HEAT DETECTION WITH TESTOSTERONE TREATED COWS AND EFFECT OF HEAT SYNCHRONIZATION ON CONCEPTION RATES IN HEIFERS

by

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LITERATURE REVIEW

METHODS OF HEAT DETECTION IN CATTLE

For artificial insemination (AI) to be effective and profitable, time and effort must be minimized during heat detection without overlooking cows that are in heat (Anderson, 1958). In an AI program, one of the biggest problems is heat detection (Braun and Bay, 1956). Failure to detect cows in heat by 60 to 90 days postpartum has been related to observation failure to a greater extent than to failure of the cow to express heat (Lauderdale, 1973). Barr (1975) found that 40.3 days per cow per year were lost due to missed heat periods and only 14.7 days per cow per year were lost due to failure to conceive. Also, 1.7 observed heats were required for conception and 1.9 heats per cow per year were missed. Approximately 53% of the heats were being missed.

Several methods of detection and aids to heat detection have been used. They have been categorized as either nonvisual methods or visual aids for heat detection (Foote, 1975).

Nonvisual methods of heat detection include rectal palpation (Zemjanis et al., 1969), changes in cervical mucus (Lamond and Shanahan, 1969; Linford, 1974), and other vaginal measurements such as cytology, pH, and temperature. These methods have proven impractical under applied conditions because measurements have to be made daily. Therefore, nonvisual methods of heat detection have been used only in clinical cases and under research conditions.

Visual observation by a herdsman was the first method of heat detection used by man. Highest frequency of both first mountings and all mountings was observed between midnight and 6 a.m. (Hurnik *et al.*, 1974). In dairy herds, observation of cows on the way to and from the dairy, and in the dairy and holding yard, was the least satisfactory way of detecting heat, since behavioral signs were minimal at this time. Observation in the field especially at night was most effective (Williamson *et al.*, 1972b). Heat detection, although labor consuming, has proven very necessary for a successful AI program.

Visual aids for heat detection can be classified as: (1) a device attached to the female being observed and (2) a device attached to a detector animal. Zemjanis *et al.* (1969) found that about 90% of the cows reported by dairymen as being anestrous were cycling. Heat mount detectors attached to the female sometimes enabled cows to be bred that otherwise would have been missed. Heat mount detectors have been reported superior to continuous observation for heat detection (Williamson *et al.*, 1972a; Williamson *et al.*, 1972b). Problems such as false positives (Williamson *et al.*, 1972a) and loss of the device (Boyd and Hignett, 1968) have been encountered. Another problem observed by Boyd and Hignett (1968) was heifers standing one day but the aid was not considered positive until the next day. This caused a delay in insemination and a lower conception rate.

Detector animals have been prepared in several ways. Chin-ball markers (Lang *et al.*, 1968) filled with dye have been the most frequently used. When the detector animal mounts an animal, dye is deposited on the back and rump.

Vasectomy has been used to prevent conception. Vasectomized bulls did not lose libido but coitus and ejaculation occurred making the spread of venereal disease possible (Frazer, 1973). Amstutz (1970) found in some cases that vasectomy was not fool-proof and some pregnancies occurred.

Penectomy or phallectomy (amputation of the penis) have also been used to prevent conception. Copulation is not possible and venereal disease would not be spread; however, it involves complicated surgery and bulls cannot be used for 6 to 8 weeks (Straub and Kendrick, 1965). Problems with bleeding and flies have been encountered (Frazer, 1973; Straub and Kendrick, 1965) as well as subsequent loss of libido (Jochle et al., 1973).

"Sidewinders" (bulls with the penis deviated to one side) have also been used as detector animals. Edema in association with the subcutaneous tunnel formed for the penis (Royes and Bivin, 1973) and urinary retention in the prepuce resulting in irritation (Jochle et al., 1973) have resulted.

Various devices have been inserted into the penal sheath to create a physical block and the penis has also been adhered to the sheath to prevent extension. Sutures to hold the penal block in place (Bieberly and Bieberly, 1973) or to hold the penis close to the sheath to form a good adhesion (Belling, 1961) are prone to breaking during sexual excitement.

Donaldson (1968) found that teasing heifers with surgically altered bulls resulted in better heat detection than observation alone. Time of observation was important. Observation at 0830 showed a 7.6% decrease in heat detection compared to heat detection at 0630.

