SYNCHRONIZATION OF ESTRUS IN GILTS WITH ALYL TRENBOLONE: FECUNDITY AFTER NATURAL SERVICE AND INSEMINATION WITH FROZEN SEMEN\textsuperscript{1,2}

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Summary

The synthetic progestogen, allyl trenbolone, was fed daily to 60 gilts at 15 mg/gilt for 18 days. Sixty-eight gilts that came into estrus the same week as treated gilts served as controls. Gilts were checked for estrus twice daily and were artificially inseminated with frozen semen or bred by natural service. All but two treated gilts returned to estrus between 4 and 7 days after withdrawal of allyl trenbolone (mean = 5.6; SD = .82). The farrowing rate among gilts inseminated with frozen semen was significantly lower than that among gilts bred by natural service (52.5 vs 89.6%). The farrowing rate among synchronized gilts was similar to that among untreated gilts (70.7 vs 73.5%). Average total and live litter sizes at birth and litter size at weaning were significantly smaller for untreated gilts inseminated with frozen semen than for synchronized gilts inseminated with frozen semen or those of untreated gilts bred by natural service. Average litter size for synchronized gilts bred by natural service was not significantly larger than that for synchronized gilts inseminated with frozen semen or that of untreated gilts bred by natural service.

(\textbf{Key Words}: Frozen Semen, Swine, Estrous Synchronization, Progestogen.)

Introduction

An effective method of synchronizing estrus in swine would provide producers with a useful management tool by reducing the labor required to detect estrus, facilitating the use of artificial insemination and assisting in batch farrowing.

Methallibure (ICI 33828) has proven to be highly effective in synchronizing estrus in swine (Gerrits and Johnson, 1964; Polge, 1964), but it cannot be used because of its teratogenic properties (King, 1969). Progestogens have not been satisfactory for use in controlling estrus because of an increased incidence of cystic follicles and decreased fertility at the first post-treatment estrus (Nellor \textit{et al.}, 1961; First \textit{et al.}, 1963).

New orally active progestogens have reportedly controlled the time of estrus in swine without producing follicular cysts or reducing subsequent fertility (Davis \textit{et al.}, 1976, 1979; Knight \textit{et al.}, 1976; Webel, 1976, 1978; Mayer and Schutze, 1977; O'Reilly \textit{et al.}, 1979).

This study was conducted to compare the fertility and fecundity of untreated gilts and gilts synchronized with an orally active progestogen (allyl trenbolone, RU-2267, 17\(a\)-allylestratriene-4-9-11, 17\(b\)-ol-3-one). Gilts were bred either by natural service or by artificial insemination (AI) with frozen semen. The use of frozen semen should have provided a maximum challenge for testing the fecundity of treated and untreated gilts. A secondary objective was to compare the efficacy of two thawing and insemination volumes.

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\textsuperscript{6}Mention of a trade name, proprietary product or vendor does not constitute a guarantee or warranty by the USDA and does not imply its approval to the exclusion of other products or vendors that may also be suitable.
Materials and Methods

The experiment was begun in November 1978 at Miles City, Montana, and involved 128 Duroc, Hampshire, Yorkshire and crossbred gilts 7 to 9 months of age. All gilts were housed outside in pens and were fed once daily 2.7 kg/head of a barley-soybean meal diet. Sixty gilts were each given 15 mg of allyl trenbolone in the feed daily for 18 consecutive days. Gilts weighed 105 to 164 kg (mean = 133 kg) at the beginning of treatment and were fed in groups of 12 to 16. Gilts were checked for estrus with a boar once daily during progestogen treatment and twice daily after cessation of treatment. Sixty-eight gilts of the same age and breeding as the treated gilts served as untreated controls. Controls came into estrus within the same week as treated gilts.

At the onset of estrus, treated and untreated gilts were randomly assigned to receive natural service by one of 19 boars or to be artificially inseminated (AI) with frozen semen from one to six boars. Gilts received the first natural service immediately after estrus was detected and a second natural service 18 to 24 hr later if they were still receptive to the boar. Gilts received the first AI 10 to 16 hr after estrus was detected and a second AI 24 to 28 hr after estrous detection. Any gilt that was still in estrus the day after the second natural service or AI was served a third time.

