

Investigating the Variability of Weaning to First Service Interval

This case study demonstrates the underlying concepts necessary to correctly interpret trends in this trait. Figure 1 below presents the Weaning to First Service Interval (WFSI) for SOP2.

Between week variability has decreased over time. For the purpose of discussion this time plot has been segregated into three periods for analysis. Period 1 runs from approximately 9850 to 0048. Period 2 runs from 0049 to 0216. Period 3 is much shorter and runs from 0217 to 0225.

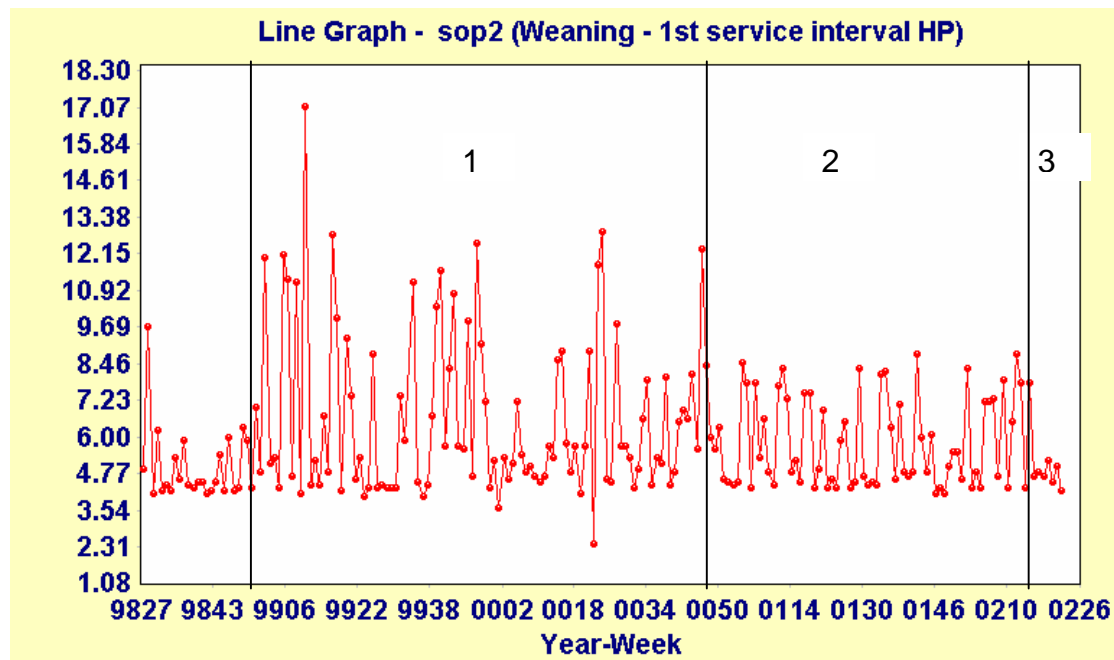


Figure 1. Time Plot of WFSI.

Figure 1 has presented a time plot of weekly means with each weekly sample mean represents approximately 20 sows. To understand the behavior of trends in sample means it is first necessary to evaluate the individual performances of all sows forming the total sample group.

Figure 2 below shows the frequency distribution of Weaning To First Service Interval from the combined periods (1, 2 and 3). The distribution is heavily skewed and thus errors in data recording become a critical issue to check first. Assuming the data is valid, 90% of sows are mated within six days of weaning. The remaining 10% of sows can take up to 78 days to be mated.

The scale of this graph makes it visually difficult to evaluate the low incidence of larger WFSI's (see the following table for further detail). For example there is one sow with a WFSI of 78, but the graph appears not to show this value as the bar is too small to see.

