An Investigation of 31 Australian Herds' Reproductive Performance.

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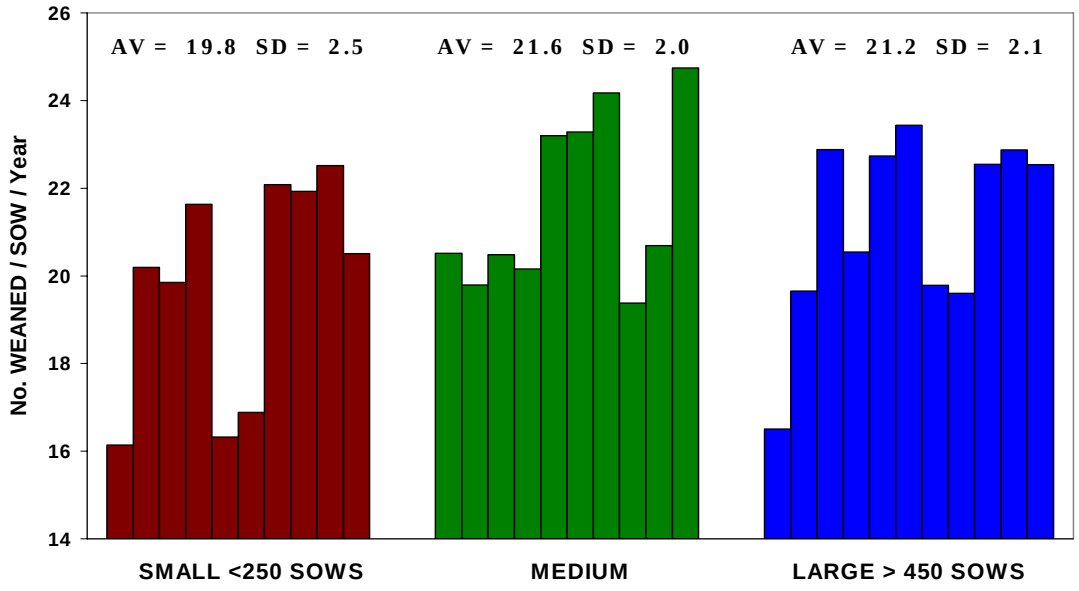
Summary

- Reproductive data from 31 piggeries was analysed by PigPulse over the last 3 years 1994/97.
- Piglets Weaned/Sow/year (WSY) is the primary indicator of reproductive success.
- Herd size does not appear to influence reproductive performance (WSY).
- The primary factor influencing WSY is the Average number of Piglets Weaned/litter (PWL).
- It is difficult to simultaneously maximise PWL and Litters/Sow/Year (LSY).
- Total Piglets Born per litter (TBL) is the major factor influencing the variability of PWL.
- Over all farms, PWL has not improved in three years 1994/97.
- 23% of farms achieved significant improvements (0.25 piglet/year) in PWL.
- PigPulse identified significant PWL changes within farms across time (1.5 piglet range 1994/97).
- Recommendation: use PigPulse to target the prevention of short term problems reducing TBL.

Background

Reproductive data from 40 Australian piggeries was collected to evaluate the number of Piglets weaned per Sow per year. Data was sourced electronically from computer herd recording programs (MIPS, PigCHAMP and PIGMANIA) and analysed using PigPulse. A subset of 31 herds (QLD 12, WA 10, NSW 6, SA 2, VIC 1) were selected on the basis of data quality and duration to evaluate eleven key reproductive traits. All herds contributed a minimum of three years data collated into weekly samples ending May 1997.

Figure 1. Influence of Herd Size on the Number of Piglets Weaned/Sow/Year 1996/97



This study selected Piglets Weaned per Sow per year as the primary indicator of reproductive success. Figure 1. presents weaning efficiency results for 31 herds categorised by herd size (average 459 sows). Herd size appears to have had no significant effect upon the number of Piglets Weaned per Sow per year. Although small herds seem to be predisposed to poorer performance, they are equally able to perform well.

Discussion of results

Table 1. presents the average, minimum and maximum values of individual farms for eleven key efficiency traits during 1996/97, together with aggregated three year 1994/97 linear trends for the group of 31 farms.

