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Evaluation of Three Estrous Synchronization Protocols in Beef Heifers[1]

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Abstract

*Objectives of this study were to evaluate synchronization, conception, and pregnancy rates of heifers synchronized with melengestrol acetate (**MGA**)-prostaglandin $F_{2\alpha}$ (**$PGF_{2\alpha}$**), Select Synch, or Select Synch preceded by MGA (MGA-Select Synch). Heifers in the MGA-$PGF_{2\alpha}$ group (n = 209; BW = 378 kg) received MGA (0.5 mg/d per heifer) for 14 d and $PGF_{2\alpha}$ (25 mg) 19 d later. Select Synch heifers (n = 213; BW = 374 kg) received gonadotropin-releasing hormone (**GnRH**; 100 μg) followed by $PGF_{2\alpha}$ (25 mg) 7 d later. The MGA-Select Synch heifers (n = 210; BW = 373 kg) were fed MGA (0.5 mg/d per heifer) for 7 d, GnRH (100 μg) the day following the last MGA feeding, and $PGF_{2\alpha}$ (25 mg) 7 d after GnRH. More (P<0.01) heifers were in estrus 1 to 4 d before $PGF_{2\alpha}$ administration in both the Select Synch (20%) and MGA-Select Synch (24%) groups than in the MGA-$PGF_{2\alpha}$ (4%) group. Pregnancy rates for heifers in estrus early (d 1 to 4 before $PGF_{2\alpha}$) were greater (P<0.05) for both Select Synch (55%) and MGA-Select Synch (63%) compared with MGA-$PGF_{2\alpha}$ heifers (18%). Synchronization rate (detected after $PGF_{2\alpha}$) was greater (P<0.01) for MGA-$PGF_{2\alpha}$ heifers (86%) compared with Select Synch (66%) and MGA-Select Synch (68%) heifers; however, conception rate did not differ (P=0.13) and averaged 72, 63, and 62% for MGA-$PGF_{2\alpha}$, Select Synch, and MGA-Select Synch heifers, respectively. Select Synch (52%), MGA-Select Synch (58%), and MGA-$PGF_{2\alpha}$ protocols (61%) provided similar (P=0.18) overall AI pregnancy rates; however, more heifers were in estrus before $PGF_{2\alpha}$ administration in protocols using GnRH.*

(Key Words: Estrous Synchronization, Gonadotropin-Releasing Hormone, Melengestrol Acetate, Heifers.)

Introduction

The melengestrol acetate (MGA)-prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) method of estrous synchronization has proven to be very successful in synchronizing estrus in beef heifers (Brown et al., 1988; Patterson and Corah, 1992; Lamb et al., 2000). Synchronization programs using gonadotropin-releasing hormone (GnRH) show promise for multiparous beef cows and possibly heifers; however, previous reports (Stevenson et al., 1999; Lamb et al., 2004) indicated a 5 to 10% lesser synchronization and pregnancy rate among heifers synchronized with the Select Synch protocol (GnRH followed by $PGF_{2\alpha}$ 7 d later) compared with the MGA-$PGF_{2\alpha}$ protocol; other researchers (Cassady et al., 1999) reported no difference in conception or pregnancy rates between MGA-$PGF_{2\alpha}$ and Select Synch estrous synchronization protocols in beef heifers. Short-term (8 d) feeding of MGA to prepubertal beef heifers has been demonstrated to stimulate pulsatile luetinizing hormone secretion, to accelerate follicular growth, and to enhance onset of puberty (Imwalle et al., 1998). It has been previously demonstrated that short-term (7 d) MGA feeding before the Select Synch protocol provided similar synchronization, conception, and pregnancy rates when compared with the MGA-$PGF_{2\alpha}$ protocol in beef heifers (Funston et al., 2002); however, this protocol was not

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compared with the Select Synch protocol alone. Therefore, the objective of this study was to evaluate synchronization, conception, and pregnancy rates of heifers synchronized with MGA-$PGF_{2\alpha}$, Select Synch, or Select Synch preceded by MGA (MGA-Select Synch).

Materials and Methods

Commercial beef heifers, primarily of British (Angus) breed composition (body condition score [**BCS**] = 5 to 6) from four sources (n = 632) were randomly allotted by BW (BW = 377 kg) to treatment (within source) and randomly to AI sire. Heifers from three sources (n = 412) were transported to one location for synchronization and AI. Heifers from the fourth source (n = 220) were all synchronized and inseminated at a second location. Synchronization protocols are illustrated in Figure 1. Heifers in the MGA-$PGF_{2\alpha}$ group (n = 209; BW = 378 kg) received MGA (0.5 mg/d per heifer; Pharmacia Animal Health, Kalamazoo, MI) in a total mixed diet for 14 d and an injection of 25 mg $PGF_{2\alpha}$ (Lutalyse®; Pharmacia Animal Health) 19 d later. Select Synch heifers (n = 213; BW = 374 kg) received an injection of 100 μg GnRH (Fertagyl®; Intervet, Millsboro, NJ) followed by $PGF_{2\alpha}$ (25 mg) 7 d later. The MGA-Select Synch heifers (n = 210; BW = 373 kg) were fed MGA (0.5 mg/d per heifer) for 7 d, received GnRH (100 μg) the day following the last MGA feeding, and $PGF_{2\alpha}$ (25 mg) 7 d after GnRH. All heifers received $PGF_{2\alpha}$ on the same day. Heifers were observed for estrus continuously during daylight from 4 d before through 5 d after $PGF_{2\alpha}$ administration and were inseminated approximately 12 h after onset of estrus. Clean-up bulls were turned in with heifers 10 d after the last AI. Transrectal ultrasonography was used to determine pregnancy status approximately 50 d after AI. Differences in synchronization