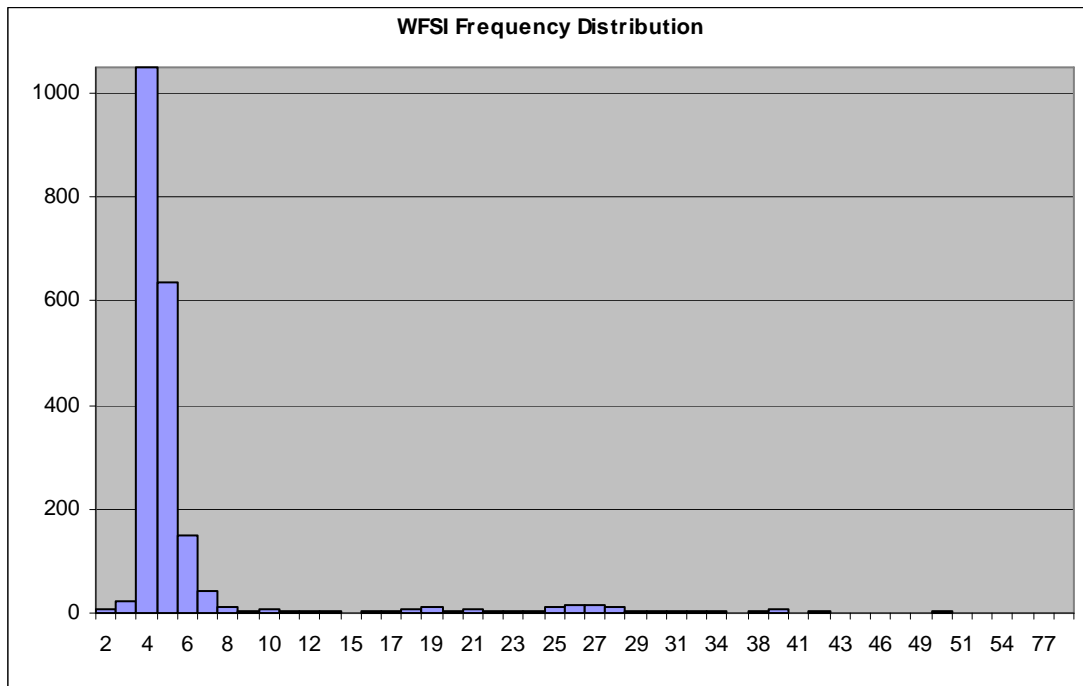


Figure 2. Frequency Distribution of WFSI

The Grand Total column of the table 1 below shows the data used to generate the graph in figure 2. Weaning to First Service Interval's are further categorized by Period.

Periods 1, 2 and 3 correspond to the three phases of production detailed in Figure 1.

The proportion of sows mated within six days of weaning increases with each period, being 87.5% in period 1, 91.3% in period 2 and 95.3% in period 3. Period 2 shows some improvement compared to period 1 in that proportionately less sows form the tail segment of the distribution and the tail is also shorter (maximum of 48 vs 78).

Period 3 is of much shorter duration and is thus not representative in comparison to periods 1 and 2. Period 3 is opportunistically included in this discussion to demonstrate the form of the distribution required to achieve low average WFSI. Period 3 is significantly different from periods 1 and 2 ($p < 0.001$).

Table 1. WFSI frequency data presented by Period

Count of WFSI	Period			Grand Total
	WFSI	1	2	
2	3	3		6
3	5	18		23
4	505	504	40	1049
5	329	277	32	638
6	72	68	9	149
7	21	17	3	41
8	9	3	1	13
9	4	1		5
10	4	2		6
11	5			5
12	5			5
13	1	1		2
15		1		1
16	1	2		3
17	2	1		3
18	3	4		7
19	6	4		10
20	4	1		5
21	4	2		6
22	2			2
23		3		3
24	3			3
25	9	2		11
26	8	7		15
27	8	7		15
28	4	6		10
29	1	4		5
30	2	3		5
31	1	2		3
32	2	1		3
34	3	2		5
37		1		1
38	2			2
39	3	3		6
41	1			1
42	1	1		2
43	1			1
44		1		1
46	1			1
48		1		1
49	1			1
50	2			2
51	1			1
53	1			1
54	1			1
58	1			1
77	1			1
78	1			1
Grand Total	1044	953	85	2082

Figure 3 below truncates the distribution presented in figure 2 to present only the tail of the distribution (greater than 7 days) and partitions each WFSI category by parity.

