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# Pubertal Response in Gilts to Type and Frequency of Boar Exposure and as Influenced by Genetic Line and Age at Initiation of Boar Contact

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# Pubertal Response in Gilts to Type and Frequency of Boar Exposure and as Influenced by Genetic Line and Age at Initiation of Boar Contact

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**Summary and Implications**

*The effectiveness of twice daily (2x) vs once daily (1x) boar exposure (BE) and the possible interaction of frequency of BE with type of BE (physical, PBE vs fence-line, FBE) was evaluated in two genetic lines of the Gene Pool population (AP, selected for early age at puberty and RLS, composite of genetic lines selected for ovulation rate or litter size) differing in average pubertal age and in RLS gilts at two different ages (130 and 154 d). Gilts from the RLS line (n=128) were allotted randomly, within litter, to once or twice daily BE, PBE or FBE and to initiation of BE starting at 130 d or 154 d. Gilts from the AP line (n=64) were allotted randomly to the same treatments except that BE was initiated at 130 d only in AP gilts. Two sets of three Gene Pool boars (16 months of age at start) were used to stimulate the gilts. Gilts were maintained in groups of eight per pen and were taken to the boar room for stimulation by boars. Duration of BE was standardized at 10 min per each exposure. Physical boar exposure induced a more rapid and more synchronous first estrous response than FBE, especially at the once daily frequency. Boar exposure was most effective at inducing a rapid and synchronous first estrous response when initiated in gilts nearing puberty, i.e., at 130 d in AP gilts and 154 d in RLS gilts. Added frequency of BE (2x vs 1x per d) tended to induce a more rapid pubertal response in gilts nearing onset of puberty (AP 130 d and RLS 154 d group), but not when gilts were in an earlier stage of pubertal development (RLS 130 d group). Proper timing of BE is essential to obtaining optimal pubertal response to BE. Physical boar exposure is required to achieve optimal pubertal responses with once daily BE but PBE and FBE produce comparable pubertal responses when provided twice daily.*

**Introduction**

Frequency of boar exposure (BE) affects synchrony of pubertal estrus but the effect depends on gilts' age at initiation of BE. Earlier studies at the University of Nebraska determined that gilts provided once-daily physical boar exposure (PBE) starting at 160 d of age showed a more rapid and more synchronous first estrous response than gilts provided alternate day BE. No difference was observed between once-daily and alternate-day PBE when boar contact was initiated at 135 d of age. Australian researchers reported recently that PBE is more effective than fence-line boar exposure (FBE) and that providing PBE two or three times per day induced a more rapid pubertal response than once-daily PBE. Nebraska studies also showed that PBE was more effective than fence-line BE and twice-daily BE tended to be more effective than once-daily BE for stimulating earlier puberty when BE was initiated at 160 days. There was a trend for an interaction between type and frequency of BE but the interaction was not statistically significant. The present study evaluated the possible interaction of type and frequency of BE when initiated at two different ages and in two genetic lines of the Gene Pool population (AP, selected for early age at puberty and RLS, composite of lines selected for high ovulation rate or high litter size) that differ in average age at puberty (2-3 wk difference).

**Materials and Methods**

Gilts from the RLS line (n=128) were allotted randomly within litter to a replicated experiment with a 2x2x2 factorial design involving initiation of BE at two ages (130 or 154 days), two types of BE (PBE or FBE with mature 16-mo Gene Pool boars) and two frequencies of BE (2x, twice daily or 1x, once daily for 10 min per each BE). Gilts from the AP line (n=64) were assigned to the 130-day age group only because typically about half of AP gilts initiate estrous cycles on their own by

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154 days of age. Gilts were maintained in groups of eight in 6 foot x 16 foot pens during development and were taken to the boar room to receive PBE or FBE. FBE gilts were provided contact with three mature boars through a 16 foot pen divider composed of open vertical bars with 4 inch spacings. PBE gilts received physical contact with a single mature boar obtained from an adjacent pen of boars. Boars were rotated daily so that all gilts received contact with a different group or different boar on consecutive days. Estrous symptoms were observed and recorded at the AM check when all gilts were exposed to boars. Gilts were bled for progesterone determinations 7 to 10 days before and at the start of treatment to verify prepubertal status. Three AP gilts had elevated progesterone before treatment and were deleted from the study.