Table 1. PigPulse Farm Statistics

Reproductive Trait	Average 1996 / 97	Minimum 1996 / 97	Maximum 1996 / 97	Linear Trend 1994 / 97
Weaning to Service Interval (d)	7.8	5.3	11.3	- 1.3
Returns to First Service (%)	8.5	3.4	26.1	- 0.4
Sow Mortality (% / y)	8.2	2.6	18.7	- 2.3
Farrowing Rate (%)	82.2	70.0	90.0	+ 1.2
Average Born Alive / Litter	10.5	9.8	11.6	+ 0.14
Average Born Dead / Litter	0.9	0.6	1.2	+ 0.09
Average Weaned / Litter	9.1	7.9	10.1	0.0
Pre-Weaning Mortality (%)	11.7	7.9	19.1	-0.02
Sow Introductions (% / y)	61.2	4.83	78.0	- 4.6
Lactation Length (d)	24.2	18.4	28.9	- 2.9
Culling Rate (%)	51.0	31.2	72.8	- 5.7

The ultimate efficiency of Piglets Weaned per Sow per year is determined by its two components:
1) Average Piglets Weaned per litter, and
2) Average Litters per Sow per year.

In order to investigate these components, farms were ranked according to their performance in 1996/97. Figures 2, 3 and 4 present the relationships between Average Piglets Weaned per Sow per year (WSY), Average Piglets Weaned/litter (WL) and Average Litters/Sow/year (LSY). There is a stronger relationship between WL and WSY (R^2=0.77) than LSY and WSY (R^2=0.58), indicating that the average number of piglets weaned per litter is more critical in determining WSY than the annual rate of litter production per sow.

