

A COMPARISON OF VARIOUS MANAGEMENT SYSTEMS
ON CONCEPTION AFTER SYNCHRONIZATION OF
ESTRUS IN BEEF COWS

by

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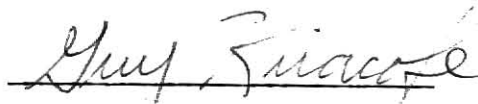
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SYNCHRONIZATION OF ESTRUS IN CATTLE

Christian and Casida (1948) first reported synchronizing estrus in cows by injecting progesterone for 14 days. Since then many different extracts of progesterone and synthetic progestogens have been used experimentally to synchronize estrus. The degree of success has varied with dose levels, modes of administration, biological potencies and so forth; however, the use of progestogens for 14 days or more has usually depressed conception at the ensuing estrus. The following workers all reported lowered fertility at the first estrus after their respective treatments: Wiltbank et al. (1967) fed dihydroxy-progesterone acetophenide (DHPA) for 20 days; Curl et al. (1968) and Woody and Pierce (1974) used subcutaneous Norethandrolone implants for 16 days; Wagner et al. (1968) used 6-chloro- Δ^6 -dehydro-acetoxypregesterone (CAP) for 20 days; Liang and Fosgate (1971) gave 17 daily injections of 17-alpha-ethyl-19-nortestosterone (Nilevar); Wiltbank et al. (1971) used Nilevar in the form of a subcutaneous implant for 16 days; Whitman et al. (1972) gave a 16 day ear implant using 17 alpha-acetoxy-beta-methyl-19-norpreg-4-ene-3, 20 dione (SC21009); Foote et al. (1973) used progesterone ear implants for 20 days; Chakraborty et al. (1971), Wetteman and Hafs (1973), Zimbelman (1961) fed Melengestrol Acetate (MGA) for 17 to 20 days; and Menge and Christian (1968) fed 6-methyl-17-acetoxypregesterone (MAP), CAP and MGA.

Several trials have been conducted to determine the cause of depressed

fertility. The following review shows some of the physiological abnormalities at the ensuing estrus due to progesterone treatment.

MGA treated cows had more abnormal ova, lower fertilization (Reed and Rich, 1972) and delayed cleavage (Wishart and Young, 1974). MGA treated heifers also had greater variation in the size of the corpus luteum and fewer Graffian follicles over 3 mm (Hill et al., 1971). This was attributed to an unusual form of follicular atresia characterized by the degeneration of the granulosa cells in most follicles (Guthrie et al., 1970)

Progesterone treatments decrease pregnancy rate especially when started late in the cycle (Woody and Pierce, 1974). This was interpreted as an action of the progesterone on the oviduct and uterus (Hendricks et al., 1973), and a lower glycogen content of the uterus at the ensuing estrus (Wordinger et al., 1970), causing an unfavorable environment for the ovum. Progesterone treated cows had a lowered mucus index (Hill et al., 1971) and greater variations in rectal temperature which indicates altered estrogen levels (Johnson and Ulberg, 1965).

Sperm capacitation is also affected with long term progesterone treatments. Lauderdale and Ericson (1970) found fewer sperm cells in the oviduct of MGA treated cows due to increased phagocytosis of acrosome damaged sperm. Because of damage to the acrosome, sperm have a shorter fertilization life span.

The abnormal hormone patterns causing the physiological abnormalities have been studied in various trials with different conclusions. Britt and Ulberg (1972) found a surge of progesterone 3 days prior to estrus in MGA treated heifers. Dobson et al. (1973)

found not only an increase in progesterone levels before estrus, but also an alteration of the progesterone-estrogen ratio causing an increased period of progesterone influence. Chow et al. (1972) found elevated estrogen levels and lowered progesterone levels. Wettemann and Hafs (1973) also found high estrogen levels in MGA treated heifers. Rodeffer et al. (1972) found the estrogen levels in untreated heifers peaked .5 days before the LH surge, while in the progesterone treated heifers, estrogen peaked .5 days after the LH surge. Hendricks et al. (1973) found total plasma and estrogen levels between treated and untreated animals were not significantly different, but plasma estradiol was significantly higher in the treated heifers. The abnormal estrogen pattern may cause the fertility problem (Rodeffer et al., 1972)

The most likely explanation for long progesterone treatments causing higher estrogen levels prior to estrus in some experiments and not in others is that the assays are not comparable. A difference could exist in the antisera or assay blanks being different for treated cows compared to untreated cows (Hendricks et al., 1973). Also the onset of elevated estrogen may be related to the day of the estrous cycle when the progesterone treatments are started (Hendricks et al., 1973).