Levine (1972) found that prenatal androgen administration to guinea pigs or neonatal androgen administration to rats suppresses female behavior patterns and causes male like behavior. Lindsey and Robertson (1961) found that ovariectomized ewes had increased sexual activity when given testosterone. Signoret (1972) reported that testosterone propionate prolonged sexual activity in ewes compared to those given estradiol. Signoret (1975) further reported that repeated testosterone injections caused male like sexual activity in cows.

Cows have also been used for heat detection. Testosterone has been administered for this purpose in many ways; (1) intravaginally positioned testosterone impregnated silicone rubber spring loaded spiral (Mauer et al., 1975), (2) intravaginally positioned testosterone impregnated polyurethane sponge pessaries (Scanlon et al., 1972), (3) intramuscular injections of testosterone propionate in oil; 200 mg every other day for 10 injections (Signoret, 1975), or 400 mg every fourth day for five injections (J. Britt, 1977, unpublished data). In all cases, the initial induction phase lasted for 20 days. This was followed by 1 or 0.5 gm testosterone enanthate injected subcutaneously every 2 weeks to maintain an androgen induced behavior.

Scanlon et al. (1972) found sponge pessaries positioned intravaginally predisposed the vagina to infection and may induce pessary loss especially in older cows. Roche (1976) reported frequent loss of silastic coils. Kiser et al. (1977) compared sponge pessaries, silastic coils, and injections of testosterone propionate (200 mg every other day for 10 injections) as induction methods and found as long as the coils and pessaries were not lost, blood levels of testosterone over 5 ng/ml were maintained. This level effectively induced mounting behavior in cows.

Kiser et al. (1975b) penned two treated cows which had received testosterone propionate injections with 62 nonpregnant and 26 pregnant cows for 21 days. Fourty-six of the 62 (74%) were marked but only 30 (48%) were observed in heat. None of the 26 pregnant cows were marked.

Kiser et al. (1975a) then exposed the treated cows to 207 cows. Twenty-six (17.5%) which were diagnosed pregnant during the AI period were marked but not observed by the herdsman. In this group, 28% of all cows detected in heat were not marked, but were observed standing. He pointed out that the ratio of breeding females per testosterone treated cow was too high in this study (58:1). Beerwinkle (1974) found that 30 cows per penectomized bull was optimal and resulted in 95% heat detection by the bull.

Kiser et al. (1975a), using 90 beef cows, compared observations by a herdsman to heat detection aided by a surgically altered bull or a testosterone treated cow. The breeding animal to detector animal ratio was 30 to 1. Number and percent of cows inseminated and conception rate was similar for the herdsman, bull, and testosterone treated cow groups. There was a slight tendency for number of cows inseminated and percent pregnant to be higher in the testosterone treated cow group.

Chapman _et al_. (1977) found testosterone treated cows superior to bulls for heat detection. Cows received injections of either 10, 15, or 20 mg testosterone propionate subcutaneously every other day. Thirty-six cows were marked out of 52 non-pregnant cows. Eighty-four percent of the 36 conceived. Some detector cows were treated with either 2, 3, or 4 mg estradiol benzoate subcutaneously every other day. Cows with this treatment marked 28 cows out of 51 non-pregnant cows. Of the 28 inseminated 54% conceived. Bulls were penned with 53 non-pregnant cows and marked 33 of them. Of the 33 inseminated, 44% conceived.

Steers have also been used for heat detection (Goodeaux _et al_., 1977a; Morrison _et al_., 1977; Goodeaux _et al_., 1977b). The steers were treated with testosterone enanthate and estradiol valerate. Results were variable but treated steers were comparable to surgically altered bulls at stocking rates of 50 cycling cows per detector animal.

Recently, trained dogs have been used for heat detection (Kiddy _et al_., 1977). Each dog was tested 90 times with one estrus swab and one nonestrus swab from a single cow. Correct detection for 6 dogs was 67%. When cows instead of swabs were used, correct detection was 79%. The dogs would sit down behind an estrual cow for a positive indication.

