FACTORS INFLUENCING THE INITIATION OF ESTROUS CYCLES AND EXPRESSION OF ESTRUS IN BEEF COWS

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Summary

Body condition, parity, and days postpartum at the onset of the breeding season determine the proportion of cows that initiated first postpartum ovarian activity and ovulated before the start of the breeding season. Hormonal treatments that included both GnRH and a source of progestin enhanced expression of estrus and led to greater pregnancy rates of suckled beef cows.

(Key Words: Suckled Cows, Body Condition, Parity, Days Postpartum, Estrus.)

Introduction

The factor most limiting early impregnation of suckled cows is the proportion of cows that are not cycling (anestrous) at the beginning of the breeding season. Continual presence of a suckling calf prolongs anestrus and delays the reinitiation of estrous cycles. Although insufficient energy and protein intake and insufficient body condition at calving are also limiting factors, temporary or permanent weaning of the calf usually initiates estrus within a few days. Younger cows nursing calves generally have more prolonged anestrus because of their additional growth requirement.

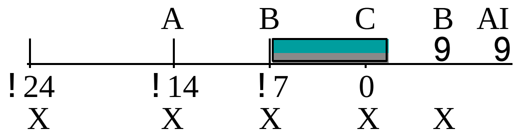
Nutrients are used by cows according to an established priority. The first priority is maintenance of essential body functions to preserve life. Once that maintenance requirement is met, remaining nutrients accommodate growth. Finally, lactation and the initiation of estrous cycles are supported. Because older cows have no growth requirement, nutrients are more likely to be available for milk synthesis and estrous cycle initiation. Because of this priority system, young, growing cows generally produce less milk and are anestrous longer after calving.

During the past 6 years, we have given more than 2,200 beef cows various hormonal treatments to synchronize estrus, ovulation, or both, in an attempt to achieve conception early in the breeding season and maximize the proportion of cows pregnant to genetically superior AI sires. As part of these studies, we measured the incidence of cyclicity at the beginning of the breeding season, both prior to hormonal treatments and in response to these treatments. This report summarizes the factors (body condition, parity, and days since calving) that influence the proportion of cows cycling before and in response to hormonal treatments.

Experimental Procedures

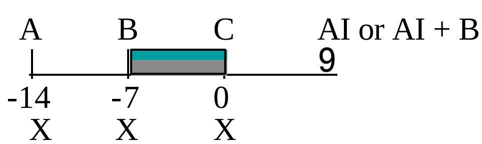
Five studies were conducted during the spring 1995-1999 breeding seasons on four private ranches and at the KSU Purebred Beef Unit.

Study 1 (1994-1995). Purebred suckled cows (Simmental, Angus, and Hereford; n = 279) at KSU were used. Controls received two injections of Lutalyse® (25 mg of $PGF_{2\alpha}$; Pharmacia & Upjohn, Kalamazoo, MI) on days -14 and 0 and were inseminated at estrus, or in the absence of estrus, at 80 hr after the second Lutalyse. Treated cows received 25 mg of Lutalyse on days -14 and 0 plus 100 µg of Cystorelin® (GnRH; Merial Limited, Iselin, NJ) on day -7 and had a norgestomet (NORG) ear implant (Syncro-Mate-B®; Merial Limited, Iselin, NJ) in place for 8 days beginning on day -7. Treated cows were inseminated at 72 hr after Lutalyse and 18 hr after a second injection of Cystorelin given at 54 hr after Lutalyse.



A = Lutalyse®
B = Cystorelin®
C = Lutalyse®
X = Blood sample
Norgestomet ear implant =

Study 2 (1996). Purebred suckled Angus, Gelbvieh, and Hereford cows and crossbred suckled cows (Simmental, Angus, and Hereford) (n = 890) on three private ranches were used. Control cows received two injections of Lutalyse on days !14 and 0. A second group of cows received Cystorelin on day !7 and Lutalyse on day 0 (Select Synch). Select Synch + NORG cows also had a norgestomet implant in place for 7 days beginning on day !7. Cows were inseminated after detected estrus. In addition, 164 purebred suckled cows received the Select Synch + NORG treatment at KSU. Cows were either inseminated after detected estrus (one-half) or at 48 hr after PGF_{2a} and given 100 *u*g of Cystorelin at the time of AI.



