THE EFFECTS OF SYNCRO-MATE B AND/OR CALF MANAGEMENT ON REPRODUCTIVE PERFORMANCE IN THE BEEF COW

by

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REVIEW OF LITERATURE

The use of estrus synchronization could decrease costs associated with artificial insemination of cattle especially if it did not adversely affect fertility. In addition the technique might be used to increase the number of cows calving early in the calving season which would result in a heavier weaning weight. Some treatments might also be a means to start anestrous postpartum cows to cycle.

Many methods and materials have been employed in an attempt to control the estrous cycle of cattle. One method is to supply progesterone or a progestagen to a group of cows until their own endogenous supply of progesterone has dropped and then by removing the exogenous progestagen all cows should start their next cycle at about the same time. Another approach is to supply some agent that causes regression of the corpus luteum and in turn diminishes the progesterone thus allowing the animals to start a new cycle. A combination of these two methods could also be used to synchronize estrus.

One of the first methods used to control the estrous cycle was daily injections of progesterone (Christian and Cassida, 1948). They found daily injections of 50 mg of progesterone would suppress estrus and ovulation. Subsequently, Ulberg et al. (1951) found that injections of progesterone as low as 12.5 would prevent estrus and ovulation but anything

lower than 12.5 mg would allow estrus and ovulation to occur during treatment. Trimberger and Hansel (1955) found that a 14 day treatment of progesterone lowered fertility on the first service after treatment withdrawal.

Since the first use of progesterone, other progestagens have been found that could be administered in ways other than by injection. Some of these progestagen agents are CAP, MAP, MGA, norethandrolone, DHPA and norgestomet (SC21009). The use of 6-chloro-6-dehydro-17-acetoxyprogesterone (CAP) as a synchronizing agent has been studied by several investigators (VanBlake et al., 1963; Hansel et al., 1966; Wagner et al., 1968; Rey, 1975; Grunert, 1975). Estrus is synchronized at 4 to 9 days following withdrawal of CAP (VanBlake et al., 1963; Rey, 1975). However, fertility following an 18 day feeding regime of CAP was lowered at the first estrus following CAP withdrawal (Hansel et al., 1966). Wagner et al. (1968) also reported low fertility when CAP was fed for 14 days. The effect was observed in ova fertilization rate 3 days post-breeding and the number pregnant 60 days post-breeding. However, they found a significant reduction in both controls and CAP treated animals in the number pregnant 60 days post-breeding when compared to 3 day ova fertilization rates. Methods to increase fertility following 18 days of 10 mg/day of CAP were investigated by Grunert (1975). He found that 5 mg estradiol benzoate 24 hr before first insemination had no affect on fertility, and 1000 iu of HCG 6 hr before first

insemination decreased fertility. However, 1.5 mg GnRH 5 hr before first insemination increased fertility from 36.4% to 63.3%.

Another progestagen evaluated for estrus synchronization is 6-methyl-17-acetoxy-progesterone (MAP). Hansel et al. (1966) and Dhindsa et al. (1967) both reported fertility at the synchronized estrus following MAP was equal to that of controls. Dhindsa et al. (1967) reported a significantly higher calving rate during three estrous cycles for MAP fed cows than controls (97% vs 83%).

The use of a 16-day implant of 17-ethyl-19-norestosterone (norethandrolone) has been found to be an effective means of synchronizing estrus (Curl et al., 1968; Wiltbank et al., 1971). Fertility at the first estrus was reduced as with most other long term progestagens.

With the use of dihydroxyprogesterone acetophenide (DHPA) Wiltbank et al. (1967) reported that 96% of treated heifers exhibited estrus within a 48 hr period when fed 500 mg DHPA/head/day for 20 days. They reported that there was no significant difference from controls in the fertility of these heifers.

Melengestrol acetate (MGA), another progestagen, has been shown effective in synchronizing estrus if 1 mg/head/day is fed for 14 or more days. It has also been put into an ear implant and found to be just as effective. Estrus usually occurs between day 2 and 6 following MGA withdrawal. Lauderdale

et al. (1972) reported that with a 14-day MGA ear implant 87.5% of the heifers exhibited estrus between days 2 and 6 after implant removal. It has also been reported that fertility on the first estrus after MGA removal is significantly reduced if MGA is present for 14 days or more (Chakraborty et al., 1971; Lauderdale et al., 1972; Henricks et al., 1973; Wetteman and Hafs, 1973).

Progesterone impregnated silicone implants, placed subcutaneous in the neck region, effectively synchronize estrus (Reynolds et al., 1973; Roche, 1974b). They found when the implants were removed 20 days after insertion estrus was synchronized, but fertility at first estrus was lowered.

Since most researchers found that a long term treatment of progesterone or progestagen lowered fertility at first estrus following treatment, the possibility of shortened progestagen treatment is attractive. A short-term progesterone treatment could be used if an agent that would cause early regression of the corpus luteum were available. Wiltbank et al. (1961) found that if estrogen was given to heifers before day 10 of their cycle the corpora lutea underwent early regression 80 to 90 percent of the time. Loy et al. (1960) reported impaired maintenance of the corpus luteum with daily injections of estradiol-17β on days 1 through 13 of the estrous cycle. The corpus luteum was smaller, contained less progesterone and had fewer functional luteal cells. Impaired maintenance occurred with either an injection of progesterone on day 1 or day 5 of the estrual cycle.

The use of short-term progesterone or progestagen treatment plus an estrogen injection for early corpus luteum regression has been investigated by many researchers. Wiltbank et al. (1971) compared fertility of heifers treated with norethandrolone implants for 16 days with heifers given norethandrolone implants for 9 days and an injection of 5 mg estradiol valerate (EV) given at implantation with untreated controls. The percent heifers showing estrus within 96 hr of implant removal was no different between the 16-day treatment and 9-day treatment (87% vs 93%). First service conception rate was not different for the 9-day treatment or controls (61% vs 65%), however, the first service conception rate for the 16-day treatment was significantly lowered (38%). Roche (1974) reported that reducing the period of administration of progesterone from 20 to 10 days and giving 5 mg estradiol benzoate (EB) on day of implant insertion increased the conception rate to normal but lowered estrus response.

Thimonier et al. (1975) reported better estrus synchronization with 6 or 7 mg/day norethandrolone for 18 days than either 7 mg/day norethandrolone or 12 mg implants of SC21009 for 9 to 10 days with an injection of 5 mg EV on the first day of treatment (100% vs 68.2%). Fertility as calving percent, was just the opposite (33.9% vs 56.3%). They concluded that a high conception rate seems imcompatible with a high degree of synchronization obtained by a long progestagen treatment. Chupin et al. (1975) reported that as duration of progestagen

SC21009 treatment increased, fertility at the induced estrus decreased.

Several researchers have investigated possible reasons for lowered fertility at the first estrus of progesterone and progestagen treated cattle. Reed and Rich (1972) reported a faster passage of ova through the tract in MGA treated cows than controls. Hill et al. (1971) found a higher proportion of uncleaved ova in MGA treated heivers than controls. They also reported fewer graffian follicles (>3mm) were on the ovaries of heifers receiving MGA. Reed and Rich (1972) found a higher percent ovarian abnormalities in MGA treated cows than controls (24.5% vs 7.7%). Wordinger et al. (1970) found that endometrial and glandular epithelial cell heights were greater in the MGA treated animals than untreated controls.

Dobson et al. (1973) found lowered progesterone levels in MGA treated cows during the follicular phase. Rodeffer et al. (1972) reported that the mean estrogen peak preceded the mean LH peak by about .5 days in untreated heifers and that in heifers given progesterone for 18 days the mean estrogen peak was .5 days after the mean LH peak. Wetteman and Hafs (1973) found that MGA treated cows had significantly elevated levels of estradiol at proestrus and estrus. They concluded that this prolonged duration of elevated estradiol during or after MGA may be related to infertility, possibly by altering the uterine and oviducal environments.

