

Data for this analysis was mined from the herd recording system (EliteHerd, Genetic Solutions Ltd, Palmerston North, NZ). Selection was based on any gilt that entered the herd and successfully farrowed her first litter during this period, thus the data consists of sows that have completed their time in the herd and those that are still active. Owing to the nature of the herd and how data was recorded, apart from pedigree information there was no information available for all gilts included in the study prior to entering the herd as a ready to mate sow. Records available for analysis included:

- Pedigree information; Dam ID, Dam parity at birth, Date of birth.
- Age at first and subsequent mating – **Age** (days).
- Reproductive data at each parity during the investigated period;
    - Gestation length – **GL** (days)
    - Total born per litter – **TB**
    - Pigs born alive per litter – **PBA**
    - Number of stillborns per litter – **SB**
    - Number of mummified piglets per litter – **MM**
    - Number of pigs weaned per litter - **#W**
    - Lactation length – **LL** (days)
    - Wean to oestrus interval – **WOI** (days)
- Removal information
    - Age at removal – **RemAge** (days)
    - Parity at removal – **RemParity**
    - Reason for removal.

4.3 Data Analysis

Data was interrogated and cleaned up by tracking each individual sow within the herd recording software, with obvious entry errors corrected for. Data was analysed using GenStat (GenStat ed 18.1, VSN International Ltd, Hemel Hempstead, UK). A General Linear Model ANOVA was used to analyse continuous variables (age at first mating, reproductive data, etc.) with dam parity (gilt vs sow, or P1 (gilt) vs P2 vs P3 vs P4 vs P5 vs P6 vs P7) as the treatment factor. Chi-square ($\chi 2$) analysis was used to assess discrete variables (reasons for removal).

5. Results

Breeders selected from gilt litters were older at first mating (P = 0.027) than those selected from sows, although the small difference would have little impact on production (Table 1.1). There was no difference in gestation or lactation length between treatments. There was no difference in the number of piglets born alive in the first parity, however, breeders from gilts had a higher number of stillborn piglets per litter (P = 0.047). The major difference between the treatments was in wean to oestrus interval where breeders from gilts took 1.15 days longer to return to oestrus (P < 0.001). Whilst lactation length and age at first mating were different when looking at individual dam parities (P < 0.001 and P = 0.008, respectively) there was no discernible pattern, however, wean to oestrus interval showed a distinct pattern of difference of breeders from gilt litters (P1) to all other parities.

*Table 1.1 The performance of breeders in their **first** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	1034	228.8^{a}	116.3	11.25	10.40	1.67^{a}	1.36	9.91	22.5	8.76^{a}
Sow	4721	227.5^{b}	116.2	11.15	10.41	1.56^{b}	1.37	9.88	22.5	7.61^{b}
SED		0.61	0.05	0.09	0.09	0.06	0.07	0.05	0.08	0.27
P value		0.027	0.231	0.274	0.947	0.047	0.913	0.486	0.825	<0.001
Gilt (P1)	1034	228.8^{c}	116.3	11.25	10.40	1.67	1.36	9.91	22.5^{b}	8.76^{a}
P2	1213	227.1^{abc}	116.3	11.14	10.42	1.48	1.39	9.90	22.4^{ab}	7.77^{b}
P3	1176	228.3^{b}	116.2	11.04	10.29	1.60	1.39	9.83	22.5^{b}	7.48^{b}
P4	828	226.5^{ab}	116.3	11.18	10.44	1.63	1.42	9.86	22.5^{b}	7.61^{b}
P5	727	229.4^{c}	116.2	11.24	10.50	1.59	1.34	9.91	22.8^{c}	7.50^{b}
P6	496	226.4^{a}	116.2	11.25	10.52	1.54	1.21	9.91	22.5^{ab}	7.44^{b}
P7	281	225.2^{a}	116.2	11.06	10.40	1.45	1.40	10.02	22.2^{a}	8.03^{b}
SED		0.97	0.08	0.15	0.14	0.10	0.11	0.07	0.13	0.44
P value		<0.001	0.556	0.556	0.631	0.146	0.622	0.347	0.008	0.003

^{a,b,c}Means in a column with different superscripts differ significantly; SED, standard error of difference of the means.

