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Value and Use of Artificial Insemination by Beef Producers

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Abstract
Artificial insemination and estrous synchronization remain underutilized by U.S. beef producers. The most recent National Animal Health Monitoring Survey (NAHMS 2007–08) reported that 7.6% of producers used artificial insemination and 7.9% used estrous synchronization. The most common reason cited for not using these reproductive technologies was time and labor, followed by cost and difficulty. Little information is available on actual management practices used by producers who do use these technologies and their value to such operations.

Keywords
artificial insemination, estrous synchronization, calf value

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Value and Use of Artificial Insemination by Beef Producers

*S.K. Johnson and G. Dahlke*

**Introduction**
Artificial insemination and estrous synchronization remain underutilized by U.S. beef producers. The most recent National Animal Health Monitoring Survey (NAHMS 2007–08) reported that 7.6% of producers used artificial insemination and 7.9% used estrous synchronization. The most common reason cited for not using these reproductive technologies was time and labor, followed by cost and difficulty. Little information is available on actual management practices used by producers who do use these technologies and their value to such operations.

**Experimental Procedures**
An online survey was developed to assess a variety of production practices, synchronization methods, and available tools used with artificial insemination and estrous synchronization. The survey tool was pretested on a subset of producers and extension professionals and refined according to that input.

A link to the online survey was sent to e-mail addresses of those who registered with the Iowa Beef Center when they downloaded software used to plan artificial insemination programs (Estrus Synchronization Planner). In addition, a link to the survey was promoted through electronic extension publications, contact lists, and cooperating news media.

Logistic regression was used to determine differences in practices based on involvement in the industry (commercial cow-calf, seedstock, commercial heifer development, veterinarian, artificial insemination technician, other). Because of small numbers in some categories and allowance for multiple areas of activity, a new group defined as Multiple was created for responses with any combination of two or more areas of industry involvement. Responses for Multiple, Commercial, or Seedstock industry groups used for analysis numbered 164, 90, and 136, respectively.

**Results and Discussion**
The survey was accessed by 546 individuals, and 425 completed the survey. Responses came from 42 states; Kansas led in responses with 10%, followed by Iowa at 7%. When asked to describe all areas of involvement in the cattle industry, respondents repre-

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sented commercial cow-calf herds (56%), seedstock herds (67%), commercial heifer
development (14%), artificial insemination technicians (18%), veterinarians (18%), and
other (11%; club calf most common listed). The importance of cattle sales to income
and number of females inseminated are shown in Table 1.

The value of calves sired by artificial insemination compared with natural service–sired
calves on a per-head basis was the highest for Seedstock producers ($709), followed by
Multiple ($389) and Commercial ($187); however, marketing endpoint was not neces-
sarily the same. The average semen cost (Table 2) used by these groups reflected the
value of calves sired by artificial insemination and was highest for the Seedstock group
and did not differ between Commercial and Multiple groups. Commercial producers
reported fewer years of artificial insemination experience than Seedstock or Multiple
producers.

The value of replacements and reducing calving difficulty were the most common fac-
tors cited as contributing to the profitability of artificial insemination, and frequency
was not affected by industry subgroup or number of cows inseminated (Table 3). For
Seedstock and Multiple, the odds of raising bulls for others as a source of profitability
was 8.2 to 10 times, respectively, as large as for Commercial producers. Commercial
producers were just as likely to raise bulls for themselves as were Seedstock producers,
whereas the odds were 2.8 times greater for Multiple compared with Commercial pro-
ducers to raise bulls for themselves. Seedstock producers were less likely than Commer-
cial producers to indicate that a premium at weaning contributed to the profitability of
calves sired by artificial insemination.

A majority of producers used artificial insemination for both cows and heifers (87%),
with 8% using it on heifers only and 5% on cows only. Frequency of use of estrus syn-
chronization was always (46%), usually (26%), sometimes (28%), rarely (6%), or never
(4%). Proportions in each of the use categories were similar for cows and heifers. Those
who responded that they always used estrous synchronization inseminated more owned
cows and heifers (Table 4) than those who used it less often.