Lauderdale and Ericson (1970) hypothesized that the cause of reduced fertility at synchronized estrus may be due to the

"hyper-estrogenic" condition triggering increased leukocytic activity in the uterus which speeds up alteration of sperm physiology and phagocytosis of sperm. Lowered fertility would then be a result of fewer sperm in the oviduct as a result of increased phagocytosis of sperm and sperm having a shorter fertilizing life span between normal time of insemination and ovulation.

Progesterone impregnated intravaginal silastic coils for 12 days with an injection of 5 mg estradiol benzoate and 50 mg progesterone at time of insertion synchronized estrus with 91% of 340 cows exhibiting estrus within 2 to 6 days following coil removal (Roche, 1975). Fertility was not different between controls and synchronized cows bred by estrus. Fertility following a fixed time insemination at 48 hr with 100 µg GnRH given 30 or 36 hr after coil removal or at 56 hr or 56 and 74 hr without GnRH was not significantly different from controls (Roche, 1975; Roche, 1976).

The use of a 9-day ear implant of 6 mg 19-alpha-acetoxy-11-beta-methyl-19 nor Preg 4-ene 3,2 dione (SC21009) with an injection of 5 or 6 mg estradiol valerate for estrus synchronization has been shown to result in at least 75% of the heifers exhibiting estrus in the first 3 days following implant removal (Burrell et al., 1972; Knox et al., 1972; Smith and Vincent, 1973). Smith and Vincent (1973) reported that 58% of the heifers exhibited estrus in the first 3 days following this treatment if they were on day 5, 6 or 7 of their cycle

when treatment was initiated. They got 82% of heifers, later than day 7 of their cycle when treatment started, to exhibit estrus within 3 days post-treatment. They, therefore, concluded that this treatment didn't effectively synchronize heifers in the first 7 days of their cycle when treatment began.

A 9-day ear implant of 6 mg SC21009 with an injection of 3 mg SC21009 and 5 or 6 mg estradiol valerate is referred to as the Syncro-Mate B treatment. Wiltbank and Gonzalez-Padilla (1975) found they could induce estrus in non-cycling heifers with the Syncro-Mate B treatment. They found 94% of the treated heifers exhibited estrus within 4 days while only 50% of the untreated controls showed estrus in 45 days. After 45 days of breeding 94% of the treated and 7% of the controls were pregnant.

Wishart (1975) observed ovulation time in heifers after the Syncro-Mate B treatment. He concluded Syncro-Mate B synchronizes ovulation to an extent which should permit insemination of animals at one or more pre-determined times following implant removal with the expectation of similiar levels of fertility to those animals inseminated on detection of estrus after Syncro-Mate B treatment.

Wishart and Young (1974) in using the Syncro-Mate B treatment found 88% of the cattle showed estrus by 72 hr after implant removal. First service conception rates were 51%, 41.2% and 65.2% for cattle bred by estrus, bred at 48 hr and bred at 48 hr and 60 hr after Syncro-Mate B treatment.

Injection of prostaglandin $F_{2}\alpha$ ($PGF_{2}\alpha$) has been shown to induce luteolysis in a variety of species including cattle (Rowson et al., 1972; Lauderdale, 1972; Liehr et al., 1972; Louis et al., 1972). Moore (1975) found that a single infusion of 4 mg $PGF_{2}\alpha$ was the most effective intrauterine treatment. No advantage was gained from 2 infusions either 8 or 24 hr apart. Intramuscular injection was as effective as intrauterine infusion, but the effective dose was some 4 or 5 times greater. In this report rarely did more than 65% of the animals exhibit estrus within 6 days. The peak time of estrus was 2 to 4 days after treatment.

Investigators have found that $PGF_{2}\alpha$ is not effective in causing luteolysis in cattle that are earlier than day 5 of their estrous cycle (Liehr et al., 1972; Rowson et al., 1972; Hill et al., 1973; Hendricks et al., 1974). Roche (1974) synchronized estrus in a group of heifers between day 5 and 20 of their cycle with an intramuscular (im) injection of 20 mg $PGF_{2}\alpha$ and found the majority of heifers to be in estrus within 4 days of injection. No difference in fertility was seen between treated and untreated with regard to fertility. Lauderdale et al. (1974) also found no difference in fertility between untreated controls, treated bred by estrus and treated bred at 72 and 90 hr after the injection when all cows had a palpable corpus luteum at the time of injection.

Two injections of $PGF_{2}\alpha$, given 11 to 12 days apart, will synchronize estrus in the majority of the cycling heifers and

cows (Lauderdale, 1975; Hafs et al., 1975). They reported normal fertility can be achieved independent of estrus detection if the cows are bred at 70 and 88 hr or 72 and 90 hr after the second injection of $PGF_2\alpha$.

ICI 79939 and ICI 80996 are synthetic prostaglandin analogues. Dobson et al. (1975) reported good synchronization and normal hormone levels after two injections im of 750 µg ICI 79939 10 days apart. Cooper and Furr (1974) reported the majority of heifers exhibited estrus 48 to 72 hr after two injections of 500 µg ICI 80996 10 to 12 days apart. Cooper (1974) and Cooper and Rowson (1975) with this same treatment reported 91% of the heifers were detected in estrus between 48 and 72 hr after the second injection. They found fertility to be no different from untreated controls when bred by estrus or 72 and 96 hr after the second injection.

EXPERIMENT 1

THE EFFECTS OF SYNCRO-MATE B AND CALF MANAGEMENT ON REPRODUCTIVE PERFORMANCE

SUMMARY

Three trials were conducted to evaluate Syncro-Mate B and calf management on reproductive performance of the beef cow. The Syncro-Mate B treatment was used on all synchronized groups to synchronize estrus.

Trial 1 included 85 2-year-old Angus, Hereford, Polled Hereford and Simmental X Hereford heifers. Heifers were allotted into two treatments (synchronized and untreated) and inseminated approximately 12 hr after detected in estrus.

Within 5 days after removal of implants, 76.2% of the synchronized heifers were in estrus. First service conception, 25-day pregnancy rate and 60-day pregnancy rate was 42.9%, 73.4%, 93.3% and 61.8%, 58.6%, 81.8% for synchronized and untreated, respectively.

In trial 2, 75 2-year-old Angus, Hereford, Polled Hereford and Simmental X Hereford heifers were allotted to four treatment groups: (1) synchronized; (2) synchronized, calves removed for 48 hr following implant removal; (3) nonsynchronized, calves removed for 48 hr prior to the start of the breeding season; (4) untreated. All heifers were inseminated approximately 12 hr after detected in estrus.

The percent of the group exhibiting estrus in the first 5 days of the breeding season was 84.2, 100.0, 26.3 and 5.6 for groups 1 through 4, respectively. First service conception, 25-day pregnancy rate and 60-day pregnancy rate was 47.1%, 69.8%, 91.4%; 31.6%, 60.5%, 78.2%; 50.0%, 46.9%, 85.4% and 73.3%, 71.1%, 99.8% for groups 1 through 4, respectively.

In trial 3, 109 mature Simmental X Hereford and Hereford cows were allotted to six treatment groups: (1) synchronized; (2) synchronized, calves removed for 48 hr following implant removal; (3) synchronized, calves weaned at implantation; (4) synchronized, calves weaned at implant removal; (5) non-synchronized, calves weaned 10 days prior to the breeding season; (6) untreated. All synchronized cows were inseminated 48 hr following implant removal. Any cows detected in estrus after 5 days at first insemination were inseminated like the non-synchronized groups approximately 12 hr after detected in estrus. Half of each synchronized group received 5 mg estradiol valerate (EV) and the other half received 6 mg EV.