*Table 1.2 The performance of breeders in their **second** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	869	378.0^{a}	116.4	11.69^{a}	10.92	1.58	1.27	9.82	22.8^{a}	6.06
Sow	3752	375.3^{b}	116.3	11.45^{b}	10.78	1.47	1.24	9.79	23.0^{b}	5.83
SED		0.74	0.06	0.11	0.11	0.06	0.05	0.05	0.09	0.19
P value		<0.001	0.309	0.037	0.175	0.060	0.606	0.542	0.028	0.216
Gilt (P1)	869	378.0^{b}	116.4	11.69^{bc}	10.92	1.58	1.27	9.82	22.8^{a}	6.06^{bc}
P2	947	375.1^{ab}	116.4	11.54^{bc}	10.81	1.51	1.20	9.86	23.0^{ab}	6.22^{c}
P3	929	375.8^{ab}	116.3	11.38^{abc}	10.74	1.42	1.21	9.79	23.0^{ab}	6.09^{c}
P4	670	374.4^{a}	116.4	11.37^{ab}	10.71	1.42	1.22	9.79	23.2^{b}	5.47^{ab}
P5	572	377.1^{b}	116.4	11.43^{abc}	10.72	1.53	1.37	9.63	23.2^{b}	5.63^{abc}
P6	415	374.2^{a}	116.3	11.74^{c}	11.09	1.50	1.26	9.82	23.0^{ab}	5.43^{a}
P7	219	373.7^{a}	116.3	11.12^{a}	10.55	1.52	1.23	9.82	22.8^{a}	5.33^{a}
SED		1.18	0.09	0.18	0.17	0.10	0.09	0.08	0.14	0.30
P value		<0.001	0.641	0.048	0.148	0.356	0.445	0.071	0.031	0.004

^{a,b,c}Means in a column with different superscripts differ significantly; SED, standard error of difference of the means.

The difference in age at first mating is maintained through subsequent parities (Table 1.2 to 1.7) although it loses its significance after parity three (Table 1.3). Similarly, breeders from gilt litters tend to have a higher wean to oestrus interval than those from sow litters. Although the differences are not as large as what was observed in the first parity, there is still a difference of up to half a day observed (third parity, Table 1.3).

*Table 1.3 The performance of breeders in their **third** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	661	525.0[a]	116.4	12.38	11.32	1.73	1.31	9.71	22.9	6.33[a]
Sow	2896	522.9[b]	116.3	12.37	11.42	1.64	1.40	9.67	23.0	5.89[b]
SED		0.94	0.07	0.13	0.12	0.07	0.07	0.06	0.11	0.21
P value		0.024	0.741	0.928	0.383	0.242	0.182	0.463	0.139	0.037
Gilt (P1)	661	525.0[c]	116.4	12.38	11.32	1.73	1.31	9.71	22.9	6.33
P2	714	523.5[bc]	116.3	12.44	11.39	1.74	1.38	9.71	22.9	5.80
P3	711	523.0[abc]	116.3	12.41	11.43	1.65	1.39	9.68	23.2	5.92
P4	524	521.7[ab]	116.4	12.49	11.61	1.57	1.46	9.62	23.1	5.79
P5	465	525.1[c]	116.4	12.14	11.31	1.58	1.39	9.62	23.1	6.04
P6	317	520.4[a]	116.5	12.25	11.35	1.64	1.29	9.64	23.0	5.81
P7	165	522.4[abc]	116.3	12.30	11.41	1.52	1.51	9.79	22.7	6.25
SED		1.52	0.11	0.21	0.19	0.12	0.11	0.10	0.17	0.34
P value		0.015	0.375	0.554	0.632	0.377	0.535	0.640	0.121	0.391

[a,b,c]Means in a column with different superscripts differ significantly; SED, standard error of difference of the means.

There are no significant differences between breeders from gilt or sow litters in later parities, with only a small difference (0.3 days, P = 0.007) observed in lactation length in the fourth parity observed after parity three.

