Breeding gilts at natural or a hormone-induced estrus: Effects on performance over four parities

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Summary

Objective: To determine the effect of gonadotropins on the lifetime reproductive performance and longevity of breeding female swine.

Methods: A retrospective analysis was performed over four parities of sows originally bred as gilts either at first observed spontaneous estrus ("Control"), a spontaneous estrus after a gonadotropin-induced estrus ("Skip"), or at a gonadotropin-induced ("Bred") estrus.

Results: Original breeding treatment had no effect (*P*>.2) on either the average number of litters produced per sow (3.47 for Control, 3.17 for Skip, 3.39 for Bred) or on total number of pigs produced during four parities (45.0 for Control, 45.1 for Skip, 45.8 Bred).

Implications: Under the conditions of this study, breeding gilts at a gonadotropin-induced estrus produced no adverse effect on subsequent sow productivity.

Keywords: swine, gilts, eCG/hCG, long-term performance

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The exogenous gonadotropins—equine chorionic gonadotropin (eCG; also known as PMSG) and human chorionic gonadotropin (hCG)—can be used to stimulate the onset of estrus and ovulation in gilts and sows.[1] The decision to employ exogenous gonadotropins, however, must take into account the possibility that using them to stimulate quiescent ovaries may result in the breeding of females that are otherwise innately relatively infertile. Should this occur, it is reasonable to expect longevity and lifetime-pigs-produced in those females to be reduced. We recently examined a database in which primiparous sows received 400 IU eCG with 200 IU hCG (PG600®, Intervet; Whitby, Ontario) at weaning, and found no effect on lifetime productivity.[2] The animals involved in that study, however, had some proven degree of fertility in that they had successfully delivered and reared a litter. Many animals are culled for infertility prior to producing their first litter.[3] It is possible that relatively infertile gilts that farrow after being bred at a gonadotropin-induced estrus will have a reduced lifetime performance.

Recommendations concerning the breeding of gilts frequently state that they should be bred at their second or third estrus so as to capture an increase in first litter size. However, the accumulated nonproductive days make the economic justification for delayed breeding suspect, unless it translates into improved lifetime performance. Controlled experiments consistently fail to demonstrate any advantage from delayed matings, although anecdotal evidence suggests that gilts bred at a young age, especially if it is at the pubertal estrus, suffer a higher culling rate.

The objectives of the present study were to determine the effect of

- age at first breeding,
- breeding at a first or second observed estrus, and
- breeding at a gonadotropin-induced estrus

on the reproductive performance of gilts over four parities.

Materials and methods

The present study analyzed a database derived from a study of the effects of eCG/hCG on gilt productivity.[1] Gilts were of Yorkshire and Landrace breeding (PIC genotype), and were housed in groups of approximately 15. These gilts were fed ad libitum until estrus was detected, after which they were placed in gestation stalls for breeding. Gilts and sows were fed to condition during gestation, with a target backfat depth at farrowing of 20 mm at the P2 position. Sows were weaned into gestation stalls where estrus detection and breeding were conducted. At the time of the study, the manager reported a failure to meet breeding targets because gilts in the replacement pool were failing to exhibit estrus. Although gilt ages were available, gilt weights were not. However, gilt weights were subjectively assessed to be > 100 kg bodyweight. Based on gilt age, assessed weight, and the high proportion of gilts which were not detected in estrus, a tentative diagnosis of delayed puberty was made and an intervention strategy involving alternate gilts receiving eCG/hCG was implemented during a 3-week period. For the current analysis, the data capture period was extended for an additional week to ensure inclusion of sufficient control animals. Some gilts were sold as sows to other farms and were not included in the analysis.

Treatments were:

- Control; gilts bred at their first observed estrus ("Control"; n=132).
- eCG/hCG-treated and bred at the induced estrus ("Bred"; n=140).
- eCG/hCG-treated and bred at a subsequent spontaneous estrus which had to be at least 20-days after eCG/hCG treatment ("Skip"; n=60).

There were fewer gilts in the Skip group because in the original study[1] the use of eCG/hCG resulted in available gilts in excess of the breeding target and excess gilts were allowed to cycle. Gilts treated with eCG/hCG had equal opportunity to be bred or skipped. Gilts remained in their

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treatment groups regardless of whether they farrowed to first or subsequent service. All breedings (gilt and sow) were by artificial insemination and the targeted lactation length was 16 days. In any parity, females failing to conceive at the first and second service (i.e., those that returned to service twice) were culled.

Data recorded were:

- age at first service,
- number of services to obtain a farrowing event in each parity,
- total and live born litter size in each parity,
- lactation length in each parity, and
- wean-to-estrus interval in each parity.

Sow productivity was examined in terms of the number of litters produced and total number of pigs produced. The retrospective analysis encompassed the period from initial gilt breeding until the rebreeding after weaning of the fourth litter. Only gilts with a breeding event were recorded (gilts culled for failure to exhibit a first estrus were not recorded).

Statistical analysis

Analysis was performed using GLM procedures of SAS® (Statistical Analysis Systems Inc.; Cary, North Carolina). Dependent variables included in the model were: number of litters produced per sow, total number of pigs produced per sow, total number of liveborn pigs produced per sow, and lactation length in each parity. Because we observed a significant treatment difference in first lactation length (13.9 days for Control, 14.9 days for Bred, and 13.7 days for Skip), we included first lactation length as a covariate in the analysis of treatment differences in first weaning-to-estrus interval (WEI) and second litter size (total and alive). Treatment effects on farrowing rate to first service were examined by χ^2. For analyses of the influence of initial service age on productivity over the four parities, gilts were assigned to service ages of

- < 180 days,
- 180–199 days,
- 200–219 days, and
- ≥ 220 days.