Despite numerous studies on factors that cause depressed fertility in long term progesterone treatments, the exact physiological causes are still unknown (Roche, 1976). It can be concluded that these exogenous hormones fail to completely control the reproductive system (Johnson and Ulberg, 1965).

The apparent key to improving fertility in synchronized cows is to reduce the period of progesterone treatment. Woody and Pierce (1974)

and Lemon (1975) found short term progesterone treatments did not depress fertility, but were not effective in synchronizing those cattle in the first 5 days of their estrous cycle. This problem was circumvented by the use of a luteolytic agent at the start of treatment (Wiltbank and Kasson, 1968).

Wiltbank et al. (1961), Rich et al. (1972) and Kaltenbach et al. (1964) used estrogen to cause early regression of the corpus luteum. Lemon (1975) found that the cycle lengths were shortened after an intramuscular injection of either estradiol benzoate or estradiol valerate when given in midcycle. Estrogen was either luteotrophic or luteolytic when given early in the cycle. There was no effect on the corpus luteum when estrogen was given late in the cycle.

Using 5 mg of estradiol valerate at the start of treatment to induce corpus luteum regression in the first part of the cycle along with a 9 day progesterone treatment satisfactorily synchronized cattle without lowering fertility (Wiltbank et al., 1967, 1968, 1971; Burrell et al., 1972; and Woody and Abenes, 1975), but other trials have shown contradictory results. Woody and Pierce (1974) using a 9 day Norethandrolone and 5 mg estradiol valerate found those treated before day 10 of the estrous cycle were not successfully synchronized. Smith and Vincent (1973) utilizing the combination of a 6 mg implant of SC21009 and a 6 mg injection of estradiol valerate also observed ineffective synchronization in cows treated in the first 7 days of their cycle. Woody and Abenes (1975) found the lowest percentage of heifers that synchronized were heifers that were implanted at estrus: 50 percent synchronized when using a 6 mg SC21009 implant and a 5 mg injection of estradiol valerate.

Using silastic coils or implants containing progesterone for 9 days and a 5 mg injection of estradiol benzoate, Roche (1974) experienced a high degree of synchronization in cattle that began treatments on day 5 through 15 of their cycle, but low synchronization on those animals started on other days.

A short treatment of progesterone with an injection of estrogen has not successfully synchronized those cattle which are very late or very early in their cycle or at estrus at the start of the treatment. Animals late in their cycle probably ovulate and fail to show a synchronized estrus (Roche, 1974). Cattle near estrus may need another exogenous hormone to shorten their cycle.

Roche and Gosling (1977) observed lower progesterone levels during the first 2 days after onset of progesterone treatment in animals that did not successfully synchronize.

Woody and Abenes (1975) reported heifers given a dose of 12 mg of progesterone in implants instead of 6 mg of SC21009 had a higher incidence of heat. They also found progesterone along with estrogen will cause luteal regression when given together early in the cycle. In agreement with this Woody and Ginther (1968) reduced the estrous cycle length in heifers using daily progesterone injections on days 3-10 and 1-10 of the heifer's cycle. This is probably because injections of progesterone near estrus will inhibit the LH response to estrogen (Hobson and Hansel, 1972).

Using the combination of SC21009 and estradiol valerate, Lemon (1975) modified the action of the estrogen when administered early in the estrous cycle, causing it to be luteolytic. The combination of progesterone and estrogen will shorten the cycle in cows early in the

estrous cycle. Roche (1974) confirmed this when he observed improved synchronization by injecting 50 mg of progesterone along with 5 mg of estradiol benzoate at the start of the 9 day progesterone treatment. Synchronization was also improved in animals near estrus when Wiltbank and Gozalez-Padilla (1975) utilized a combination of both 5 mg of estradiol valerate and 3 mg of Norgestomet in an injection at the start of a 9 day Norgestomet treatment.

