Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
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Journal of Applied Sciences 8 (2): 241-251, 2008
ISSN 1812-5654

Schemes for Oestrus Synchronization Protocols and Controlled Breeding Programs in Cattle

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Abstract: Today prostaglandin and progesterone has been found widely used in several schemes of oestrus synchronization and controlled breeding program. Several controlled breeding program, have been developed for synchronizing groups of all open or lactating cows within a breeding group with or without ovarian palpation. Such programs are reviewed in this article which involves extending the luteal phase by treatment with exogenous progesterone such as: progesterone treatment regimes using syncro-mate-B, progesterone releasing intravaginal device, melengesterol acetate-select and melegestrol acetate plus prostaglandin. Also reviewed in the program is the termination of the luteal phase by treatment with prostaglandin or its analogues. These includes, controlled breeding without ovarian palpation such as, the 7-days program; 11-days program, target breeding, ovsynch program, Heat synch, Cosynch and pre synch-ovsynch program. In our opinion full potential of progesterone and prostaglandin for the detection of oestrus and timed artificial insemination should be utilized. This reduces the much labour input employed in previous years. The practitioner of the livestock herd health must-develop strategies for the delivery of this technology to livestock farmers, its use and limitations.

Key words: Oestrus synchronization, control breeding, luteal phase, exogenous progesterone, prostaglandin analogues, cattle

INTRODUCTION

While oestrus synchronization and controlled breeding schemes are being considered as management techniques, they also be closely related in dairy cows to the problems of unobserved oestrus for which the use of progesterone and prostaglandin are often considered therapeutic. This is essential to maintain a short Calvin interval and is a primary factor affecting the profitability of any cattle breeding enterprises.

Synchronization of oestrus is the fact of making a number of cows come into heat at the same time. This allows better planning of breeding activities and wider use of artificial insemination. Cows to be used in such programs must not be pregnant and be undergoing normal sexual circles (Chaudhari and Sabo, 2006). Many oestrus synchronization protocols can induce 75 to 90% of the cycling animals to display oestrus within a 5 day period. Additionally, many protocols can induce a fertile heat in as much as 50% of the anestrous cows. Thus, it is typical for many of these synchronization protocols to result in 45 to 55% of the animals being pregnant by the end of the first week of the breeding period. Several fixed time AI options can result in 40 to 50% of the cows pregnant following one single day of breeding with zero hours spent for heat detection (Dejarnette *et al*., 2004). The strategy is based on controlling the luteal phase of the oestrus cycle and can be achieved through two main approaches:

- Extending the luteal phase by treatment with exogenous progesterone.
- Terminatings the luteal phase by treatment with prostaglandin or its analogues.

EXTENDING THE LUTEAL PHASE BY TREATMENT WITH EXOGENOUS PROGESTERONE

Various synthetic progesterone products, or progestogens (Brown, 1988; O'Connor, 1998), have been used for synchronization of ovulation and oestrus. Synchro-Mate-B (SMB) is the only progestogens

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currently approved for use in dairy heifers. Two other systems, Melengestrol acetate (MGA), which is administered in the feed and the Progesterone-Releasing Intravaginal Device (PRID) have been thoroughly researched. Sunchro-mate-B consists of an ear implant containing the progestogen (Norgestomet) and an injectable solution of Norgestamet and oestradiol valerate. The injection causes premature regression of the Corpus Luteum (CL) in heifers that recently ovulated and inhibits the final stage of follicular development in other heifers. The implant inhibits development of new CL and simultaneously prevent follicular growth until its removal nine days later. Once the implant is removed, a new circle commences and heifers generally exhibits signs of heat beginning at 38 to 48 h later. The mechanism of action of PRID is similar to SMB. Compared to prostaglandin, progestogen treatment has the advantage of inducing oestrus in some prepubertal heifers (Fogwell, 1986; O'Connor, 1998).

Progesterone treatment regimes using synchro-mate-B (EAZI-BREED): Two basic systems for SMB are currently approved for heifers.

It involves:

- Implanting the animals with Norgestomet (CIDR) and
- An intramuscular injection of Norgestomet and oestradiole valerate.

