Calf removal improves conception rates to the Ovsynch and CO-Synch protocols[1]

T. W. Geary*,[2,3], J. C. Whittier†, D. M. Hallford‡, and M. D. MacNeil*

*USDA-ARS, Fort Keogh, Miles City, MT 59301; †Department of Animal Sciences, Colorado State University, Fort Collins, 80523; and ‡Department of Animal and Range Sciences, New Mexico State University, Las Cruces, 88003

ABSTRACT: Beef cows (n = 473) from two locations were stratified by breed, postpartum interval, age, and AI sire and were randomly allotted to one of four treatments for synchronization of ovulation. Ovulation synchronization protocols included the Ovsynch protocol with (n = 114) or without (n = 123) 48-h calf removal from d 7 to 9 (d 0 = 1st GnRH injection) or the CO-Synch protocol with (n = 119) or without (n = 117) 48-h calf removal from d 7 to 9. The Ovsynch protocol included administration of GnRH (100 μg; i.m.) on d 0, $PGF_{2\alpha}$ (25 mg; i.m.) on d 7, GnRH (100 μg; i.m.) on d 9, and timed insemination on d 10. The CO-Synch protocol included administration of GnRH (100 μg; i.m.) on d 0, $PGF_{2\alpha}$ (25 mg; i.m.) on d 7, and GnRH (100 μg; i.m.) with timed insemination on d 9. Blood samples were collected from all cows on d −10 and d 0 for analysis of serum progesterone. Cows with at least one serum progesterone concentration greater than 1 ng/mL were considered to be cyclic at the time of treatment. Conception rates of cows that received the CO-Synch + calf removal, Ovsynch + calf removal, CO-Synch, or Ovsynch protocol (63, 61, 54, and 52%, respectively) were not different ($P = 0.50$). Conception rates were not different ($P = 0.80$) among CO-Synch- and Ovsynch-treated cows; however, both estrual status and 48-h calf removal affected conception rates. Conception rates of cyclic cows (66%) were greater ($P = 0.01$) than those of anestrous cows (53%), regardless of which synchronization protocol was used. When data were pooled across synchronization protocol, conception rates of cows with 48-h calf removal (62%) were greater ($P = 0.09$) than conception rates of cows without calf removal (53%). The CO-Synch + calf removal protocol induces a fertile ovulation in cyclic and anestrous cows, requires handling cattle just three times, results in high conception rates from timed insemination, and should be a useful program for synchronization of ovulation in beef cows.

Key Words: Calf Removal, Insemination, Synchronized Females Ovulation

 J. Anim. Sci. 2001. 79:1–4

Introduction

Less than 6% of beef cows in the United States are artificially inseminated each year (NAHMS, 1997). An important reason why so few are artificially inseminated is the problem of estrus detection (NAHMS, 1998). An estrous synchronization protocol that induces estrous cycles, is easy and inexpensive to administer, can be administered in a short period of time, and synchronizes follicular development to allow timed insemination is needed by the beef industry.

Timed insemination with the Ovsynch protocol resulted in higher conception rates than Syncro-Mate-B (Geary et al., 1998). The Ovsynch protocol requires handling cows three times for injections and a fourth time for mass insemination (Figure 1). Variations in the Ovsynch protocol that included timed insemination at the same time as the third injection (CO-Synch; Figure 1) resulted in lower conception rates compared with insemination 24 h later (Geary and Whittier, 1998). Temporary calf removal for 48 h has generally increased conception rates of beef cows to a timed insemination with other synchronization protocols (Smith et al., 1979; Kiser et al., 1980; Yelich et al., 1995). Our hypothesis was that 48-h calf removal would increase

[1]The authors wish to acknowledge financial support of this research from the National Association of Animal Breeders (NAAB) and the donations of Cystorelin from Merial and Lytalyse from Pharmacia & Upjohn. We also wish to thank CSU beef herd managers Gary Mathiews and Trey Patterson for their assistance with data collection.

[2]Correspondence: Route 1, Box 2021 (phone: 406-232-8215; fax: 406-232-8209; E-mail: tgeary@larrl.ars.usda.gov).

[3]USDA-ARS, Northern Plains Area, is an equal opportunity/affirmative action employer. All agency services are available without discrimination. Mention of a proprietary product does not constitute a guarantee or warranty of the product by USDA or the authors and does not imply its approval to the exclusion of other products that may also be suitable.

