OVULATION INDUCTION METHODS COMPARED AMONG NON-CYCLING BEEF COWS

By

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INTRODUCTION:

Normally, cows that calve during a sixty day calving period have little difficulty returning to estrus and rebreeding in order to maintain a 365 day calving interval. However, many cows calve late due to poor nutrition, disease, a difficult delivery or a retained placenta or because they were mated to subfertile bulls. The use of ovulation induction techniques developed recently may allow cattlemen to shorten the time between calving and rebreeding, and thus shift a late calving cow into the normal calving herd.

PREVIOUS WORK:

The chain of events that occur between calving and the start of regular estrus periods is not completely understood. Short and co-workers (1972) found that cows having several cycles before breeding had higher conception rates than those bred at the first estrus following calving. Cows that cycle soon after calving have a chance for several cycles and higher fertility levels at the start of the breeding season. The effects of progesterone on estrus and ovulation have been investigated intensively since its discovery in 1935. When fed in the form melengestrol acetate $(MGA)^R$ or implanted in the ear $(Syncro\text{-}Mate\ B)^R$ it causes a unique "priming" response in non-cycling cows which aids in the resumption of regular estrus cycles. Smith et al. (1983) and Troxel et al. (1980) found that cows "primed" with Syncro-Mate B $(SMB)^R$ had an increased release of lutenizing hormone (LH) when gonadotropin releasing hormone (GnRH) was given thirty hours after removal of the SMB implant. Troxel and Kessler (1983) and Smith et al. (1987) evaluated progesterone concentrations of cows given GnRH. They reported that progesterone priming produced normal corpus luteum life spans provided blood serum levels of progesterone were maintained between two-three nanagrams per milliliter of serum. Timing of GnRH administration is important if a sustainable LH release is to be obtained in the non-cycling cow. Troxel and coworkers (1980) found that interruption of nursing for a minimum of twenty-four hours was needed to obtain a satisfactory GnRH induced LH release. Smith et al. (1983) found that thirty-two hour calf removal (CR) increased pituitary responsiveness to injected GnRH provided calves were not allowed with their mothers for at least eight hours after the GnRH was given. Further review of the literature indicates that most emphasis has been placed on the use of GnRH as an ovulation induction compound when used with progesterone. Human chorionic gonadotropin (HCG), which has primarily LH activity, also produces a similiar effect in the non-cycling cow. Pratt et al. (1982) evaluated GnRH and HCG in non-cycling cows and found both compounds increased the proportion of cows with palpable corpus luteums, although the luteal phases measured were abnormally short.

Considering the findings of these researchers, a breeding management study was designed to evaluate the ovulation induction potential of progesterone priming when used with or without short-term calf removal and with either GnRH or HCG as precursor treatments to a seven day single injection Lutalyse synchronization program. The objective was to determine if ovulation induction techniques administered to cows thirty-three days after calving would induce an additional heat cycle before breeding that would result in a higher number of first service and twenty-five day pregnancies, when compared to untreated controls, in a Lutalyse synchronization breeding program. The trial was further designed to compare the first service and twenty-five day pregnancy rate responses between cows bred at the induced heat cycle with cows that were not bred until the second heat cycle following induction. The last objective was to monitor the life span of luteal tissue formation.

PROCEDURE:

The experiment contains two phases. In Phase I, cows were subjected to several ovulation induction treatments but breeding was delayed until the start of the second heat cycle at which time the cows were subjected to a seven day single injection Lutalyse synchronization program. In Phase II, a second but unrelated group of cows were subjected to one of the ovulation induction treatments without the use of Lutalyse, and were bred naturally on the induced heat. A schematic of the trial design in shown in Table 1.

PHASE I:

Forty-nine third calf and older Hereford and Angus x Hereford cows and their calves were used in the investigations. After calving, but before the induction period began, the cows and calves were kept in a sheltered pasture area of approximately 20 acres. The cows were observed twice daily for standing heat and if detected in heat they were removed from the study. While the induction treatments were administered and during a thirty day progesterone monitoring period the cows were housed in drylot to simplify blood serum collections. While in drylot they were maintained on the following ration:

INGREDIENT	DRY MATTER
Alfalfa hay	7.7
Mixed Hay	6.6
Soybean meal	1.0
Corn silage	13.0
TOTAL	28.3

*Minerals were fed free choice in mineral feeders in the following ration: One part TM salt to one part dicalcium phosphate.