The mechanism of action of this treatment was described earlier. The implants are removed after nine days and cattle are inseminated when they are observed in heat.

The animals are inseminated by appointment, 48 to 54 h after implant removal. A modification of this system involves a second insemination of those heifers which exhibit oestrus after 48 to 54 h, timed insemination (Brown, 1988; O'Connor, 1998; Lucy *et al*., 2001; Steveson *et al*., 2003).

Progesterone-releasing intravaginal device (PRID): The development of controlled intra-vaginal progesterone releasing devices such as the PRID (progesterone-releasing intra-vaginal device; Sanofi Animal Health Ltd., France) and CIDR (controlled internal drug releasing device, DEC-Inter Ag, Hamilton, New Zealand) allowed the development of long-term hormonal treatments, which minimized the requirement for repeated handling of animals and circumvented delivery problems associated with the feeding of oral progestogens or injecting progesterone (Garcia-Winder *et al*., 1987; Geary *et al*., 1998; Lamb *et al*., 2001; Lucy *et al*., 2001). This device is inserted into the vagina and gradually it releases progesterone, which is absorbed by the vaginal tissue. The progesterone produces physiological effects similar to the progestogen in the SMB treatment described above. After a specific number of days (usually seven), the device is removed and the cows are inseminated by appointment or when they exhibit heat (Fogwell, 1986; O'Connor, 1998; Stegner *et al*., 2004).

Melegensterol acetate (MGA) plus Prostaglandin (PG): Melegensterol acetate is an orally active progestogen that was developed in 1962 (O'Connor, 1998). Early studies on feeding MGA for short or long term duration resulted either in poor synchrony of oestrus or good oestrus synchronization, but with poor fertility. More recently, an MGA plus PG system was developed.

Malegestrol acetate is fed at a rate of 0.5 mg/bd/day for a 14 day period. The MGA is fed in a grain carrier and either top dressed or blended-in with larger quantities of feed. Consistent intake of MGA is critical. Heifers will exhibit heat beginning within 48 h after withdrawal of MGA. However, since fertility is low. They should not be inseminated at this time. The heifers are injected with PG 17 days after MGA withdrawal and then inseminated based on observed oestrus (Patterson, 1990; Patterson and Corah, 1992; O'Connor, 1998; Patterson *et al*., 2002; Stegner *et al*., 2003; Steveson *et al*., 2003; Dejarnette *et al*., 2004).

Use of PRID and HCG: Moreira *et al*. (2001) reported that in combined use of norgestomet implants and HCG in sucled beef cows when implant were removed, 53% of cows were induced oestrus compared with 0% of cows that did not receive implants (Chaudhari and Sabo, 2006).

Use of PRID and oestradiol: Many researchers have demonstrated that oestradiol stimulates ovulation and expression of oestrus following progesterone treatment and reduced the interval to conception, compared with untreated controls (Burke *et al*., 2000, 2001). However, variable results were demonstrated in resumption of oestrus and conception rate in cows treated with progesterone (PRID, CIDR, implants or oral use) alone or in combination with oestradiol (Firke *et al*., 1997; Taufa *et al*., 1997; Rhodes *et al*., 1998a, b, 2001, 2002; Verkerk *et al*., 1998; Henlen *et al*., 2000; Xu *et al*., 2000a; McDougall, 2001; Steveson *et al*., 2000).

Use of PRID, GnRH Analogues and $PGF_2\alpha$: Use of PRID may be combined with GnRH analogues for the additional effect of inducing ovulation and the formation of corpus luteum (Xu *et al*., 2000a). Following progesterone device

removal, $PGF_2\alpha$, is generally injected to ensure oestrus in cows. In another study it was reported that higher conception rates to first insemination and interval to conception decreased by inclusion of GnRH (Lamb *et al*., 2001). The use of GnRH agonist at the commencement of progesterone treatment and $PGF_2\alpha$ at the end produce good responses in anestrous beef and dairy cattle (Steveson *et al*., 2000; Patterson *et al*., 2000; Xu *et al*., 2000b; Lamb *et al*., 2001; Larson *et al*., 2004; Chaudhari and Sabo, 2006).

