OVULATION INDUCTION METHODS COMPARED AMONG NON-CYCLING BEEF COWS

By

D. G. Landblom, J.L. Nelson and D. Redmer

INTRODUCTION

In the spring of 1987, an experiment was initiated to evaluate several ovulation induction methods which, based upon basic research, appear to be viable methods for shortening the interval from calving to rebreeding in beef cattle. Normally, cows that calve during a sixty-day calving season have very little problem cycling and rebreeding by the start of the next breeding season. However, there are a number of situations that can affect fertility in both cows and breeding bulls that can result in extended calving seasons. Ovulation induction techniques have been developing rapidly in recent years and show promise for shortening the interval between calving and the return to regular cyclicity. This trial is designed to investigate the use, management, and on-farm application of ovulation induction techniques.

PREVIOUS WORK

A thorough understanding of the chain of events that occur between calving and the resumption of regular estrous cyclicity is limited. However, the value of early return to estrus was shown by Short and co-workers (1972) who found that conception rates were lower among cows bred at the first estrus following calving than cows that were bred after several cycles.

Progesterone, especially its effects on estrus and ovulation in the female, has been investigated extensively since its discovery in 1935, and when fed (MGA) or implanted (Syncro-Mate-B), produces a unique "priming" response in the non-cycling cow. This priming response aids in initiating resumption of regular cycles. Smith et al (1983) and Troxel et al (1980) found that when cows were primed with the progesterone implant, Syncro-Mate-B, an increased release of lutenizing hormone (LH) could be obtained when a compound named gonadotropin releasing hormone (GnRH) was given approximately thirty hours after the progesterone implant was removed. Troxel and Kessler (1983) and Smith et al (1987) evaluated progesterone concentrations of cows given GnRH and reported that progesterone priming netted corpus luteum life spans of normal duration, provided sustained blood serum levels of progesterone are held between 2 – 3 nanagrams/ml.

Administration timing of GnRH is important if a sustainable LH release is to be obtained in the non-cycling cow. Troxel and co-workers (1980) were able to show that interruption of nursing for at least twenty-four hours was needed to obtain a satisfactory GnRH induced LH release, and Smith et al (1983) found that a thirty-two hour calf removal increased pituitary responsiveness to injected GnRH provided calves were not returned to their mothers for at least eight hours after GnRH was given.

Further review of the scientific literature indicates that most emphasis has been placed on the use of GnRH as an ovulation induction compound when used with progesterone. However, human chorionic gonadotropin, which has primarily LH activity, also produces a similar effect in the non-cycling cow. Pratt et al (1982) evaluated GnRH and HCG in the non-cycling cow and found that treatment with either compound increased the proportion of cows in heat on day eight through twelve and the proportion of cows with palpable corupus luteums did not differ between treatments. While corpus luteum palpations did not differ, the luteal phases measured where characterized as being abnormally short.

Considering the findings of these researchers, the primary objectives of this project are to evaluate the ovulation induction potential of progesterone priming under drylot and range conditions when used with or without short-term calf removal and with either GnRH or HCG, to determine which treatment will stimulate luteal tissue formation of normal life span, and to determine the overall conception rates and economics of each method. The secondary objectives are to identify any handling problems associated with short-term removal of the young calf, and to determine the effect that ovulation induction in the first year has on return to regular cyclicity in the subsequent breeding season.

PROCEDURE

This experiment is separated into two phases. In phase one, 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 synchronized artificial breeding program. In phase two, a second but unrelated group of cows were subjected to one of the ovulation induction treatments and were bred naturally with bulls on the induced heat. A schematic of the trial design is shown in Table 1.

Phase I

Forty-nine third calf and older Hereford and Angus X Herford cows and their calves were used in the investigations. After calving, but before the induction period began, the cows and calves were housed together 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 consideration in the study. While the induction treatments were being administered and during a thirty day progesterone monitoring period the cows were housed in dry-lot to simplify blood collections. While in drylot they were maintained on the following ration:

Pounds Dry Matter	Ingredient	Pounds as Fed (58% Moist.)
7	Alfalfa Hay	7.7
6	Mixed Hay	6.6
1	Soybean Meal	1.0
13	Corn Silage	48.0
	Minerals*	
	Total	**63.3**

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

The postpartum interval of cows selected for randomization to treatments ranged from twenty-nine to thirty-nine days and averaged thirty-five days when Syncro-Mate-B implants were installed.