Figure 2. Litter Size and Weaned/Sow/yr

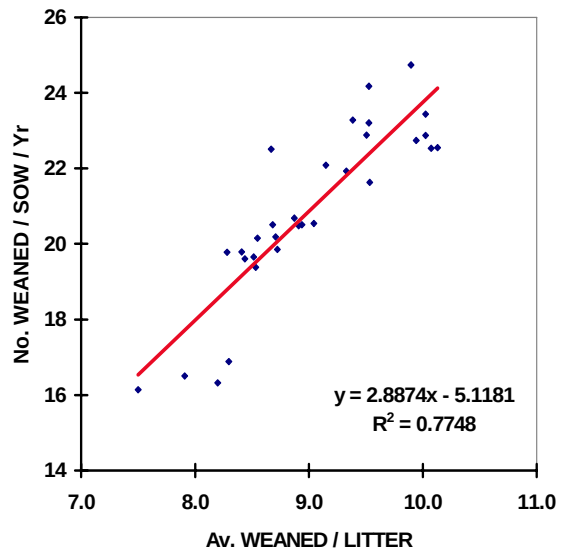


Figure 3. Litter Rate and Weaned/Sow/yr

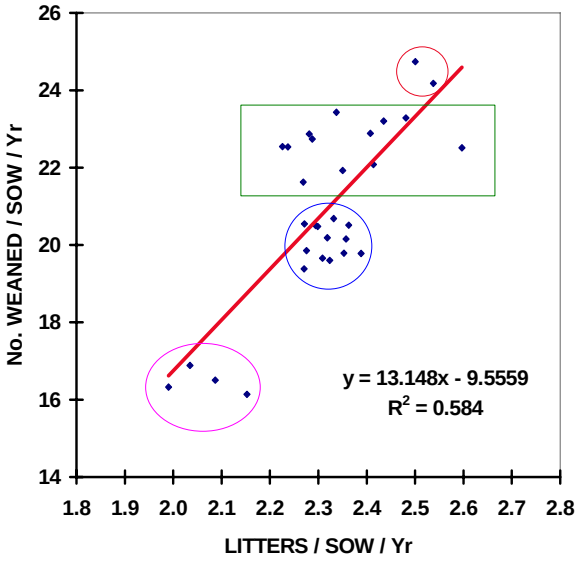


Figure 4. Litter Size and Litter Rate

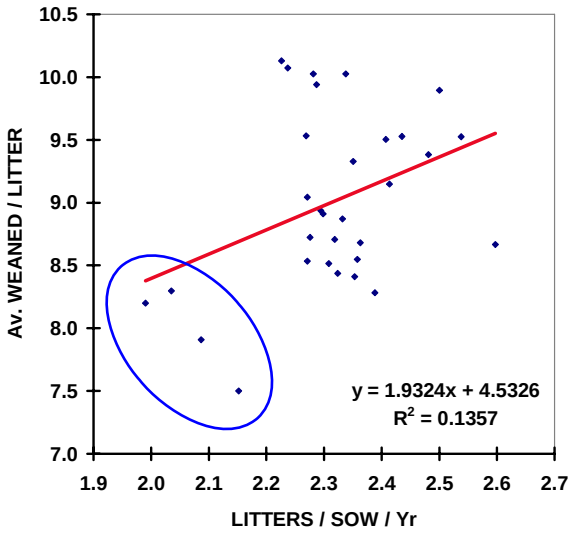


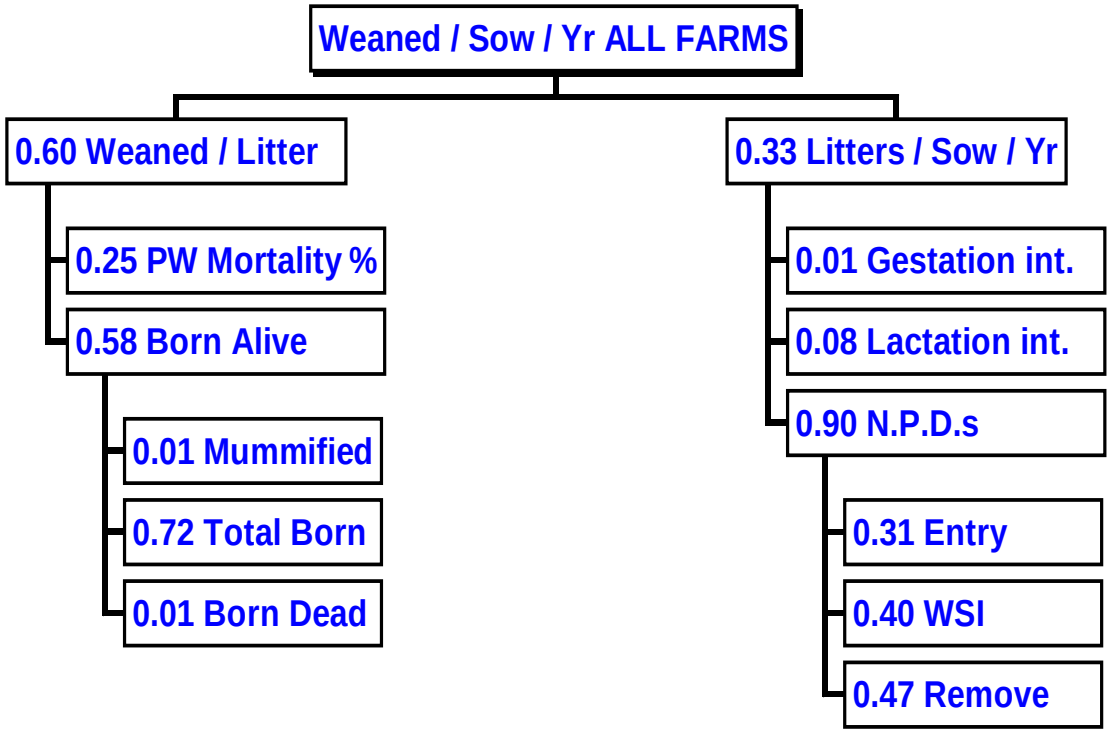
Figure 3. presents the relationship between LSY and WSY. The farms circled in blue form a tight group producing 20 piglets weaned per sow per year from 2.3 litters per sow year.

The green rectangle bounds farms producing 22 piglets per sow per year from a diverse range of litters per sow per year performance. This indicates that there are many varied combinations of litter size and litter rates existing in practice to achieve 22 piglets weaned per sow per year.

The two farms circled in red suggest that to exceed 24 piglets weaned per sow per year, litter rates must be maximised.

