

Construction of a Model for Prediction of Sows Failing to Express Symptoms of Estrus Within Seven Days Postweaning

Marek Gotszling, graduate student,
and Tom J. Baas, assistant professor,
Department of Animal Science

ASL-R1577

Summary and Implications

Data were compiled and analyzed to identify sows that are most likely to fail to express symptoms of estrus within 4–7 days after weaning. Five variables expected to influence estrus expression in sows were considered. Identification of those sows would allow producers to induce estrus by injection of gonadotropin hormone (PG600) at weaning. In that way reduction of nonproductive days is possible.

Genetic line and parity had a significant effect on rebreeding rate in this study. Line C-15 females had significantly lower rebreeding rate when compared to C-42 and C-22 females. A lower rebreeding rate for first parity females was observed. Administration of gonadotropins to females with a greater likelihood of a prolonged wean to estrus interval and lower rebreeding rate may help to improve reproductive performance of sows and decrease nonproductive days.

Introduction

Production performance in farrowing units is limited by noninfectious problems and infectious diseases. Either one of these factors can adversely affect the sow and result in increased lifetime nonproductive days and diminish the number of pigs weaned per sow per year. To achieve weaning goals of 20–23 pigs per sow per year, producers must identify and eliminate infectious and noninfectious problems that prolong the onset of estrus after weaning, increase nonproductive days, and diminish fertility at breeding and lifetime productivity of animals. Increases in nonproductive days per year limit average number of litters produced per sow per year and therefore total number of pigs produced per year from the farm. One nonproductive day equates to 0.05 baby pig and 0.007 litter per sow per year. Thus, a 10-day reduction in nonproductive days increases sow productivity by 0.5 pig per year or 0.07 litter per year.

To exhibit postweaning estrus (rebreeding rate) on time and with adequate fertility, sows that have produced large litters and lost body weight must undergo rapid follicular growth under the metabolic stress of their most recent lactation. Successful reproduction in sows requires the coordination of at least four organs: the hypothalamus, pituitary gland, ovary, and uterus. In general, the hypothalamus receives the sensory input from internal and

external sources and translates this information into an endocrine signal in the form of gonadotropin releasing hormone (GnRH). The pituitary gland is stimulated by GnRH to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These two hormones are referred to as gonadotropins and are responsible for stimulating follicular growth, steroid hormone production, and ovulation on the ovaries.

At weaning sows are moved from farrowing facilities to pens or stalls near the breeding area in preparation of mating. The recovery period usually takes 4–7 days and during this time mammary involution occurs and endocrine functions change to initiate follicle growth on the ovaries.

Materials and Methods

The purpose of this observational study was to develop a model for prediction of sows failing to express symptoms of estrus within seven days after weaning. Data for this study were compiled at a 2,400-sow, commercial farrowing unit. Data contain measurements taken from 1,052 sows. All sows were housed in identically designed farrowing crates with uniform lactation length lasting approximately 17 days. To accomplish the objectives, five variables were selected for inclusion in the model of prediction.

Genetic line. Three different PIC dam lines were evaluated in this study:

- Camborough-42 - the mother line for Camborough-22;
- Camborough-22 – the newest PIC genetic line intended for commercial operations; and
- Camborough-15 – the older PIC genetic line that is being replaced by C-22.

Feed consumption. Recent research has suggested nutrient intake during lactation and the availability of body tissue reserves are major factors that influence postweaning anestrus. Low energy and protein intake during lactation has been considered as a cause of anestrus. In our research, the number of pounds of feed consumed during the first five days of lactation was measured. Two levels of this variable were established. Daily feed consumption varied from 2 to 50 lb. Sows that consumed less than 30 lb were included in level one, the remaining were included in level two.

Sow condition. Condition of the sow is often described as a factor influencing reproductive performance. Yang et al. (14) reported that thinner sows farrow fewer pigs during subsequent parities than females with higher tissue reserves. Thin sows have been shown to have longer periods of postweaning anestrus (11) than females with adequate body reserves. It has also been reported that an excessive amount of body weight

and fat content have a deleterious effect on reproductive performance of sows. In our study three levels of sow condition were established, based on subjective assessment.