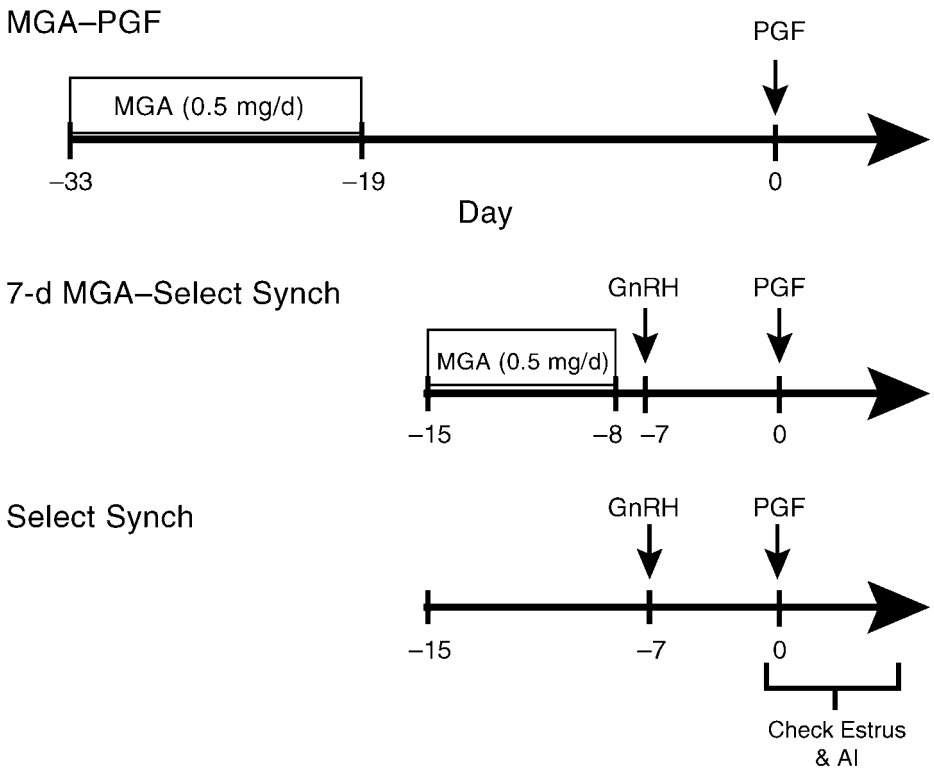

Figure 1. Illustration of the MGA-$PGF_{2\alpha}$, MGA-Select Synch, and Select Synch protocols. MGA-$PGF_{2\alpha}$ = Melengestrol acetate (MGA; 0.5 mg/d per heifer for 14 d; Pharmacia Animal Health, Kalamazoo, MI) plus 25 mg prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$; Lutalyse®; Pharmacia Animal Health) administered 19 d later; MGA-Select Synch = MGA (0.5 mg/d per heifer) for 7 d + gondotropin-releasing hormone (GnRH; 100 μg; Fertagyl; Intervet, Millsboro, NJ) the day following the last MGA feeding and $PGF_{2\alpha}$ (25 mg) 7 d after GnRH; and Select Synch = 100 μg GnRH followed by $PGF_{2\alpha}$ (25 mg) 7 d later.

(data were analyzed before and after $PGF_{2\alpha}$ and the overall 9-d detection period), AI conception, and pregnancy rates were determined using CATMOD procedures of SAS® (SAS Institute, Cary, NC). Included in the model were treatment, source, and the interaction of treatment and source.

Results and Discussion

More (P<0.01) heifers were observed in estrus before $PGF_{2\alpha}$ injection in both the Select Synch (20%) and MGA-Select Synch (24%) groups than in the MGA-$PGF_{2\alpha}$ (4%) group. Pregnancy rates for heifers observed in estrus before $PGF_{2\alpha}$ were greater (P<0.05) for both Select Synch (55%) and MGA-Select Synch (63%) compared with MGA-$PGF_{2\alpha}$ heifers (18%). Synchronization rate (through 5 d after $PGF_{2\alpha}$) was greater (P<0.01) for MGA-$PGF_{2\alpha}$ heifers (86%) compared with Select Synch (66%) and MGA-Select Synch (68%) heifers; however, conception rate did not differ (P=0.13; 72, 63, and 62% for MGA-$PGF_{2\alpha}$, Select Synch, and MGA-Select Synch, respectively). Estrous response over the 9-d observation period was greater (P<0.05) for MGA-Select Synch (92%) compared with Select Synch (86%) but did not differ (P>0.05) from the MGA-$PGF_{2\alpha}$ (90%) treatment. The Select Synch (52%), MGA-Select Synch (58%), and MGA-$PGF_{2\alpha}$ protocols (61%) provided similar (P=0.18) overall AI pregnancy rates. Lamb et al. (2004) also reported similar pregnancy rates in beef heifers synchronized with Select Synch (47%) and