Figure 4. shows no association between litter size and litter rate which suggests that these traits are acting quite independently. The relationship would deteriorate further if the four poor performing farms circled in blue were removed from the analysis. The majority of farms indicate that there are practical difficulties in optimising both traits simultaneously.

Figure 5. Decision Tree analysis of factors determining Piglets Weaned/Sow/yr



To further understand the factors driving reproductive variability, a detailed decision tree analysis was conducted on subset of 23 farms supporting sufficient recording detail during 1995/96. This analysis seeks to explain the week to week variation of a parent cell using each child cell (independently). The child cell with the largest R^2 value is the most important factor driving the variability of the parent

trait. For example, referring to Figure 5, Weaned per Litter explained more variation in Weaned per Sow per Year than Litters per Sow per Year did. Continuing down the tree, Live Births determined weaning numbers more than mortality rates did. Similarly, the total number of piglets born exerted most influence upon Born Alive.

Thus figure 5. indicates that the total number of Piglets Born per litter is the single most important factor contributing to the variability of Piglets Weaned per Sow per year. This implies that WSY would increase markedly if the below average weeks (Total Born) could be transformed into above average weeks.

Figure 6. Group Trend of 31 farms for Average Piglets Weaned per litter 1994 / 97

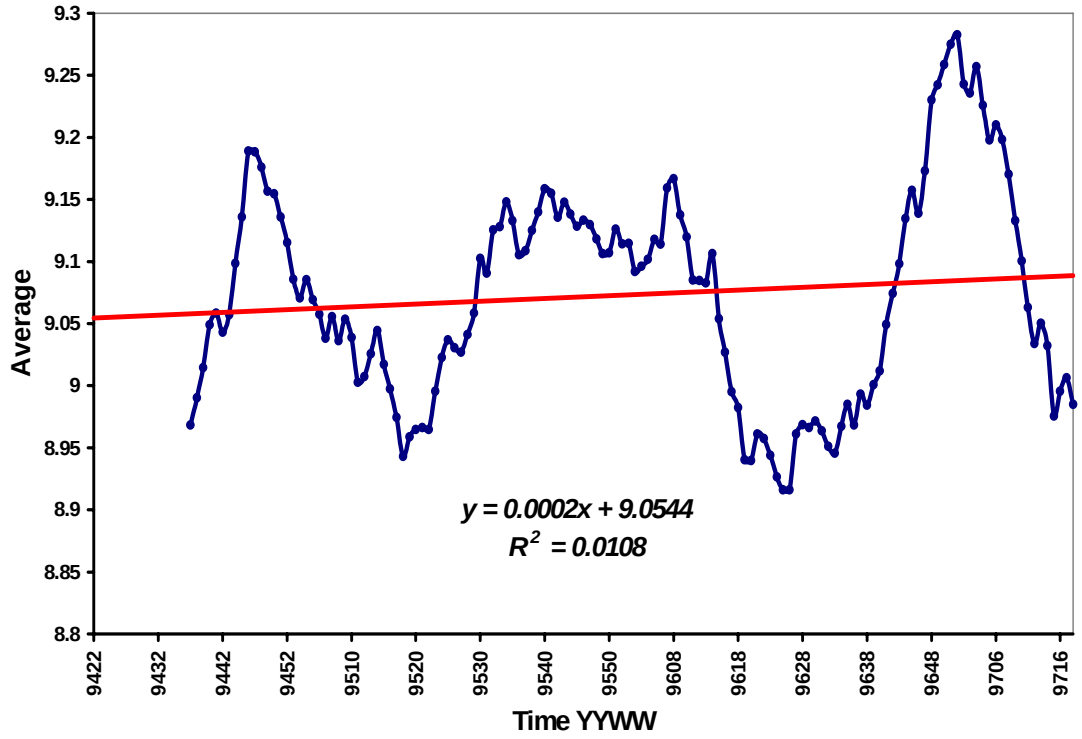


Figure 6. presents the group average trend of Average Piglets Weaned per litter for all 31 farms. Although there is some seasonal effect evident, there has been no change in performance for this important trait. Figure 7. selectively presents a subset of seven farms that have achieved significant improvements in weaning performance. The values graphed in figure 7. are 52 week rolling averages, each series represents a farm and the series without symbols depicts the average performance of all seven farms.