MGA-SELECT: The MGA-select system superimpose the MGA heifer protocol on the select synch protocol. Cows are fed MGA (0.5 mg/head/day) for 14 days and treated with select-synch starting 12 days after last day of MGA feeding. As with select-synch, cows are bred to observed heats or 72 to 80 h after $PGF_2\alpha$ and non-respondents are mass-mated with a concurrent-injection of GnRH. Alternatively cows may be mass-mated with concurrent GnRH injection at 72 to 80 h after $PGF_2\alpha$. The MGA feeding helps to jump start cyclicity in many anoestrus cows and pre-synchronizes cycling cows for optimum response to select-synch. Most studies indicated the MGA-select yields outstanding synchronized AI pregnancy rates ranging from 55 to 65% with both heat detect and fixed time AI breeding options. As with heifer protocol, do not breed cows detected in heat within 10 days of MGA feeding (Patterson, 1990; Steveson *et al*., 2000; Patterson *et al*., 2001; Dejarnette *et al*., 2004).

MGA-PG system: The MGA-PG system is a time tested proven method for synchronizing oestrus in beef and dairy heifers. Melengestrol Acetate (MGA) is a synthetic form of the naturally occurring hormone, progesterone. For the best result mix MGA with 3 to 5 Lbs of grain supplement and feed at the rate of 0.5 mg/head/day for 14 days. Wither 3 to 5 days after MGA feeding, most heifers will display standing heat. DO NOT BREED at this heat as conception rates are reduced. Wait 17 to 19 days after the last day of MGA feeding and inject all heifers with a single does of $PGF_2\alpha$. For the next 5 to 7 days, inseminate animals 8 to 12 h after detected oestrus.

Success of the MGA system depends on adequate bunk space and proper feeding rates so the appropriate dosage is consumed by each heifer on a daily basis. In addition to stimulating cyclicity, researchers at the University of Kentucky (Patterson, 1990) found the MGA-PG system resulted in higher oestrus response and conception rates when compared to synchronization using $PGF_2\alpha$ alone. With good heat detection of well-managed heifers at the proper age, weight and body condition, you can expect to achieve synchronized pregnancy rates of 50 to 70% (Patterson, 1990; Patterson *er al*., 2001; Dejarnette *et al*., 2004).

TERMINATING THE LUTEAL PHASE BY TREATMENT WITH PROSTAGLANDIN OR ITS ANALOGUES

Controlled breeding using prostaglandin alone:
Controlled breeding using ovarian palpation: The use of single injections of prostaglandin is based on the identification of cows which posses susceptible corpora-lutea. While the scheme described above requires multiple prostaglandin ($PGF_2\alpha$) treatment and some effort in oestrus detection, identification of cows with susceptible corpora lutea may reduce the necessary number of treatment to one and does not necessarily require oestrus detection. Upon identification of susceptible corpora lutea (usually by rectal palpation, although progesterone assay is another possibility), $PGF_2\alpha$ is administered and insemination is performed according to appointment (Timed, A.I. 72-80 h) or observation of oestrus (Cooper, 1981; Segiun, 1983) or a combination of appointment breeding and oestrus detection (Segiun, 1983).

Controlled breeding without ovarian palpation (7 days program): This scheme involves oestrus detection and insemination of cows, for seven days followed by $PGF_2\alpha$ treatment of all those not detected in oestrus. Treated cows are then inseminated by appointment (Timed, A.I, 72-80 h) or upon observation of oestrus (Cooper, 1981; Segiun, 1983). Segiun (1983) has suggested that the pre-treatment oestrus detection period should perhaps be extended to eight days in lactating dairy cows.

11 days program: Two-prostaglandin injection given 11 days apart with insemination performed during a restricted period following the second treatment (Mughal *et al*., 1998). This system reduces the time required for oestrus detection to several days following the second injection, or eliminates oestrus detection by appointment breeding (Timed, A.I. 72-80 h). Another variation of the two-treatment scheme utilizes oestrus detection and insemination of detected cows in the several days following the prostaglandin treatment. Uniseminated cows are treated again 11 days after the first injection and are inseminated by appointment (Timed, A.I. 72-80 h) (Mughal *et al*., 1998).