EXPERIMENT 1

EFFECT OF AGE AND TYPE OF TESTOSTERONE TREATMENT ON COWS USED FOR HEAT DETECTION

SUMMARY

Twelve cows with Hereford, Polled Hereford, and crossbred Simmental breeding were treated with testosterone and used to aid in heat detection. All cows were injected intramuscularly (IM) with 200 mg testosterone propionate (TP) on alternate days until 10 injections had been given. Cows were classified as either aged (6 to 8 years) or young (2 to 4 years) and were allotted to the following treatment groups: (1) aged cows injected with 200 mg TP every 10 days; (2) aged cows injected with 1 gm testosterone enanthate (TE) every 14 days; (3) young cows injected with 200 mg TP every 10 days; or (4) young cows injected with 1 gm TE every 14 days. Aged TP-treated cows, aged TE-treated cows, young TP-treated cows, and young TE-treated cows marked 88.9%, 73.2%, 68.7%, and 51.5% of the cows in heat, respectively. Out of 249 cows observed in heat, 240 cows were marked (96.4%). Under these conditions, TP was more effective than TE as a booster for maintaining cows as heat detectors. Also, aged cows marked more estrual cows than did young cows.

INTRODUCTION

Several aids have been developed to help improve the efficiency of heat detection due primarily to the increased popularity of artificial insemination. Most of these aids can be classified as; (1) a device attached to the female being observed, and (2) a device attached to a detector animal.

Disadvantages of a device attached to the female being observed are false positives due to crowding or another cow in heat mounting a nonestrual cow (Williamson et al., 1972b; Baker, 1965), loss of aid, and delayed detection (Boyd and Hignett, 1968). Aids of this type have been found superior to continuous observation (Williamson et al., 1972a) and observation at time of milking in dairys (Williamson et al., 1972b).

Detector animals can be prepared in several ways. A vasectomy can be used but problems with venereal disease and some cases of fertility have been observed (Frazer, 1973). Bulls lose libido if the penis is amputated, adhered to the sheath, or physically blocked (penal block) (Jochle et al., 1973). Surgical displacement of the penis sometimes cause edema (Royes and Bivin, 1973) and irritation from urine (Jochle et al., 1973) in association with the subcutaneous tunnel formed for the penis. Heat detection with surgically altered bulls has been found superior to observation by a herdsman (Donaldson, 1968).

Cows culled because of low mothering ability, infertility or low production can be used as a detector animal eliminating the cost of raising or buying an animal for heat detection. Signoret (1975) found that injections of 200 mg testosterone propionate every second day for 20 days followed by 2 monthly injections of a long acting androgen induced a high level of male sexual behavior in cows. This method is simpler and as efficient as vasectomized bulls. Testosterone enanthate is a suitable long acting androgen (Kiser et al., 1975a).

Testosterone enanthate is expensive and not readily available to producers compared to testosterone propionate. Therefore, this study was undertaken to determine: (1) if testosterone propionate could be substituted for testosterone enanthate as the booster injection; (2) whether a cow's age affects her effectiveness as a heat detector; and (3) if ovulation occurs in the face of exogenous testosterone treatment.

MATERIALS AND METHODS

Twelve Hereford, Polled Hereford, and crossbred Simmental cows were treated with testosterone and used in heat detection. All cows were injected intramuscularly (IM) with 200 mg testosterone propionate (TP) on alternate days until 10 injections had been given. Cows were classified as either aged (6 to 8 years) or young (2 to 4 years), and allotted to the following treatment groups: (1) aged cows injected with 200 mg TP every 10 days; (2) aged cows injected with 1 gm testosterone enanthate (TE) every 14 days; (3) young cows injected with 200 mg TP every 10 days; or (4) young cows injected with 1 gm TE every 14 days (Figure I). All injections were IM. A cow from each of the four treatments was paired with a cow from one of the other treatments and equipped with a chin-ball marker. Paired cows had different color dyes in their markers. All possible pair combinations were made among the four treatment groups. Once paired, the treated cows were not separated for the duration of the experiment. Each pair was placed in a pasture with 40 to 60 nonpregnant-suckling beef cows. The cows were checked for marks and other signs of heat twice daily for 30 to 50 days. Cows from each treatment were rectally palpated every 7 to 10 days to determine significant ovarian structures.

