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PROGESTERONE CONCENTRATIONS, ESTROUS RESPONSE, AND FERTILITY IN BEEF HEifers AFTER ESTROUS SYNCHRONIZATION USING MELENGESTROL ACETATE® AND PROSTAGLANDIN F₂α

C. W. Peters, R. L. Larson², and L. R. Corah

Summary

Melengestrol acetate (MGA®) and prostaglandin F₂α (PG; Lutalyse®) were used to synchronize estrus in 757 yearling, virgin, beef heifers on six commercial ranches. Heifers were inseminated artificially (AI) 12 h after first detected estrus; those not detected in estrus were time-inseminated 72 h post-PG injection. Heifers detected in estrus by 72 h had higher AI and overall pregnancy rates than their counterparts not detected in estrus. Heifers with serum progesterone > 1 ng/ml at PG administration were generally more fertile than those with progesterone < 1 ng/ml. Of the heifers not detected in estrus and with low progesterone (< 1 ng/ml), 24% still conceived to the timed insemination at 72 h, but only 73% became pregnant during the entire breeding period. Overall AI conception rate, based on estrous detection and timed insemination, was 49% and varied from 24% to 69% among the six ranches. Heifers exhibiting estrus and with elevated (> 1 ng/ml) serum progesterone showed acceptable pregnancy rates (63% AI and 94% overall).

(Key Words: Melengestrol Acetate, Prostaglandin, Beef Heifers, Fertility, Estrus, Progesterone.)

Introduction

Estrous synchronization has been a popular and profitable tool for producers in recent years. Research at KSU has focused on combining melengestrol acetate (MGA) and prostaglandin F₂α (PG) to synchronize effectively estrus in virgin beef heifers. Successful synchronization reduces the length of the breeding period, shortens the calving season, and allows the effective use of AI. Along with reduced labor and older, heavier calves at weaning, selecting appropriate AI sires can minimize calving difficulty in virgin heifers and offer exceptional replacement females. However, substantial variation can occur in estrous response and fertility with MGA/PG synchronization. Our objective was to determine the relationships among estrous activity, serum concentrations of progesterone, and fertility in yearling beef heifers.

Experimental Procedures

During the spring of 1991 at six Kansas ranches, estrus of 757 yearling beef heifers was synchronized using MGA and PG. MGA was fed at .5 mg per hd/d for 14 d in a feed supplement. Then MGA was removed and 17 d later, each heifer received an

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intramuscular injection of 25 mg PG. At the
time of the PG injection, blood samples were
taken for progesterone analysis. Beginning 12 h
after PG, heifers were checked for
behavioral estrus each morning and night and
inseminated 12 h after estrus was observed.
Any heifer not detected in estrus was time-
inseminated at 72 h after PG. Heifers were
exposed to bulls approximately 10 d following
the timed insemination; bulls remained with
heifers for 45 to 75 d. Heifers were palpated
for pregnancy and fetal age 45 to 60 d after
bulls were removed. Overall pregnancy rates
to AI and natural mating were calculated and
confirmed from calving data. Pregnancy data
were available on 620 heifers.

Results and Discussion

Table 1 demonstrates that more heifers
bred after estrus conceived (60%) than heifers
that did not show estrus and were time-
inseminated 72 h after PG (32%). Pregnancy
rate was 49% for all heifers bred AI (both
estrus and time inseminated). Overall pregnan-
cy rate (AI plus clean-up bulls) also favored
heifers that exhibited estrus by 72 h (92%)
compared to those that were time inseminated
(80%).

Heifers conceiving to AI (estrus + time-
insemination) had higher (P < .001) concentra-
tions of serum progesterone at the time of PG
injection than heifers not conceiving to AI (2.6
vs 2.0 ng/ml). Heifers pregnant at the end of
the breeding period (AI + natural service) had
higher (P < .001) serum progesterone at PG
injection than nonpregnant heifers (2.4 vs 1.6
ng/ml).

Table 1 details also the effect of proges-
terone concentration at the time of PG injection
on AI and overall pregnancy rate. More
heifers conceived to AI (56 vs 33%) and were
pregnant at the end of the breeding season (91
vs 77%) when they had serum progesterone >
1 ng/ml compared to heifers

with serum progesterone < 1 ng/ml. Syn-
chronization improved fertility less in heifers
with serum progesterone > 2 ng/ml than in
heifers with progesterone from 1 to 2 ng/ml.

Theoretically, all heifers fed MGA for 14
d and injected with PG 17 d later should have
possessed a functional corpus luteum (CL).
This is documented by high concentrations of
serum progesterone, generally > 1 ng/ml.
Heifers with serum progesterone < 1 ng/ml
would be less likely to have a functional CL
and less likely to respond to PG. However,
24% of the heifers that did not exhibit estrus
still conceived to AI when serum progesterone
was < 1 ng/ml at the time of the PG injection.
Of those with progesterone less than 1 ng/ml at
the time of PG injection that were detected in
estrus, 46% conceived to AI mating.

Table 1 shows the relationship of combined
estrus and progesterone status on fertility.
First-service AI conception rate in heifers that
exhibited estrus and had an elevated serum
progesterone was acceptable at 64%. Overall
pregnancy rate was lowest for heifers that did
not exhibit estrus and also had low serum
progesterone (73%). Heifers that both
exhibited estrus and had high serum
progesterone had an overall pregnancy rate of
94%. These results support the importance of
using AI following both heat detection and
timed insemination at 72 h. Without timed
insemination, 76 heifers (25% of all heifers
bred AI) would not have conceived to AI.
Nearly 50% of all heifers conceived to AI, an
acceptable level in most cattle operations.