Parity of the sow. Many researchers have shown that age of the sow influences reproductive performance. In our study animals representing seven parities were included. This variable was split into three levels. First parity animals were entered as level one, parity 2–4 sows were entered as level two, and older sows (parity 5–7) were assumed as a level three.

Number of piglets born. Choice of this variable was based on the assumption that number of developing fetuses in the previous gestation period may have an effect on subsequent sow performance. Number of properly developed fetuses (piglets born alive and stillborn) was measured. Two levels of this variable were set. Sows that farrowed fewer than eight piglets were entered as level

one and sows that farrowed eight or more piglets were listed as level two.

Every day, after all sows had farrowed, litter size was standardized. Each sow received 10 or 11 piglets to nurse. After lactation, lasting approximately 17 days, sows were moved to the breeding crates. Females were checked for estrus once a day. On the first four days after weaning sows were checked for estrus with boars held in the area adjacent to the females. From day five through seven after weaning unbred sows were physically exposed to a boar. All animals that failed to express estrus within seven days after weaning were considered as problem breeders and candidates for administration of PG-600. Data were analyzed using SAS statistical computer software.

Results and Discussion

In our study, 17% of sows that were under observation did not express symptoms of estrus within seven days after weaning. Analysis of variance presented in Table 1 showed that genetic line and parity were the only variables that had a significant effect on estrus occurrence.

Table 1. Analysis of variance.

SOURCE	DF	F VALUE	Pr>F
Genetic Line	2	4.2	0.015
Feed Intake	1	0.18	0.671
Sow Condition	2	1.97	0.141
Parity	2	4.85	0.008
Pigs Born/Litter	1	0.42	0.519

Means and standard deviations for rebreeding rate for each level of all analyzed variables are reported in Table 2.

Table 2. Rebreeding rate in % and standard error for each variable.

VARIABLE	LEVEL	REBREEDING RATE	STD DEV
Genetic Line	C-42	89	6
	C-22	86	6
	C-15	51	13
Feed Intake	0-29 lb	77	10
	30+ lb	73	4
Sow Condition	Thin	85	8
	Adequate	86	5
	Fat	70	6
Sow Parity	1	61	8
	2-4	77	8
	5+	88	7
Pigs Born/Litter	0-7	71	11
	8+	79	3

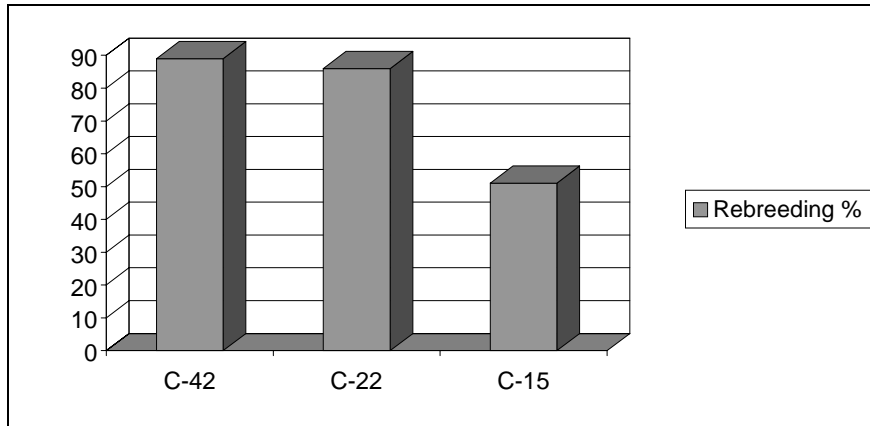
In this study feed intake did not have an influence on estrus occurrence. The average feed intake during the first five days of lactation was 37 lb with a standard deviation

of 7.6 lb. Interactions between feed intake and parity and feed intake and genetic line were evaluated but were not significant. Different response of estrus occurrence was

detected for different genetic lines ($P < 0.05$). The relationship between genetic line and rebreeding rate is

presented in Figure 1.

