Parity and nutritional effects on seasonal infertility
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Report prepared for the Co-operative Research Centre for High Integrity Australian Pork

By

Professor Paul Hughes & Dr. William van Wettere

Southern Star Pork Alliance, Roseworthy Campus, Roseworthy, SA 5371.

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Executive Summary

For nearly 20 years Australian pig producers have accepted that high feeding in early gestation during the period of seasonal infertility can ameliorate the reductions seen in farrowing rate. This practice is based on the research of Dr. Bob Love at Sydney University (see Love et al, 1995). However, during the preparation of a guide to seasonal infertility for the Pork CRC we re-evaluated this research & felt it needed to be re-assessed in terms of the practical advice that can be abstracted from it. The basic data, as given in the published paper, suggested that high feeding gilts & parity 1 sows (but not older sows) in early pregnancy overcame the farrowing rate reduction normally seen in the Summer & early Autumn. Conversely, high feeding sows, but not gilts, in the Winter reduced farrowing rate. They further reported that, in sows moderately fed in early gestation during the Summer period, farrowing rate was significantly lower for group-housed v. individually housed sows (69% v. 82%). The issues that these data raise are:

1. Does this still apply with today's genotype given the research was done at least 16 years ago ?
2. We should pursue this further given we're rapidly moving to non-confinement housing during gestation
3. Actual feed levels need checking given Bob Love used 1.6-2.0kg/d as LOW, 2.5kg/d as MODERATE & >3.6kg/d as HIGH

A single study was conducted using 1,383 females (440 gilts, 261 parity 1 sows & 682 parity 2+ sows) at a large commercial piggery. These females entered the study 1-4 days after breeding when they were transferred into gestation housing equipped with electronic sow feeders (ESFs). The gilts & sows had their body condition scored (BCS 1, 2 or 3) prior to allocation to treatment which was on a BCS basis. Within each parity group approximately equal numbers of females were fed 1.9kg/d, 2.3kg/d & 2.7kg/d of a standard dry sow diet (DE = 13 MJ/kg, CP = 14.6% & Av. Lys. = 0.55%) for the first 4 weeks of gestation. The study was run January-March & July-August 2011. Farrowing rate & litter size data were then retrieved from the commercial herd recording scheme.

Results indicate that the provision of different feed levels in early gestation had little overall effect on pregnancy outcomes regardless of season. However, there were strong indications that parity 1 sows, but not gilts or parity 2+ sows, did respond to differential feeding in early gestation. Specifically, increasing feed level in early gestation improved farrowing rate but decreased litter size. This suggests that there is little overall benefit of increasing feed level in early gestation in order to ameliorate the effects of season on fertility & fecundity. Interestingly, the study also indicated that those gilts & sows that adapted poorly to ESFs in the first few days after transfer to an ESF-fed shed (i.e. they failed to eat their full allocated ration for the first three days after transfer) exhibited a reduced farrowing rate in Winter & a reduced litter size in Summer.

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1. Introduction

For nearly 20 years Australian pig producers have accepted that high feeding in early gestation during the period of seasonal infertility can reduce the reductions seen in farrowing rate. This practice is based on the research of Dr. Bob Love at Sydney University (see Love et al, 1995). However, during the preparation of a guide to seasonal infertility for the Pork CRC we re-evaluated this research & feel it needs to be re-assessed in terms of the practical advice that can be abstracted from it. The basic data, as given in the published paper, is presented in Tables 1 & 2:

Table 1 - A re-evaluation of the Love *et al* data for farrowing rate

			Early gestation feed level	
		n	LOW	HIGH
Summer farrowing rates	Gilts	142	55%	88%
	Parity 1 sows	182	69%	82%
	Parity 2+ sows	298	80%	77%
Winter farrowing rates	Gilts	169	85%	81%
	Parity 1 sows	70	95%	84%
	Parity 2+ sows	242	90%	79%

Table 2 - A re-evaluation of the Love et al data for farrowing rate & housing type

		Housing system*	
		Individual	Group
Summer farrowing rates	No. sows	103	87
	Farrowing rate	82%	69%

*all sows fed moderately in early gestation

We interpret these results as follows:

1. High feeding in early gestation only improves FR to Summer matings in the first 2 pregnancies
2. High feeding in early gestation reduces FR in all sows (but not gilts) in Winter
3. The seasonal problem is greater in group-housed females

The issues that these data raise are:

1. Does this still apply with today's genotype given the research was done at least 16 years ago ?
2. We should pursue this further given we're rapidly moving to non-confinement housing during gestation
3. Actual feed levels need checking given Bob Love used 1.6-2.0kg/d as LOW, 2.5kg/d as MODERATE & >3.6kg/d as HIGH