Received May 16, 2000.

Accepted August 11, 2000.

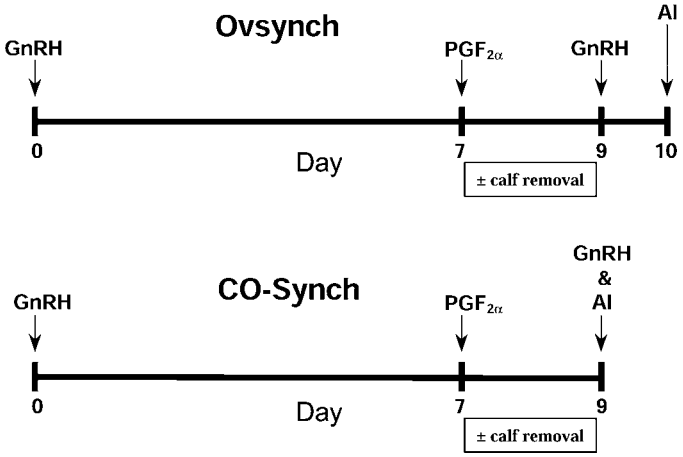

Figure 1. Illustration of the Ovsynch and CO-Synch synchronization protocols with and without 48-h calf removal.

conception rates to a timed insemination with the Ovsynch and CO-Synch protocols to levels that would be acceptable to beef producers. Thus, the objective of this research was to evaluate effects of 48-h calf removal on conception rates of cows synchronized using the Ovsynch or CO-Synch protocols.

Materials and Methods

Multiparous Angus or Hereford cows (n = 473) from two locations were used to evaluate effects of 48-h calf removal on conception rates following synchronization of ovulation using the Ovsynch or CO-Synch protocols. The two herds were located in Fort Collins, CO, and near Saratoga, WY. Cows at each location were stratified by age, postpartum interval, and AI sire and were randomly divided into four treatment groups. Treatment groups included cows that received the CO-Synch protocol with (n = 119) or without (n = 117) 48-h calf removal or the Ovsynch protocol with (n = 114) or without (n = 123) 48-h calf removal. Both synchronization protocols included a 100-μg i.m. injection of GnRH (Cystorelin, Merial, Iselin, NJ) on d 0, a 25-mg i.m. injection of $PGF_{2\alpha}$ (Lutalyse, Pharmacia & Upjohn, Kalamazoo, MI) on d 7, another 100-μg i.m. injection of GnRH on d 9, and timed insemination on d 9 (CO-Synch) or d 10 (Ovsynch; Figure 1). Cows that were exposed to 48-h calf removal had their calves removed from the time of the $PGF_{2\alpha}$ injection until the time of the second GnRH injection. During calf removal, calves were held in pens out of sight from their dams and were provided clean water and grass hay. At each location, cows were inseminated by one of two technicians and were not observed for signs of estrus before insemination. At both locations, bulls were placed with cows 5 d following timed insemination. Pregnancy was diagnosed using rectal palpation by a skilled technician at 60 and 90 d following insemination.

Two blood samples were collected from each cow on d –10 and d 0 before the start of synchronization. Blood samples were incubated on ice for approximately 12 h, and serum was separated by centrifugation at 3,000 × *g* for 20 min. Serum was collected and stored at –20°C until analyzed for progesterone concentration to identify cyclic and anestrous cows at the time of synchronization (Schneider and Hallford, 1996). Cows that had one serum sample with a progesterone concentration greater than 1 ng/mL were considered to have resumed cyclicity.

Differences in conception rate between treatments were analyzed using procedures for categorical data (Catmod) in SAS (SAS Inst. Inc., Gary, NC). Independent variables were location, cow age, synchronization protocol, calf removal, cyclicity status, and all interactions.