## Results and Discussion

*Pubertal responses of AP vs RLS gilts to BE at 130 days*

AP gilts, as expected, showed a more rapid and more synchronous first estrous response to BE at 130 d than RLS gilts (interval to first estrus, 12.4 vs 35.2 d, P<0.01, Table 1). Overall, 69% of AP gilts and 9.4% of RLS gilts expressed estrus during the first two weeks of BE. AP gilts reached a 90% cyclic rate by the end of the fourth week of BE (91.8%) whereas RLS gilts required nine weeks to reach a comparable cyclic rate (90.3%, Figures 1 and 2). Type of BE, but not frequency of BE, affected the interval to estrus when BE was initiated at 130 d. However, there was a trend (P<0.08) for an interaction between type and frequency of BE (Table 1). PBE induced earlier expression of first estrus than FBE when BE was provided once daily (PBE, 18.8 vs FBE, 29.6 d, P<0.01), but there was no difference between PBE and FBE when BE was provided twice-daily (PBE, 23.1 vs FBE, 23.7 d, P>0.1).

Because of the more rapid response to BE, AP gilts also reached puberty at a younger age (145.5 vs 168.0d, P<0.01) than RLS gilts (Table 2). There was

**Table 1. Interval to first estrus (average ± SE, days) as affected by genetic line and type and frequency of boar exposure (BE) initiated at 130 days.**

| Line[a] | Age at BE, d | Type of BE[b] | Frequency of BE 1x/d | Frequency of BE 2x/d | Combined |
|---|---|---|---|---|---|
| AP | 130 | FBE | 16.8±4.1 | 9.7±4.4 | |
| | | PBE | 12.9±4.1 | 10.1±4.4 | |
| | | Combined | 14.8 | 9.9 | 12.4[c] |
| RLS | 130 | FBE | 42.4±4.1 | 37.6±4.1 | |
| | | PBE | 24.6±4.1 | 36.2±4.1 | |
| | | Combined | 33.5 | 36.9 | 35.2 |
| Overall | | FBE | 29.6±2.9 | 23.7±3.0 | 26.6[d] |
| | | PBE | 18.8±2.9 | 23.1±3.0 | 20.9 |
| | | Combined | 24.2 | 23.4 | |

[a]AP and RLS are early age at puberty and ovulation rate-litter size select lines from the Gene Pool population.
[b]FBE and PBE = Fence-line and physical boar exposure, respectively.
[c]AP vs RLS, P<0.01.
[d]PBE vs FBE, P<0.05.

**Table 2. Age at puberty (average ± SE, days) as affected by genetic line and type and frequency of boar exposure (BE) initiated at 130 days.**

| Line[a] | Age at BE, d | Type of BE[b] | Frequency of BE 1x/d | Frequency of BE 2x/d | Combined |
|---|---|---|---|---|---|
| AP | 130 | FBE | 150.2±4.1 | 143.0±4.2 | |
| | | PBE | 146.1±4.1 | 142.9±4.3 | |
| | | Combined | 148.1 | 142.9 | 145.5[c] |
| RLS | 130 | FBE | 175.6±4.1 | 170.6±4.1 | |
| | | PBE | 157.2±4.1 | 168.5±4.1 | |
| | | Combined | 166.4 | 169.6 | 168.0 |
| Overall | | FBE | 162.9±2.9 | 156.8±2.9 | 159.9[d] |
| | | PBE | 151.6±2.9 | 155.7±3.0 | 153.7 |
| | | Combined | 157.3 | 156.2 | |

[a]AP and RLS are early age at puberty and ovulation rate-litter size select lines from the Gene Pool population.
[b]FBE and PBE = Fence-line and physical boar exposure, respectively.
[c]AP vs RLS, P<0.01.
[d]PBE vs FBE, P<0.05.