2. Methodology

A single study was conducted using 1,383 females (440 gilts, 261 parity 1 sows & 682 parity 2+ sows) at a large commercial piggery. These females entered the study 1-4 days after breeding when they were transferred into gestation housing equipped with electronic sow feeders (ESFs). The gilts & sows had their body condition scored (BCS 1, 2 or 3) prior to allocation to treatment which was on this BCS basis. Within each parity group approximately equal numbers of females were fed 1.9kg/d, 2.3kg/d & 2.7kg/d of a standard dry sow diet (DE = 13 MJ/kg, CP = 14.6% & Av. Lys. = 0.55%) for the first 4 weeks of gestation. After the first 4 weeks all sows were offered the standard dry sow diet at a common feeding allowance (2.3 kg/day). The animals were mated in either January-March or July-August 2011. Farrowing rate & litter size data were then retrieved from the commercial herd recording scheme. Data were analysed using a 3-way unbalanced general ANOVA.

3. Outcomes

The data presented in Table 3 show that early gestation feeding did not, overall, affect farrowing rate or subsequent litter size. Season did not significantly alter farrowing rate but subsequent litter size was significantly reduced following breeding in the Summer/early Autumn period. Subsequent litter size, but not farrowing rate, was significantly higher for parity 2+ sows compared to parity 0 & 1 sows.

Table 3 -The effects of nutrition, season & parity on farrowing rate or subsequent litter size

Factor	No. sows	Farrowing rate (%)	Subsequent litter size (TB)
Parity			
Parity 0	439	82.3	**10.96***
Parity 1	260	80.4	**10.87***
Parity 2+	691	82.3	**11.66***
Treatment			
Low	463	81.2	11.49
Medium	454	81.7	11.31
High	473	83.1	11.10
Season			
Winter	711	84.0	11.61^a
Summer	679	80.0	10.95^b

a,b: within a factor means differ significantly (P<0.05)

*When gilt litter size is compared with sow litter size (i.e. Parity 1 & Parity 2+ sows combined) a significant difference is detected (10.96 v. 11.45, P<0.01)

However, when the interaction between parity, nutrition & season is investigated a clear effect of early gestation feeding, but not season, is seen in parity 1 sows (Tables 4 & 5). This suggests that higher feeding in early gestation for parity 1, but not parities 0 or 2+ sows, increases farrowing rate but decreases subsequent litter size (total born).This possibly reflects a positive effect of the higher feeding level on rescuing the pregnancies of sows carrying smaller litters. Interestingly, this finding is in direct contrast to that of Hoving et al (2011) who reported that higher feeding in early gestation improved subsequent litter size but did not significantly affect farrowing rate in parity 1 sows. This difference may reflect differences in genotype since the Dutch research used hyperprolific sows.

Table 4 -The effects of season & early gestation feed level on farrowing rate(%)

	Winter			Summer		
	Parity 0	Parity 1	Parity 2+	Parity 0	Parity 1	Parity 2+
Feed level						
LOW	**87.2^{x}**	**80.0^{xy}**	**81.6^{xy}**	**79.2^{y}**	71.4^{ay}	86.0^{xy}
MEDIUM	80.6	85.7	82.6	82.6	79.7^{ab}	**83.8**
HIGH	**86.2**	**95.0**	**83.9**	**78.5**	**84.8^{b}**	**81.3**

a,b: means followed by a different superscript within a column are significantly different (P=0.05)
x,y: means followed by a different superscript within a row are significantly different (P<0.05)

Table 5 - The effects of season & early gestation feed level on subsequent litter size (total born).

	Winter			Summer		
Feed level	**P0**	**P1**	**P2+**	**P0**	**P1**	**P2+**
LOW	**11.10**	**11.87^{a}**	**12.09**	**11.14**	**11.00^{a}**	**11.38**
MEDIUM	**11.16**	**11.39^{ab}**	**12.14**	**11.13**	**10.12^{b}**	**11.01**
HIGH	**10.64**	**10.53^{b}**	**11.87**	**10.65**	**10.29^{ab}**	**11.36**

a,b: means followed by a different superscript within a column are significantly different (P<0.05)

This effect is even clearer when the data for the two seasons is combined (Tables 6 & 7)

Table 6 - The effects of early gestation feed level on farrowing rate (%) – number of sows is shown in brackets.

Feed level	**P0**	**P1**	**P2+**
LOW	**84.5^{x} (142)**	**73.3^{ya} (90)**	**83.6^{x} (225)**
MEDIUM	**81.3 (141)**	**81.2^{ab} (85)**	**83.3 (226)**
HIGH	**83.1 (159)**	**87.2^{b} (86)**	**82.7 (231)**

a,b: means followed by a different superscript within a column are significantly different (P<0.05)
x,y: means followed by a different superscript within a row are significantly different (P<0.05)

Table 7 - The effects of early gestation feed level on subsequent litter size (total born) – number of sows is shown in brackets.