Figure 1. Relationship between genetic line and rebreeding rate.

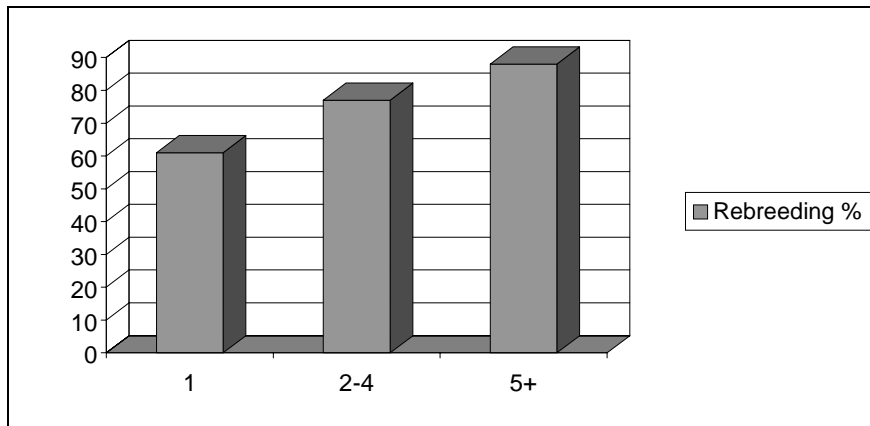


A total of 89% of sows from line C-42 and 86% from line C-22 came into heat within seven days after weaning, whereas only 51% of sows from line C-15 exhibited postweaning estrus during the same period of time. Low frequency of estrus occurrence among sows in line C-15

supports the decision of rapid elimination of this genetic line from the herd.

Parity is another variable for which differences in estrus expression were statistically significant ($P < .01$). These differences are presented in Figure 2.

Figure 2. Relationship between sow parity and rebreeding rate.



The problem of delayed return to estrus in first parity sows has become more apparent in many swine operations. First parity sows attained the lowest mean value for estrus occurrence in this study. Only 61% of them showed symptoms of estrus within seven days after weaning. First parity sows did not have adequate body reserves needed for intense milk production during first lactation. Also, the lactation diet used on the farm contained only 16% crude protein and 0.85% lysine, whereas requirements necessary for continuous growth of

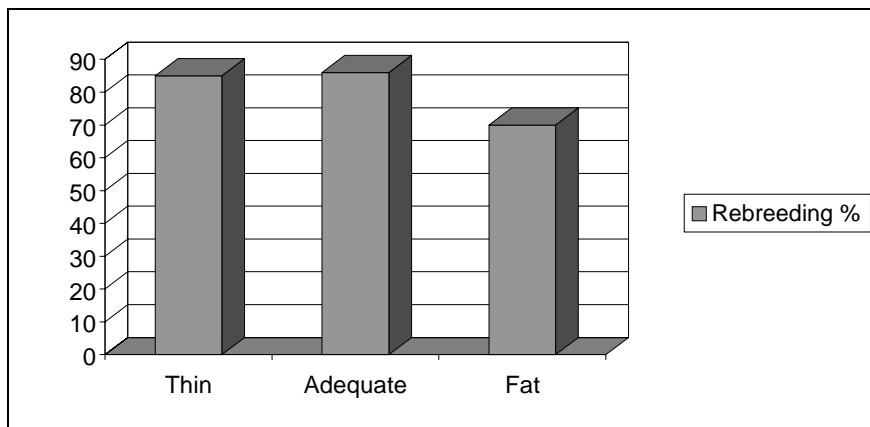
young animals are 18% of crude protein and 1.3% lysine. Therefore, loss of condition in the first parity was observed. Parity 2–4 females exhibited estrus at a rate of 77%. The oldest sows on the farm, parity five and higher, had the highest rate of early rebreeding (88%). After multiple culling/selection decisions during the sow’s lifetime, only the most prolific and efficient are retained for later parities.