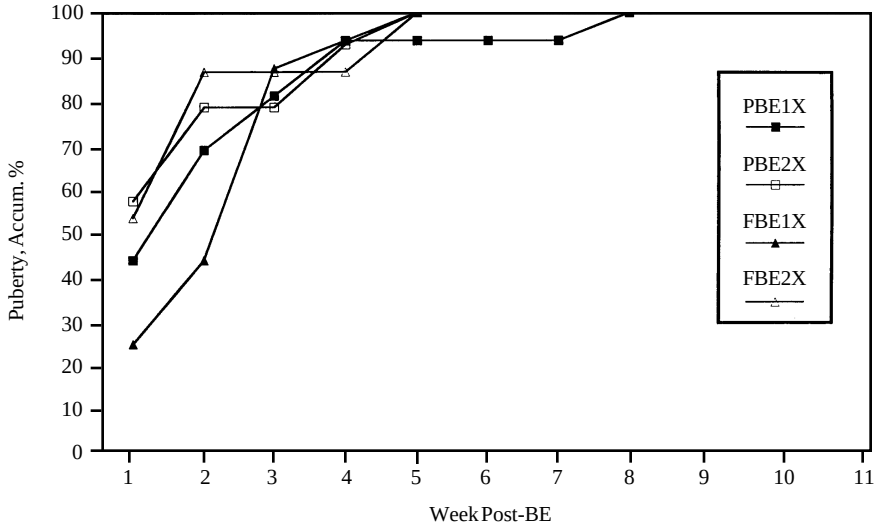


**Figure 1. Accumulative pubertal response (%) of AP gilts to boar exposure (BE) by weekly intervals from initial BE at 130 days. FBE, fence-line boar exposure; PBE, physical boar exposure; 1x, once daily; 2x, twice daily.**

**Table 3. Interval to first estrus (average ± SE, days) in RLS gilts as affected by age of gilts and type and frequency of boar exposure (BE).**

| Age BE, d | Type of BE[b] | Frequency of BE 1x/d | Frequency of BE 2x/d | Combined |
|---|---|---|---|---|
| 130 | FBE | 42.4±4.4 | 37.6±4.4 | |
| | PBE | 24.6±4.4 | 36.2±4.4 | |
| | Combined | 33.5 | 36.9 | 35.2 |
| 154 | FBE | 25.5±4.4 | 18.2±4.4 | |
| | PBE | 24.2±4.4 | 19.1±4.4 | |
| | Combined | 24.8 | 18.6 | 21.8 |
| Overall | FBE | 33.9±3.1 | 27.9±3.1 | 30.9[c] |
| | PBE | 24.4±3.1 | 27.6±3.1 | 26.0 |
| | Combined | 29.2 | 27.8 | |

[a]FBE and PBE = Fence-line and physical boar exposure, respectively.
[b]Age, P<0.01.
[c]PBE vs FBE, P<0.11.

**Table 4. Age at puberty (average ± SE, days) in RLS gilts as affected by age of gilts and type and frequency of boar exposure (BE).**

| Age BE, d | Type of BE[b] | Frequency of BE 1x/d | Frequency of BE 2x/d | Combined |
|---|---|---|---|---|
| 130 | FBE | 175.6±4.4 | 170.6±4.4 | |
| | PBE | 157.2±4.4 | 168.5±4.4 | |
| | Combined | 166.4 | 169.6 | 168.0[b] |
| 154 | FBE | 179.5±4.4 | 172.1±4.4 | |
| | PBE | 177.6±4.4 | 172.3±4.4 | |
| | Combined | 178.6 | 172.2 | 175.4 |
| Overall | FBE | 177.6±3.1 | 171.3±3.1 | 174.5[c] |
| | PBE | 167.4±3.1 | 170.4±3.1 | 168.9 |
| | Combined | 172.5 | 170.9 | |

[a]FBE and PBE = Fence-line and physical boar exposure, respectively.
[b]130 vs 154, P<0.01.
[c]PBE vs FBE, P<0.08.