The postpartum interval of cows used ranged from twenty-nine to thirty-nine days and averaged thirty-three days when the Syncro-Mate-B implants were installed.

Cows receiving Syncro-Mate-B, were implanted between 8 A.M. and 10 A.M. and the implants were removed nine days later.

The calves were separated from their mothers when the implants were removed, and were returned to their mothers forty-eight hours later. While separated from their mothers, they were housed in a sheltered feedlot pen with fresh water and first cutting alfalfa hay.

Those treatments assigned to receive GnRH or HCG were injected thirty hours after implant and calf removal. Each cow, depending upon treatment, was injected with either 2000 IU of HCG or 1000 micrograms of GnRH in the rump muscle.

After the induction techniques were completed, the cows were observed for standing heat with the aid of epididectomized marker bulls equipped with chin ball marking devices. Corpus luteum development and its subsequent life span was monitored by measuring serum progesterone levels gathered during the period of ovulation indication and during the sixteen day period following gonadotropin administration. Whole blood samples were collected in heparinized tubes via jugular vein puncture. The samples were placed in an ice water bath immediately after collection. Once collection was completed, the samples were held at refrigerator temperature until the following morning when they were centrifuged and the serum collected and frozen for later analysis by radioimmunoassy. The assay was conducted by Mr. Jim Hirsh under the direction of Dr. Dale Redmer, NDSU reproductive physiologist.

Beginning on May 27, 1987, cows from all treatments were combined and subjected to a single injection Lutalyse synchronization program. During the first seven days of the breeding season the cows were detected for standing heat using sterile bulls equipped with chin ball marking harnesses, and were inseminated twelve-fourteen hours later using semen from two Charolais sires. On the morning of the seventh day (8am), all remaining cows were injected with 5 ml. (25mg) of Lutalyse^{R} deep in the rump muscle. Following the Lutalyse^{R}, the cows were detected and inseminated for an additional five days.

In September, the cows were pregnancy tested and those not determined pregnant were sold. The remaining cows calved in the spring of 1988.

PHASE II:

In 1987, fifty-one cows from two to eight years old were used in Phase II and consisted of Hereford, Angus x Hereford, Milking Shorthorn x Angus x Hereford, and Simmental x Hereford breeding. The cows were grouped by calving date into three ovulation induction groups. The interval between calving and SMB implantation for the groupings was 35, 37, and 30 days for Groups One, Two, and Three. Each of the groups was induced using the Syncro-Mate-B/HCG/48 hr. calf removal method and were bred naturally at the induced heat cycle. Lutalyse^{R} was not used in Phase II. Syncro-Mate-B implants remained in place for eleven days. The implants were removed and calves separated from their mothers at 8 A.M. on the morning of the eleventh day, and 2000 IU of HCG was injected thirty hours after implant removal. Fertile Charolais bulls were placed with groups of from five to seven cows per group following removals of the implants. Once the induced heat cycle was completed, the cows were combined with a single Charolais bull until the breeding season was completed on August 10, 1987.

In 1988, Phase II was expanded to include the following four treatments: 1) Control, 2) SMG-HCG-CR, 3) SMG-HCG, and 4) SMG-HCG-CR-Lutalyse. Each of these treatments, except Treatment Four, was used and described in Phase I. In Treatment Four, Lutalyse was administered seventeen days after the SMG-HCG-CR regime was completed. Breding was done naturally using a ratio of seven cows per bull.

Data from the 1987 breeding have been summarized in Tables 1, 2 and 3. Table 1 contains a schematic of the trial design and the 1988 modifications to Phase II. Development and longevity of the corpus luteum, based on serum progesterone level is shown in Table 2 and the Phase I and II pregnancy rates for the various treatments are summarized in Table 3.

SUMMARY:

In Phase I, progesterone priming increased the number of cows identified in standing heat following implant removal, and cows in the progesterone primed treatments had a much higher incidence of normal corpus luteum development based on progesterone monitoring. While the progesterone priming appears to have been quite consistent in those treatments where priming was used, the pregnancy data is inconsistent. There appears to be a substantial set back in early pregnancy rate where short-term calf removal was used in conjunction with progesterone priming. By contrast, when either GnRH or HCG were used with progesterone priming, a marked increase was measured in the first service pregnancy rate and the number of cows pregnant in the first twenty-five days of breeding season. Compared to the control group, pre-treatment with HCG-CR one heat cycle prior to synchronization with Lutalyse was the only treatment with a higher first service conception rate. Using the HCG-CR pre-treatment resulted in a 100% first service pregnancy rate as compared to 85.7% in the control group.