Although our results did not indicate a detrimental effect of sow condition on rebreeding rate ($P = .14$), there was a higher percentage of sows that were anestrus among

overweight animals. Rebreeding rate was 70% for fat sows compared with 86% for sows in adequate condition

and 85% for thin animals (Figure 3).

Figure 3. Relationship between sow condition and rebreeding rate.



Many researchers explain this phenomenon as resulting from inadequate feed intake during lactation by overweight sows that results in suppression of postfarrowing hormonal development and follicular growth under the metabolic stress of the most recent lactation.

No evidence was found for the effect of number piglets born in the litter on rebreeding rate. Correlation coefficients among all variables in this study were different from zero but were low and not significant. Correlation coefficients are presented in Table 3.

Table 3. Pearson correlation coefficients.

	Feed Intake	Condition	Parity	Pigs/Litter	Estrus
Feed Intake	1.0				
Condition	0.01	1.0			
Parity	0.11	-0.02	1.0		
Pigs/Litter	-0.03	-0.05	0.23	1.0	
Estrus	0.01	-0.03	0.06	0.04	1.0

References

1. Aherne, F.X., and R.N. Kirkwood. 1985. Nutrition and sow prolificacy. *J. Reprod. Fert.* 33 (Suppl.): 169.
2. Baas, T.J. 1995. Breeding herd efficiency and the SEW sow. Iowa State University, Ames, IA.
3. Britt, J.H, J.D. Armstrong, N.M. Cox, 1988. Metabolic interface between nutrition and reproduction in pigs. *Proc. 11th Int. Cong. Anim. Reprod. A.I.* 5: 118–125.
4. Christenson, R. K. 1986. Swine management to increase gilts reproductive efficiency. *J. Anim. Sci.* 63: 1280.
5. Dewey, C.E, S.W. Martin, R.M. Friendship. 1992. The effect of lactation length and the weaning to conception

- rate interval on litter size in Ontario swine. *Proc. Int. Pig. Vet. Soc.* 12: 552.
6. Flowers, W.L. 1997. Reproductive management of early weaned sows. Technical Report No 15. North Carolina State University.
7. Hurtgen, J.P., and A.D. Leman. 1981. Effect of parity and season of farrowing on the subsequent farrowing interval of sows. *Vet. Rec.* 108: 32–34.
8. Kirkwood, R.N., S.K. Baidoo, F.X. Aherne, and A.P. Sather. 1987. The influence of feeding level during lactation on the occurrence and endocrinology of the postweaning estrus of sows. *Can. J. Anim. Sci.* 67: 405–415.

9. Leman, A.D. 1990. Mate sows once 3-5 days after weaning. *Int. Pigletter*. 10:8, pp 29–32.
11. Reese, D.E., B.D. Moser, E.R. Peo, Jr., A.J. Lewis, D.R. Zimmerman, J. E. Kinder, and W.W. Stroup. 1982. Influence of energy intake during lactation on subsequent gestation, lactation and postweaning performance of sows. *J. Anim. Sci.* 55: 867.
12. Reese, D.E., B.D. Moser, E.R. Peo, Jr., A.J. Lewis, D.R. Zimmerman, J.E. Kinder, and W.W. Stroup. 1982. Influence of energy intake during lactation on the interval
10. Lover, R.J. 1979. Reproductive performance of first parity sows. *Vet. Rec.* 104: 238–240.
- from weaning to first estrus in sows. *J. Anim. Sci.* 55: 590.
13. Thacker, P.A. 1992. Feeding methods to achieve optimum sow productivity. *National Pig Info Database*.
14. Yang, H., P.R. Eastham, P. Phillips, and C.T. Whittemore. 1989. Reproductive performance, body weight and body condition of breeding sows with differing body fatness at parturition, differing nutrition during lactation, and differing litter size. *Anim. Prod.* 43: 181