First service conception, 25-day pregnancy rate and 60-day pregnancy rate was 33.4%, 39.0%, 75.8%; 33.4%, 69.0%, 95.8%; 52.5%, 95.1%, 95.1%; 29.8%, 86.4%, 86.4%; 28.1%, 50.5%, 86.6% and 54.0%, 51.0%, 96.2% for groups 1 through 6, respectively. The level of EV (5 or 6 mg) administered had no effect on synchronization of estrus or on fertility.

Estrus was synchronized with Syncro-Mate B but fertility was variable. Synchronization with calf manipulation (temporary

removal or weaning) or weaning alone was more effective in initiating postpartum anestrus cows to start cycling than synchronization alone.

INTRODUCTION

For estrus synchronization to work effectively in the cattle industry, it must provide economic benefits to cattlemen. It must provide an efficient method of getting cattle to conceive in a short time period, thus saving labor during the breeding season and possibly during the calving period or it must provide an economic advantage by initiating cycling in postpartum anestrus cows or prepuberal heifers.

Considerable data has been reported on the Syncro-Mate B treatment developed by G. D. Searle Co. It consists of a 9-day ear implant of 6 mg norgestomet (SC21009) plus an injection of 3 mg SC21009 and 5 or 6 mg estradiol valerate (EV) at time of implanting. Wishart (1975) indicated that ovulation was synchronized with the Syncro-Mate B treatment to an extent that should permit insemination by appointment after implant removal and that conception rates similar to those in cows inseminated according to estrus after implant treatment could be expected.

Various techniques and insemination procedures have been employed with Syncro-Mate B. Wishart and Young (1974) reported a higher first service conception rate for cows bred 48 and 60 hr after Syncro-Mate B than cows bred once at 48 hr or cows

bred as they showed estrus. Kaltenbach et al. (1978) reported a higher first service conception rate and 24-day pregnancy rate for cows bred 54 hr following Syncro-Mate B if the calves were removed from the cows for 24 hr just prior to breeding. Henderson (1978) reported a higher 25-day pregnancy rate in cows after Syncro-Mate B treatment in conjunction with calf removal and timed insemination (removal from explant until insemination 48 hr later) over controls. This was also evident with cows less than 42 days postpartum. Only 21% of these cows were known to be cycling while 68% of the controls were known to be cycling. Walters et al. (1977) reported early weaning, either alone or in conjunction with Syncro-Mate B, more effectively induced estrus than 48 hr calf removal with Syncro-Mate B in thin anestrous beef cows.

Suckled beef cows have a longer postpartum interval to estrus than dry cows. Short et al. (1976) reported weaning calves 3 to 7 days postpartum reduced the interval from calving to first estrus from 76 days to 28 days. Randel and Welker (1976) reported that once daily suckling, when compared to ad libiditum suckling, reduced the postpartum period (116 days vs 69 days) and significantly increased the number of cows in estrus by 90 days postpartum. Carter et al. (1977) found that weaning or weaning and injecting gonadotrophin releasing hormone (GnRH) reduced the postpartum intervals to first estrus, first ovulation and interval from first ovulation to second ovulation by 43, 27 and 10 days,

respectively, relative to suckled cows. No apparent advantage was gained by treating weaned cows with GnRH, but GnRH by itself also reduced postpartum anestrus in the beef cow.

Previous research indicates the Syncro-Mate B treatment may be a practical approach to estrus synchronization in beef cattle; however, its effectiveness may be influenced by specific management conditions, age or type of cattle, level of hormones administered, suckling and insemination procedures.

Trials were designed with Syncro-Mate B and/or weaning to determine: (1) efficacy of synchronizing estrus in 2-year-old heifers; (2) the effect of removing calves for 48 hr with or without estrus synchronization on fertility in 2-year-old heifers; (3) fertility rates after insemination by appointment with estrus synchronization alone or in conjunction with 48 hr calf removal or early weaning; (4) efficacy of 5 vs 6 mg estradiol valerate in the Syncro-Mate B treatment and (5) effects of early weaning alone on reproductive performance.

MATERIALS AND METHODS

Syncro-Mate B (G. D. Searle and Co.) was used on all synchronized cattle. This consists of an ear implant containing 6 mg SC21009 for 9 days with an injection of 3 mg SC21009 and 5 or 6 mg estradiol valerate (EV) at the time the implant was placed in the ear.

Trial 1. Eighty-five 2-yr-old Angus, Hereford, Polled Hereford and Simmental X Hereford heifers were randomly

allotted within breed and previous nutrition treatment into two treatments (synchronized and untreated). The three pre-calving nutrition treatments were 100% National Research Council (NRC) recommended energy for 120 days prior to calving, 70% NRC energy from 120 days prior to calving to 70 days prior to calving then 100% NRC energy to calving and 70% NRC energy from 120 days prior to calving to 70 days prior to calving then 120% NRC energy to calving. All heifers were fed to meet NRC recommendations after calving. The 42 synchronized heifers received 6 mg of EV in the synchronizing treatment and were bred artificially with the 43 controls for 25 days. Heifers were checked for signs of estrus at least twice daily and bred about 12 hr after detection of estrus. Heifers were then pastured with bulls for another 35 days (60 day breeding season).

Trial 2. This trial was the same as trial 1 except 75 2-yr-old heifers were allotted into four treatments. Thirty-eight heifers were synchronized and 19 had their calves removed from implant removal until the cows were bred but not more than 48 hr. Nineteen of the 37 nonsynchronized heifers had their calves removed for 48 hr prior to the start of the breeding season. The remaining 18 heifers were untreated and served as controls.

Trial 3. One-hundred nine mature lactating Simmental X Hereford and Hereford cows were allotted into 6 treatments: synchronized, synchronized plus calf removal for 48 hr following implant removal, synchronized and calves early weaned at time of implanting, synchronized and calves early weaned at time of implant removal, nonsynchronized and calves early weaned 10 days prior to start of breeding and untreated controls. Half of each synchronized group was given 5 mg EV and the other half 6 mg EV. All synchronized cows were inseminated 48 hr following implant removal. Any cows detected in estrus after 5 days of the first insemination were inseminated like the controls approximately 12 hr after first observation of estrus. Checks for estrus were made starting 35 days prior to the onset of the breeding season and for 33 days during which cows were bred artificially. Bulls were then placed with the cows for an additional 27 days (60 day breeding season). All groups were maintained in drylot conditions year round and were fed to gain the same weight.

Results were analyzed by least squares analysis of variance (Kemp, 1972).

RESULTS AND DISCUSSION

Trial 1

Synchronization of Estrus With Syncro-Mate B in Two-Year-Old Heifers

Synchronization of estrus with Syncro-Mate B increased the percentage of heifers showing estrus in the first 5 days ($P<.01$) and first 25 days ($P<.10$) of the breeding season. The percentage of heifers conceiving to first service was lower (42.8% vs 61.8%) for the synchronized heifers; however, the difference was not statistically significant. Burrell et al. (1972), Whitman et al. (1972) and Henderson (1978) also noted lower first service conception after Syncro-Mate B.