As a subset, this group has improved average weaned per litter by approximately 0.5 of a piglet over a period of two years. Farm 1001 has doubled this rate of improvement, but is well below average. Interestingly, the best performing farm (1017) in the group is steadily improving and now weans in excess of 10 piglets per litter. Farm 1006, the highest ranked farm for Piglets Weaned per Sow per year, has increased average weaned per litter by 0.5 piglets in less than 12 months.

Just as Figure 6. hides the improvements of selected farms, figure 7. hides much of the week to week variability experienced within farms over time. Figure 8. presents three farms selected to demonstrate the enormous amount of week to week variation in average Piglets Weaned per litter.

Figure 7. Seven selected farms improving Average Piglets Weaned per litter.

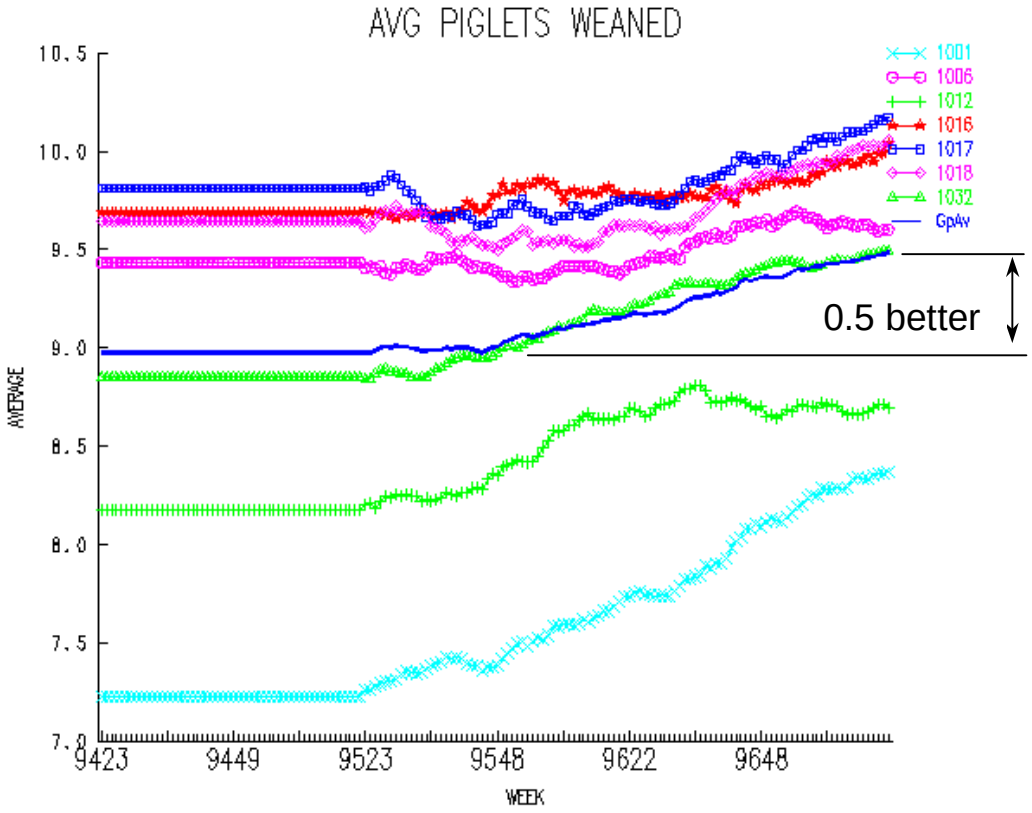
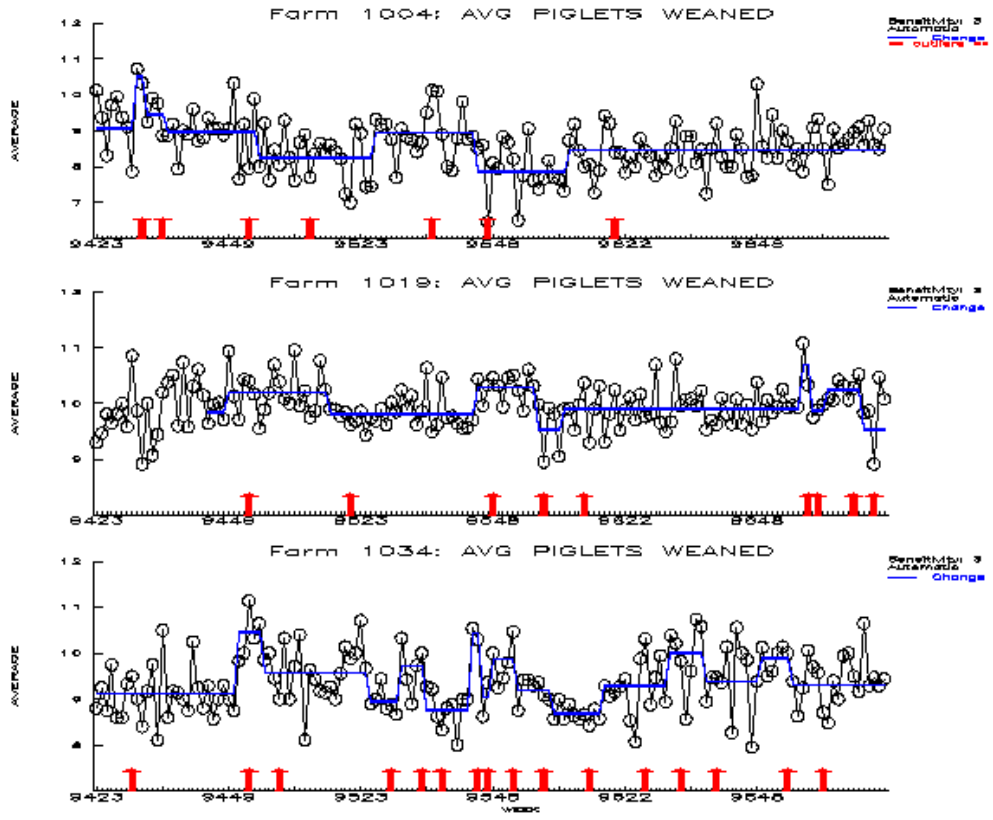