BREEDING AT A PREDETERMINED TIME AFTER SYNCHRONIZATION TREATMENT

Estrus detection is very important in order to determine the optimum time to breed. Incorrect timing of insemination leads to reduced fertility (Deas, 1970). Estrus detection becomes more difficult in a synchronized group of cattle due to the varying degrees of estrus activity being shown by the majority of the animals (Wishart and Young, 1974). Synchronized animals may also fail to show an overt estrus. Sreenan and Muleville (1975) using a 10 day intravaginal SC9880 progestogen treatment and a 5 mg injection of estradiol valerate, noted that some cows not detected in heat after implant removal were in estrus 17 to 21 days later, indicating they had ovulated during the synchronized period.

Wishart and Young (1974) employing a 9 day SC21009 treatment and an injection of 3 mg of SC21009 and 5 mg of estradiol valerate (Syncro-Mate B treatment, Searle Co.) at implantation, noted that 3 of 4 cows failing to show estrus, did ovulate during the synchronized period.

The need for accurate estrus detection of cattle in various stages of estrus, as well as those cattle not exhibiting an overt estrus

has led several workers to breed synchronized cattle at a predetermined time following implant removal. Sreenan and Muleville (1974) obtained higher conception rates in heifers bred at 42 and 72 hours after removal of a 10 day SC9880 vaginal pessary and an injection of 7.5 mg of estradiol benzoate at pessary insertion than in controls. Wishart and Young (1974) obtained a higher conception rate by breeding at 48 and 60 hours following Syncro-Mate B treatment than in those bred by estrus or those bred at 48 hours after implant removal.

Breeding at 48 hours may be too early following implant removal in the Syncro-Mate B treatment for highest conception rates since Wishart and Young (1974) obtained higher conception when breeding at 48 and 60 hours instead of only at 48 hours after implant removal. Morrison (1975) using the same treatment obtained higher conception when breeding at 60 hours following implant removal than 48 or 54 hours.

EXPERIMENT 1: TIME AND METHOD OF BREEDING AFTER SYNCHRONIZATION

SUMMARY

One hundred and fifty-five mature lactating Polled Hereford cows were assigned to four treatment combinations: (1) bred according to estrus versus bred 60 hours after implant removal; (2) artificially inseminated at synchronized estrus versus unsynchronized estrus; (3) artificially inseminated once a day (cows found in estrus either in the morning or in the evening were bred the next morning) versus artificially inseminated twice a day (cows found in estrus in the evening were bred the next morning and cows found in estrus in the morning were bred that evening); (4) artificial insemination versus natural service.

Within 3 days after removal of implants, 77.2 percent of the treated cows were in estrus. The percent conceived to first service and percent conceived the first 25 days of the breeding season were: cows bred according to estrus - 49.6, 56.9; cows bred 60 hours after implant removal - 38.9, 83.3; cows synchronized - 44.3, 67.1; cows not synchronized - 50.6, 52.6; cows in the group bred once a day - 33.3 54.2; cows in the group bred twice a day - 55.1, 62.6; cows artificially inseminated - 46.0, 60.2; cows bred naturally - 54.8, 59.5.

INTRODUCTION

Syncro-Mate B is the trade name for an experimental treatment developed by G. D. Searle Company to synchronize estrus in cattle. This treatment consists of a subcutaneous progestogen (SC21009) ear implant given for 9 days plus injecting SC21009 and estradiol valerate at the time of implantation.

It is now generally accepted that progesterone treatment over 14 days will reduce fertility in synchronized cattle (Wishart, 1975). Previous studies have shown the short term SC21009 treatment can result in normal fertility, but the results are not consistent (Morrison, 1975; Smith and Vincent, 1973; Woody and Abenes, 1975). There is also evidence (Wishart, 1975) that the Syncro-Mate B will synchronize ovulations close enough to permit insemination at predetermined times following implant removal and obtain fertility equal to those animals inseminated according to detection of estrus after treatment.

Studies have also shown that the time of ovulation may be altered by synchronization (Wiltbank et al., 1967 and Wishart, 1975), and that synchronized animals may fail to show an overt estrus, but still ovulate. Also estrus detection becomes more difficult in synchronized animals due to the varying signs of estrus activity (Wishart and Young, 1974). If synchronization alters the relationship between estrus and ovulation, or signs of estrus do not occur; breeding at a predetermined time following implant removal could eliminate the need for estrus detection.

No reports have been found that compare one insemination period each day (cows in estrus either in the morning or evening are bred the next morning) to the traditional two insemination periods each day (cows found in estrus in the evening are bred the next morning and those found in estrus in the morning are bred that evening). However, several ranchers (M. Miller, and P. Cagliero, personal communication) employed this practice to save labor and obtained satisfactory results.