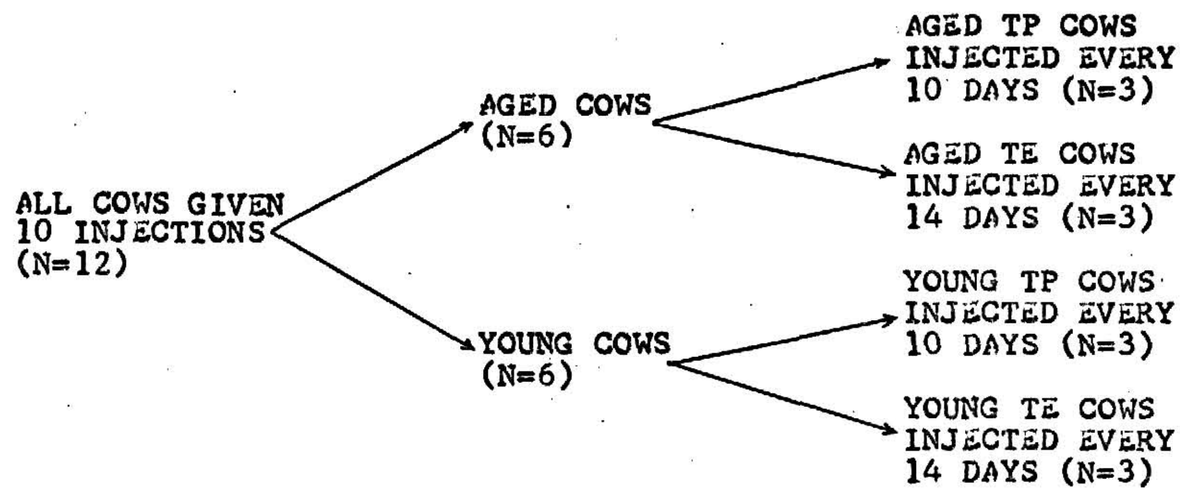

FIGURE I: EXPERIMENTAL DESIGN

RESULTS AND DISCUSSION

The aged TP cows marked the highest percentage of cows in heat. The aged TE cows were next followed by the young TP cows and the young TE cows (Table I). The randomized incomplete balanced block design (Hicks, 1964) was used to determine significance of the results. Age of cow and treatment used both significantly affected ($P<.05$) efficiency of heat detection. Age effect concurs with the assumption of J. Britt (1977, unpublished data) that mature cows may be more active sexually after testosterone therapy than yearling heifers. He further stated that part of the increased sexual activity is likely a "learned response" in addition to being a testosterone-induced response. In this study, it appeared that age and treatment were additive. Aged detector cows marked 20.9 percent more cows than young detector cows. The TP treated cows marked 16.4 percent more cows than TE treated cows. The combination of affects resulted in the aged TP cows marking 37.4 percent more cows than the young TE cows.

Of the 249 observed heats, 240 were marked by the treated cows. The estrual cows were artificially inseminated at this heat. Results are shown in Table II. One cow conceived at this breeding, one cow did not return to heat for the remaining observation period, and seven cows returned to heat and were marked at this heat. All seven cows were bred and six cows conceived at this breeding. This enforces two points: (1) treated cows were marking cows that were in heat, and (2) cows that were not marked may have been questionable at the time

TABLE I. EFFECT OF AGE AND TYPE OF TESTOSTERONE TREATMENT ON EFFICIENCY OF HEAT DETECTION BY DETECTOR COWS

Age and treatment[a] group of detector cow	No. of cows in heat	No. of cows marked
Aged TP	153	136 (88.9%)
Aged TE	112	82 (73.2%)
Young TP	134	92 (68.7%)
Young TE	99	51 (51.5%)
Aged	265	218 (82.3%)[b]
Young	233	143 (61.4%)[c]
TP	287	228 (79.4%)[b]
TE	211	133 (63.0%)[c]
Total[d]	249	240 (96.4%)

[a]Aged cows (6 to 8 years) and young cows (2 to 4 years) were given a preliminary treatment of 200 mg testosterone propionate (TP) every other day for 20 days then booster injections of either 200 mg TP given every 10 days or 1 gm testosterone enanthate (TE) given every 14 days.

[b]Significantly different from [c] ($P<.05$).

[d]Nine estrual cows were not marked.

TABLE II. COWS BRED AT HEAT OBSERVED BY HERDSMAN

Cow no.	Date observed	Date marked	Pregnancy diagnosis[a]
135	5-21	6-8	Pg 6-8
311	5-21	6-7	Pg 6-7
525	5-21	---	Pg 5-21
2116	5-22	6-10	Pg 6-10
581	5-22	6-9	Pg 6-9
127	5-23	6-14	Pg 6-14
184	5-23	6-18	Pg 6-18
5130	5-23	6-8	Open
4158	6-9	---	Open

[a]Data refers to estimated time of conception.

the cows were observed in heat and not marked.