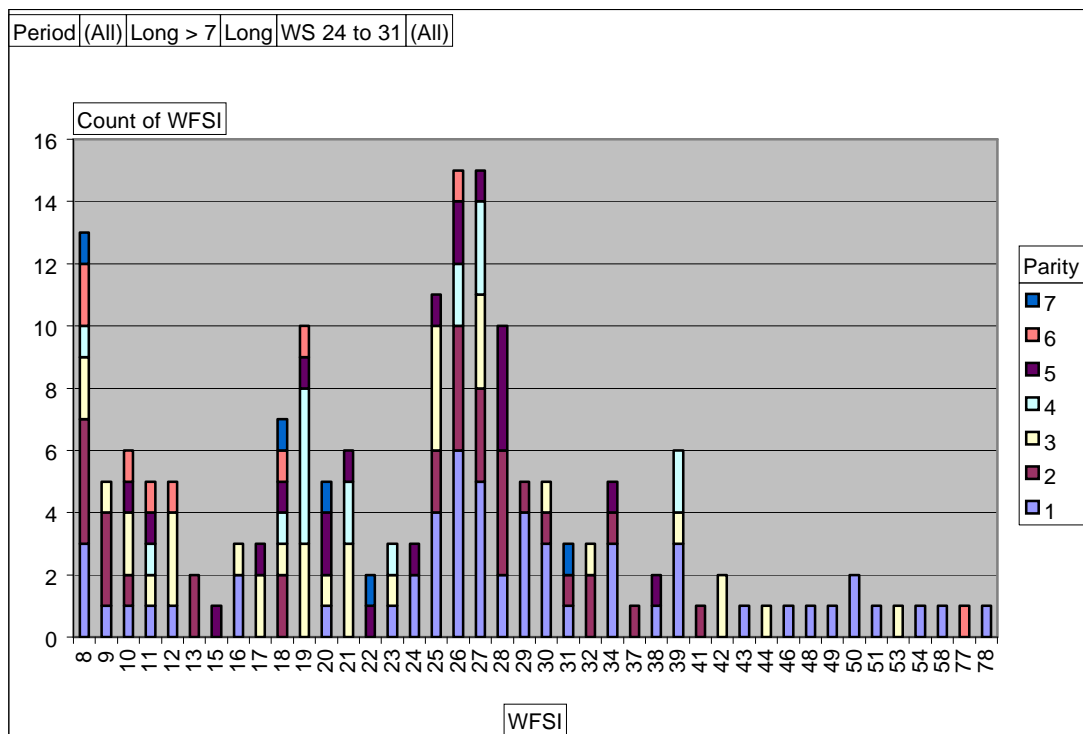


Figure 3. Truncated Frequency Distribution segregated by Parity.

Focusing on the tail of the Weaning to First Service Interval distribution reveals the following observations of interest:

- Parity 1 sows are overtly prevalent within the tail
- There is a concentration of sows within the 25 to 28 day period that corresponds to a one cycle (20 to 22 day) offset from expectation (4 to 6 days)
- Parity 1 sows are disproportionately prevalent within the above period.
- Parity 1 sows dominate the extreme tail of the distribution (> 42 days)
- Parity 6 and 7 sows are most prevalent between 8 and 19 days.

The following conclusions may be drawn from these observations:

- Gilts may be experiencing silent heats or are being accidentally missed or are being observed and being deliberately spelled for a cycle.
- A policy to cull stale gilts at 6 weeks post mating will truncate 36 days off the tail of the distribution.

Thus the variability of weekly means presented in figure 1 is totally a function of the underlying frequency distribution of WFSI. As this distribution is heavily

positively skewed (tail pointing to the right towards larger values) the low incidence of large values is having an inordinately large impact upon the calculation of weekly means.

Given a weekly sample of 20 sows (equivalent to a 400 sow herd), 2 (10%) sows will have “outlying” WFSI drawn from the tail (> 6 days) of the distribution. With 90% of sows averaging 5 days and perhaps 10% of sows averaging 50 days, the tail has effectively doubled the mean from 5 to 10 days. So the tail is very much wagging the dog.