A = Lutalyse®
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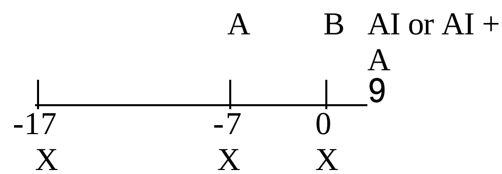
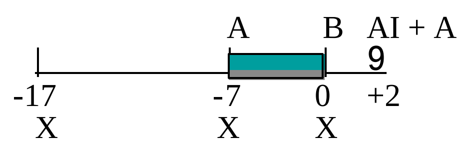
X = Blood sample
Norgestomet ear implant =

Study 3 (1997). Crossbred suckled cows (n = 406) (Simmental, Angus, and Hereford crosses) on two private ranches, plus 158 purebred Simmental, Angus, and Hereford suckled cows at KSU were used. Cows were treated with 100 *u*g of Cystorelin on day !7 and Lutalyse on day 0. They were inseminated after detected estrus, or in the absence of estrus, at 54 hr after Lutalyse and given 100 *u*g of Cystorelin at the time of AI.



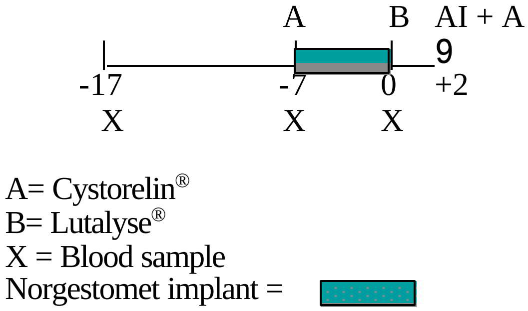
A = Cystorelin®
B = Lutalyse®
X = Blood sample

Study 4 (1998). Purebred Angus, Simmental, and Hereford cows (n = 187) at KSU were used. All cows received 100 *u*g of Cystorelin of day !7 and 25 mg of Lutalyse on day 0. Half of the cows also received an intravaginal progesterone insert (CIDR-B, InterAg, Hamilton, NZ) on day !7, which was removed on day 0. All were inseminated at 48 hr after Lutalyse and given 100 *u*g of Cystorelin at the time of AI.



A= Cystorelin®
B= Lutalyse®
X = Blood sample
CIDR® insert =

Study 5 (1999). Purebred Angus, Simmental, and Hereford cows (n = 187) at KSU were used. All cows received 100 *u*g of Cystorelin on day !7 and 25 mg of Lutalyse on day 0. Half also received an ear implant containing 6 mg of norgestomet on day !7. It was removed on day 0. All cows were inseminated 48 hr after Lutalyse and given 100 *u*g of Cystorelin at the time of AI.



Blood samples were collected prior to hormonal treatments to determine if cows had a functional corpus luteum. At least two blood samples were collected between 7 and 11 days before hormone administration and just prior to each hormone injection. Progesterone was measured by radioimmunoassay. If either or both samples contained one or more ng of progesterone per ml, then the cows were assumed to have ovulated and be cycling. If neither sample contained elevated progesterone, then the cow was anestrous. Further blood samples allowed us to determine if hormonal treatments induced ovulation in previously anestrous cows.

Body condition scores (1 = thin, 9 = fat) were assigned to cows on the first day of the breeding season, and days since calving were calculated for each cow.

The data were treated by analyses of variance to determine the effects of body condition score, parity, and days postpartum at the beginning of the breeding season on cyclicity. Further, the effects of various hormone treatments on the detection and expression of estrus were determined. In all analyses, herd and year were absorbed into the model.

Results and Discussion

Cyclicity

Body condition, parity, and days postpartum significantly affected the percentage of cows that were cycling before hormonal treatments and the beginning of the breeding season. Figure 1 illustrates the effect of body condition score. As body condition increased the percentage of cows cycling increased (P<.001) in a linear fashion. For every unit increase in body condition (range of 1 to 7), percentage of cows cycling increased (P<.01) by 18 ± 2%.

The literature indicates that beef cows should calve with a body condition score of at least 5 to prevent prolonged anestrus after calving. Cows may gain or lose body condition between calving and the beginning of the breeding season, depending on nutritional conditions, early grass growth, and supplementation. Clearly, body condition scores are predictive of cycling activity.

Percentage cycling was less (P<.001) for first-calf 2-year-olds than that for older cows even though the 2-year-olds calved 2 to 3 weeks earlier (Figure 2). The extra nutrient demand for growth clearly limits the proportion of 2-year-olds cycling at the beginning of the breeding season.

Estrus status also was influenced by days since calving (Figure 3). Percentage of cycling cows increased (P<.001) linearly before reaching a peak by 70 days postpartum. For every 10-day interval since calving (from <50 to 70 days), the percentage of cows cycling increased (P<.01) by 7.5 ± .7%. Thus, early calving is critical, because it allows more cows to be cycling by the start of the breeding season.

Estrus Expression

The percentage of cows expressing estrus during the first week of the breeding season is illustrated in Figure 4. A greater (P<.001) proportion of cycling cows than anestrous cows (70 vs. 40%) showed behavioral estrus early in the breeding season. However, an impressive proportion of anestrous cows was induced to show estrus by estrus-synchronization hormones.