Those cows that were assigned to receive the progesterone priming implant, Syncro-Mate-B, were implanted between 8 and 10 A.M. on the morning of April 29, 1987 and the implants remained in place until they were removed, in approximately the same time frame, on the morning of May 7, 1987; a period of nine days.

At the time Syncro-Mate-B implants were removed, calves in the calf removal treatments were removed for a period of 48 hours. The withholding period began when the calves were sorted from their mothers for implant removal on May 7, 1987 (8 am), and they were returned to their monthers on May 9, 1987 (8 am). While removed, the calves were housed in a sheltered feedlot pen with fresh water and calf starter pellets available.

Those treatments that were assigned to receive GnRH or HCG were given the gonadotropins 30 hours after calf removal. Each cow received 2000 IU of either GnRH or HCG in the rump muscle.

After the induction techniques were completed the cows were observed for standing heat both visually and with the aid of epididectomized marker bulls equipped with chin ball marking devices. Serum progesterone levels were used to monitor corpus luteum development and subsequent life span, which required blood sample collection during the period of ovulation induction, and during the 16 day period following gonadotropin administration. Whole blood samples were collected, centrifuged and the serum collected and frozen for analysis by radioimmunoassy. The assay was conducted by Dale Redmer, NDSU reproductive physiologist.

Beginning on May 27, 1987, cows in all treatments were put together 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 epididectomized marker bulls equipped with chin ball markers, and visual observation. Those cows detected in heat were inseminated 12-14 hours later. Charolais semen from two different sires was used. On the morning of the seventh day (8 am), all cows that had not been detected and inseminated were injected with 5 ml. (25mg) Lutalyse deep in the rump muscle. Following the injections, the cows were detected and inseminated for an additional five days.

All cows were pregnancy tested on September 1, 1987 and the fetal age was estimated.

Phase II

Fifty-one cows used in Phase II were Hereford, Angus x Hereford, Milking Shorthorn x (Angus x Hereford), and Simmental x Hereford breeding and ranged in age from two to eight years. The cows were grouped according to calving date into three ovulation induction groups. The interval between calving and implantation for the groupings was 35, 37 and 30 days for groups one, two, and three. Each of the groups were induced using the Syncromate-B/HCG/short term calf removal method and were bred naturally at the induced heat cycle. In this phase, Syncro-Mate-B implants remained in place for a period of eleven days. HCG was then injected as near to thirty hours after implant removal as possible. Depending on the size of the group, five to seven cows were placed with each bull. Once the induced heat cycle was completed, the cows were grouped together with a single bull until the breeding season was completed on August 10, 1987.

SUMMARY

The data being presented here are incomplete, and definite conclusions are not possible.

Progesterone priming did improve the number of cows that were identified in standing heat following implant removal, and those cow groups that were primed 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 all of the treatments where priming was used, the pregnancy data are 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 progesterone priming was not used in conjunction with either of the gonadotropins, GnRH or HCG, calf removal resulted in a marked increase in the first service pregnancy rate and the number of cows pregnant in the first 25 days of the breeding season. In addition, those cows that received either gonadotropin along with calf removal had equal pregnancy rates (100%) in the first 25 days of the breeding season when compared to the control group, but the gonadotropin/calf removal groups had a substantially higher proportion of first service pregnancies. This is in agreement with Troxel and co-workers who were able to show that cows not primed with progesterone, but subjected to short term calf removal (27-32 hours), demonstrated increased pituitary responsiveness to the gonadotropin GnRH.

Short term calf removal has not been difficult, although it does require extra labor and tight holding facilities with easily accessible water and high quality hay. Mothering-up calves could be a potential problem, but has not been in the studies done using this technique.

Breeding naturally, in the progesterone primed/HCG/Calf removal group in which breeding was done on the induced heat cycle, produced extended pregnancies. While this did occur, the number of cows identified as pregnant in the first 25 days of the breeding season was still quite encouraging and ranged from 60% in group three to 72.7% in group two.

More work needs to be done with ovulation induction, particularly as it pertains to the timely application of treatments. In the next breeding season the number of treatments that will be bred naturally on the induced heat cycle will be expanded.