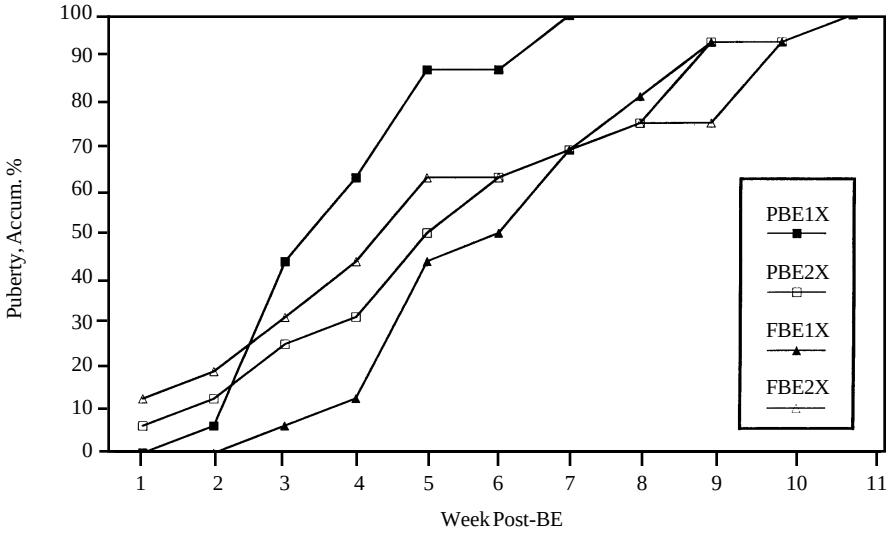


**Figure 2. Accumulative pubertal response (%) of RLS gilts to boar exposure (BE) by weekly intervals from initial BE at 130 days. FBE, fence-line boar exposure; PBE, physical boar exposure; 1x, once daily; 2x, twice daily.**

also a trend for an interaction between type and frequency of BE (P<0.08). PBE gilts reached puberty 11.3 d earlier than FBE gilts when gilts were provided once daily contact with boars (151.6 vs 162.9 d, P<0.01) but PBE and FBE gilts showed comparable ages at puberty when provided twice-daily BE (PBE, 155.7 vs FBE, 156.8 d, P>0.1).

*Pubertal responses to BE at 130 vs 154 days in RLS gilts*

RLS gilts first exposed to boars at 130 days reached puberty earlier than RLS gilts first exposed to boars at 154 d of age (168 vs 175.4 d, P<0.01, Table 4) but the interval to puberty after initiation of BE was substantially shorter in the 154-d gilts (21.8 vs 35.2 d, P<0.01, Table 3). RLS gilts first exposed to boars at 154 d also showed greater heat grouping (43.8% vs 9.4% expressed estrus within first two weeks) and achieved a 90% cycling rate sooner (92.2% in 8 wk vs 90.6% in 9 wk) than RLS gilts that received BE at 130 d (Figures 2 and 3). Overall, PBE tended to be more effective than FBE (P<0.11), but the effect on age at puberty was significant only when BE was provided once daily and initiated at 130 d of age (Table 4). Twice daily BE tended to induce a more rapid pubertal response than once daily BE in gilts nearing onset of puberty (RLS 154 d, 18.7 vs 24.8 d, P<0.05, Table 3), but not when gilts were stimulated earlier in pubertal development (RLS 130 d, 36.9 vs 33.5 d, P>0.1, Table 3).

Results of the present experiment confirmed previous findings at UNL regarding the timing of boar exposure and expected pubertal response. Initiating BE at an early stage of pubertal development (e.g., at 130 d in RLS gilts in the present study) induces earlier average age at puberty as long as boar exposure is not initiated too far ahead of the average pubertal age of the genetic group being stimulated. Previous findings at UNL revealed that Gene Pool gilts exposed to boars at 100 d (~55 d before mean pubertal age) were delayed achieving puberty

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compared to gilts provided BE starting at 125 d of age (~30 d before mean pubertal age). British researchers reported similar findings with Large White gilts. But exposing gilts to boars in early stages of pubertal development results in a delayed response to BE and induces little, if any, synchrony of pubertal estrus compared to gilts that are in more advanced stages of pubertal development when first exposed to boars (e.g., at 130 d in AP gilts and 154 d in RLS gilts in the present study). AP 130 and RLS 154 gilts first were exposed to boars about two weeks before the average pubertal age of each genetic group (145.5 and 168 d mean pubertal age of AP 130 d and RLS 130 d groups, respectively). The more rapid and more synchronous first estrous response with more optimum timing of boar exposure can be achieved with little delay in average age at puberty. RLS gilts that received BE at 154 d expressed first estrus only 7 d later than RLS gilts exposed to boars at 130 d. Synchrony of first estrus is desirable when programming replacement gilts into the gilt pool for later breeding. And the time and labor required to stimulate gilts may be reduced, depending on the method used to stimulate developing gilts with boars.