The most effective hormonal treatments are those that include both Cystorelin and a progestin (Select Synch + NORG), compared to Cystorelin alone or injections of Lutalyse. Lutalyse is incapable of inducing estrus in noncycling cows, whereas norgestomet, Cystorelin, or both successfully induce cycling activity in suckled cows.

The percentage distribution of cows in estrus after treatment was influenced by a treatmentx cycling status interaction (P<.01; Figures 5 and 6).

The two treatments that included Cystorelin had similar distributions of estrus for cycling cows, with a peak percentage occurring between 49 and 60 hr. Estrus in the 2xPGF control occurred across a broad 144-hr period and lacked a defined peak.

The distribution of estrus among noncycling cows differed (P<.01) among treatments. The Select Synch cows were detected in estrus earlier than cows in the other treatments. A distinct peak in estrus of the Select Synch + NORG cows occurred between 37 and 48 hr, whereas estrus in the 2xPGF controls was distributed more broadly across the 144-hr period. The Select Synch + NORG treatment induced both the earliest and tightest synchrony of estrus. In that treatment, 50.5% showed estrus between 25 and 48 h after the PG_{F2a} injection, compared to 32.4% in the Select

Average interval from Lutalyse injection to estrus was affected by treatment (P<.01); location (P<.01); and cycling status at the beginning of the breeding season (anestrus vs. cycling; 54 ± 3 vs. 68 ± 3 hr; P<.001). Intervals to estrus for treatments that included Cystorelin + NORG (55 ± 4 hr) or Cystorelin alone (58 ± 4 hr) were similar but shorter (P<.05) than those in the 2xPGF controls (71 ± 5 hr). Body condition had no effect on interval to estrus, but for every 10-day increase in days between calving and the start of the breeding season (range of 22 to 120 days), a 2.2 ± 1 hr decrease (P=.05) occurred in the interval from Lutalyse to estrus.

Having more cycling cows at the beginning of the breeding season will maximize the proportion of cows that conceive to AI sires. More cows calving early during each successive calving season will enhance AI pregnancy rates, because more cows will be cycling before the breeding season begins. In addition, winter supplementation programs must maintain cows in body condition sufficient for cycling.

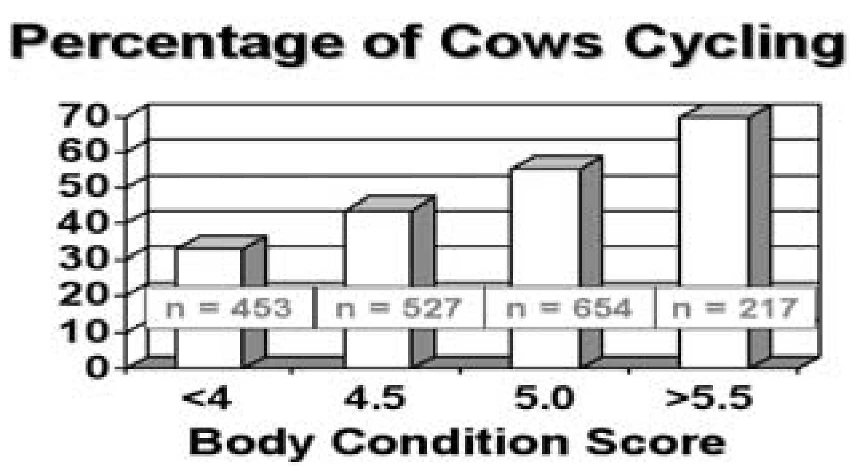


Figure 1. Effect of Body Condition Score on Percentage of Cows Cycling.

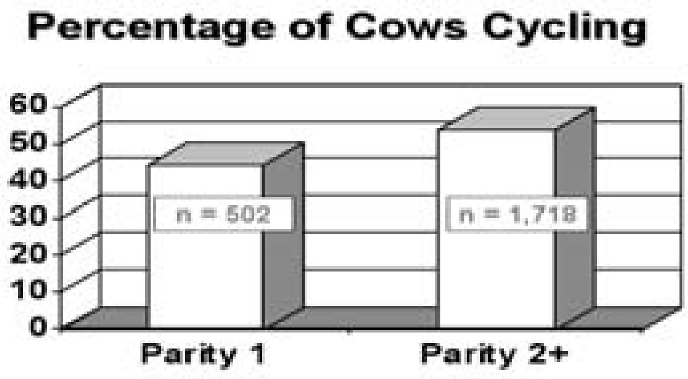


Figure 2. Effect of Parity on Percentage of Cows Cycling.