The 5-day pregnancy rate was higher ($P<.05$) for the synchronized group as was the 25-day pregnancy rate (73.4% vs 58.6%); although the difference was not statistically significant at 25 days. The synchronzied heifers also had a slightly higher 60-day pregnancy rate than nonsynchronized heifers. Higher 25-day and 60-day pregnancy rates for synchronized heifers could be because Syncro-Mate B induced some heifers to start cycling earlier postpartum than would otherwise be expected, or simply that estrus occurred early in the breeding season, thus allowing more opportunities for conception. These possibilities are suggested since Syncro-Mate B resulted in 90.5% of the synchronized heifers exhibiting estrus during the first 25 days of breeding compared to 76.7% of the

nonsynchronized heifers. This may also explain for the lower first service conception if the induced estrus at synchronization was also the first estrus following parturition. Conception at the first estrus after calving is lower, especially if it occurs before 40 days postpartum (Odde and Kiracofe, 1978).

When looking at the percent cycling in 5 days for the synchronized group (Table 1), it appears that Syncro-Mate B synchronized estrus in most of the cycling heifers. The same percentage of synchronized heifers showed estrus in the first 5 days as nonsynchronized heifers in the first 25 days of the breeding season (76.2% vs 76.7%).

Trial 2

Effect of Calf Removal With or Without Estrus Synchronization in Two-Year-Old Heifers

The removal of calves for 48 hr after synchronization increased the percentage of heifers exhibiting estrus in the first 5 days of the breeding season (Table 3). Nonsynchronized heifers with 48 hr calf removal had a higher proportion of heifers showing estrus within the first 5 days than the nonsynchronized heifers with the calves left on (5 of 19 vs 1 of 18). These data suggest that 48 hr calf removal has an affect on heifers exhibiting estrus early in the breeding season, regardless of synchronization.

Synchronization in conjunction with 48 hr calf removal had a higher percentage of heifers showing estrus in the first 25 days of the breeding season than any other group (Table 3).

The percent of heifers showing estrus in the first 25 days was 16% higher in the synchronized group with 48 hr calf removal than other groups, which were similar. Calf removal in conjunction with Syncro-Mate B was effective in initiating estrous cycles in postpartum cows.

First service conception, 25-day pregnancy rate and 60-day pregnancy rate was higher for nonsynchronized controls than other groups. Five-day pregnancy rate was higher ($P<.05$) for the synchronized than nonsynchronized groups. Calf removal for 48 hr had a detrimental affect on first service conception and 25-day pregnancy rate in both synchronized and nonsynchronized groups. The reduction in 25-day pregnancy rate was due to the lower first service conception. Conception rates following first estrus seem to be normal when compared to their respective control groups. However, this is not in agreement with Henderson (1978). He reported equal first service conception between cows that were synchronized with Syncro-Mate B and had their calves removed for 48 hr and ones that didn't. He also found no difference between synchronized and nonsynchronized groups relative to first service conception.

Since the synchronization procedure and type of animals used were the same in trials 1 and 2, data were combined for analysis on the effectiveness of the Syncro-Mate B treatment. All synchronized heifers (with or without calf removal) and all nonsynchronized heifers (with or without calf removal) were combined in trial 2 and compared with synchronized and

nonsynchronized groups in trial 1. Synchronization increased ($P<.01$) the percentage of heifers exhibiting estrus in the first 5 days of the breeding season (Table 5). The percent of synchronized heifers expressing estrus in the first 25 days was also higher ($P<.10$). There was no difference between trials 1 and 2 for first service conception, 5, 25 and 60-day pregnancy rates. First service conception was lowered ($P<.01$) for the synchronized heifers (41.3% vs 62.3%). The 5-day, 25-day and 60-day pregnancy rates were higher for synchronized heifers (Table 6). Five-day pregnancy rate was higher ($P<.01$) as would be expected from the number of heifers cycling the first 5 days of the breeding season.

When both trials were combined, breed had a significant ($P<.05$) affect on 25-day pregnancy rate. Polled Herefords had a 20% lower 25-day pregnancy rate than other breeds. This was not due to a lower first service conception, but appeared to result from fewer heifers cycling during the early post-partum period.

Trial 3

Estrus Synchronization and/or Calf Manipulation in Mature Beef Cows

The percent of cows exhibiting estrus before the start of the breeding season was significantly ($P<.01$) greater for the nonsynchronized group, which had their calves weaned 10 days prior to the breeding season (70.6%). Most of these cows exhibited their first estrus during the 10 days prior to

breeding (53%). Cows in the nonsynchronized, early weaned group that exhibited estrus in the 10 days between weaning and the start of the breeding season, 77.8% had a short estrual cycle that averaged 8 days in length. The synchronized group that had their calves weaned when the implant was removed (explant) had the lowest percentage of cows exhibiting estrus prior to the start of the breeding season (11.1%). This group also had a slightly shorter postpartum interval to the start of the breeding season (Table 7); however, there was not much difference from the synchronized group plus 48 hr calf removal. Though postpartum interval to the start of the breeding season was similiar for the two groups, the synchronized group plus 48 hr calf removal had a higher percent of cows exhibiting estrus prior to the start of the breeding season (40.0% vs 11.1%). This may be due to the fact that the synchronized plus 48 hr calf removal group had a higher average weight (454 kg vs 447 kg) and a higher weight:height ratio (3.65 kg/cm vs 3.49 kg/cm) indicating better condition.

Calf manipulation (weaning or 48 hr calf removal) in conjunction with Syncro-Mate B increased ($P<.01$) the percentage of cows in estrus the first 25 days of the breeding season when compared to Syncro-Mate B alone (Table 7) which did not differ from untreated controls. In nonsynchronized groups, early weaning increased the percentage of cows cycling the first 25 days over cows left lactating. This data indicates

that weaning calves, either permanently or temporarily, has more of an effect on initiating cycling in postpartum anestrus cows than does the Syncro-Mate B treatment alone.

Treatment had no significant affect on first service conception or 5-day pregnancy rate (Table 8). Five-day pregnancy rates for the synchronized groups were somewhat higher than the nonsynchronized groups (Table 8). First service conception and 5-day pregnancy rate was essentially the same for all synchronized groups except the synchronized plus weaning at implant. In the two synchronized, weaned groups, a larger percent were pregnant first service and to the first 5 days in the group that had their calves weaned at the time the Syncro-Mate B implant was placed in the ear. This is not in agreement with Walters et al. (1977). They reported that early weaning in conjunction with Syncro-Mate B resulted in higher first service conception rates when calves were weaned at implant removal as compared with these weaned at implantation. The reason for this difference may be that their cows were known to be in postpartum anestrus and were inseminated by appointment at 60 hr post implant removal. The cows in this study were inseminated by appointment 48 hr post implant removal and were close to cycling as indicated by the increase in the number of nonsynchronized cows cycling the first 25 days over the number that was cycling prior to the start of the breeding season (Table 7).

Fertility data was adjusted for differences in percent of cows cycling prebreeding because of the differences across

treatments (Table 7). Those cows expressing estrus at least once prior to the start of the breeding season had a higher ($P<.01$) first service conception, 5-day pregnancy rate and 25-day pregnancy rate than those not expressing estrus prior to the start of the breeding season. First service conception was 57.1% for the synchronized groups that were time inseminated and had exhibited estrus prior to the start of the breeding season while only 17.6% conceived to first service if they had not exhibited estrus prior to the start of the breeding season.

The level of estradiol valerate administered in the Syncro-Mate B treatment (5 or 6 mg) had no significant affect on degree of synchronization or fertility in the treatments studied.

TABLE 1. DEGREE OF SYNCHRONIZATION AND FIRST SERVICE CONCEPTION AFTER SYNCRO-MATE B TREATMENT IN TWO-YEAR-OLD HEIFERS

Treatment	No.	Percent of heifers exhibiting estrus		First service conception[b] (%)
		In 5 days	In 25 days	
Synchronized[a]	42	76.2[c]	90.5[e]	42.9
Nonsynchronized[a]	43	16.3[d]	76.7[f]	61.8

[a]Both synchronized and nonsynchronized heifers were inseminated approximately 12 hr after detected in estrus.