Setup PG treatment prior to breeding period (Targeted breeding): An aggressive program, termed targeted breeding has been used. Cows administered PG prior to

the end of the Voluntary Waiting Period (VWP). The purpose of this treatment is to synchronise (setup) cows into a stage of the cycle, when they are most likely to respond to the breeding shot of PG administered 14 days later (Steveson *et al*., 1997; Drost and Thatcher, 1992). Generally with this system, cows are not inseminated if they exhibit oestrus following the initial PG injection. Once a VWP is established for the herd, cows are listed chronologically according to Calving date. Those cows within 14 days to the end of the VWP are administered the setup shot. Fourteen days later, the cows received the first breeding injection of PG and are observed for heat two to five days after injection and inseminated accordingly.

Cows that do not exhibit heat are re-injected 14 days later, observed for heat and inseminated. Injections are continued at 14 days intervals until oestrus is exhibited. Some veterinarians and producers may prefer to examine cows that fail to exhibit heat after the third PG injection. Others may wish to appointment breed at a specific time after the third injection (McDougall *et al*., 1995; Milo, 1998; O'Conner, 2001).

Controlled breeding using prostaglandin ($PGF_2\alpha$) and gonadotrophin releasing hormone (GNRH):

Modified target breeding (GnRH plus PG system): This system improves the target breeding program by using Gonadotrophin Releasing Hormone (GnRH). It involves insemination of cows detected in heat following the synchronization program and timed insemination of those cows not observed in heat. Eligible cows received PG 21 days before the end of the VWP. This is followed by GnRH injection 14 days later and second PG injection 7 days after the GnRH injection (Macmillan and Thatcher, 1991; Drost and Thatcher, 1992). During the three days following the PG injection, cows are inseminated based on observed heat. Cows not observed in heat by 72 h post PG injection are inseminated between 72 and 80 h. Thus all cows are inseminated (O'Conner, 2001).

Ovsynch programme: GnRH-PG-GnRH program-Timed A.I: The ovsynch program has been developed which synchronizes ovulation which result in conception rates to time A.I. than can be achieved with traditional PG programs. The capacity of GnRH analogues to induce ovulation during the postpartum anovulatory anestrous period, as described above, has been used in programs in combination with $PGF_2\alpha$ (Dejarnette *et al*., 2001), to initiate resumption of oestrus cycles, without the requirement for exogenous progesterone treatments. A protocol developed for use in dairy cows that have resumed oestrus cycles involves the sequential injection of GnRH, $PGF_2\alpha$ and GnRH at intervals of 7 and 2 or 2.5 days, respectively, with all treated cows being inseminated 16 to 24 h after the final injection of GnRH, without oestrus detection (Ovsynch or Intercept) (Steveson *et al*., 1996; Geary *et al*., 1998; Lammongolia *et al*., 1998; Rivera *et al*., 1998; Peters *et al*., 1999; Steveson *et al*., 1999). This program synchronizes follicular development and ovulation which allow effective Timed, A.I. (Thatcher *et al*., 1989; O'Conner, 2001; Navanukraw *et al*., 2001). An injection of GnRH or one of its analogues followed seven days later with PG (Macmillan and Thatcher, 1991; Drost and Tatcher, 1992), has been shown to synchronize oestrus effectively.

GnRH affects follicular growth by causing either ovulation or luteinization of the dominant follicle and prevents oestrus until after the PG injection, which causes the corpus luteum or luteinized follicle to regress (Thatcher *et al*., 1989). A new dominant follicle forms and is available to be ovulated by the second GnRH injection given 48 h after PG injection followed by timed A.I. 10-20 h later (Mee *et al*., 1990).