This study was undertaken to determine the effectiveness of breeding at a predetermined time and to compare one versus two insemination periods a day in lactating beef cows after Syncro-Mate B treatment.

MATERIALS AND METHODS

One hundred and fifty Polled Hereford cows averaging 63 days postpartum were used in a 2 year study. Cows were divided into seven breeding groups:

Group 1. Cows were allowed to mate naturally with a bull wearing a chinball marker. Cows were checked daily and breeding dates were recorded.

Group 2. Estrus was synchronized and cows were placed with 5 bulls.

Group 3. Cows were artificially inseminated approximately 12 hours after estrus was observed. Those in estrus in the morning were bred in the evening, and those in estrus in the evening were bred the next morning.

Group 4. Cows were artificially inseminated once a day approximately 12 to 24 hours after detected in estrus. Those detected in estrus either in the morning or in the evening were bred the next morning.

Group 5. Estrus was synchronized and cows were bred artificially twice a day approximately 12 hours after estrus was detected, as in group 3.

Group 6. Estrus was synchronized and cows were artificially bred once a day, as in group 4.

Group 7. Estrus was synchronized and cows were artificially

bred 60 hours after implants were removed without regard to estrus.

In all cases estrus was synchronized with SC21009 progestogen ear implants and an injection of 6 mg estradiol valerate plus 3 mg SC21009 at implantation. Implants were removed 9 days later. Checks for estrus were made twice daily, in the morning and in the evening. Cows in groups 5, 6, and 7 were placed with bulls equipped with chinball markers 6 days after implants were removed. Eighteen days after implant removal cows were artificially inseminated again for five days. For the remainder of the season a bull wearing a chinball marker was placed with the cows. Cows were checked daily and breeding dates were recorded.

All cows were kept on range for the duration of the experiment. Bulls were removed after a 65 day breeding season (including A.I.). Pregnancy was determined by rectal palpation at approximately 50, 75, and 100 days following the start of the breeding season.

RESULTS AND DISCUSSION

Within 48 hours after implant removal, 51 of 66 (77.2%) Syncro-Mate B treated cows were in estrus. To analyze the results, cows were assigned to four treatment combinations: (1) bred according to estrus, versus bred 60 hours after implant removal; (2) artificially inseminated at synchronized estrus versus unsynchronized estrus; (3) artificially inseminated once a day (cows found in estrus either in the morning or in the evening were bred the next morning) versus artificially inseminated twice a day (cows found in estrus in the evening were bred the next morning and cows found in estrus in the morning were bred that evening); (4) artificial insemination versus natural service. The percent conceiving to the first service and the first 25 days of the breeding season is shown in table 1.

Cows in the group bred twice a day had a higher conception rate at first service and the first 25 days than cows in the group bred once a day. This indicates that breeding in the evening 12 to 24 hours after detected in estrus was too late thus lowered conception. Barrett and Casida (1946) found when cows were inseminated 3 to 25 hours after detection of estrus there was little variation in the conception rate; but these results depend upon the prompt detection of estrus. There is an inevitable delay between when a cow first comes into estrus and when she is detected. This was especially true in this trial. The cows were located in five pastures on 1388 acres. Heat checks requiring 2 to 3

hours were made in the morning and evening.

Cows in the once a day breeding group found in estrus in the morning were left until the next morning to be bred. If she came into estrus after an evening check it could be as much as 36 hours after the onset of estrus before she was bred. Considering the delay between when a cow first comes into estrus till detection then to insemination; if she was bred directly after found in estrus, this may be closer to the optimum time to breed, rather than waiting till the next morning.

Synchronized cows had a lower conception rate at first service than unsynchronized cows, but by the first 25 days a higher percentage of synchronized cows were bred.

The average number of days to conception from the start of the breeding season was 15.2 days for the synchronized cows and 22.1 for the unsynchronized cows. The average calving date for the synchronized cows was one week earlier than for nonsynchronized cows.

Cows that were synchronized required less labor than the unsynchronized A.I. bred cows. They were artificially bred less than 10 days compared to 25 days for the nonsynchronized A.I. cows.

Cows bred 60 hours after implant removal had a lower conception at first service than cows bred at estrus, but by the end of the first 25 days they had the highest percent pregnant compared to any other group. One of the four cows failing to show estrus conceived, indicating she had ovulated.