[b]First service conception represents the percent of heifers that conceived of those that exhibited estrus and were inseminated in the first 25 days of the breeding season.

[cd]Means in the same row with different superscripts differ ($P<.01$).

[ef]Means in the same row with different superscripts differ ($P<.10$).

TABLE 2. PREGNANCY RATES OF TWO-YEAR-OLD HEIFERS FOLLOWING SYNCRO-MATE B TREATMENT

Treatment	No.	Pregnant 5 days (%)[a]	Pregnant 25 days (%)	Pregnant 60 days (%)
Synchronized	42	34.6[b]	73.4	93.3
Nonsynchronized	43	11.5[c]	58.6	81.8

[a]Pregnancy rates were adjusted for nutrition and breed differences.

[bc]Means in the same row with different superscripts differ ($P<.05$).

TABLE 3. DEGREE OF SYNCHRONIZATION AND FIRST SERVICE CONCEPTION AFTER SYNCRO-MATE B AND/OR 48 HOUR CALF REMOVAL IN TWO-YEAR-OLD HEIFERS

Treatment[b]	No.	Percent of heifers exhibiting estrus		First service conception[b] (%)
		In 5 days*	In 25 days	
Synchronized	19	84.2	84.2	47.1
Synchronized plus 48 hr calf removal	19	100.0	100.0	31.6
Nonsynchronized plus 48 hr calf removal	19	26.3	84.2	50.0
Nonsynchronized	18	5.6	83.3	73.3

[a]All treatments were inseminated approximately 12 hr after detected in estrus.

[b]First service conception represents the percent of heifers that conceived of those that exhibited estrus and were inseminated in the first 25 days of the breeding season.

*$P<.01$.

TABLE 4. PREGNANCY RATES OF TWO-YEAR-OLD HEIFERS FOLLOWING SYNCRO-MATE B AND/OR 48 HOUR CALF REMOVAL

Treatment	No.	Pregnant 5 days (%)[a]*	Pregnant 25 days (%)	Pregnant 60 days (%)
Synchronized	19	43.3	69.8	91.4
Synchronized plus 48 hr calf removal	19	33.0	60.5	78.2
Nonsynchronized plus 48 hr calf removal	19	15.9	46.9	85.4
Nonsynchronized	18	3.3	71.1	99.8

[a]Pregnancy rates were adjusted for nutrition and breed differences.

*$P<.05$.

TABLE 5. COMBINED DATA FROM TRIAL 1 AND 2 ON DEGREE OF SYNCHRONIZATION AND FIRST SERVICE CONCEPTION FOLLOWING SYNCRO-MATE B IN TWO-YEAR-OLD HEIFERS

Treatment[a]	No.	Percent of heifers exhibiting estrus		First service conception[b] (%)
		In 5 days	In 25 days	
Synchronized[c]	80	83.8[e]	91.3[g]	41.3[e]
Nonsynchronized[d]	80	16.3[f]	80.0[h]	62.3[f]

[a]Both synchronized and nonsynchronized were inseminated approximately 12 hr after detected in estrus.

[b]First service conception represents the percent of heifers that conceived of those that exhibited estrus and were inseminated in the first 25 days of the breeding season. First service conception was adjusted for breed, trial and trial by treatment interaction.

[c]Includes both heifers treated with Syncro-Mate B alone and in conjunction with 48 hr calf removal.

[d]Includes nonsynchronized heifers with and without 48 hr calf removal.

[ef]Means in the same row with different superscripts differ ($P<.01$).

[gh]Means in the same row with different superscripts differ ($P<.10$).

TABLE 6. COMBINED DATA FROM TRIAL 1 AND 2 ON PREGNANCY RATES OF TWO-YEAR-OLD HEIFERS FOLLOWING SYNCRO-MATE B

Treatment	No.	Pregnant 5 days (%)	Pregnant 25 days (%)	Pregnant 50 days (%)
Synchronized[a]	80	36.6[c]	72.2	90.1
Nonsynchronized[b]	80	11.7[d]	61.9	88.5

[a]Includes heifers treated with Syncro-Mate B alone or in conjunction with 48 hr calf removal.

[b]Includes nonsynchronized heifers with and without 48 hr calf removal.

[cd]Means in the same row with different superscripts differ ($P<.01$).

TABLE 7. EFFECT OF POSTPARTUM INTERVAL, CYCLING STATUS, SYNCHRONIZATION AND CALF MANIPULATION ON OCCURRENCE OF ESTRUS IN BEEF COWS

Treatment	No.	Average days postpartum[a]	Cycling prebreeding (%)[b]*	Cycling the first 25 days of the breeding season (%)*
Synchronized	20	65.0	40.0	70.0
Synchronized plus 48 hr calf removal	20	58.7	40.0	95.0
Synchronized and calves weaned at implant	14	67.0	21.4	100.0
Synchronized and calves weaned at explant	18	57.4	11.1	100.0
Nonsynchronized calves early weaned[c]	17	68.3	70.6	94.1
Nonsynchronized	20	64.9	35.0	65.0

[a]Average number of days from calving to start of breeding season.

[b]The percent of cows exhibiting estrus before the start of the breeding season.

[c]Calves were weaned 10 days prior to the start of the breeding season.

*$P<.01$.

TABLE 8. FERTILITY OF MATURE BEEF COWS FOLLOWING SYNCRO-MATE B AND/OR CALF MANIPULATION

Treatment	No.	First service conception[a] (%)	Pregnant 5 days (%)[b]	Pregnant 25 days (%)*	Pregnant 60 days (%)
Synchronized[c]	20	33.4	33.4	39.0	75.8
Synchronized plus 48 hr calf removal[c]	20	33.4	33.4	69.0	95.8
Synchronized and calves weaned at implant[c]	14	52.5	52.5	95.1	95.1
Synchronized and calves weaned at explant[c]	18	29.8	29.8	86.4	86.4
Nonsynchronized calves early weaned[de]	17	28.1	22.5	50.5	86.6
Nonsynchronized[e]	20	54.0	15.1	51.0	96.2

[a]First service conception represents the percent of cows that conceived of those inseminated in the first 33 days of the breeding season. Data was adjusted for cycling prebreeding.

[b]Pregnancy rates were adjusted for cycling prebreeding.

[c]All synchronized cows were inseminated by appointment approximately 48 hr post implant removal.

[d]Calves were weaned 10 days prior to the start of the breeding season.

[e]Nonsynchronized cows were inseminated approximately 12 hr after detected in estrus.

*$P<.01$.

TABLE 9. THE EFFECT OF PREBREEDING ESTRUS ON FERTILITY OF SYNCRO-MATE B TREATED AND UNTREATED MATURE BEEF COWS

Treatment	No.	First service conception[a] (%)	Pregnant 5 days (%)	Pregnant 25 days (%)	Pregnant 60 days (%)
Expressed estrus prior to start of breeding season	40	55.0[b]	45.0[b]	77.5[b]	92.5
Did not express estrus prior to start of breeding season	69	19.4[c]	14.5[c]	47.8[c]	85.5

[a]First service conception represents the percent of cows that conceive of those inseminated in the first 33 days of the breeding season.

[bc]Means in the same row with different superscripts differ ($P<.01$).

EXPERIMENT 2

INCIDENCE OF SHORT ESTROUS CYCLES FOLLOWING EARLY WEANING

SUMMARY

Thirty-seven mature crossbred Simmental cows that had not been detected in estrus since calving were selected on May 7, 1978 for this experiment. On May 8, four of the 37 cows were detected in estrus and were assigned to a lactating group along with eight noncycling cows randomly selected from the remaining 33 cows. Calves were weaned from the remaining 25 cows on May 10. All cows were inseminated approximately 12 hr after observed in estrus subsequent to weaning.