*Table 1.4 The performance of breeders in their **fourth** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	501	671.9	116.3	12.62	11.41	1.75	1.34	9.52	23.2[a]	6.34
Sow	2240	670.3	116.4	12.40	11.32	1.78	1.34	9.59	22.9[b]	6.01
SED		1.13	0.08	0.15	0.14	0.08	0.06	0.07	0.12	0.25
P value		0.169	0.094	0.148	0.495	0.728	0.972	0.368	0.007	0.186
Gilt (P1)	501	671.9	116.3	12.62	11.41	1.75	1.34	9.52	23.2[c]	6.34
P2	546	670.3	116.4	12.53	11.47	1.79	1.24	9.58	22.9[bc]	6.12
P3	532	670.6	116.4	12.29	11.16	1.79	1.43	9.59	23.1[b]	6.12
P4	430	669.5	116.4	12.42	11.32	1.75	1.33	9.64	22.9[bc]	5.64
P5	360	672.6	116.5	12.27	11.18	1.72	1.35	9.46	23.0[bc]	6.16
P6	241	667.9	116.3	12.39	11.37	1.94	1.48	9.60	22.7[ab]	6.20
P7	131	670.1	116.5	12.69	11.63	1.73	1.16	9.76	22.4[a]	5.55
SED		1.82	0.12	0.24	0.22	0.14	0.10	0.11	0.20	0.40
P value		0.196	0.243	0.479	0.362	0.859	0.114	0.405	0.011	0.392

[a,b,c]Means in a column with different superscripts differ significantly; SED, standard error of difference of the means.

*Table 1.5 The performance of breeders in their **fifth** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	346	820.1	116.5	12.83	11.29	2.02	1.33	9.41	23.0	6.44
Sow	1650	817.6	116.5	12.54	11.24	1.88	1.41	9.41	22.9	6.03
SED		1.41	0.10	0.18	0.16	0.10	0.09	0.09	0.15	0.29
P value		0.079	0.512	0.110	0.752	0.139	0.330	0.964	0.223	0.165
Gilt (P1)	346	820.1	116.5	12.83	11.29	2.02	1.33	9.41	23.0	6.44
P2	396	817.3	116.4	12.68	11.31	1.86	1.41	9.48	22.8	5.61
P3	401	818.2	116.5	12.36	11.12	1.81	1.42	9.36	22.9	6.13
P4	321	815.8	116.6	12.47	11.22	1.83	1.39	9.36	23.2	6.22
P5	263	820.2	116.5	12.54	11.22	1.91	1.42	9.29	22.7	6.54
P6	173	816.0	116.4	12.68	11.30	2.13	1.51	9.52	22.9	6.14
P7	96	817.5	116.5	12.78	11.54	1.89	1.24	9.69	22.4	5.11
SED		2.26	0.15	0.28	0.25	0.16	0.13	0.14	0.23	0.46
P value		0.185	0.817	0.414	0.869	0.341	0.771	0.280	0.058	0.075

SED, standard error of difference of the means.

In the sixth parity (Table 1.6) there is an increase in the variation in pigs born alive when looking at individual parities. There is a greater number of pigs born alive in breeders born to parity 7 dams, however, this is likely to be an anomaly of the data and a reflection of reduced number of sows included in the analysis, as it is not supported by previous or subsequent parities.