Feed level	**P0**	**P1**	**P2+**
LOW	**11.12 (120)**	**11.46^{a} (66)**	**11.75 (188)**
MEDIUM	**11.15 (115)**	**10.78^{b} (69)**	**11.60 (188)**
HIGH	**10.64 (132)**	**10.41^{b} (75)**	**11.62 (191)**

a,b: means followed by a different superscript within a column are significantly different (P<0.05)

It is also interesting to look at the effects on subsequent performance of regular failure by sows to consume the allocated feed – a common situation when sows are first transferred to an electronic feeding system. Table 8 shows the subsequent reproductive of sows that failed to eat their full feed allocation on the first three days after transfer to the shed fitted with electronic sow feeders.

Table 8 - The effects of failure to consume all allocated feed in early gestation on adjusted farrowing rate & subsequent litter size (born alive).

Feed consumed first 3days on ESFs	No. sows	Adj. farr. rate (%)	Litter size (total born)
All	1189	82.9[a]	11.4[a]
Not all	202	76.7[b]	10.9[b]

a,b: means followed by a different superscript within a column are significantly different ($P<0.05$)

Within this dataset there are interesting differences depending on both the offered feed level & the season of the year (Tables 9 & 10).

Table 9 - The effects of feed treatment & failure to consume all allocated feed in early gestation on farrowing rate (FR).

		Feed consumed in first 3 days on ESFs	
	No. sows	All	Not all
Low fed	463	81.0	82.5
Medium fed	454	83.0	73.8
High fed	473	84.8	74.4

Table 10 -The effects of season & failure to consume all allocated feed in early gestation on farrowing rate (FR) & subsequent litter size born alive (LS-BA).

		Feed consumed in first 3 days on ESFs	
	No. sows	All	Not all
Winter			
FR	711	84.9[a]	74.6
LS-TB		11.54	11.60
Summer			
FR	679	80.6[b]	77.7
LS-TB		11.15	10.31

a,b: means followed by a different superscript within a column are significantly different ($P<0.05$)

4. Application of Research

Australian pig producers have accepted that high feeding in early gestation during the period of seasonal infertility can reduce the reductions seen in farrowing rate. This study has failed to replicate this effect suggesting there is little or no benefit to be gained from increasing early gestation feeding in the Summer & early Autumn. However, this study did indicate that gilts/sows that adapt slowly to the use of ESFs in early gestation may show reduced fertility & fecundity.

5. Conclusion

This study must be treated with some caution as the seasonal infertility seen in this herd was unusual in that it was mainly manifested as a drop in subsequent litter size rather than a significant reduction in farrowing rate. The provision of different feed levels in early gestation had little overall effect on pregnancy outcomes regardless of season. However, there were strong indications that parity 1 sows, but not gilts or parity 2+ sows, did respond to differential feeding in early gestation. Specifically, increasing feed level in early gestation improved farrowing rate but decreased litter size. This suggests that there is no benefit to increasing feed level in early gestation in order to ameliorate the effects of season on fertility & fecundity. Interestingly, the study also indicated that those gilts & sows that adapted poorly to ESFs in the first few days after transfer to an ESF-fed shed (i.e. they failed to eat their full allocated ration for the first three days after transfer) exhibited a reduced farrowing rate in Winter & a reduced litter size in Summer.

6. Limitations/Risks

Even though this study used nearly 1400 gilts & sows interpretation of the results is fraught with difficulty as there are numerous interactions occurring between parity, feed level & season. This is further compounded by the fact that not all animals adapted well to feeding from ESFs in the early part of the study, this influencing their subsequent performance. Lastly, while most reports in the literature indicate that seasonal infertility is usually manifested as either a problem with return to oestrus post-weaning and/or reduced farrowing rate, the herd on which this study was conducted showed neither of these problems but did exhibit a significantly reduced litter size following breeding in the Summer & early Autumn.

7. Recommendations

The results of this study suggest that:

- increasing feeding level in early gestation is unlikely to ameliorate seasonal infertility.
- the parity 1 sow is the animal at greatest risk of seasonal infertility problems.
- increasing feed level in early gestation for parity 1 sows during Summer increases farrowing rate but reduces subsequent litter size. This finding requires further investigation.
- gilts & sows need to be accustomed to ESFs prior to breeding, trained well in their use immediately after transfer to sheds using them or not placed on ESFs until at least 2 weeks post-breeding.

8. References

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