The percent of cows exhibiting estrus in the first 10 days and first 25 days of the breeding season was 64.0%, 92.0%; 50.0%, 66.7% for early weaned and controls, respectively. Early weaning increased the percentage of cows exhibiting a short estrual cycle (7 to 10 days in length) as compared to lactating cows (78.3% vs 29.0%).

INTRODUCTION

Recent increased use of artificial insemination in the beef industry has resulted in more attention being paid to estrous cycles. A "normal" estrous cycle is considered to be between 18 and 24 days in length. Any cycle outside this range is generally considered abnormal. Estrual cycles of 7

to 12 days in length (short cycles) have been observed in both heifers and cows. Although short cycles have been observed in heifers, the majority have been in postpartum cows. Whether or not this is a clinically abnormal situation has not yet been determined. It is not known if an ovulation occurs at the first, second or both estrus periods.

It has been shown in dairy cattle that the first ovulation postpartum is usually without visible signs of estrus and that the first detected estrus follows first ovulation by 8 to 12 days. Stevenson and Britt (1977) observed a group of Holstein cows and found the first ovulation occurred 17.6 $\pm$ 1.0 days postpartum and the first detected estrus occurred 28.4 $\pm$ 2.1 days postpartum. This would have resulted in an 8 to 14 day cycle if estrus would have occurred at the first ovulation following parturition.

Randel et al. (1977) reported that weaning calves from beef cows within 24 hr after birth increased the proportion of cows exhibiting abnormal length first estrous cycles. They reported 7 of 14 weaned cows had short cycles while only 2 of 14 lactating cows had short cycles. Inskeep (1978) reported that corpora lutea induced by GnRH at 33 days postpartum invariably had a shortened life span.

Data from experiment 1 (Trial 3) indicated that early weaning of postpartum anestrus cows increased the number of cows expressing short cycles. Of those cows expressing estrus within 10 days after early weaning, 77.8% had a short cycle that averaged 8 days in length.

In view of the status of short cycles, a study was undertaken to determine if the expression of short cycles could be increased with early weaning of postpartum anestrus cows.

MATERIALS AND METHODS

Eight-eight crossbred Simmental cows were checked for signs of estrus three times daily from calving until the end of the experiment. Thirty-seven cows (19 to 68 days postpartum) that had not been detected in estrus by May 7, 1978 were selected for use in the experiment. Blood was collected by jugular vena puncture daily between 0630 and 0900 beginning May 8. The first day of blood collection, four cows were detected in estrus and were assigned to the lactating control group along with eight other randomly selected cows. Twenty-five cows had their calves weaned on the third day of bleeding (May 10).

Ovaries of all cows were palpated the third day of bleeding. Ovaries were also palpated 6 days postestrus in all cows showing estrus. In all cases, blood was collected prior to palpation. Blood was collected from all cows until May 20 (10 days postweaning) and was continued in cows that exhibited estrus or signs of estrus by May 20. Collections continued for 10 days following the second estrus of a short cycle (7 to 10 days) or until second estrus if it occurred within 20 days.

After weaning, all cows in both groups were artificially inseminated approximately 12 to 18 hr after detected in estrus.

Cows in the weaned group that exhibited estrus within 10 days after weaning were inseminated with Angus semen and if they had a subsequent estrus they were inseminated with Simmental semen. All lactating cows were inseminated with Simmental semen.

RESULTS AND DISCUSSION

Early weaning of calves (average 44 days postpartum) increased the percentage of cows exhibiting estrus in the first 10 days and the first 25 days of the breeding season (Table 1). This occurred despite assignment of four cows to the lactating group because they exhibited estrus on the first day of the experiment.

Early weaning of postpartum anestrus cows also increased the percentage of cows exhibiting a short estrual cycle (7 to 10 days in length) over cows that were lactating (72% vs 25%). The removal of the suckling stimulas may cause an increase in estrogen plasma levels at the first ovulation postpartum if in fact there is an ovulation associated with this estrus following weaning. Inskeep et al. (1977) reported that 48 hr calf removal increased levels of estrogen after gonadotropin releasing hormone (GnRH) over cows that were left with their calves and given GnRH.

Of those cows that had their calves early weaned and either showed definite estrus or some signs of estrus (hyperactivitity) in the first 12 days postweaning, 18 of 21 (85%)

had a short estrual cycle of 7 to 10 days in length. For lactating cows during this period, only 2 of 7 (29%) had a short estrual cycle. Interestingly, the calf on one of the lactating cows died and the cow showed estrus 2 and 10 days later.

These data indicate that short cycles are not clinically abnormal if they occur at the first postpartum estrus. A suckling stimulas may inhibit estrogen production by the ovary at the first postpartum ovulation and removal of the suckling stimulus allows estrus to be exhibited with the first ovulation. Alternatively, the cows CNS may be more sensitive to circulating estrogens. The corpus luteum resulting from the first ovulation has a short life span.

TABLE 1. POSTPARTUM INTERVAL AND EFFECT OF WEANING ON OCCURRENCE OF ESTRUS IN BEEF COWS

Treatment group	No.	Average days postpartum[a]	Percent of cows exhibiting estrus		Cows having a short estrual cycle
			In 10 days	In 25 days	
Cows with calves weaned	25	43.9	64.0	92.0	78.3[c]
Lactating control cows	12	44.5	25.0[b]	50.0[b]	29.0[d]

[a]Average number of days from calving to May 10 (date of weaning).

[b]Calculated on eight cows since four cows were placed in this group because they showed estrus.

[c]Percent of cows (18 of 21) having a short cycle of 7 to 10 days of those showing estrus in 25 days.

[d]Four cows did not show estrus and one calf died; therefore, calculation is based on seven cows.

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LITERATURE CITED

Burrell, C., J. N. Wiltbank, D. G. LeFever and G. Rodeffer. 1972. Ear implant (SC21009) for estrous control in heifers. J. Anim. Sci. 34:915. (Abstr.).

Carter, M. L., E. R. Hauser, D. J. Dierschke and J. J. Rutledge. 1977. Ovarian activity and reproductive performance of early weaned and gonadotropin releasing hormone (GnRH) treated postpartum cows. American Society of Animal Science Abstracts, 69th Annual Meeting, p. 143.

Chakraborty, R. R., R. H. Kliewer and F. Hisaw, Jr. 1971. Synchronization of estrus, reproductive performance and lactational response of Holstein heifers treated with melengestrol acetate. J. Dairy Sci. 54:1866.

Christian, R. E. and L. E. Casida. 1948. The effects of progesterone in altering the estrous cycle of the cow. J. Anim. Sci. 7:540. (Abstr.).

Chupin, D., J. Pelot and J. Thimonier. 1975. The control of reproduction in the nursing cow with a progestagen short-term treatment. Ann. Biol. Anim. Bioch. Biophys. 15:263.

Cooper, M. J. 1974. Control of oestrus cycles of heifers with a synthetic prostaglandin analogue. Vet. Rec. 95:200.

Cooper, M. J. and B. J. A. Furr. 1974. The role of prostaglandins in animal breeding. Vet. Rec. 94:161.

Cooper, M. J. and L. E. A. Rowson. 1975. Control of the oestrus cycle in Friesian heifers with ICI 80996. Ann. Biol. Anim. Bioch. Biophs. 15:427.

Curl, S. E., W. Durfey, R. Patterson and D. W. Zinn. 1968. Synchronization of estrus in cattle with subcutaneous implants. J. Anim. Sci. 27:1189. (Abstr.).