Results and Discussion

There were no differences ($P = 0.60$) in conception rate due to location; therefore, data were pooled for further analyses. The interaction of synchronization protocol and calf removal did not affect ($P = 0.50$) conception rate (Figure 2). Conception rates were also not different ($P = 0.80$) between Co-Synch- (58%) and Ovsynch- (57%) treated cows. However, calf removal increased ($P = 0.09$) conception rates to timed AI by nine percentage points (62% and 53% for calf removal and no calf removal, respectively) when data were pooled between synchronization protocols. Others have reported similar improvements in conception rates with 48-h calf removal (Smith et al., 1979; Kiser et al., 1980; Yelich et al., 1995). Similar numerical increases in conception rates were observed with calf removal between

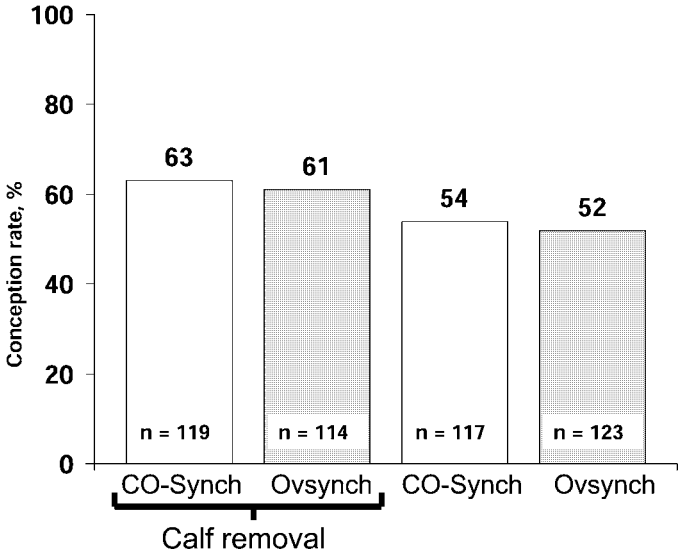

Figure 2. Conception rates of cows that received the CO-Synch or Ovsynch protocol for synchronization of ovulation with or without 48-h calf removal ($P = 0.50$).

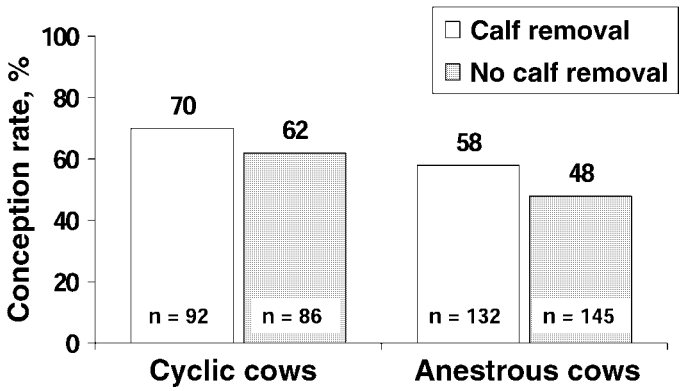

Figure 3. Effects of calf removal on conception rate of cyclic and anestrous cows that were mass-mated following synchronization of ovulation with the CO-Synch or Ovsynch protocols ($P = 0.01$ for cyclic vs anestrus).

treatments (Figure 2) and between cyclic and anestrous cows (Figure 3). Short-term calf removal increased GnRH and LH pulse frequency to levels similar to those in proestrus (Edwards, 1985; Shively and Williams, 1989) and increased the amount of LH released in response to a GnRH challenge (Smith et al., 1983) in anestrous cows. An ovulatory follicle that is exposed to increased basal and pulsatile LH may differentiate into a CL with improved steroid production and life span. The entire mechanism by which calf removal increased GnRH and LH release sufficiently to culminate in ovulation is not completely understood but seems to have both a calf recognition and a suckling component (Silveira et al., 1993; Hoffman et al., 1996; Lamb et al., 1999). Housing the calves away from the cows during the 48-h calf removal in the present study probably was not necessary (Lamb et al., 1999). Short-term calf removal (48 h) shortened the time interval to estrus in cows synchronized with the Syncro-Mate-B (Smith et al., 1979) and MGA/$PGF_{2\alpha}$ (Yelich et al., 1995) protocols. This is the first study to report a trend ($P = 0.21$) toward improved conception rates with calf removal among cyclic cows. Calf removal coupled with GnRH administration may have resulted in an earlier and(or) larger LH surge that improved the synchrony of ovulation among both cyclic and anestrous cows relative to the time of insemination in the present study. Cows that had calves removed for 48 h after MGA supplementation exhibited estrus within 72 h compared with 240 h for cows without calf removal (Yelich et al., 1995). Forty-eight-hour calf removal does not affect overall calf performance (Lesmeister and Drake, 1978; Odde et al., 1986).