Table I. Schematic of Ovulation Induction Treatments in Phases I and II

Phase I

Calf Treatment	Steroid Treatment	Gonadotropin Treatment	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

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

Table 2. Summary of Corpus Luteum Development, Life Span, and Subsequent Pregnancy Rate among Phase I Ovulation Induction Treatments, and Pregnancy Rate by Cycle among Phase II Induction Groups

PHASE I 1/								
					Percent of Cows Pregnant in Each Heat Cycle:			
Treatments	**Ovulations with Normal CL Dev.**	**Ovulations with Altered CL Dev.**	**No Ovulation Response**	**Days From Calving to Gonad. Trmt.**	**1st Cycle**	**2nd Cycle**	**3rd Cycle**	**Open**
Syncro-Mate-B, GnRH, Calf Removal	5/7 - 71.4%	2/7 - 28.6%	-----	43 da	28.6%	14.3%	28.6%	28.6%
Syncro-Mate-B, HCG, Calf Removal	4/7 - 57.2%	1/7 - 14.3%	2/7 - 28.6%	42 da	42.8%	28.6%	14.3%	14.3%
Syncro-Mate-B, GnRH, No Calf Removal	5/7 - 71.4%	1/7 - 14.3%	1/7 - 14.3%	41 da	85.7%	--	--	14.3%
Syncro-Mate-B HCG, No Calf Removal	5/7 - 71.4%	2/7 - 28.6%	-----	43 da	57.1%	42.8%	--	--
GnRH & Calf Removal	1/7 - 14.3%	2/7 - 28.6%	4/7 - 51.7%	42 da	71.4%	28.5%	--	--
HCG & Calf Removal	2/7 - 28.3%	3/7 - 42.8%	2/7 - 28.3%	43 da	71.4%	28.5%	--	--
Control	2/7 - 28.6%	5/7 - 71.4%	-----	43 da	57.1%	42.8%	--	--
PHASE II 2/								
Syncro-Mate-B HCG, Calf Removal			Group One	49 da	--	71.4%	14.3%	14.3%
			Group Two	49 da	27.3%	45.4%	13.6%	13.6%
			Group Three	41 da	46.7%	13.3%	-- 3/	40.0% 4/

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

2/ Phase II cows were subjected to ovulation induction treatments and bred naturally at the induced estrus.

3/ Cows in the third induction group calved very late in the calving season and therefore had only 25 days to become pregnant before the end of the breeding season.

4/ On September 11th, when these cows were pregnancy tested, they all were scored as "open" but may possess undetectable pregnancies.

LITERATURE CITED

Pratt, B.R., Berardinelli, J.G., Stevens, L.P., and Inskeep, E.K. 1982. Induced Corpora Lutea in the Postpartum Beef Cow. 1. Comparison of Gonadotropin Releasing Hormone and Human Chorionic Gonadotropin and Effect of Progestogen and Estrogen. J. Anim. Sci. 54:822.

Short, R.E., Bellows, R.A., Moody, E.L. and Howland, B.E. 1972. Effects of Suckling and Mastectomy on Bovine Postpartum Reproduction. J. Anim. Sci. 34:70.

Smith, M.F., Lishman, A.W., Lewis, G.S., Harms, P.G., Ellersieck, M.R., Inskeep, E.K., Wiltbank, J.N., and Amoss, M.S. 1983. Pituitary and Ovarian Responses to Gonadotropin Releasing Hormone, Calf Removal and Progestogen in Anestrous Beef Cows. J. Anim. Sci. 57:418.

Smith, V.G., Chenalt, J.R., McAllister, J.F., and Lauderdale, J.W. 1987. Response of Postpartum Beef Cows to Exogenous Progestogens and Gonadotropin Releasing Hormone. J. Anim. Sci. 64:540.

Troxel, T.R., Kesler, D.J., Noble, R.C. and Carlin, S.E. 1980. Ovulation and Reproductive Hormones Following Steroid Pretreatment, Calf Removal and GnRH in Postpartum Suckled Beef Cows. J. Anim. Sci. 51:652.

Troxel, T.R. and Kesler, D.J. 1983. Progestin Pretreatment Enhances the Function of Corpora Lutea Induced by Gonadotropin Releasing Hormone Treatment in Postpartum Suckled Beef Cows. J. Anim. Sci. 57 (Suppl. 1): 107.