The ovsynch program is effective in improving the percentage of cows pregnant by 60 to 100 days in milk (Steveson *et al*., 1990; Coleman *et al*., 1991; Drost and Thatcher, 1992; Guilbault *et al*., 1991) and may reduce the days to first service. The timing of the first GnRH injection is not critical. However, the timing of the other injection is critical so that insemination occurs at a reasonable time of the day (O'Conner, 2001). Some point to consider when using this programme;

- The conception rate with Ovsynch is generally lower compared to insemination after detected oestrus. However, the advantage is that cows are time-inseminated without oestrus detection. It will likely increase pregnancy rate early in the breeding period.
- This program should not be used for heifers.
- Conception rate based on ultrasonography at 25 to 35 days after inseminating were slightly greater when the insemination was made at 16 h after the second GnRH injection compared to other time intervals.
- If a cow exhibits oestrus before the completion of hormonal treatment, she should be inseminated and the remaining injection should not be administered.
- It may be useful for cows that simply do not express oestrus after several attempts with PG.
- This program is also useful in herds where cattle are not turned-out for heat detection on a routine basis.
- Eliminates heat detection prior to first service.
- Caution; since time breeding is used on first service, dairy producers may be less diligent in catching return heat.

Presynch program (presynch-ovsynch system): The purpose of the presynch program is to synchronize a group of cows into a stage of their cycle (day 5-12) when they will have a high probability of responding to the ovsynch system. It is a timed breeding program. Approximately 28 days (+ 3 days) prior to the initiation of the ovsynch program, a group of cows will receive an initial injection of PG. The program can be initiated at a specified number of days postpartum depending on the VWP selected by the herd manager. Cows can be assigned to the group within +3 days of the target. This is followed by a second PG injection 14 days later (Dejarnette *et al*., 2004). Ideally, the ovsynch program is initiated 12 days after the second PG injection.

However, to simplify the program, the ovsynch program can be initiated 14 days following the second PG injection (O'Conner, 2001). Thus the injection are on a two- week schedule to this point. There are more injection with the presynch, program but there is better synchrony of ovulation (Moreira *et al*., 2000).

Heat synch: Heat synch is a newly synchronization protocol developed (Dejarnette *et al*., 2001) that uses the less expensive hormone estradiol cypionate (ECP) in place of the second GnRH injection of the Ovsynch protocol. However, because of differences in how these hormones work, there are also several important differences in protocol implementation. To induce ovulation in cattle we must first induce a surge of L.H. The difference between using GnRH or E.C.P. to induce L.H. surge is equivalent to the difference between a direct flight and a connecting flight. No matter how good your connection, direct flight always will get you there more quickly. GnRH has a direct and almost immediate effect on the release of L.H, while ECP has a delayed effect (Fernandez *et al*., 1996; Pancarci *et al*., 2002; Dejarnette *et al*., 2004). A recent study (Steveson *et al*., 2002) found that cows injected with GnRH have an L.H surge within an hour, while the L.H. surge of ECP-treated cows was not detected for 41 h. This difference in time to LH surge means the hormonal injection intervals must also be altered when substituting ECP for GnRH. Both ovsynch and Heat synch call for a GnRH injection followed seven days later with an injection of $PGF_2\alpha$. Heat synch then prescribes a one milligram injection of ECP 24 h later. Because of the delayed interval to the LH surge, the recommended interval to fix time A.I. is 72 h after $PGF_2\alpha$ (48 h after ECP). The biggest difference that producer immediately will notice between heat synch and ovsynch (Bartolome *et al*., 2002) is the percentage of cows that will show visual signs of oestrus. ECP, as all oestrogen, stimulate oestrus expression following injection (Pancarci *et al*., 2002). Heat synch cows detected in oestrus should be bred according to a.m/p.m. rule or at 72 h after P.G. injection.

Heat-synch reduces hormone costs, more efficient use of expensive semen in higher conception-rate cows that are allowed to express oestrus and also easier scheduling and implementation, since all injections and AI are at 24 h intervals (Dejarnette *et al*., 2004).