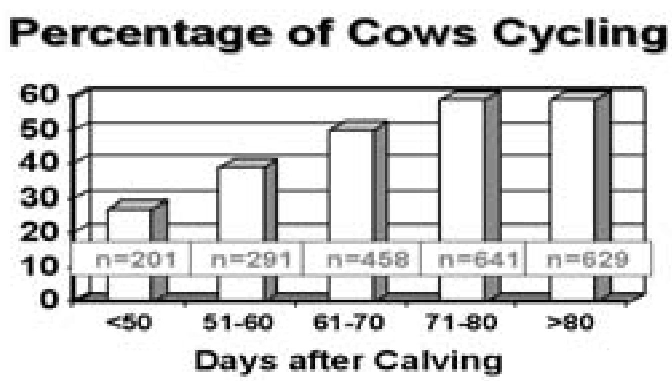


Figure 3. Effect of Days since Calving on Percentage of Cows Cycling.

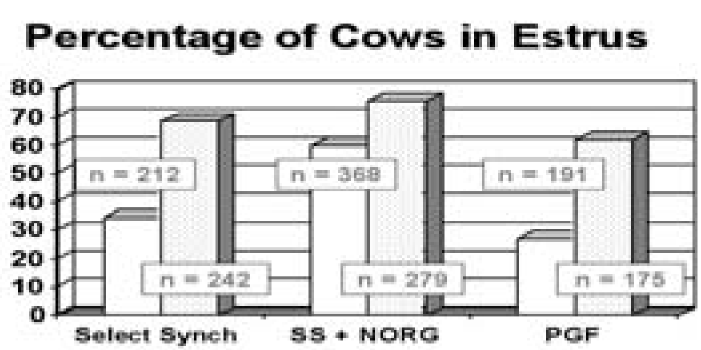


Figure 4. Effect of Hormonal Treatments on Percentage of Cows in Estrus during First Week of Breeding Season. (Open bars = anestrous; shaded bars = cycling.)

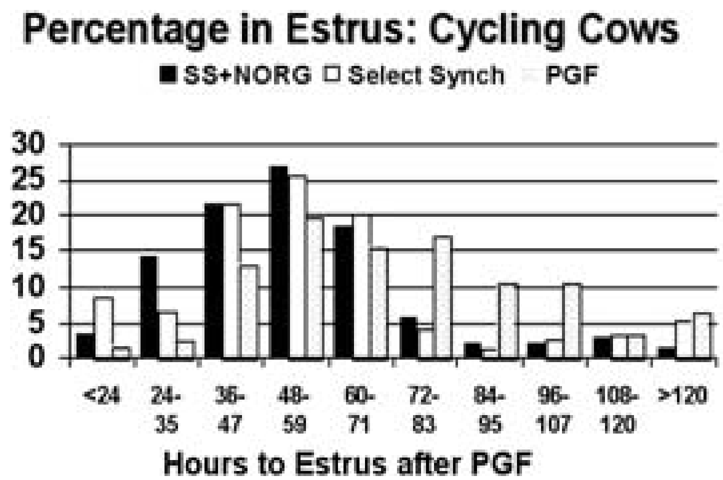


Figure 5. Effect of Hormonal Treatments on Percentage of Cycling Cows in Estrus.

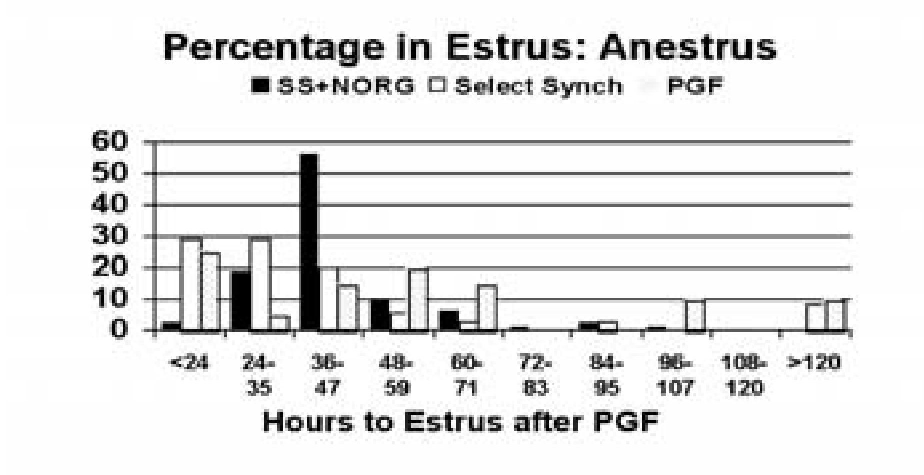


Figure 6. Effect of Hormonal Treatment on Percentage of Anestrous Cows in Estrus.