Wishart and Young (1974) found most heifers in heat between 24 and 48 hours after implant removal, and according to Deas (1970) cows should be bred at mid- to late estrus. Breeding at 60 hours after implant removal might have been too late for some cows.

Conception rates calculated by a least squares mean test for the four treatment combinations is shown in table 2. Because of incomplete experimental design, the total number of cows could not be used for this comparison. Least square results concur with the uncorrected data, except for the synchronized versus unsynchronized treatment combination. In table 2, a higher percentage of the synchronized cows were pregnant to the first service. This is because of the 47 cows analyzed, 13 cows were bred naturally. The naturally bred group was the only synchronized group that had a higher conception rate than a unsynchronized group. This indicates that natural breeding following synchronization could increase the fertility following synchronization.

Table 1. CONCEPTION RATES OF COWS AFTER SYNCHRONIZATION, ONE VERSUS TWO INSEMINATION PERIODS A DAY, AND BREEDING AT A PREDETERMINED TIME.

Treatment	No.	% conceived at first service	% conceived first 25 days
bred according to estrus	137	49.6	56.9
bred 60 hr after explant	18	38.9	83.3
synchronized	76	44.3	67.1
not synchronized	79	50.6	52.6
bred 1 X day ^a	48	33.3	54.2
bred 2 X day ^b	107	55.1	62.6
artificially inseminated	113	46.0	60.2
bred naturally	42	54.8	59.5

^acows in estrus either in the morning or evening were bred the next morning

^bcows in estrus in the evening were bred the next morning; those in estrus in the morning were bred that evening

Table 2. LEAST SQUARES MEAN CONCEPTION RATES OF COWS AFTER SYNCHRONIZATION, ONE VERSUS TWO INSEMINATION PERIODS A DAY, AND BREEDING AT A PREDETERMINED TIME.

Treatment	No.	% conceived at first service	% conceived first 25 days
bred according to estrus	34	49.3	61.4
bred 60 hr after explant	18	40.3	84.0
synchronized	47	55.8	68.0
not synchronized	60	51.8	57.3
bred 1 X day ^a	30	26.2	36.4
bred 2 X day ^b	65	52.6	63.3
artificially inseminated	65	52.5	63.2
bred naturally	42	55.1	61.9

^acows in estrus either in the morning or evening were bred the next morning.

^bcows in estrus in the evening were bred the next morning; those in estrus in the morning were bred that evening

EXPERIMENT 2: EFFECT OF CALF REMOVAL ON SYNCHRONIZATION

SUMMARY

Two hundred and six mature lactating Hereford, Angus, Angus-Hereford cross, Simmental cross and Charolais cross cows were divided into three treatment groups. Group 1 was synchronized, calves were removed at time of implant removal for 48 hours, and cows were artificially bred 48 hours after implant removal. Group 2 was synchronized and bred 48 hours after implant removal. Group 3 received no treatment, and were artificially bred following estrus.

The percent conceived at first service and the percent conceived the first 25 days of the breeding season were: synchronized plus calf removal - 40.1, 59.8; synchronized - 51.7, 65.3; unsynchronized - 56.1, 58.1.

There was no difference in using either 5 or 6 mg of estradiol valerate on conception rates, according to a least squares analysis of variance; therefore data for the estradiol treatments were pooled.

Cows that were synchronized and had their calves removed, had a lower first service conception when compared to both the unsynchronized and the synchronized only group; but by the first 25 days of the breeding season, there was no difference between groups.

INTRODUCTION

The Syncro-Mate B treatment, consisting of a 6 mg synthetic progestogen (SC21009) 9 day ear implant along with 6 mg estradiol valerate and 3 mg SC21009 injection at the time of implantation, will successfully synchronize heifers (Woody and Abenes, 1975). Reports have shown that fewer lactating beef cows will exhibit a synchronized estrus than heifers under the same conditions. Wiltbank et al. (1977) using a synthetic progestogen (Nilevar) in a 9 day ear implant with 5 mg estradiol valerate at the time of implantation reported 98 percent of the heifers treated were in estrus within 48 hours; while 93 percent of the similarly treated cows showed estrus. Wiltbank and Kasson (1968), feeding 400 mg of DHPA per day for 9 days and injecting 5 mg of estradiol valerate on the second day of feeding DHPA, caused 95 percent of the treated heifers to synchronize, but only 77 percent of the similarly treated cows showed a synchronized estrus.