Cosynch: Ovsynch has proven to be a reliable timed AI program for cows (Geary *et al*., 1998), ovsynch requires four trips through the reworking chute. Research at Colorado State University demonstrated that comparable pregnancy rates can be achieved with only animals handling by breeding all cow coinciding with the several GnRH injection (Geary *et al*., 2001). Thus the name cosynch.

For better result inject GnRH on day zero followed by $PGF_2\alpha$ on 7th day after first GnRH injection, 48 to 64 h after $PGF_2\alpha$ injection the second GnRH is administered. Inseminate animals at the same time as well as the 2nd GnRH injection. As with any fixed time AI protocol, results to cosynch can be variable, but in general range from 40 to 50%. As with ovsynch, pregnancy rates are maximized if the early heats are visually detected and bred using the Am/Pm rule (Dejarnette *et al*., 2004).

Select synch: With the select synch (Dejarnette *et al*., 2004), cows are injected with GnRH and $PGF_2\alpha$ 7 days apart. Heat detection begins 24-48 h before the $PGF_2\alpha$ injection and continues for the next 5-7 days. The $PGF_2\alpha$ injection is excluded for cows detected in oestrus on day 6 or 7. Animals are inseminated 8 to 12 h after they are observed in standing oestrus. Alternatively, heat detection and AI until 48-60 h after $PGF_2\alpha$ and then GnRH and timed AI of non-responders at 72 h after PG.

Major benefits of the select synch system are simplicity and higher synchrony of oestrus. Most animal will display standing oestrus 2 to 4 days after the $PGF_2\alpha$ injection. Overall, oestrus response rates in well-managed beef herd average 70 to 75% with no adverse effect on conception rates (60 to 70%), resulting in synchronized pregnancy rates that average between 45 to 50%.

Select synch followed by heat detection and 72 h fixed time AI allow producers to maximize potential pregnancy rates while minimizing labour requirements for oestrus detection (Geary *et al*., 2000; Dejarnette *et al*., 2001, 2004).

Herd managers and veterinarians must adhere to the time schedule for injections, heat detection, insemination and pregnancy.

FACTORS AFFECTING CONTROLLED BREEDING PROGRAMS

Nutrition: It has been well established that a balanced diet providing sufficient protein and energy is essential for normal fertility to be maintained. Deficiency in sodium, phosphorus and selenium have been shown to cause infertility, while deficiencies in iodine, manganese and zinc can also cause reproductive disorders. Beta-carotene is one of the most important vitamins. Deficiency of Beta-carotene can occur if animals are maintained solely on cereal straws and can lead to silent or delayed ovulation, a low conception rate and high embryo mortality (Perera, 1999).

Low nutrition can also prevent final growth of follicles due to a negative feed back effect of oestradiol on the hypothalamus to reduce pulses of GnRH. The resulting decrease in L.H. pulses causes follicles not to grow sufficiently to reach to preovulatory size so that sufficient oestradiol can be produced to elicit an L.H surge and ovulation (Milo, 1998).

The number of follicular waves during an oestrus cycle can be altered by nutrition. As shown in Table 1 there is an increased percentage of heifers with three follicular waves when lower amount of energy are fed.

Treatment: Treatment to reduce anoestrus due to nutritional deficiency and to improve reproduction must focus on increasing L.H. pulses frequency and allowing follicles to reach the final stages of maturation. The most obvious method that should be used is to reduce the negative energy balance during the post-partum period. In addition environmental and disease conditions should be minimized. Cows that lose one or more body condition scores will be more likely to be anoestrus. Optimal nutrition during the transition period as well as during early lactation are critical to reducing anoestrus (Milo, 1998).

Season: In most nomadic herds and wild species there is a period of seasonal anoestrus that allows reproductive function and particularly birth of young to coincide with a time that should allow maximal likelihood of survival of young. There are three key points that need to be clear in order to understand seasonal reproduction.

- In breeding season oestradiol primarily regulates L.H. secretion by a direct action on the pituitary, where as progesterone inhibits L.H. secretion by directly inhibiting GnRH secretion by the hypothalamus.