Semen for AI was from two Duroc, two Hampshire and two Yorkshire stud boars. Semen was frozen by the Beltsville procedure (Pursel and Johnson, 1975). Each AI dose consisted of 3 to 6 x 10^9 sperm, contained in 10 ml of frozen pellets. At thawing, pellets were removed from liquid nitrogen, scattered evenly on a styrofoam surface for 3 min and thawed in a bath of cold saline (55-ml insemination volume) or 70 ml of Beltsville thaw solution (BTS) preheated to 42 C in a water bath (80-ml insemination volume). Synchronized and control gilts were randomly selected to receive either 55- or 80-ml insemination volumes. Disposable plastic insemination rods with a 30° bend about 2 cm from the tip were used for inseminations.

Farrowing rate data were tested by chi-square analysis. Litter size data were tested by the general linear models procedure of the Statistical Analysis System (Barr et al., 1979). Because of significant interactions among main effects for litter size data, the simple effects were compared within each main effect.

Results and Discussion

Interval to Estrus. Onset of estrus was highly synchronized after treatment with allyl trenbolone (table 1). The average interval from last day of treatment to estrus was 5.6 days (SD = .82). On days 5 and 6, a total of 76% of treated gilts exhibited estrus. Only two of 60 gilts failed to exhibit estrus after treatment. The estrous response was similar to that reported earlier for gilts treated with similar amounts of allyl trenbolone (Webel, 1978; Redmer et al., 1979).

Farrowing Rate and Litter Size. The overall farrowing rate among gilts synchronized with allyl trenbolone was similar to that among untreated gilts (70.7% vs 73.5%; P = .72; table 2). The farrowing rate among synchronized gilts inseminated with frozen semen was not significantly lower than that among untreated gilts inseminated with frozen semen (48.3% vs 56.7%; P = .51). However, the farrowing rate for gilts inseminated with frozen semen was lower than that for gilts bred by natural service (52.5% vs 89.6%; P < .0001). The farrowing rate among gilts bred to each of the six boars supplying frozen semen varied from 40 to 60%. A similar difference in farrowing rate has recently been reported between sows inseminated with frozen and sows inseminated with fresh semen (47 vs 79%; Johnson et al., 1979).

Average total and live litter sizes at birth and litter size at weaning were smaller for untreated gilts than for those inseminated with frozen semen.

| TABLE 1. NUMBER OF GILTS EXHIBITING
ESTRUS AFTER ADMINISTRATION
OF ALLYL TRENBOLONE |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Day of onset of estrus</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>No. of gilts</td>
</tr>
<tr>
<td>% of total</td>
</tr>
</tbody>
</table>

*Owned by International Boar Semen, United Suppliers, Eldora, IA.

fTotal number of gilts treated = 60.

fDay of last feeding of allyl trenbolone = day 0.
TABLE 2. FARROWING RATE AND LITTER SIZE OF SYNCHRONIZED AND UNTREATED GILTS BRED BY NATURAL SERVICE AND ARTIFICIAL INSEMINATION WITH FROZEN SEMEN