Suckling will delay the return to estrus in a lactating beef cow (Wiltbank, 1977). Wiltbank (1977) found early weaning calves at 40 days caused a greater number of cows to be in estrus by 70 days post partum than weaning at 180 days.

This has led researchers to employ early calf removal at the time of implant removal when using the Syncro-Mate B treatment.

Wiltbank (1977) using the Syncro-Mate B treatment and calf removal for 48 hours after implant removal obtained 96 percent of his cows in estrus within 4 days. By 42 hours 85 percent of the synchronized cows with calves removed had started into estrus, while only 45 percent of

the synchronized cows nursing calves had been detected.

Wiltbank (1977) also noted cows synchronized well enough to breed 48 hours after implant removal. Breeding at 48 hours after implant removal did not decrease pregnancy rate when compared to breeding 12 hours after detected in estrus.

The purpose of this trial was to repeat Wiltbank's work by evaluating Syncro-Mate B plus calf removal and breeding at a predetermined time of 48 hours after implant removal; as well as to test the effectiveness of 5 and 6 mg of estradiol valerate in the Syncro-Mate B treatment for mature cows.

MATERIAL AND METHODS

Two hundred and six mature lactating Hereford, Angus, Angus-Hereford cross, Simmental cross and Charolais cross cows were divided into three treatment groups. Group 1 was synchronized, calves removed at time of implant removal for 48 hours, and cows were artificially bred 48 hours after implant removal. Group 2 was synchronized and artificially bred 48 hours after implant removal. Group 3 received no treatment, and were artificially bred following estrus.

Cows were synchronized with a Syncro-Mate B treatment consisting of a 6 mg progestogen (SC21009) ear implant and an injection of either 5 or 6 mg of estradiol valerate plus 3 mg of SC21009 at time of implantation. Implants were removed 9 days later.

Pregnancy was determined by rectal palpation 101 days after implant removal. Results were analyzed by least squares analysis of variance (Kemp, 1972).

RESULTS AND DISCUSSION

Results are shown in table 1.

Table 1. LEAST SQUARES MEAN CONCEPTION RATES OF COWS AFTER SYNCRO-MATE B TREATMENT PLUS CALF REMOVAL AND SYNCRO-MATE B TREATMENT ALONE.

Treatment	No.	% conceived at first service	% conceived first 25 days
synchronized plus calf removal	73	40.1	59.8
synchronized	75	51.7	65.3
unsynchronized	59	56.1	58.1

Thirteen unsynchronized cows were not detected in estrus and were not bred during the first 25 days. Of those bred, 29 of 46 conceived to the first service (63.0%).

There was no difference in using either 5 or 6 mg of estradiol valerate on conception rates, according to a least squares analysis of variance; therefore data for the estradiol treatments were pooled.

Cows that were synchronized and had their calves removed, had a lower first service conception when compared to both the unsynchronized and the synchronized only group; but by the first 25 days of the breeding season, there was no difference between groups. This indicates that calf removal did not have a beneficial effect at first service, which is not in agreement with Wiltbank's (1977) findings.

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LITERATURE CITED

- Barrett, G. R., and L. E. Casida. 1946. Time of insemination and conception rate in artificial breeding. J. Dairy Sci. 29:556. (Abstr.).
- Britt, J. H. and L. C. Ulberg. 1972. Melengestrol acetate administration to dairy heifers and progesterone levels in the peripheral blood plasma. J. Reprod. Fertil. 29:119.
- Burrell, C., J. N. Wiltbank, D. G. Le Fever and G. Rodeffer. 1972. Ear implants (SC21009) for estrous control in heifers. J. Anim. Sci. 34:915. (Abstr.).
- Chakraborty, P. K., R. H. Kliever 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.
- Chow, L. A., W. W. Thatcher, J. C. Chenault, P. S. Kalra and C. J. Wilcox. 1972. Effects of MGA on bovine plasma ovarian steroids. J. Anim. Sci. 35:239.
- 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.).
- 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.).
- Deas, D. W. 1970. The timing of insemination. Vet. Rec. 86:450.
- Dobson, H., L. J. Boyd and D. Exley. 1973. Circulating oestrogens and progesterone in the bovine after synchronization with melengestrol acetate. J. Reprod. Fertil. 33:231.
- Foot, W. C., R. A. Bellows, T. M. De Rouen and D. C. Meyerhoeffer. 1973. Influence of progesterone implants on reproduction of cows. J. Anim. Sci. 37:250. (Abstr.).
- Guthrie, H. D., D. R. Lamond, D. M. Hendricks and J. F. Dickey. 1970. Ovarian follicular changes in heifers treated with melengestrol acetate. J. Reprod. Fertil. 22:363.
- 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.