Figure 8. Three selected farms' weekly production trends for Av Piglets Weaned/litter.



The stepped blue lines in figure 8. indicate periods of significantly different production performance. Each blue step is "pointed to" by a red arrow below it which signals the date when the change in performance was first detected. These three farms are all experiencing periods of elevated performance followed by depressed performance. The difference between highest and lowest segments is approximately 1.5 piglets weaned per litter.

Farm 1004 and farm 1019 are similar and experience approximately eight significant production changes in three years. Farm 1034 is somewhat different and experiences twice as many production changes (16) and is obviously experiencing difficulty in controlling production.

Reflecting back to the decision tree analysis, it is reasonable to surmise that much of this variability is being caused by the variation in average total born per litter. There is thus great benefit to be reaped by addressing the management factors impacting upon Total Piglets Born per litter, for example; mating timing and frequency, boar fertility, lactation weight loss, etc.

Each red arrow in figure 8. identifies an opportunity to investigate the production system to address problems and develop management strategies to prevent production down turns. As each production issue is addressed, fewer negative shifts of mean performance will be experienced and production will rise as production improvements are locked into the system. It is important to attempt to address these issues as they arise, before the evidence of change disappears or staff memories fade.

The amount of production control evident in the herds studied varied substantially. Those herds with stable production systems tended to have good control of all production traits.

Figure 9. Comparison of production control between best and worst ranked herds.