TABLE 1. Artificial insemination conception and pregnancy rates by location for heifers synchronized with melengestrol acetate (MGA)-prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$), Select Synch, or MGA-Select Synch[a].

Item[b]	MGA-$PGF_{2\alpha}$	MGA-Select Synch	Select Synch
	[no./no. (%)]		
Estrus detection			
Source 1[c]	39/43 (91)	37/41 (90)	42/46 (91)
Source 2	25/29 (86)	27/30 (90)	21/29 (72)
Source 3	54/64 (84)	60/66 (91)	52/64 (81)
Source 4	71/73 (97)	70/73 (96)	68/74 (92)
Overall	189/209 (90)	194/210 (92)	183/213 (86)
Conception rate			
Source 1	23/39 (59)	24/37 (65)	32/42 (76)
Source 2	21/25 (84)	17/27 (63)	13/21 (62)
Source 3	39/54 (72)	34/60 (57)	33/52 (63)
Source 4	45/71 (63)	46/70 (66)	33/68 (49)
Overall	128/189 (68)	121/194 (62)	111/183 (61)
Pregnancy rate			
Source 1	23/43 (53)	24/41 (59)	32/46 (70)
Source 2	21/29 (72)	17/30 (57)	13/29 (45)
Source 3	39/64 (61)	34/66 (52)	33/64 (52)
Source 4	45/73 (62)	46/73 (63)	33/74 (45)
Overall	128/209 (61)	121/210 (58)	111/213 (52)

[a]MGA-$PGF_{2\alpha}$ = MGA (0.5 mg/d per heifer for 14 d; Pharmacia Animal Health, Kalamazoo, MI) plus 25 mg $PGF_{2\alpha}$ (Lutalyse®; Pharmacia Animal Health) administered 19 d later; MGA-Select Synch = MGA (0.5 mg/d per heifer) for 7 d + gondotropin-releasing hormone (GnRH; 100 μg; Fertagyl; Intervet, Millsboro, NJ) the day following the last MGA feeding and $PGF_{2\alpha}$ (25 mg) 7 d after GnRH; and Select Synch = 100 μg GnRH followed by $PGF_{2\alpha}$ (25 mg) 7 d later.

[b]For heifers detected in estrus and inseminated –4 to 5 d after $PGF_{2\alpha}$.

[c]Sources 1 through 3 were synchronized and inseminated at one location; source 4 heifers were synchronized and inseminated at a second location.

MGA-$PGF_{2\alpha}$ (56%). Conception rate after $PGF_{2\alpha}$ and overall pregnancy rate tended to be influenced by the interaction of treatment and source (P=0.09 and P=0.08 for conception and overall pregnancy rate, respectively; Table 1). Overall AI pregnancy rate was greatest for MGA-$PGF_{2\alpha}$ followed by MGA-Select Synch and Select Synch for three sources of heifers, but the order was reversed for one source of heifers (Table 1). This variation in response contributed to the inability to detect significant treatment differences in conception and overall pregnancy rate. Lamb et al. (2004) also found a treatment by location interaction when comparing Select Synch, MGA-$PGF_{2\alpha}$, and two-shot $PGF_{2\alpha}$ synchronization systems in beef heifers.

One disadvantage of GnRH-$PGF_{2\alpha}$-based synchronization protocols is that 5 to 18% of cyclic heifers and cows exhibit estrus before or immediately after $PGF_{2\alpha}$ administration (Geary et al., 2000; Kojima et al., 2000; Lamb et al., 2004). In the present study, we observed early estrus (d 1 to 4 before PGF) in 20 to 24% of the animals in protocols involving GnRH; however, previously Funston et al. (2002) used short-term MGA feeding before the Select Synch protocol with only 4% of the heifers (of similar genetics as the present study) exhibiting estrus before the prostaglandin injection. Heifers in the previous study were approximately 12 mo of age and might have had a lesser percentage cycling than in this study (heifers were approximately 14 mo of age) and responded to the GnRH protocol differently.

Implications

Estrous synchronization programs need to be inexpensive, effective, and easy to administer. The MGA-$PGF_{2\alpha}$ protocol provided the least variability in estrous response; however, the Select Synch protocol provided acceptable pregnancy rates and may be considered for producers who want a shorter synchronization program or when MGA cannot be fed or uniformly consumed. Feeding MGA before the Select Synch program did not provide any benefit in pregnancy rate or decreasing the percentage of animals in estrus before $PGF_{2\alpha}$ administration.

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