- Hill, J. R., D. R. Lamond, D. M. Hendricks, J. F. Dickey and G. D. Niswender. 1971. Effect of melengestrol acetate (MGA) on ovarian function and fertilization in beef heifers. *Biol. Reprod.* 4:16.
- Hobson, W. D. and W. Hansel. 1972. Plasma levels after ovariectomy, corpus luteum removal and estradiol administration in cattle. *Endocrinol.* 91:185.
- Johnson, A. D. and L. C. Ulberg. 1965. Some physiological manifestations in the bovine estrus cycle during control with exogenous hormones. *J. Anim. Sci.* 24:403.
- Kaltenbach, C. C., G. D. Niswender, D. R. Zimmerman and J. N. Wiltbank. 1964. Alteration of ovarian activity in cycling, pregnant, and hysterectomized heifers with exogenous estrogens. *J. Anim. Sci.* 23:995.
- Kemp, K. E. 1972. Least squares analysis of variance, a procedure, a program, and examples of their use. *Kans. Agr. Exp. Sta. Res. Bul.* 7.
- 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.
- Lemon, M. 1975. The effect of oestrogen alone or in association with progestogens on the formation and regression of the corpus luteum of the cyclic cow. *Ann. Biol. Anim. Bioch. Biophys.* 15:243.
- Liang, L. and O. T. Fosgate. 1971. Estrus synchronization and subsequent fertility in dairy cattle treated with 17-alpha-ethyl-19-nortestosterone (Nilevar) and 17-alpha-ethynyl-19-nortestosterone (SC4640). *J. Anim. Sci.* 33:96.
- Morrison, D. 1975. Induced calving and estrus synchronization in beef cattle. Masters Thesis. Kansas State University, Manhattan, Kansas.
- Menge, A. C. and J. J. Christian Jr. 1968. Estrus synchronization in cattle following feeding of six progestogens. *J. Dairy Sci.* 51:1284.
- Reed, I. D. and T. D. Rich. 1972. Influence of MGA on cow fertility. *J. Anim. Sci.* 35:1123.
- Rich, T. D., C. L. Johnson and R. D. Randel. 1972. Plasma LH, progestins and corticoids in heifers injected with estradiol valerate and FSH during estrous synchronization with MGA. *J. Anim. Sci.* 35:90.
- Roche, J. F. 1974. Effect of short term progesterone treatments on oestrus response and fertility in heifers. *J. Reprod. Fertil.* 40:433.

- 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.
- Roche, J. F. and F. P. Gosling. 1977. Control of estrus and progesterone levels in heifers given intravaginal progesterone coils and injections of progesterone and estrogen. J. Anim. Sci. 44:1026.
- Rodeffer, G. H., M. L. Hopwood and J. N. Wiltbank. 1972. LH and estrogen following estrous control. J. Anim. Sci. 34:901
- Smith, L. E. Jr. and C. K. Vincent. 1973. Stage of cycle effect on bovine estrous control. J. Anim. Sci. 36:216.
- Sreenan, J. M. and P. Muleville. 1975. The application of long- and short-term progestagen treatments for estrous cycle control in heifers. J. Reprod. Fertil. 45:367.
- Wagner, J. F., E. L. Veenhuizen, R. P. Gregory and L. V. Tonkinson. 1968. Fertility in the beef heifer following treatment with 6-chloro- Δ^6 -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 for estrous control in cows. J. Anim. Sci. 34:915. (Abstr.).
- Wiltbank, J. N. Ways to solve special breeding problems. Simmental Shield. February, 1977.
- Wiltbank, J. N. and E Gonzalez-Padilla. 1975. Synchronization and induction of estrus in heifers with a progesterone 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 oestrogens alone or in combination with gonadotrophins on the oestrous cycle of beef heifers. J. Anim. Sci. 20:341.
- Wiltbank, J. N. and C. W. Kasson. 1968. Synchronization of estrus in cattle with an oral progestational agent and an injection of an estrogen. J. Anim. Sci. 27:113.
- 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. N., J. C. Sturges, D. Wideman, D. G. Le Fever, and L. C. Faulkner. 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
- Woody, C. O. and F. B. Abenes. 1975. Regulation of ovarian function in Holstein heifers with SC21009 implants and estradiol valerate. *J. Anim. Sci.* 41:1057.
- Woody, C. O. and O. J. Ginther. 1968. Effect of exogenous progesterone on corpora lutea in unilaterally hysterectomized heifers. *J. Anim. Sci.* 27:1387.
- Woody, C. O. and R. A. Pierce. 1974. Influence of day of estrus cycle at treatment on response to estrus cycle regulation by Norethandrolone implants and estradiol valerate injections. *J. Anim. Sci.* 39:903.
- Wordinger, R. J., J. F. Dickey and J. R. Hill. 1970. Effect of MGA on bovine endometrium. *J. Anim. Sci.* 31:234.
- Zimbelman, R. G. 1961. The control of estrus and ovulation in heifers by orally administered 6-alpha-methyl-17-alpha-acetoxy-progesterone. *J. Dairy Sci.* 44:1195. (Abstr.).