The CO-Synch protocol with 48-h calf removal, which resulted in the highest numerical conception rate, was the easiest protocol to administer because it required handling cows and calves less than the other protocols. Previous research indicated higher conception rates among Ovsynch-treated cows when compared with CO-Synch-treated cows (Geary and Whittier, 1998). These results may differ, in part, due to differences in the percentage of anestrous cows at the onset of treatment between the two studies. Anestrous cows that received the first two injections of the synchronization protocol used in the present study exhibited estrus earlier and with less variation in time to estrus following $PGF_{2\alpha}$ than cyclic cows (Geary et al., 2000). In addition, the study by Geary and Whittier (1998) did not include any 2-yr-old cows in their treatments. Based on serum progesterone levels, 61% of the cows used in the present study were anestrous at the start of treatment. Conception rates were higher ($P = 0.01$) among cyclic cows (66%) than among anestrous cows (52%), regardless of treatment. We have reported similar findings among cyclic and anestrous Ovsynch-treated cows (Geary et al., 1998).

Conception rates were affected ($P < 0.05$) by age and age × cyclicity interaction. Conception rates increased with increasing age. The percentage of anestrous cows before synchronization decreased ($P < 0.05$) with increasing age (Table 1). Calf removal appears to have been more beneficial for 3- and 4-yr-old cows than for first-calf heifers (2-yr-olds) and older cows (Table 1). Both of these herds traditionally breed virgin heifers 1 wk earlier than the cow herd. The heifers probably had not calved early enough to benefit from 48-h calf removal (Table 1). Among older cows (5+ yr old), calf removal did not improve conception rates of anestrous cows but appears to have improved the conception rates of cyclic cows. It is likely that the anestrous older cows were in a shallower state of anestrus and consistently responded to hormonal treatment independent of calf removal. Among the cyclic older cows, the timing of an induced ovulation may have been improved relative to

Table 1. Conception rate of cows by age, cycling status, and calf removal

Age and cycling status	Anestrus[a]	Conception rate	
		Calf removal[b]	No calf removal[b]
	no./no. (%)		
2 yr old	71/94 (76)	21/46 (46)	22/48 (46)
Cyclic		8/12 (67)	9/11 (82)
Anestrus		13/34 (38)	13/37 (35)
3 yr old	45/68 (66)	20/35 (57)	12/33 (36)
Cyclic		9/14 (64)	5/9 (56)
Anestrus		11/21 (52)	7/24 (29)
4 yr old	45/74 (61)	26/39 (67)	15/35 (43)
Cyclic		13/19 (68)	6/10 (60)
Anestrus		13/20 (65)	9/25 (36)
5+ yr old	116/219 (53)	73/104 (70)	73/115 (63)
Cyclic		34/47 (72)	32/56 (57)
Anestrus		39/57 (68)	41/59 (69)

[a]Cyclicity was based on at least one serum progesterone concentration greater than 1 ng/mL on d –10 or 0 before the start of synchronization. Cyclicity status was undetermined for 18 cows because of missing or mislabeled blood samples. Age × cyclicity interaction ($P = 0.03$).
[b]Cyclicity status was undetermined for nine cows in each category. Calf removal was for 48 h from the time of $PFG_{2\alpha}$ injection until the second GnRH injection.

the time of insemination by calf removal. Shively and Williams (1989) reported that increasing the duration of calf removal from 48 to 96 h or to 144 h increased the LH pulse frequency for a longer period of time and increased the percentage of early-postpartum cows that ovulated. The response of cows by age in the present study may have been similar and dependent on the ability of GnRH alone or in combination with calf removal to induce ovulation. These observations may help explain some of the variation in response to 48-h calf removal that has been reported previously (Smith et al., 1979; Kiser et al., 1980; Odde et al., 1986).

Implications

In choosing the most practical estrous or ovulation synchronization protocol, producers must estimate which females have resumed normal estrous cycles and fertility following calving. This study demonstrates that high conception rates to a timed insemination are possible with either the Ovsynch or CO-Synch protocols among both cyclic and anestrous cows. The CO-Synch protocol requires handling cows only three times and, thus, would be easier to incorporate into an AI program. Calf removal for 48 h improves conception rates regardless of whether insemination occurs at the time of the second GnRH injection or 24 h later. However, the beneficial effects of calf removal appear to be age-related. This information may be valuable for beef producers who have considered using short-term calf removal to improve conception rates.