Pairing had varying effects on detection efficiency (Table III). The young TP cow paired with a young TE cow (pair 2) marked 97.5% of the estrual cows while the young TP cow paired with a more aggressive aged TP cow (pair 4) marked only 37.3% of the estrual cows. Since aged TP cows were more aggressive than young TP cows and young TP cows were more aggressive than young TE cows, the young TP cow in pair 4 may not have had an opportunity to mount. R. Kilgour (1977, personal communication) hypothesized that a more aggressive detector animal may protect an estrual cow. However, if more than one cow was in heat, an aggressive animal could not protect all estrual cows. With more than one cow in heat, the incidence of mounting increases from 11.2 mounts to 52.6 mounts with 3 cows in heat. Also, the duration of standing heat is longer when more than one cow is is heat (Hurnik *et al*., 1975). This gave a less aggressive cow more opportunity to mount.

Results of ovarian palpation were inconclusive. Some cows continued to have periodic ovulations, some did not ovulate, and some retained a corpus luteum (CL) for the duration of the experiment. Ovarian function may have been related to the reproductive state of the cow when testosterone treatment was started. Unfortunately, the functional status of the ovaries nor cycling was checked prior to treatment. However, the occurrence of a retained CL was highest in the TP cows. This could be advantageous since Shemesh *et al*. (1975) found the functioning bovine CL contains appreciable levels of testosterone.

TABLE III. PAIR EFFECT OF AGE AND TYPE OF TESTOSTERONE USED ON EFFICIENCY OF HEAT DETECTION BY DETECTOR COWS

Pair	No. of cows in heat	Cows marked	Age and treatment[a] group of detector cow
1	38	31 (81.6%)	Aged TP
		17 (44.7%)	Young TE
2	40	39 (97.5%)	Young TP
		21 (52.5%)	Young TE
3	56	47 (83.9%)	Aged TP
		32 (57.1%)	Aged TE
4	59	58 (98.3%)	Aged TP
		22 (37.3%)	Young TP
5	35	32 (91.4%)	Aged TE
		31 (88.6%)	Young TP
6	21	18 (85.7%)	Aged TE
		13 (61.9%)	Young TE

[a]Aged cows (6 to 8 years) and young cows (2 to 4 years) were given a preliminary treatment of 200 mg testosterone propionate (TP) every other day for 20 days then booster injections of either 200 mg TP given every 10 days or 1 gm testosterone enanthate (TE) given every 14 days

This could enhance the treatment of testosterone making the cows even more aggressive. The presence of a functioning CL should cause progesterone production and this could inhibit follicle stimulating hormone (FSH) release from the anterior pituitary. If FSH were depressed, no follicular growth would occur on the ovaries since FSH stimulates this growth. Estrogen is produced by ovarian follicles and is necessary for signs of heat and ovulation. Therefore, if progesterone was being secreted, the treated cows would not express heat themselves. This would minimize the possibility of false mounting.

Since testosterone propionate maintained male behavior in heat detector animals more effectively than testosterone enanthate, it was concluded this treatment is an effective method of heat detection since the testosterone enanthate treatment was found to be superior or equivalent to any other heat detection method (Kiser et al., 1975b; Chapman et al., 1977). Older cows were more effective heat detectors than young cows. It must be pointed out that these detection aids are only aids to heat detection and must not be relied on entirely (Miller, 1977).

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EXPERIMENT 2

BREEDING BY APPOINTMENT AND BY HEAT AFTER SYNCHRONIZATION OF HEAT IN VIRGIN HEIFERS

SUMMARY

Four hundred and twenty-two virgin Angus and Maine Anjou crossbred heifers were assigned to five treatment groups: (1) synchronized, artificially inseminated (AI) 48 hours after implant removal; (2) synchronized, AI 54 hours after implant removal; (3) synchronized, AI 8 hours after observed heat; (4) synchronized, AI 18 hours after observed heat; or (5) no treatment, AI 12 hours after observed heat.

The percent of the group pregnant at first service in 21 days was 35.3, 32.9, 35.5, 45.7, and 34.4 for groups 1-5, respectively. The percent pregnant the first 25 and 45 days of the breeding season was: 56.1 and 59.2 for the synchronized heifers and 42.2 and 51.7 for the heifers not synchronized, respectively.