*Table 1.6 The performance of breeders in their **sixth** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	203	967.1	116.5	12.48	11.07	2.00	1.32	9.21	23.0	6.15
Sow	952	964.4	116.4	12.61	11.22	1.91	1.39	9.24	22.8	5.86
SED		1.74	0.12	0.23	0.21	0.15	0.10	0.12	0.21	0.35
P value		0.117	0.596	0.566	0.474	0.536	0.464	0.769	0.534	0.400
Gilt (P1)	203	967.1^{b}	116.5	12.48	11.07^{a}	2.00	1.32	9.21	23.0	6.15
P2	224	964.2^{ab}	116.3	12.67	11.23^{a}	1.84	1.41	9.29	22.9	5.60
P3	233	965.3^{ab}	116.4	12.51	11.28^{a}	1.84	1.42	9.34	22.9	5.92
P4	190	961.5^{a}	116.5	12.42	10.98^{a}	1.86	1.40	8.96	23.1	6.05
P5	144	968.9^{b}	116.4	12.43	10.92^{a}	2.04	1.36	9.19	22.7	6.32
P6	108	961.4^{a}	116.4	12.84	11.34^{a}	2.25	1.50	9.32	22.4	5.32
P7	53	963.6^{ab}	116.3	13.58	12.30^{b}	1.74	1.08	9.63	22.4	5.79
SED		2.72	0.19	0.36	0.33	0.23	0.16	0.19	0.33	0.55
P value		0.030	0.948	0.209	0.047	0.507	0.615	0.073	0.343	0.566

^{a,b}Means in a column with different superscripts differ significantly; SED, standard error of difference of the means.

*Table 1.7 The performance of breeders in their **seventh** parity compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7), comparing gestation length (GL), total born (TB), pigs born alive (PBA), stillborns (SB), mummified piglets (MM), number weaned (#W), lactation length (LL) and wean to oestrus interval (WOI).*

	N.	Age	GL	TB	PBA	SB	MM	#W	LL	WOI
Gilt	159	1113.9	116.6	12.00	10.31	2.56	1.39	9.01	21.6	4.75
Sow	785	1109.9	116.5	11.91	10.27	2.35	1.43	9.15	22.4	6.09
SED		2.36	0.15	0.27	0.25	0.21	0.14	0.13	0.39	0.99
P value		0.089	0.477	0.730	0.867	0.289	0.761	0.297	0.066	0.178
Gilt (P1)	159	1113.9	116.6	12.00	10.31	2.56	1.39	9.01	21.6	4.75
P2	185	1106.9	116.4	12.11	10.39	2.36	1.56	9.04	22.6	4.75
P3	194	1111.4	116.6	11.86	10.24	2.20	1.24	9.20	21.7	6.38
P4	154	1108.9	116.4	11.76	10.06	2.67	1.34	8.95	22.6	6.59
P5	118	1115.3	116.2	12.08	10.28	2.45	1.54	9.18	22.5	5.59
P6	89	1107.5	116.7	11.30	10.15	1.92	1.40	9.48	22.7	5.77
P7	45	1109.8	116.4	12.53	10.89	2.32	1.50	9.30	22.3	10.33
SED		3.714	0.23	0.42	0.39	0.31	0.23	0.21	0.60	1.39
P value		0.092	0.457	0.330	0.758	0.270	0.540	0.143	0.157	0.067

SED, standard error of difference of the means.

There was no difference in the average parity (P = 0.540) or age (P = 0.760) at which breeders from either gilts or sows were removed from the herd (Table 1.8). Whilst there were significant differences when looking at removal parity (P = 0.003) and age (P = 0.010) from an individual parity perspective there was no discernible pattern to the differences.

Table 1.8 The parity (RemParity) and age (RemAge) of breeders removed from the breeding herd compared by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7).

	N.	RemParity	RemAge
Gilt	834	4.31	890.4
Sow	3726	4.36	893.8
SED		0.08	11.11
P value		0.540	0.760
Gilt (P1)	834	4.31^{ab}	890.4^{abc}
P2	945	4.18^{a}	869.5^{a}
P3	940	4.28^{ab}	883.6^{ab}
P4	649	4.59^{c}	922.3^{c}
P5	582	4.46^{bc}	911.5^{bc}
P6	406	4.46^{bc}	902.2^{abc}
P7	204	4.37^{abc}	895.8^{abc}
SED		0.13	17.93
P value		0.003	0.010

^{a,b,c}Means in a column with different superscripts differ significantly; SED, standard error of difference of the means.

Table 1.9 The reasons for removal of breeders compared, using Chi-square (χ^2) test analysis, by the parity of their dam – Gilt (Parity 1) or Sow (P2, P3, P4, P5, P6, P7).