<table>
<thead>
<tr>
<th>Item</th>
<th>Synchronized</th>
<th></th>
<th>Combined</th>
<th></th>
<th>Untreated</th>
<th></th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NS&lt;sup&gt;a&lt;/sup&gt;</td>
<td>FS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Combined</td>
<td></td>
<td>NS&lt;sup&gt;a&lt;/sup&gt;</td>
<td>FS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Combined</td>
</tr>
<tr>
<td>No. of gilts bred</td>
<td>29</td>
<td>29</td>
<td>58</td>
<td></td>
<td>38</td>
<td>30</td>
<td>68</td>
</tr>
<tr>
<td>No. of gilts farrowed</td>
<td>27</td>
<td>14</td>
<td>41</td>
<td></td>
<td>33</td>
<td>17</td>
<td>50</td>
</tr>
<tr>
<td>Farrowing rate, %</td>
<td>93.1</td>
<td>48.3</td>
<td>70.7</td>
<td></td>
<td>86.8</td>
<td>56.7</td>
<td>73.5</td>
</tr>
<tr>
<td>Total litter size, mean ± SE</td>
<td>11.0 ± .40</td>
<td>9.6 ± .61</td>
<td>10.5 ± .35</td>
<td></td>
<td>10.3 ± .45</td>
<td>6.8 ± .79</td>
<td>9.1 ± .46</td>
</tr>
<tr>
<td>Live litter size, mean ± SE</td>
<td>10.3 ± .43</td>
<td>9.2 ± .63</td>
<td>9.9 ± .36</td>
<td></td>
<td>10.1 ± .43</td>
<td>6.4 ± .84</td>
<td>8.8 ± .47</td>
</tr>
<tr>
<td>Weaned litter size, mean ± SE</td>
<td>9.0 ± .52</td>
<td>8.4 ± .62</td>
<td>8.8 ± .40</td>
<td></td>
<td>9.1 ± .32</td>
<td>5.5 ± .64</td>
<td>7.9 ± .39</td>
</tr>
</tbody>
</table>

<sup>a</sup>NS = natural service.  
<sup>b</sup>FS = frozen semen.

gilts inseminated with frozen semen than for synchronized gilts inseminated with frozen semen and for untreated gilts bred by natural service (P<.003 for each comparison). Average litter size of synchronized gilts bred by natural service was not significantly larger than those of synchronized gilts inseminated with frozen semen and untreated gilts bred by natural service. The larger litter size for synchronized gilts inseminated with frozen semen may have resulted from enhanced sperm transport or a higher ovulation rate among these animals. Either of these factors could have produced a larger litter size because the use of frozen semen results in poor sperm transport and failure of ovum fertilization (Pursel et al., 1978). Higher ovulation rate is the more likely explanation, because in several studies gilts treated with allyl trenbolone had more ovulations (average 1.5 to 4.0) than control gilts (Davis et al., 1976; Knight et al., 1976; Redmer et al., 1979). Webel (1978) also reported a larger litter size in one trial for sows synchronized with allyl trenbolone than for control sows (11.3 vs 10.0; P<.05).

**Insemination Volume.** Farrowing rate was slightly higher and litter size slightly larger for gilts inseminated with 80 ml of frozen semen thawed at 42 C than for gilts inseminated with 55 ml of frozen semen thawed at 52 C, although the differences were not significant (table 3). This trend toward improved fecundity with larger insemination volume agrees with results reported by Pursel and Johnson (1976).

In conclusion, our results showed that allyl trenbolone, when fed daily for 18 days at 15 mg/gilt/day, was highly effective in synchronizing estrus in gilts. Gilts that were treated with allyl trenbolone and bred by natural service conceived and farrowed at the same rate as untreated gilts. Furthermore, after AI with frozen semen, the farrowing rates were equivalent and litter size was significantly larger for synchronized gilts than for untreated gilts.

**Table 3. Farrowing Rate and Litter Size for Gilts Inseminated with 55 ml or 80 ml of Frozen-Thawed Semen**

<table>
<thead>
<tr>
<th>Item</th>
<th>Insemination volume</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55 ml</td>
<td>80 ml</td>
<td></td>
</tr>
<tr>
<td>No. of gilts bred</td>
<td>29</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>No. of gilts farrowed</td>
<td>13</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Farrowing rate, %</td>
<td>44.8</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td>Total litter size, mean ± SE</td>
<td>7.7 ± .62</td>
<td>8.4 ± .87</td>
<td></td>
</tr>
<tr>
<td>Live litter size, mean ± SE</td>
<td>7.3 ± .57</td>
<td>7.9 ± .94</td>
<td></td>
</tr>
<tr>
<td>Weaned litter size, mean ± SE</td>
<td>6.6 ± .54</td>
<td>7.0 ± .81</td>
<td></td>
</tr>
</tbody>
</table>

**Literature Cited**


SYNCHRONIZATION OF ESTRUS IN GILTS 133