Insemination after observed estrus was the most common method of insemination,
followed by single fixed-time artificial insemination, then artificial insemination af-
ther observed estrus with cleanup timed artificial insemination (42%, 34%, and 24%,
respectively). Industry subgroup did not influence the proportion of each insemination
method used. The frequency of use did not differ between cows and heifers; rather, they
were most likely to use the same method on both age groups. The average number of
owned cows inseminated when cows were bred with insemination after observed estrus
or single fixed-time artificial insemination was similar, but if a combination was used,
the average number of owned cows inseminated was higher (51, 75, and 105, respec-
tively). A similar pattern was apparent in the number of owned heifers inseminated
after observed estrus, single fixed-time artificial insemination, or the combination (26,
26, and 45, respectively).

The most frequently used system for synchronization of estrus in both cows and heifers
was a 7-day CO-Synch + CIDR protocol (Table 5). This was the preferred system for
53% of those synchronizing cows. Although it was the most commonly reported system used in heifers, only 33% reported using it.

**Implications**

The value of calves sired by artificial insemination compared with natural service–sired calves was greater for Seedstock producers than Commercial producers, but marketing endpoint was not necessarily the same. Commercial producers still reported an added value of $187/head for calves sired by artificial insemination.

The value of replacements and reducing calving difficulty were the most common factors contributing to the profitability of artificial insemination.

<table>
<thead>
<tr>
<th>Income</th>
<th>n</th>
<th>%</th>
<th>No. owned heifers artificially inseminated</th>
<th>No. owned cows artificially inseminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30% of income from cattle sales</td>
<td>185</td>
<td>45</td>
<td>12 ± 7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28 ± 11&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>30–50% of income from cattle sales</td>
<td>98</td>
<td>22</td>
<td>29 ± 9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>61 ± 14&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>50–80% of income from cattle sales</td>
<td>75</td>
<td>18</td>
<td>50 ± 11&lt;sup&gt;b&lt;/sup&gt;</td>
<td>93 ± 18&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>&gt;90% of income from cattle sales</td>
<td>44</td>
<td>11</td>
<td>100 ± 14&lt;sup&gt;c&lt;/sup&gt;</td>
<td>157 ± 22&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Do not own cattle</td>
<td>6</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a,b,c</sup> Means within column differ, P < 0.01.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>n</th>
<th>Value of calves sired by artificial insemination&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Semen cost ($/straw)</th>
<th>Years of artificial insemination experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>72</td>
<td>187 ± 79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22.2 ± 1.6&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11.4 ± 1.3&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Seedstock</td>
<td>115</td>
<td>709 ± 63&lt;sup&gt;c&lt;/sup&gt;</td>
<td>29.7 ± 1.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>16.9 ± 1.0&lt;sup&gt;y&lt;/sup&gt;</td>
</tr>
<tr>
<td>Multiple</td>
<td>135</td>
<td>398 ± 58&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.6 ± 1.2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>15.4 ± 0.9&lt;sup&gt;y&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> Involvement in the cattle industry: Commercial cow-calf producer, seedstock producer, commercial heifer development, artificial insemination technician, veterinarian, or other; more than one response was allowed.

<sup>2</sup> Only Commercial, only Seedstock, or Multiple (any combination of areas of involvement in the cattle industry including Seedstock and Commercial).

<sup>3</sup> Increase in value of calves sired by artificial insemination compared to calves sired by natural service, $/head.

<sup>x,y,z</sup> Means within a column differ P < 0.05.
Table 3. Frequency of factors cited as contributing to the profitability of artificial insemination