	Gilt		Sow			
	N.	**%**	**N.**	**%**	χ^2	***P* value**
N.	1034		4721			
Active	200	19.3	995	21.1	1.55	0.213
Culled						
Age	262	25.3	1280	27.1	1.36	0.243
Reproduction	308	29.8	1325	28.1	1.24	0.266
Health	25	2.4	116	2.5	0.01	0.941
Structure	141	13.6	558	11.8	2.62	0.105
Other	55	5.3	262	5.5	0.09	0.769
Death	39	3.8	181	3.8	0.01	0.925
Destroyed	4	0.4	24	0.5	0.26	0.611

The analysis of removals and the reason for their removal indicates that there was very little difference between treatments (Table 1.9), with pattern of reasons for removals very simulator between treatments.

There is also a very similar pattern of retention of breeders within the herd (Figure 1.1) with no differences observed between treatments.

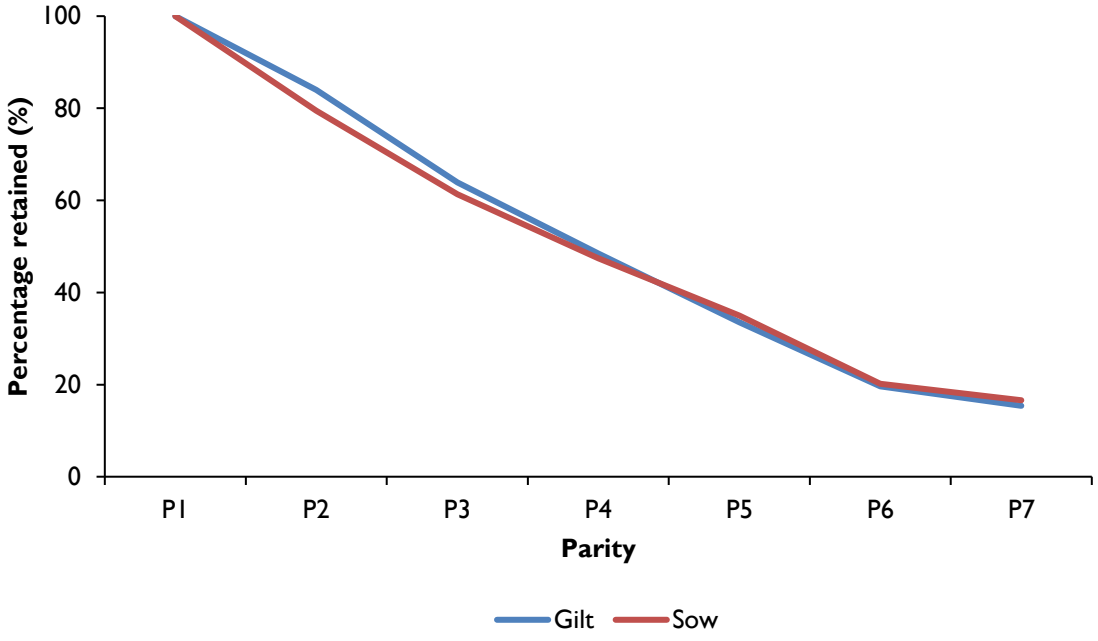

Figure 1.1 Percentage of breeders retained in the herd at each parity compared by the parity of their dam – Gilt (Parity 1) or Sow (Parity 2+).

6. Discussion

There appears, from this analysis, to be little cause for concern for reduced reproductive performance from selecting breeding stock from gilt litters when compared to breeding stock selected from sow litters. Whilst this dataset couldn't investigate patterns of performance prior to the gilts entering the breeding herd, the known reduction in health and performance of gilt progeny (Miller *et al.*, 2012) did not impact their reproductive performance.

Breeders from gilt litters were just over one day older at first mating than those from sows, but well within the natural variation that would be seen in the day-to-day operations of a commercial piggery. Given the known performance differences in growth of lighter weight progeny from gilts (Miller *et al.*, 2012; Rehfeldt and Kuhn, 2006) this small difference in age is not unexpected, in fact the lack of age difference would tend to indicate that the weight of breeders from gilts at first mating would be expected to be lower, this may be associated with some of the other observed effects.