Treatment had no effect on first service pregnancy rate or percent of the group pregnant after 45 days of the breeding season. Synchronized heifers had a higher pregnancy rate for the first 25 days of the breeding season ($P<.10$) when compared with controls.

INTRODUCTION

The first reported heat synchronization technique in heifers was suppression of heat and ovulation by injecting 50 mg progesterone for 14 days. The use of progesterone for this length of time depressed conception at the heat following treatment (Christian and Casida, 1948).

Wiltbank et al. (1967) found that feeding 16-alpha-17-dihydroxyprogesterone acetophenonide (DHPA) for 20 days did not significantly effect fertilization rate, ova transport, duration of heat to ovulation or fertility. Fertility, however, did tend to be lower in synchronized heifers than in control heifers. Wiltbank and Kasson (1968) injected estradiol valerate at the beginning of a nine day feeding of DHPA and observed successful synchronization (95%) and good conception rate at first service.

Wagner et al. (1968) fed 6-chloro-Δ^6-acetoxyprogesterone (CAP) and Zimbelman (1961) fed 6-alpha-methyl-17-alpha-acetoxyprogesterone (MAP) to synchronize heat. First service conception rates were lowered in both cases as well as 60 day pregnancy rates. Ova survival was lowered slightly.

Melengestrol Acetate (MGA) used in heat synchronization has resulted in poor conception (Chakraborty et al., 1971; Zimbelman, 1961). Many theories have been suggested for the poor conception of MGA. Hill et al. (1971) found MGA resulted in elevated LH levels and a higher percent of uncleaved ova. These elevated LH levels may be a result of elevated estradiol levels and lowered progesterone levels because of alteration of ovarian secretory activity (Chow et al., 1972). The progesterone trough after withdrawal from MGA was lengthened from 2 days to 13 days (Hendricks _et al._, 1973). Reed and Rich (1972) found that eggs moved more swiftly through the oviduct while Britt and Ulberg (1972) found increased levels of progesterone before heat. An alteration of the progesterone estrogen ratio has also been observed by Dobson _et al._ (1973). MGA alters either the quantity or kind of gonadotrophin secreted by the pituitary gland resulting in follicular atresia associated with proliferation of the theca interna, the membrana granulosa, or both (Guthrie _et al._, 1970). Wordinger _et al._ (1970) found endometrial and glandular epithelial cell height greater and lamina propria and connective tissue stroma denser and less edematous in MGA treated heifers. Lauderdale and Ericson (1970) reported that in the heat after MGA withdrawal, a high percentage of the tetracycline hydrochloride is removed resulting in the sperm being more susceptible to leukocytic phagocytosis.

Woody and Pierce (1974) using a norethandrolone implant for 16 days, beginning on day 2 of the estrous cycle, reported synchronized heat and good conception. Conception was depressed if treatment was started on day 14 of the estrous cycle. Using a nine day implant, they reported good conception if treatment was started on either day 2 or 14 but poor synchrony if treatment was started on day 2. By adding an injection of estradiol valerate at time of implantation, they reported decreased conception if injected on day 2.

Nilevar (17-alpha-ethyl-19-nortestosterone) has also been used to synchronize heat. Seventeen daily injections resulted in 100% synchrony in 2 to 6 days with 1.2 services per conception (Liang and Fosgate, 1971). Wiltbank _et al._ (1971) used a 16 day implant and found it effective in controlling heat and ovulation but conception was depressed. Greater synchrony was achieved using a 9 day implant with an injection of estradiol valerate at time of implantation. Conception rates were comparable to controls. If an injection of estradiol valerate was also given 24 hours after implant removal, 100% heat synchrony and ovulation was observed. Conception rate, however, was depressed.

An implant of 19-alpha-acetoxy-11-beta-methyl-19 nor Preg 4-ene 3,2 dione (SC21009) has also been used for synchronizing heat. Sixteen day implants resulted in depressed conception rates (Smith and Vincent, 1973). Nine day implants with an injection of estradiol valerate resulted in conception rates comparable to controls (Burrell _et al._, 1972; Woody and Abenes, 1975) while pregnancy rate at 4 and 26 days after insemination was higher (Burrell _et al._, 1972).