Table 2 shows the wide variability in
pregnancy rates that can occur among different
locations. Conception rate to AI varied more
than twofold among different ranches, whereas
overall pregnancy rate ranged from 75 to 97%.
These differences in fertility could be due to
differences in heifer development,
management, AI technicians, or fertility of
clean-up bulls.
### Table 1. Fertility in Beef Heifers Synchronized with Melengestrol Acetate and Prostaglandin F₂α

<table>
<thead>
<tr>
<th>Item</th>
<th>AI, %</th>
<th>No.</th>
<th>AI + bull, %</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to estrus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In estrus by 48 h post-PG&lt;sup&gt;b&lt;/sup&gt;</td>
<td>56</td>
<td>70/125</td>
<td>89</td>
<td>111/125</td>
</tr>
<tr>
<td>In estrus 48 to 72 h post-PG</td>
<td>63</td>
<td>156/249</td>
<td>94</td>
<td>233/249</td>
</tr>
<tr>
<td>Time inseminated (72 h)</td>
<td>32</td>
<td>76/239</td>
<td>80</td>
<td>191/239</td>
</tr>
<tr>
<td>Serum progesterone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₄ &gt; 1 ng/ml&lt;sup&gt;c&lt;/sup&gt;</td>
<td>55</td>
<td>253/456</td>
<td>91</td>
<td>416/456</td>
</tr>
<tr>
<td>P₄ &gt; 1 ng/ml</td>
<td>33</td>
<td>54/164</td>
<td>77</td>
<td>126/164</td>
</tr>
<tr>
<td>P₄ 1 to 2 ng/ml</td>
<td>50</td>
<td>66/132</td>
<td>89</td>
<td>117/132</td>
</tr>
<tr>
<td>P₄ &gt; 2 ng/ml</td>
<td>58</td>
<td>187/324</td>
<td>92</td>
<td>299/324</td>
</tr>
<tr>
<td>Estrus and progesterone level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No estrus, &lt; 1 ng/ml P₄&lt;sup&gt;d&lt;/sup&gt;</td>
<td>24</td>
<td>23/97</td>
<td>73</td>
<td>71/97</td>
</tr>
<tr>
<td>Estrus, &lt; 1 ng/ml P₄</td>
<td>46</td>
<td>31/67</td>
<td>82</td>
<td>55/67</td>
</tr>
<tr>
<td>No estrus, &gt; 1 ng/ml P₄</td>
<td>37</td>
<td>53/142</td>
<td>84</td>
<td>120/142</td>
</tr>
<tr>
<td>Estrus, &gt; 1 ng/ml P₄</td>
<td>64</td>
<td>195/307</td>
<td>94</td>
<td>289/307</td>
</tr>
</tbody>
</table>

<sup>a</sup>AI = artificial insemination.  
<sup>b</sup>PG = prostaglandin F₂α.  
<sup>c</sup>P₄ = serum progesterone.  
<sup>d</sup>No estrus = heifers not detected by 72 h after prostaglandin F₂α; Estrus = heifers detected in estrus by 72 h.

### Table 2. Variability among Ranches in Estrus Response and Fertility of Beef Heifers Synchronized with Melengestrol Acetate and Prostaglandin F₂α

<table>
<thead>
<tr>
<th>Item</th>
<th>A&lt;sup&gt;a&lt;/sup&gt;</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of heifers</td>
<td>74</td>
<td>189</td>
<td>202</td>
<td>77</td>
<td>92</td>
<td>123</td>
</tr>
<tr>
<td>Detected in estrus by 72 h after prostaglandin injection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>76</td>
<td>81</td>
<td>42</td>
<td>53</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>No.</td>
<td>53/70</td>
<td>151/187</td>
<td>85/201</td>
<td>41/77</td>
<td>54/91</td>
<td>73/123</td>
</tr>
<tr>
<td>Conceived to AI when detected in estrus&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>74</td>
<td>73</td>
<td>32</td>
<td>70</td>
<td>54</td>
<td>NA&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>No.</td>
<td>39/53</td>
<td>103/142</td>
<td>27/85</td>
<td>28/40</td>
<td>29/54</td>
<td>NA</td>
</tr>
<tr>
<td>Conceived to AI of total (estrus and time inseminated)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>64</td>
<td>69</td>
<td>24</td>
<td>71</td>
<td>37</td>
<td>NA</td>
</tr>
<tr>
<td>No.</td>
<td>47/74</td>
<td>125/180</td>
<td>49/202</td>
<td>53/75</td>
<td>33/89</td>
<td>NA</td>
</tr>
<tr>
<td>Overall pregnancy rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>91</td>
<td>97</td>
<td>75</td>
<td>91</td>
<td>92</td>
<td>NA</td>
</tr>
<tr>
<td>No.</td>
<td>67/74</td>
<td>174/180</td>
<td>151/202</td>
<td>68/75</td>
<td>82/89</td>
<td>NA</td>
</tr>
</tbody>
</table>

<sup>a</sup>The six ranch locations are denoted by the letters A through F.  
<sup>b</sup>AI = artificial insemination.  
<sup>c</sup>NA = not available.