Influence of conception at first or second service on subsequent litter size was examined within parity.

Results

The breeding of gilts at a gonadotropin-induced estrus resulted in a reduced ($P < .001$) age at first service and a lower ($P < .001$) farrowing rate to first service (Table 1). The first litter size and subsequent total pig production and longevity were unaffected by the treatment (Table 1). Conception at first or second estrus had no effect on the first litter size. However, the second litter size was larger ($P<.001$) for sows conceiving at the second compared to the first postweaning estrus. A similar but smaller effect ($P<.07$) of estrus of conception was noted for the total born in the third litter (Table 2).

Age at gilt breeding had no effect on first litter size, total pig production, or numbers of litters produced (Table 3).

Discussion

The present results indicate that administering eCG/hCG and then breeding gilts at the induced estrus was not associated with reduced long-term performance. However, it must be emphasized that the gilts included in the present study averaged > 180 days of age and probably > 110 kg bodyweight; it is probably not appropriate to extrapolate these data to significantly younger and lighter gilts. Further, the breeding management of this herd was excellent (e.g., 89% gilt farrowing rate and high survival rates to fourth parity). Therefore, these results should be interpreted as indicating the effect of hormone treatment on the potential for gilt performance that may, or may not, be achieved in other herds.

Whether gilts were bred on their first or

Table 1: Effect of breeding at first spontaneous estrus (Control), hormone-induced estrus (Bred) or spontaneous estrus following hormone-induced estrus (Skip) on sow reproductive performance over four parities (means ± SE).

	Control	Bred	Skip	P
Number of gilts bred	132	140	60	
Age at first service, days	197.3 ± 1.9	184.7 ± 1.7	215.1 ± 3.9	≤.001
Farrowing rate to first service	89.4%	70.0%	89.8%	≤.001
First litter size, total	9.9 ± 0.2	9.6 ± 0.3	10.7 ± 0.4	≤.07
First litter size, alive	9.3 ± 0.2	8.8 ± 0.2	9.7 ± 0.4	≤.13
First wean-to-estrus interval, days	9.4 ± 0.7	11.4 ± 0.9	10.5 ± 1.3	≤.23
Primiparous sows bred by ≤7 days	68.3%	65.4%	67.3%	≤.88
Second litter size, total	11.5 ± 0.2	11.4 ± 0.3	11.4 ± 0.4	≤.92
Second litter size, alive	10.8 ± 0.3	10.7 ± 0.2	10.7 ± 0.4	≤.96
Number of sows having four litters	101 (76.5%)	104 (74.3%)	39 (65%)	≤.24
Total litters per sow	3.48 ± 0.09	3.39 ± 0.1	3.17 ± 0.16	≤.24
Total number of pigs per sow	45.0 ± 0.6	45.8 ± 1.2	45.1 ± 1.2	≤.82
Total number of liveborn pigs per sow	41.8 ± 0.6	41.5 ± 0.6	42.8 ± 1.1	≤.49

Table 2: Effect of service number at conception on subsequent litter size (means ± SE).

	Parity 0			Parity 1			Parity 2			Parity 3		
	Serve 1	Serve 2	P	Serve 1	Serve 2	P	Serve 1	Serve 2	P	Serve 1	Serve 2	P
Number	261	56		190	101		233	38		227	17	
Total born	9.8±0.2	10.5±0.4	≤.13	10.9±0.2	12.4±0.3	≤.001	11.5±0.2	12.5±0.6	≤.07	12.0±0.5	12.1±0.5	≤.98
Liveborn	9.1±0.2	9.3±0.4	≤.61	10.3±0.2	11.5±0.3	≤.001	10.8±0.2	11.3±0.6	≤.28	10.7±0.2	11.1±0.5	≤.53

Table 3: Effect of age at first service on first litter size (total and alive), total pigs produced (total and alive), and number of litters produced (means ± SE)

Age at first service	<180 days, n=85	180–199 days, n=102	200–219 days, n=89	≥ 220 days, n=41	*P*
First litter size, total	9.9±0.3	9.6±0.3	10.1±0.3	10.4±0.5	≤.35
First litter size, alive	9.4±0.3	8.9±0.3	9.1±0.3	9.4±0.5	≤.60
Total pigs born	45.1±0.8	45.2±1.4	46.2±0.8	43.8±1.4	≤.74
Total liveborn pigs	42.3±0.8	41.2±0.6	42.5±0.7	40.7±1.2	≤.36
Total litters per sow	3.46±0.12	3.44±0.11	3.37±0.12	3.08±0.2	≤.33

second estrus had no significant effect on the first litter size, supporting the suggestion that ovulation rate and litter size will be increased at the second estrus only when gilts become pubertal at a young age and/or light weight.[4–6] It is likely that the gilts in the present study were mature enough that litter size was not affected by breeding at their first estrus. Indeed, when first litter size and subsequent lifetime performance were compared across age groups, no effect was observed. The increased litter size associated with breeding at their second rather than the first estrus after weaning is consistent with published data on the effect of skip-a-heat breeding of primiparous sows on their subsequent litter size.[7]

In addition, it is possible that the lack of statistical significance of the litter size differences we observed is due to inadequate statistical power in the size of our sample. It is quite possible that, if the number of females we included in our Skip group had been increased, the litter size results we observed would have been statistically significant.

Implications

The breeding of gilts at a gonadotropin-induced estrus does not adversely affect their long-term performance. However, this conclusion is limited to gilts induced into estrus at an age and weight where, historically, a natural onset of puberty may be expected.

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