In Phase II, breeding on the induced heat cycle, resulted in a 36% first service pregnancy rate and a 68.7% pregnancy rate after twenty-five days of breeding. Although this is encouraging with respect to moving late calving cows up, there was an unacceptable number of open cows at the end of the breeding season. The expansion of Phase II implemented in 1988 is aimed at evaluating methods that may increase the number of first service and twenty-five day pregnancies, and lower the number of non-breeders.

LITERATURE CITED

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Table 1. Schematic of Phase I and II Ovulation Induction Treatments

Phase I

Calf Treatment	Steroid Treatment	Gonado-tropin	Releasing Hormone	No. Head
1. Removed	Syncro-Mate-B	----	GnRH	7
2. Removed	Syncro-Mate-B	HCG	----	7
3. Not Removed	Syncro-Mate-B	----	GnRH	7
4. Not Removed	Syncro-Mate-B	HCG	----	7
5. Removed	----	----	GnRH	7
6. Removed	----	HCG	----	7
7. Not Removed (Control)	----	----	----	7
			Total	49

Phase II – 1987

1. Removed	Syncro-Mate-B	HCG	Group 1	-	14
			Group 2	-	22
			Group 3	-	15
			Total		51

Phase II – 1988

1. Control	----	----		11
2. Removed	Syncro-Mate-B	HCG		14
3. Not Removed	Syncro-Mate-B	HCG		11
4. Removed	Syncro-Mate-B	HCG	Lutalyse	12
			Total	48

Table 2. Summary of Corpus Luteum Development based on Blood Serum Analysis, 1987

PHASE I 1/				
Treatments	**Ovulations with Normal Corpus L. Development**	**Ovulations with Short or Alter-ed Corpus L. Dev.**	**No. that did not ovulate**	**Days from Calving to Progesterone Priming Treatment**
SMB-GnRH-CR	5/7 - 71.4%	2/7 - 28.6%	----	34
SMB-HCG-CR	4/7 - 57.2%	1/7 - 14.3%	2/7 - 28.6%	33
SMB-GnRH-No CR	5/7 - 71.4%	1/7 - 14.3%	1/7 - 14.3%	32
SMB-HCG-No CR	5/7 - 71.4%	2/7 - 28.6%	----	34
GnRH-CR	1/7 - 14.3%	2/7 - 28.6%	4/7 - 51.7%	--
HCG-CR	2/7 - 28.3%	3/7 - 42.8%	2/7 - 28.3%	--
Control	2/7 - 28.6%	5/7 - 71.4%	----	--

1 Phase I cows were subjected to ovulation induction treatments but were not bred artificially until the second heat cycle.

Table 3. Phase I and II Pregnancy Rates Following Ovulation Induction Treatments, 1987

Phase I 1/							
Treatment	**No. Head**	**Calving to Prog. Treat.**	**Calving to Prog. Treat.**	**1st Cycle**	**2nd Cycle**	**3rd Cycle**	**Open**
SMB-GnRH-CR	7	34	44	57.1	---	28.6	14.3
SMB-HCG-CR	7	33	43	66.7	16.7	---	16.7
SMB-GnRH-NO CR	7	32	42	71.4	14.3	---	14.3
SMB-HCG-NO CR	7	34	44	85.7	14.3	---	---
GnRH-CR	7	---	43	85.7	14.3	---	---
HCG-CR	7	---	44	100.0	---	---	---
CONTROL	7	---	---	85.7	14.3	---	---
Phase II							
SMB-HCG-CR 2/							
Group 1	14	35	47	21.4	64.3	---	14.3
Group 2	23	37	49	43.5	26.1	4.3	26.1
Group 3 3/	14	30	42	42.9	7.4	---	50.0
Group Total	51	34	46	37.3	31.4	2.0	29.3
Combined 25 Day Pregnancy Rate					68.7		

1/ Phase I cows were not bred on the induced heat cycle. Breeding was delayed until the next heat cycle when the cows were bred artificially in a seven day single injection Lutalyse program.

2/ Phase II cows were bred naturally on the induced heat cycle.

3/ Cows in group three calved very late in the calving season and had only 25 days to become pregnant before the end of a 60 day breeding season.