<table>
<thead>
<tr>
<th>Industry subgroup¹</th>
<th>Value of replacements</th>
<th>Reduce calving difficulty</th>
<th>Raising bulls for others</th>
<th>Raising bulls for self</th>
<th>Premium at weaning</th>
<th>Premium for carcass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial, % (n)</td>
<td>73 (66)</td>
<td>56 (50)</td>
<td>9 (8)</td>
<td>27 (24)</td>
<td>46 (41)</td>
<td>26 (23)</td>
</tr>
<tr>
<td>Multiple, % (n)</td>
<td>85 (139)</td>
<td>58 (95)</td>
<td>52 (86)</td>
<td>51 (83)</td>
<td>54 (89)</td>
<td>38 (63)</td>
</tr>
<tr>
<td>Seedstock, % (n)</td>
<td>79 (107)</td>
<td>50 (68)</td>
<td>51 (70)</td>
<td>30 (41)</td>
<td>38 (51)</td>
<td>21 (29)</td>
</tr>
<tr>
<td>Total, % (n)</td>
<td>80 (312)</td>
<td>55 (213)</td>
<td>42 (164)</td>
<td>38 (148)</td>
<td>46 (181)</td>
<td>29 (115)</td>
</tr>
</tbody>
</table>

Subgroup, P-value
0.3532 0.6304 0.0001 0.0002 0.0105 0.0331

No. of cows inseminat-ed, P-value
0.2702 0.4328 0.5670 0.1914 0.6596 0.0025

Reference—Commercial

<table>
<thead>
<tr>
<th>Subgroup, P-value</th>
<th>10.0* (4.5, 22.2)</th>
<th>2.8* (1.5, 5.1)</th>
<th>1.0 (0.6, 1.8)</th>
<th>1.4 (0.8, 2.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple</td>
<td>-</td>
<td>8.2* (3.6, 18.4)</td>
<td>1.1 (0.6, 2.2)</td>
<td>0.5* (0.3, 0.9)</td>
</tr>
<tr>
<td>Seedstock</td>
<td>-</td>
<td>12.0* (4.5, 32.2)</td>
<td>1.8* (1.5, 2.1)</td>
<td>0.7* (0.3, 1.4)</td>
</tr>
</tbody>
</table>

¹ Only commercial, only seedstock, or multiple (any combination of areas of involvement in the cattle industry including seedstock and commercial).
* Odds ratio and 95% CI; value significant, P < 0.05.

Table 4. Likelihood of use of estrous synchronization

<table>
<thead>
<tr>
<th>Synchronize estrus²</th>
<th>Heifers, %³</th>
<th>No. owned heifers artificially inseminated</th>
<th>Cows, %³</th>
<th>No. owned cows artificially inseminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>48</td>
<td>66 ± 13*</td>
<td>44</td>
<td>128 ± 13*</td>
</tr>
<tr>
<td>Usually</td>
<td>27</td>
<td>30 ± 10*</td>
<td>24</td>
<td>55 ± 16*</td>
</tr>
<tr>
<td>Sometimes</td>
<td>16</td>
<td>20 ± 15*</td>
<td>7</td>
<td>72 ± 15*</td>
</tr>
<tr>
<td>Rarely</td>
<td>6</td>
<td>20 ± 15*</td>
<td>7</td>
<td>72 ± 15*</td>
</tr>
<tr>
<td>Never</td>
<td>3</td>
<td>20 ± 15*</td>
<td>6</td>
<td>72 ± 15*</td>
</tr>
</tbody>
</table>

¹ Chi-square cows vs. heifers, P = 0.0764.
² N = 489 heifers and 428 cows.
³ Categories grouped for analysis.
ab Means within column differ, P > 0.01.

Table 5. Preferred systems for synchronization of estrus

<table>
<thead>
<tr>
<th>System</th>
<th>Heifers</th>
<th>Cows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>7-day CO-Synch + CIDR¹</td>
<td>147</td>
<td>33</td>
</tr>
<tr>
<td>7-day CIDR</td>
<td>68</td>
<td>15</td>
</tr>
<tr>
<td>1 shot PG²</td>
<td>59</td>
<td>13</td>
</tr>
<tr>
<td>14-day CIDR-PG</td>
<td>53</td>
<td>12</td>
</tr>
<tr>
<td>MGA-PG³</td>
<td>33</td>
<td>7</td>
</tr>
</tbody>
</table>

¹ Controlled internal drug release.
² Prostaglandin.
³ Melengesterol acetate-prostaglandin.