A COMPARISON OF VARIOUS MANAGEMENT SYSTEMS
ON CONCEPTION AFTER SYNCHRONIZATION OF
ESTRUS IN BEEF COWS

by

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ABSTRACT

Three hundred and sixty-one mature lactating cows were used in two experiments to study the fertility in cows under various management systems after synchronization with Syncro-Mate B. The Syncro-Mate B treatment consists of a 6 mg synthetic progestogen (SC21009) ear implant given for 9 days plus injecting 3 mg of SC21009 and 6 mg of estradiol valerate at the time of implantation.

In the first experiment, 155 polled Hereford cows were assigned to four treatment combinations: (1) bred according to estrus, versus bred 60 hours after implant removal; (2) artificially inseminated at synchronized estrus versus unsynchronized estrus; (3) artificially inseminated once a day (cows found in estrus either in the morning or in the evening were bred the next morning) versus artificially inseminated twice a day (cows found in estrus in the evening were bred the next morning and cows found in estrus in the morning were bred that evening); (4) artificial insemination versus natural service.

Within 3 days after removal of implants, 77.2 percent of the treated cows were in estrus. The percent conceived to first service and percent conceived the first 25 days of the breeding season were: cows bred according to estrus - 49.6, 56.9; cows bred 60 hours after implant removal - 38.9, 83.3; cows synchronized - 44.3, 67.1; cows not synchronized - 50.6, 52.6; cows in the group bred once a day - 33.3 54.2; cows in the group bred twice a day - 55.1, 62.6; cows artificially

inseminated - 46.0, 60.2; cows bred naturally - 54.8, 59.5.

Cows in the group bred twice a day had a higher conception rate at the first service and first 25 days than those bred once a day. This indicates that breeding in the evening 12 to 24 hours after detected in estrus was too late for optimum conception.

Synchronized cows had a lower conception rate at first estrus than unsynchronized cows, but by 25 days a higher percentage of synchronized cows were bred. The average calving date for synchronized cows was one week earlier than for unsynchronized cows.

Cows bred at 60 hours after implant removal had a lower conception rate at first service than cows bred at estrus, but by the end of the first 25 days, they had the highest percent pregnant compared to any other group.

In the second experiment 206 Hereford, Angus, Angus-Hereford cross, Simmental cross and Charolais cross cows were divided into three treatment groups. Group 1 was synchronized, calves were removed at time of implant removal for 48 hours, and cows were artificially bred 48 hours after implant removal. Group 2 was synchronized and bred 48 hours after implant removal. Group 3 received no treatment, and were artificially bred according to estrus.

Cows were synchronized with the Syncro-Mate B treatment as in experiment one, except the effectiveness of using either 5 or 6 mg of estradiol valerate was tested in this experiment.

The results for the percent conceived at first service and the percent conceived the first 25 days of the breeding season are: synchronized plus calf removal - 40.1, 59.8; synchronized - 51.7, 65.3; unsynchronized - 56.1, 58.1.

There was no difference in using either 5 or 6 mg of estradiol valerate on conception rates, according to a least squares analysis of variance; therefore data for the estradiol treatments were pooled.

Cows that were synchronized and had their calves removed, had a lower first service conception when compared to both the unsynchronized and the synchronized only group; but by the first 25 days of the breeding season, there was no difference between groups.