Lemon (1975) found estradiol benzoate and estradiol valerate to be luteolytic if given midcycle. Early in the cycle, it was either luteolytic or luteotrophic. To insure a luteolytic effect, progesterone can be injected at the same time (Woody and Ginther, 1968). The progesterone effect may be an inhibitory effect on the LH response to estrogen (Hobson and Hansel, 1972). Nine or ten day implants of progesterone with an injection of estrogen and progesterone results in conception rates comparable to controls (Roche, 1974; Sreeman and Muleville, 1975).

Syncro-Mate B is G. D. Searle Company's experimental treatment which consists of a subcutaneous progestogen (SC21009) ear implant given for 9 days. At the time of implantation. an injection of SC21009 and estradiol valerate is also given. Wiltbank and Gonzalez-Padilla (1975) reported an increased proportion of heifers in heat by 72 hours with this treatment.

Incorrect timing of insemination leads to reduced fertility (Deas, 1970). Because the Syncro-Mate B treatment has a high proportion of heifers in heat in a short period of time, insemination at a predetermined time is a distinct possibility (Wishart, 1975). Wishart and Young (1974) also found 3 of 4 cows failing to show an overt heat following Syncro-Mate B treatment did ovulate. They found a higher conception rate breeding at both 48 and 60 hours following implant removal than just breeding at 48 hours. Roche (1976) also found reduced fertility following a single insemination at 48 hours or 56 hours and 74 hours after treatment compared to controls.

Heekin (1977) found breeding cows once a day (cows found in heat either in the morning or evening were bred the next morning) lowered conception compared to cows bred twice a day (cows found in heat in evening bred next morning and cows found in heat in the morning bred that evening). Once a day breeding resulted in breeding cows either 12 or 24 hours after observed heat.

This study was undertaken to determine the effectiveness of breeding at a predetermined time compared to breeding at one of two time periods following heat in virgin heifers after Syncro-Mate B treatment.

MATERIALS AND METHODS

Four hundred and twenty-two virgin Angus and Maine Anjou crossbred heifers were divided into five treatment groups: (Group 1) synchronized and artificially bred 48 hours after implant removal; (Group 2) synchronized and artificially bred 54 hours after implant removal; (Group 3) synchronized and artificially bred 8 hours after observed heat; (Group 4) synchronized and artificially bred 18 hours after observed heat; or (Group 5) no treatment and artificially bred 12 hours after observed heat. Heat was checked twice daily at approximately 12 hour intervals.

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

Heifers were bred artificially for 45 days and pregnancy was determined by rectal palpation 72 days after implant removal. Results were analyzed by least squares analysis of variance (Kemp, 1972).

RESULTS AND DISCUSSION

There was no difference in first service pregnancy rates (number pregnant in 21 days divided by number in group) in synchronized heifers bred either 48 or 54 hours after implant removal, synchronized heifers bred 8 hours after observed heat, and nonsynchronized heifers (Table I). Heifers bred 18 hours after observed heat had a slightly higher first service pregnancy rate. This concurs with the findings of Barrett and Casida (1946) who found no difference in conception if heifers were bred 3 to 25 hours after detection of heat.

Since there was no significant difference in first service pregnancy rate, all synchronized heifers were pooled for comparing pregnancy rates for first 25 days and for the breeding season. Synchronized heifers had a higher pregnancy rate for the first 25 days ($P < .10$). No difference in pregnancy rate was found for the 45 day breeding season. All pregnancy rates were analyzed on basis of total number of animals in each group. Only 39 of 64 (60.9%) nonsynchronized heifers showed heat in the first 25 days of the breeding season while 337 of 358 (94.1%) synchronized heifers were in heat within 60 hours post implant removal. Assuming that the same percentage of synchronized and nonsynchronized heifers were cycling, this could explain the low pregnancy rates. Synchronization apparently induced heat in most non-cycling heifers but conception was low when heat was induced.

In analyzing the data of heifers that did not conceive at first service, pregnancy rate for the rest of the breeding

TABLE I. CONCEPTION RATES OF HEIFERS AFTER SYNCHRONIZATION

Treatment	No.	% conceived at first service[a]	% conceived first 25 days	% conceived breeding season
bred 48 hours after explant	85	35.3		
bred 54 hours after explant	79	32.9		
bred 8 hours after detected heat	124	35.5		
bred 18 hours after detected heat	70	45.7	56.1[b]	59.2[b]
non-synchronized	64	34.4	42.2	51.7

[a]First service conception was calculated on the basis of total number of heifers that conceived in 25 days.