In the first parity, breeders selected from gilts had a higher rate of stillborn piglets than those breeders selected from sows. The reason for this is unclear however there are a number of potential answers. The potentially small size of breeders from gilts may be impacting the number of stillborns as larger uteruses are associated with a higher number of live births (Wu *et al.*, 1988). The lower birth weight of gilt progeny is associated with a significantly lower number of muscle fibres (Rehfeldt, 2005), which may be reflected in a lower contractile ability of the uterus in progeny of gilts.

The observed increased length of the wean to oestrus interval may also be a reflection of potentially reduced body size, and thus a lower level of body reserves available for mobilisation during lactation, with lower losses in lactation being associated with a reduced probability of an extended weaning to oestrus interval (Eissen *et al.*, 2003). This observed increased length of wean to oestrus interval of gilts born to parity 1 sows is in line with previous observations (Tummaruk *et al.*, 2001).

The lack of difference in reasons for removals and the percentage retained in the herd at subsequent parities is somewhat of a surprise, given the health and performance issues experienced by gilt progeny (Miller *et al.*, 2012). Although not investigated here, there may be some degree of self-selection occurring in breeders from first parity dams, with the poorer performing animals in the growing phase not being considered for selection. Magnabosco *et al.* (2016) didn't show a lot of correlation between birthweight and weight at first mating with retention in the herd once selection had occurred.

7. Implications & Recommendations

There does not appear to be a requirement for breeders to only be selected from sow litters, with little reproductive performance differences being observed between breeders of different dam parities. The effects of being born of a gilt litter are well known, lower levels of immunity and slower growth rates are generally observed, however, these factors do not appear to be carried through to reproductive performance. The observed response may be a reflection however of a degree of non-intentional bias in the selection of breeding stock, with those gilts presenting at selection that are smaller, or with a lower level of condition, than their sow born counterparts not being considered for selection.

8. Intellectual Property

There is no protectable intellectual property arising from this research.

9. Literature cited

Eissen, J.J., Apeldoorn, E.J., Kanis, E., Verstegen, M.W., and de Greef, K.H. (2003). The importance of a high feed intake during lactation of primiparous sows nursing large litters. *Journal of Animal Science* 81, p. 594-603.

Hendrix, W.F., Kelley, K.W., Gaskins, C.T., and Hinrichs, D.J. (1978). Porcine neonatal survival and serum gamma globulins. *Journal of Animal Science* 47, p. 1281-1286.

Magnabosco, D., Bernardi, M.L., Wentz, I., Cunha, E.C.P., and Bortolozzo, F.P. (2016). Low birth weight affects lifetime productive performance and longevity of female swine. *Livestock Science* 184, p. 119-125.

Miller, Y.J., Collins, A.M., Emery, D., Begg, D.J., Smits, R.J., and Holyoake, P.K. (2012). Piglet performance and immunity is determined by the parity of both the birth dam and the rearing dam. *Animal Production Science* 53, p. 46-51.

Rehfeldt, C. (2005). Prenatal events that determine the number of muscle fibres are important for lean growth and meat quality in pigs. *Archiv Tierzucht* 48, p. 11-22.

Rehfeldt, C., and Kuhn, G. (2006). Consequences of birth weight for postnatal growth performance and carcass quality in pigs as related to myogenesis. *Journal of Animal Science* 84, p. E113-123.

Tummaruk, P., Lundeheim, N., Einarsson, S., and Dalin, A-M. (2001). Effect of birth litter size, birth parity number, growth rate, backfat thickness and age at first mating of gilts on their reproductive performance as sows. *Animal Reproduction Science* 66, p. 225-237.

Wu, M.C., Hentzel, M.D., and Dzink, P.J. (1988). Effect of stage of gestation litter size and uterine space on the incidence of mummified fetuses in pigs. *Journal of Animal Science* 66, p. 3202-3207.

10. Publications Arising

Nil to date.