Literature Cited

Edwards, S. 1985. The effects of short term calf removal on pulsatile LH secretion in the postpartum beef cow. Theriogenology 23:777–785.

Geary, T. W., E. R. Downing, J. E. Bruemmer, and J. C. Whittier. 2000. Ovarian and estrous response of suckled beef cows to the Select Synch estrous synchronization protocol. Prof. Anim. Sci. 16:1–5.

Geary, T. W., and J. C. Whittier. 1998. Effects of a timed insemination following synchronization of ovulation using the Ovsynch or CO-Synch protocol in beef cows. Prof. Anim. Sci. 14:217–220.

Geary, T. W., J. C. Whittier, E. R. Downing, D. G. LeFever, R. W. Silcox, M. D. Holland, T. M. Nett, and G. D. Niswender. 1998. Pregnancy rates of postpartum beef cows that were synchronized using Syncro-Mate-B® or the Ovsynch protocol. J. Anim. Sci. 76:1523–1527.

Hoffman, D. P., J. S. Stevenson, and J. E. Minton. 1996. Restricting calf presence without suckling compared with weaning prolongs postpartum anovulation in beef cattle. J. Anim. Sci. 74:190–198.

Kiser, T. E., S. E. Dunlap, L. L. Benyshek, and S. E. Mares. 1980. The effect of calf removal on estrous response and pregnancy rate of beef cows after Syncro-Mate-B treatment. Theriogenology 13:381–389.

Lamb, G. C., B. L. Miller, J. M. Lynch, K. E. Thompson, J. S. Heldt, C. A. Löest, D. M. Grieger, and J. S. Stevenson. 1999. Twice daily suckling but not milking with calf presence prolongs postpartum anovulation. J. Anim. Sci. 77:2207–2218.

Lesmeister, J. L., and D. J. Drake. 1978. Effect of temporary calf removal on calf performance and estrus activity of postpartum beef cows. J. Anim. Sci. 47(Suppl. 1):144 (Abstr.).

NAHMS. 1997. National Animal Health Monitoring System, Part I: Reference of 1997 Beef Cow-Calf Management Practices. p 38. USDA-APHIS-VS, Fort Collins, CO.

NAHMS. 1998. National Animal Health Monitoring System, part III: Reference of 1997 Beef Cow-Calf Production Management and Disease Control. p 11 USDA-APHIS-VS, Fort Collins, CO.

Odde, K. G., G. H. Kiracofe, and R. R. Schalles. 1986. Effect of forty-eight hour calf removal, once- or twice-daily suckling and norgestomet on beef cow and calf performance. Theriogenology 26:371–381.

Schneider, F. A., and D. M. Hallford. 1996. Use of rapid progesterone radioimmunoassay to predict pregnancy and fetal numbers in ewes. Sheep and Goat Res. J. 12:33–38.

Shively, T. E., and G. L. Williams. 1989. Patterns of tonic luteinizing hormone release and ovulation frequency in suckled anestrous beef cows following varying intervals of temporary weaning. Domest. Anim. Endocrinol. 6:379–387.

Silveira, P. A., R. A. Spoon, D. P. Ryan, and G. L. Williams. 1993. Evidence for maternal behavior as a requisite link in suckling-mediated anovulation in cows. Biol. Reprod. 49:1338–1346.

Smith, M. F., W. C. Burrell, L. D. Shipp, L. R. Sprott, W. N. Songster, and J. N. Wiltbank. 1979. Hormone treatments and use of calf removal in postpartum beef cows. J. Anim. Sci. 48:1285–1294.

Smith, M. F., A. W. Lishman, G. S. Lewis, P. G. Harms, M. R. Ellersieck, E. K. Inskeep, J. N. Wiltbank, and M. S. Amoss. 1983. Pituitary and ovarian responses to gonadotropin releasing hormone, calf removal and progestogen in anestrous beef cows. J. Anim. Sci. 57:418–424.

Yelich, J. V., M. D. Holland, D. N. Schutz, and K. G. Odde. 1995. Synchronization of estrus in suckled postpartum beef cows with melengestrol acetate, 48-hour calf removal and $PFG_{2\alpha}$. Theriogenology 43:401–410.