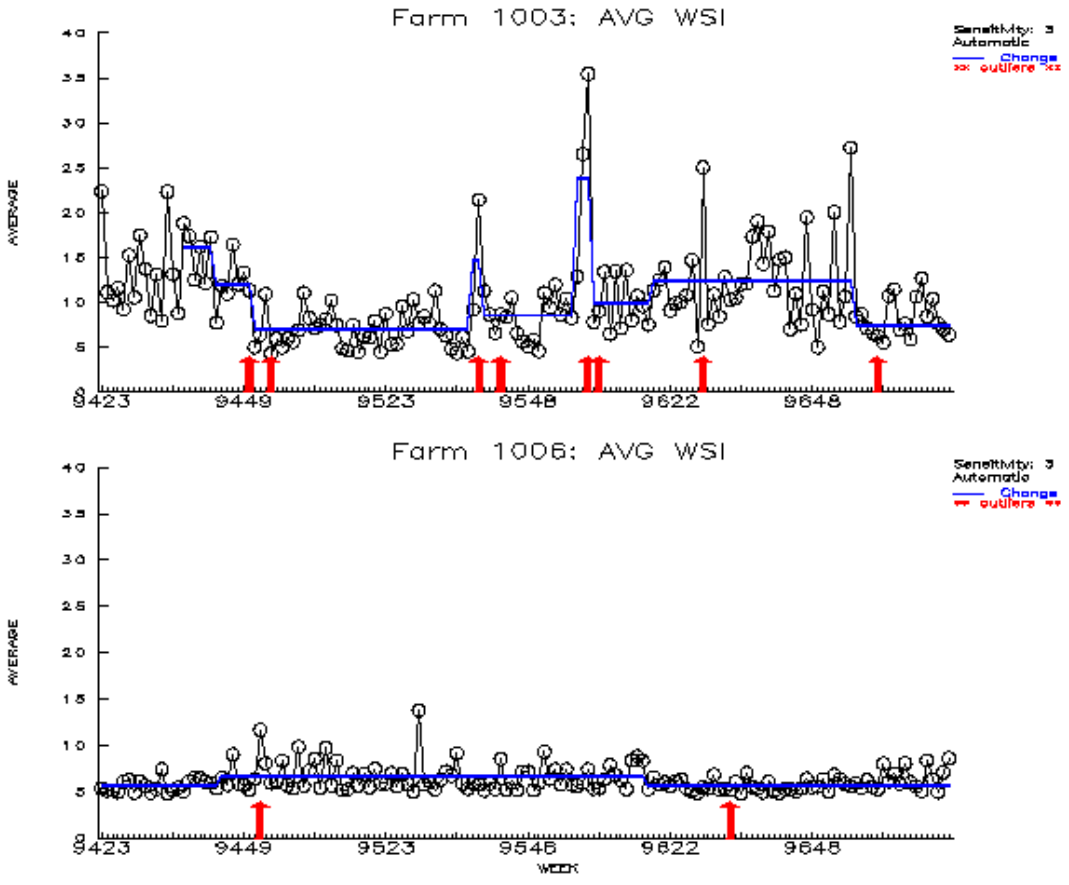


Figure 9. presents a stark comparison of production control over Weaning to Service Interval (WSI). The two herds selected for comparison are ranked best and worst for Average Piglets Weaned per Sow per year (16.1 and 24.7 respectfully, refer figure 2 for rankings). Farm 1006 is exercising very tight control over WSI with only two significant shifts of mean detected. The week to week variation in WSI is consistent at approximately ± 2 days.

In comparison, farm 1003 is experiencing much greater weekly variation with many shifts of mean performance being detected. Interestingly, farm 1003 does exhibit the potential in mid 1995 to achieve sound results.

Recommendations for achieving production improvements:

1) Use a computer recording program or bureau service to capture reproductive data.
2) Use PigPulse weekly to identify significant shifts of performance immediately they occur.
3) Use your computer recording system to investigate issues identified by PigPulse.
4) Involve production and management staff in the investigation of production issues.
5) Involve consultants and other off farm experts in problem solving and strategy development.
6) Collectively establish production procedures using best practice research literature.
7) Implement best practice procedures and use PigPulse to evaluate success / failure.
8) Join a discussion group to share case studies of production successes (eg PigPulse user group).

Acknowledgments:

The material cited in this paper has been sourced from the Pig Research and Development Corporation's Variability in Reproduction Workshop 9-11 September 1997. The full report (376 pages) is available from PRDC. P.O. Box 4804 Kingstone ACT 2604, Ph 02 6272 5139.

Further information:

PRDC is funding the Queensland Department of Primary Industires to develop the PigPulse computer program. Part of this work incorporates testing the package with real life data. Producers using computer recording programs are invited participate and receive:

- Free PigPulse analysis of their data.
- A complimentary PigPulse demonstration program (preloaded with your data).

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