The hypothesis that type and frequency of boar exposure interact in inducing a rapid and synchronous first estrous response in gilts was confirmed in this study. PBE was more effective than FBE when provided once daily and initiated at 130 d but produced comparable responses to FBE when provided twice-daily or when initiated at 154 d (RLS gilts). This occurred, in part, because gilts nearing puberty at the time of initiation of BE (AP 130 and RLS 154 groups) responded more rapidly to twice-daily BE than to once daily BE. In other words, increasing frequency from once-daily to twice-daily BE improved the pubertal response to FBE and negated the difference observed between PBE and FBE with once-daily BE.

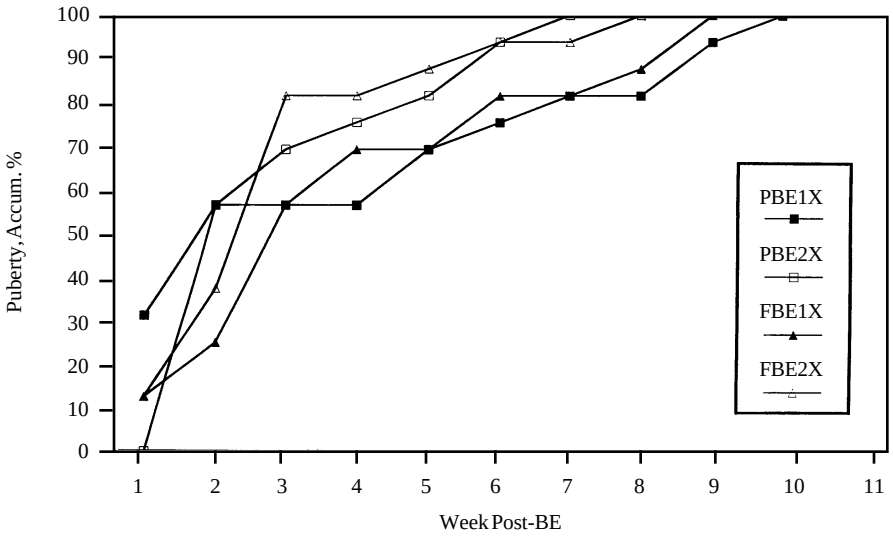


**Figure 3. Accumulative pubertal response (%) of RLS gilts to boar exposure (BE) by weekly interval from initial BE at 154 days. FBE, fence-line boar exposure; PBE, physical boar exposure; 1x, once daily; 2x, twice daily.**

Previous research findings of Australian and UNL researchers (1998 Swine Report) demonstrated that PBE is more effective than FBE at inducing earlier puberty in gilts. The Nebraska study also used RLS gilts and observed that the interval to first estrus was 9.5 d shorter in PBE than FBE gilts first exposed to boars at 160 d. Twice-daily BE also tended to be more effective than once-daily BE but most of the advantage was achieved in combination with FBE rather than PBE.

Although the interactions between type and frequency of BE were not statistically significant (P>0.05) in either study, the trend for an interaction in the present study and the consistency of responses in the two studies provides evidence that twice-daily FBE is required to produce comparable responses to once-daily PBE. Frequency of BE is of lesser concern for PBE gilts.

## Conclusion

Physical BE is required to achieve the optimal intervals and synchrony of first estrus in gilts. Increased frequency of BE from once to twice-daily offers little advantage when using PBE but is definitely more efficacious when using FBE. Initiation of BE must be timed appropriately relative to average pubertal age of the genetic group being stimulated, i.e., one to two weeks before most gilts in the group are destined to reach puberty, in order to achieve optimal intervals and synchrony of puberty estrus following boar exposure.

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[1]Dwane R. Zimmerman was professor of animal science. Tom McGargill and Dan Cheleen hold agricultural research technician II positions.