Figure 4 presents simulated time plots generated by randomly selecting 100 samples of 20 sows from each of the frequency distributions for periods 1, 2 and 3.

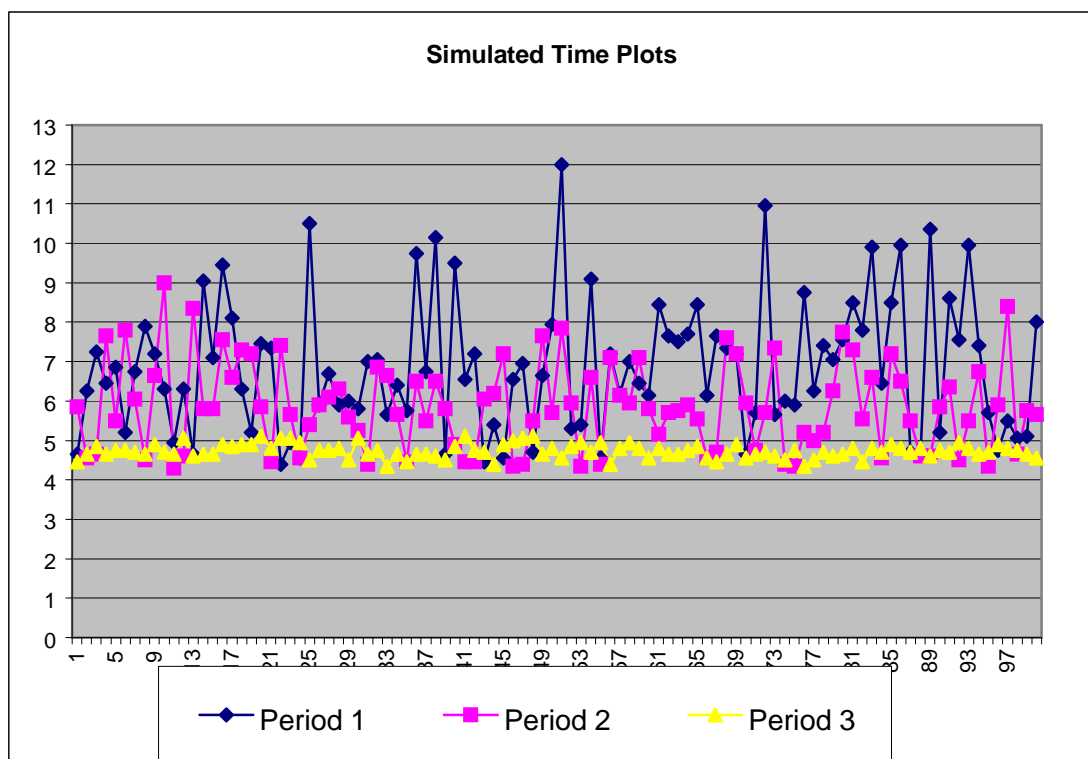


Figure 4. Simulated Time Plots for each Period.

This example graphically shows the profound impact of the exposure to “production mistakes” (WFSI > 7 days). Period 3 represents “perfect” production where virtually all sows are mated within 7 days. The pattern of variation is very tight as there are no outlying events effecting the weekly mean. Period 2 reaches a maximum of 9 days WFSI while period 1 reaches a maximum of 12 days WFSI.

Thus time plots for this trait provide a very sensitive measure of production failure. They are equally prone to recording errors, for example entering the wrong mating month instantly adds multiples of 31 days.

On the positive side, any standard operating procedure (SOP) successfully implemented only has to target a few isolated severe occurrences to rapidly

redeem the situation.

Standard Operating Procedures targeted to prevent WFSI > 6 days include:

- Optimising body fat at point of first mating in parity zero.
- Minimising fat loss in lactation.
- Parity 1 nutritional flushing.
- Oestrus stimulation
- Oestrus detection
- Mating Management (i.e. skip mating policies)

It is also worthy to note that if these SOP's fail to completely prevent extended WFSI's, management does have the ultimate control of WSI by way of strategically removing sows entering the tail of the distribution. Thus this aspect becomes part of the "Culling" or "Removal" SOP.