[b]All synchronized heifers were pooled for % conceived first 25 days and breeding season.

season was significantly higher ($P < .05$) for synchronized heifers (59.8%) than nonsynchronized heifers (39.6%). Apparently, some non-cycling heifers continued to cycle after the induced heat although many did not.

Most heifers were in heat 24 to 48 hours after implant removal in an experiment by Wishart and Young (1974) and best conception was obtained when heifers were bred mid to late heat (Deas, 1970). Heifers bred 48 hours after implant removal in our study were definitely bred mid to late heat and heifers bred 54 hours after implant removal were probably bred late heat or shortly following heat. Heekin (1977) found that breeding 60 hours after implant removal was too late for some cows.

Least squares mean pregnancy rates showed the same results as the unadjusted data although pregnancy rates were slightly higher (49.4, 42.6, 44.2, 52.9, and 42.3 for groups 1 through 5, respectively). Least squares means were adjusted for inseminator and sire differences. Pregnancy rates were higher since the inseminator and sire with the poorest pregnancy rates were used the most. Since pregnancy rate for the first 25 days was higher in the Syncro-Mate B treated heifers, they would have a higher proportion of heifers calving early which should be an additional benefit of heat synchronization.

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HEAT DETECTION WITH TESTOSTERONE TREATED COWS AND EFFECT OF HEAT SYNCHRONIZATION ON CONCEPTION RATES IN HEIFERS

by

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Two potential aids for artificial insemination in beef cattle are heat synchronization and the use of testosterone treated cows for heat detection. These techniques were investigated in separate experiments.

In the first experiment, 12 cows with Hereford, Polled Hereford, and Simmental breeding were injected with testosterone and were used to aid in heat detection. All cows were injected intramuscularly (IM) with 200 mg testosterone propionate (TP) on alternate days until 10 injections had been given. Cows were classified as either aged (6 to 8 years) or young (2 to 4 years) and allotted to the following maintenance treatment groups: (1) aged cows injected with 200 mg TP every 10 days; (2) aged cows injected with 1 gm testosterone enanthate (TE) every 14 days; (3) young cows injected with 200 mg TP every 10 days; and (4) young cows injected with 1 gm TE every 14 days. All injections were IM. Cows were assigned to pairs such that all possible combinations of the four treatment groups were represented. All cows were equipped with chin ball markers and paired cows had different color dyes in their markers. Each pair was placed in a pasture with 40 to 60 nonpregnant, suckling beef cows. The cows were checked for marks and other signs of heat twice daily for 30 to 50 days. Aged TP-treated cows, aged TE-treated cows, young TP-treated cows, and young TE-treated cows, marked 88.9, 73.2, 68.7, and 51.5 percent of the cows in heat, respectively. Out of 249 cows observed in heat, 240 cows were marked (96.4%). Under these conditions, TP was more effective than TE as a booster for maintaining cows as heat detectors. Also, aged cows marked more estrual cows than did young cows.

In the second experiment, heat was synchronized in 422 virgin Angus and Maine Anjou crossbred heifers with the Syncro-Mate B procedure. This procedure consists of an ear implant for 9 days containing 6 mg of 19-alpha-acetoxy-11-beta-methyl-10 nor Preg 4-ene 3,2 dione (SC21009) and an IM injection of 3 mg of SC21009 plus 5 mg of estradiol valerate at implantation. Heifers were assigned to five treatment groups: (1) synchronized, artificially inseminated (AI) 48 hours after implant removal; (2) synchronized, AI 54 hours after implant removal; (3) synchronized, AI 8 hours after observed heat; (4) synchronized, AI 18 hours after observed heat; (5) no treatment, AI 12 hours after observed heat.

The percent of the group pregnant at first service during the first 21 days was 35.3, 32.9, 35.5, 45.7, and 34.4 for groups 1 through 5, respectively. The percent of the group pregnant during the first 25 and 45 days of the breeding season was 56.1 and 59.2 for the synchronized heifers, and 42.2 and 51.7 for the non-synchronized heifers.

Treatment had no effect on first service pregnancy rate or percent of the group pregnant after 45 days of the breeding season. Synchronized heifers had a higher pregnancy rate for the first 25 days of the breeding season ($P < .10$) than controls.