Dhindsa, D. S., A. S. Hoversland and E. P. Smith. 1967. Estrous control and calving performance in beef cattle fed 6-methyl-17-acetoxy-progesterone under ranch condition. J. Anim. Sci. 26:167.

Dobson, H., L. J. Boyd and D. Exley. 1973. Circulating oestrogens and progesterone in the bovine after synchronization with melengestrol acetate. J. Reprod. Fert. 33:231.

Dobson, H., M. J. Cooper and B. J. A. Furr. 1975. Synchronization of oestrus with ICI 79939, an analogue of $PGF_2\alpha$, and associated changes in plasma progesterone, oestradiol-17β and LH in heifers. J. Reprod. Fert. 42: 141.

Grunert, E. 1975. Fertility of estrus synchronized dairy heifers treated with CAP alone or in combination with estradiol benzoate, HCG or GnRH. Ann. Biol. Anim. Bioch. Biophys. 15:273.

Hafs, H. D., J. G. Manns and B. Drew. 1975. Onset of oestrus after prostaglandin $F_2\alpha$ in cattle. Vet. Rec. 96:134.

Hansel, W., L. E. Donaldson, W. C. Wagner and M. A. Brunner. 1966. A comparison of estrous cycle synchronization methods in beef cattle under feedlot condition. J. Anim. Sci. 25:497.

Henderson, K. A. 1978. Conception rates of beef cows synchronized at different postpartum intervals. American Society of Animal Science Abstracts, 70th Annual Meeting, p. 365.

Hendricks, D. M., J. R. Hill and J. F. Dickey. 1973. Plasma ovarian hormone levels and fertility in beef heifers treated with melengestrol acetate (MGA). J. Anim. Sci. 37:1169.

Hendricks, D. M., J. T. Long, J. R. Hill and J. F. Dickey. 1974. The effect of prostaglandin $F_2\alpha$ during various stages of the oestrus cycle of beef heifers. J. Reprod. Fert. 41:113.

Hill, J. R., J. F. Dickey and D. M. Hendricks. 1973. Estrus and ovulation in $PGF_2\alpha$/PMS treated heifers. J. Anim. Sci. 37:315. (Abstr.).

Hill, J. R., Jr., D. R. Lamond, D. M. Hendricks, J. F. Dickey and G. D. Niswender. 1971. The effect of melengestrol acetate (MGA) on ovarian function and fertilization in beef heifers. Biol. Reprod. 4:16.

Inskeep, E. K. 1978. Factors affecting postpartum anestrus in beef cattle. Beltsville Symposia in Agriculture Research. III. Animal Reproduction. (Abstr.).

Inskeep, E. K., A. W. Lishman, R. L. Butcher and S. M. J. Allison. 1977. Effect of short-term removal of the calf on release of LH, ovulation and CL function following GnRH in beef cows. American Society of Animal Science Abstracts, 69th Annual Meeting, p. 171.

Kaltenbach, C. C., T. G. Dunn, D. W. Forrest and W. M. Moseley. 1978. Effect of temporary weaning and GnRH in synchronized cows. American Society of Animal Science Abstracts, 70th Annual Meeting, p. 370.

Kemp, K. E. 1972. Least squares analysis of variance, a procedure, a program and examples of their use. Kansas Agr. Exp. Sta. Res. Bull. 7.

Knox, J. W., J. L. Rabb, J. Y. Oakes and C. K. Vincent. 1972. Progestin injections and ear implants for control of estrus in cattle. J. Anim. Sci. 34:354. (Abstr.).

Lauderdale, J. W. 1972. Effects of $PGF_{2\alpha}$ on pregnancy and estrous cycles of cattle. J. Anim. Sci. 35:246. (Abstr.).

Lauderdale, J. W. 1975. The use of prostaglandins in cattle. Ann. Biol. Anim. Bioch. Biophys. 15:419.

Lauderdale, J. W. and R. J. Ericson. 1970. Physiological conditions affecting the ability of cattle uteri to influence the fertilizing capacity of sperm. Biol. Reprod. 2:179.

Lauderdale, J. W., C. W. Kasson and M. L. Ogilvie. 1972. Estrus and fertility after MGA implant removal. J. Anim. Sci. 35:246.

Lauderdale, J. W., B. E. Sequin, J. N. Stellflug, J. R. Chenanlt, W. W. Thatcher, C. K. Vincent and A. F. Layancano. 1974. Fertility of cattle following $PGF_{2\alpha}$ injection. J. Anim. Sci. 38:964.

Liehr, R. A., G. B. Marion and H. H. Olson. 1972. Effects of prostaglandin on cattle estrous cycles. J. Anim. Sci. 35:247. (Abstr.).

Louis, T. M., H. D. Hafs and D. A. Morrow. 1972. Estrus and ovulation after uterine prostaglandin $F_{2\alpha}$ in cows. J. Anim. Sci. 35:247. (Abstr.).

Loy, R. G., R. G. Zimbelman and L. E. Casida. 1960. Effects of injected ovarian hormones on the corpus luteum of the estrual cycle in cattle. J. Anim. Sci. 19:175.

Moore, N. W. 1975. The use of prostaglandin $F_{2\alpha}$, given either intrauterine infusion or by intramuscular injection for the control of oestrus and ovulation in cattle. Ann. Biol. Anim. Bioch. Biophys. 15:451.

Odde, K. G. and G. H. Kiracofe. 1978. Effect of postpartum breeding interval on conception rates in beef cows. Cattlemen's Day Report, Kansas Agr. Exp. Sta. Report of Progress 320, p. 7.

Randel, R. D., R. E. Short and R. A. Bellows. 1977. Effect of state postpartum upon serum progesterone and luteinizing hormone during the first postpartum estrous cycle in cows. American Society of Animal Science Abstracts, 69th Annual Meeting, p. 199.

Randel, R. D. and B. A. Welker. 1976. Once daily suckling effect on cow-calf performance. American Society of Animal Science Abstracts, 68th Annual Meeting, p. 301.

Reed, I. D. and T. D. Rich. 1972. Influence of MGA on cow fertility. J. Anim. Sci. 35:1123. (Abstr.).

Rey, J. 1975. Normal fertility induced in cows by double short treatment with Chlormadinone Acetate (CAP). Ann. Biol. Anim. Bioch. Biophys. 15:297.

Reynolds, W. L., W. C. Foote, R. A. Bellows, T. M. DeRouen and D. C. Meyerhoeffer. 1973. Influence of progesterone implants on reproduction of cows. J. Anim. Sci. 37:250. (Abstr.).

Roche, J. F. 1974a. Synchronization of estrus and fertility following artificial insemination in heifers given prostaglandin F2α. J. Reprod. Fert. 37:135.

Roche, J. F. 1974b. Synchronization of oestrus in heifers with implants of progesterone. J. Reprod. Fert. 41:337.

Roche, J. F. 1975. Synchronization of oestrus in cows using intravaginal silastic coils containing progesterone. Ann. Biol. Anim. Bioch. Biophys. 15:301.

Roche, J. F. 1976. Calving rate of cows following insemination after a 12-day treatment with silastic coils impregnated with progesterone. J. Anim. Sci. 43:164.

Rodeffer, G. H., M. L. Hopwood and J. N. Wiltbank. 1972. LH and estrogen following estrous control. J. Anim. Sci. 34:901. (Abstr.).

Rowson, L. E. A., R. Tervit and B. Brand. 1972. The use of prostaglandins for synchronization of estrus in cattle. J. Reprod. Fert. 29:145. (Abstr.).

Short, R. E., B. B. Staigmiller, I. K. Baber, J. B. Carr and R. A. Bellows. 1976. Effects of mammary denervation in postpartum cows. American Society of Animal Science Abstracts, 68th Annual Meeting, p. 304.

Smith, L. E., Jr. and C. K. Vincent. 1973. Stage of cycle effect on bovine estrous control. J. Anim. Sci. 36:216. (Abstr.).

Stevenson, J. S. and J. H. Britt. 1977. Luteinizing hormone, estradiol and progesterone before first ovulation in postpartum cows. American Society of Animal Science Abstracts, 69th Annual Meeting, p. 211.

Trimberger, G. W. and W. Hansel. 1955. Conception rate and ovarian function following estrus control by progesterone injections in dairy cattle. J. Anim. Sci. 14:224.

Thimonier, J., D. Chupin and J. Pelot. 1975. Synchronization of estrus in heifers and cyclic cows with progestagens and prostaglandin analogues alone or in combination. Ann. Biol. Anim. Bioch. Biophys. 15:437.

Ulberg, L. C., R. E. Christian and L. E. Casida. 1951. Ovarian response in heifers to projesterone injections. J. Anim. Sci. 10:752.

VanBlake, H., M. A. Brummer and W. Hansel. 1963. Use of 6-chloro-6-dehydro-17-acetoxyprogesterone (CAP) in estrous cycle synchronization of dairy cattle. J. Dairy Sci. 46:459.

Walters, D. L., B. Songster, M. Valencia, W. C. Burrell and J. N. Wiltbank. 1977. Steroids in conjunction with 48 hr calf removal or early weaning in thin anestrous cows. American Society of Animal Science Abstracts, 69th Annual Meeting, p. 215.

Wagner, J. F., E. L. Veenhuizen, R. P. Gregory and L. V. Tonkinson. 1968. Fertility in the beef heifer following treatment with 6-chloro-acetoxyprogesterone. J. Anim. Sci. 27:1627.

Wetteman, R. P. and H. D. Hafs. 1973. Pituitary and gonadal hormones associated with fertile and nonfertile inseminations at synchronized and control estrus. J. Anim. Sci. 36:716.

Whitman, R. W., J. N. Wiltbank, D. G. LeFever and A. H. Denham. 1972. Ear implant (SC21009) for estrous control in cows. J. Anim. Sci. 34:915. (Abstr.).

Wiltbank, J. N. and E. Gonzalez-Padilla. 1975. Synchronization and induction of estrus in heifers with a progestagen and estrogen. Ann. Biol. Anim. Bioch. Biophys. 15: 255.

Wiltbank, J. N., J. E. Ingalls and W. W. Rowden. 1961. Effects of various forms and levels of estrogens alone or in combinations with gonadotrophins on the estrous cycle of beef heifers. J. Anim. Sci. 20:341.

Wiltbank, J. N., R. P. Shumway, W. R. Parker and D. R. Zimmerman. 1967. Duration of estrus, time of ovulation and fertilization rate in beef heifers synchronized with dihydroxyprogesterone acetophenide. J. Anim. Sci. 26: 764.

Wiltbank, J. M., J. C. Sturges, D. Wideman, D. G. LeFever and L. C. Falkner. 1971. Control of estrus and ovulation using subcutaneous implants and estrogens in beef cattle. J. Anim. Sci. 33:600.

Wishart, D. F. 1975. The time of ovulation in heifers after progestin (SC9880; SC21009) treatment. Ann. Biol. Anim. Bioch. Biophys. 15:215.

Wishart, D. F. and I. M. Young. 1974. Artificial insemination of progestin (SC21009) treated cattle at predetermined times. Vet. Rec. 95:503.

Wordinger, R. J., J. F. Dickey and J. R. Hill. 1970. Effect of MGA on bovine endometrium. J. Anim. Sci. 31:234. (Abstr.).

THE EFFECTS OF SYNCRO-MATE B AND/OR CALF MANAGEMENT ON REPRODUCTIVE PERFORMANCE IN THE BEEF COW

by

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Syncro-Mate B (G. D. Searle and Co.) was used on all synchronized cattle. This consists of an ear implant of 6 mg norgestomet (SC21009) for 9 days with an injection of 3 mg SC21009 and 5 or 6 mg estradiol valerate (EV) at the time the implant is placed in the ear.

Trial 1 included 85 two-year-old Angus, Hereford, Polled Hereford and Simmental X Hereford heifers. Heifers were allotted into two treatments (synchronized and controls). All heifers were artificially inseminated approximately 12 hr after detected in estrus. The synchronized group had 76.2% of the heifers in estrus in the first 5 days of the breeding season, which was higher ($P<.01$) than the controls (16.3%). First service conception, 25-day pregnancy rate and 60-day pregnancy rate was 42.9%, 73.4%, 93.3%; 61.8%, 58.6%, 81.8% for synchronized and controls, respectively.

In trial 2, 75 two-year-old Angus, Hereford, Polled Hereford and Simmental X Hereford heifers were allotted into four treatment groups: (1) synchronized; (2) synchronized, calves removed for 48 hr following implant removal; (3) nonsynchronized, calves removed for 48 hr prior to start of breeding season; (4) no treatment. All heifers were artificially inseminated approximately 12 hr after detected in estrus.

The percent of the group exhibiting estrus in the first 5 days of the breeding season was 84.2, 100.0, 26.3 and 5.6 for groups 1 through 4, respectively. First service conception, 25-day pregnancy rate and 60-day pregnancy rate was

47.1%, 69.8%, 91.4%; 31.6%, 60.5%, 78.2%; 50.0%, 46.9%, 85.4%; 73.3%, 71.1%, 99.8% for groups 1 through 4, respectively. Calf removal tended to lower first service conception in both synchronized and nonsynchronized groups.

In trial 3, 109 mature Simmental X Hereford and Hereford cows were allotted into 6 treatment groups: (1) synchronized; (2) synchronized, calves removed for 48 hr following implant removal; (3) synchronized, calves weaned at implantation; (4) synchronized, calves weaned at implant removal; (5) nonsynchronized, calves weaned 10 days prior to the breeding season; (6) no treatment. Half of each synchronized group were given 5 mg EV and the other half 6 mg EV. All synchronized cows were inseminated 48 hr following implant removal. Any cows detected in estrus after 5 days of the first insemination were inseminated like the nonsynchronized groups, approximately 12 hr after detected in estrus.

First service conception, 25-day pregnancy rate and 60-day pregnancy rate was 33.4%, 39.0%, 75.8%; 33.4%, 69.0%, 95.8%; 52.5%, 95.1%, 95.1%; 29.8%, 86.4%, 86.4%; 28.1%, 50.5%, 86.6%; 54.0%, 51.0%, 96.2% for groups 1 through 6, respectively. Pregnancy rate for 25 days was higher ($P<.01$) for the synchronized groups with weaning than for all other groups.

The level of EV (5 or 6 mg) administered in the Syncro-Mate B treatment had no effect on synchronization of estrus or on fertility.

In trial 4, checks for signs of estrus were made three times daily on 88 mature crossbred Simmental cows from calving

until the end of the experiment. Thirty-seven cows (19 to 68 days postpartum) that had not been detected in estrus by May 7, 1978 were selected for use in the experiment. On May 8, four cows were detected in estrus and assigned to the lactating control group along with eight other randomly selected cows that had not been detected in estrus. Twenty-five cows had their calves weaned May 10. After weaning all cows were inseminated approximately 12 hr after detected in estrus.

The percent of cows exhibiting estrus in the first 10 days and first 25 days of the breeding season was 64.0%, 92.0%; 50,0%, 66.7% for early weaned and controls, respectively. Early weaning increased the percentage of cows exhibiting a short estrual cycle (7 to 10 days in length) over the control cows (72% vs 25%). It appears that removal of the suckling stimulus will initiate cycling in postpartum cows with an increase in the incidence of short estrual cycles.