Table 1: Effect of dietary intake on proportion of heifers with 2 and 3 dominant follicles during the oestrus cycle

Parameters	Low feed	Medium feed	High feed
No. of heifers	7	7	5
% with 2 waves	29%	57%	80%
% with 3 waves	71%	34%	20%
Max Diameter of DF (mm)	11.3±3	13.2±3	13.7±4
Persistence of DF (days)	9.8±7	11.9±7	12.7±8
Duration of cycle (days)	20.7±6	21.4±6	21.6±7

Adopted from Milo (1998). Bovine proceedings No. 31 September, 1998.
DF: Development Follicle

Table 2: Ovarian response to ovsynch treatments in cows with different types of cysts

Classification of cyst	Response to 1st GnRH	Response to to $PGF_2\alpha$	Response to 2nd GnRH
Follicular	Luteinization	Regression	Ovulation of DF
Luteal	Ovulation of DF	Regression	Ovulation of DF
Benign follicular	Ovulation of DF	Regression	Ovulation of DF

DF: Development Follicle. Adapted form Milo (1998)

- In anoestrus season low level of oestradiol will inhibit pulsatile secretion of GnRH by the hypothalamus. Thus, a low level of oestradiol (2 pg mL^{-1}) will not inhibit L.H. pulses in the anoestrus season but is inhibitory to L.H. secretion during the anoestrus season
- Inhibition of L.H. secretion will not allow final stages of follicle development continues during seasonal anoestrus but there is no sufficient L.H. to drive a follicle through the final stages of development (Goodman, 1994; Milo, 1998).

Disease (Effect of ovarian cyst): One important physiological situation that leads to lack of ovulation is the ovarian cysts. They are generally classified into two categories, follicular, luteal or benign. Follicular cysts are thin-walled large ovarian structures and low amount of progesterone are found in the milk or blood. Many times these cows will show frequent heats (nymphomania). There may also be a fairly constant discharge from the vulva. Most times there are multiple follicle on the ovaries of cows and those structures may be very large. Luteal cyst are thick-walled structures that are generally only found as single structure. There are medium to high concentration of progesterone in the milk or serum. Cows do not show heat. It was speculated from field operation that there should be a third classification of ovarian cysts that was termed benign follicular cysts. These structure are thin- walled large but seem to have little or no hormonal or functional activities when it was removed from the ovary they have few if any cells in the follicle (Milo, 1998).

Treatment: Any treatment of cows should be done with the clear understanding that cysts have probably not

been accurately classified into follicular, luteal, or benign categories. A treatment with GnRH may help a follicular cysts but could do nothing for the cow with a luteal or benign cysts. The best treatment is probably to select a treatment that will be effective for cows with any of the three types of cysts. The use of ovsynch is such a treatment. The Table 2 shows the responds of different cysts to the three hormonal injections that are part of the ovsynch protocol.

ALTERNATIVE STRATEGIES FOR TIMED INSEMINATION OF COWS

Although there were no control in this field of study, the result clearly show that excellent oestrus response and acceptable conception and pregnancy rate were obtained. Researchers felt what differences among herds may have been due to inconsistent administration of hormones or low numbers of heifers that were cycling at the time the treatment were initiated (Table 4).

The system of MGA has been shown to be superior to SMB (Table 3). Although this is a 31 day program, the advantages of the MGA+PG system are the good oestrus response, the superior fertility, easy of administration of hormones and reasonable cost.

Treatment of heifers with GnRH followed 7 days later by injection with $PG_2\alpha$ increased the number of animals synchronized within a 5 days period and also enhanced precision of synchrony during days 2 and 3 after $PGF_2\alpha$ injection as compared with cows treated with $PGF_2\alpha$ alone where oestrus were detected (Drost and Thatcher, 1992). Additional 56% study have been conducted in which oestrus was synchronized with injection of GnRH followed 8 or 7 days later by an injection of $PGF_2\alpha$. Approximately 89% of the heifers were detected in oestrus for a day 7 and 8 experiment (Drost and Thateher, 1992).

Recent data have also shown that anoestrous beef cattle can be synchronized by using a modified ovsynch protocol that includes a progestin treatment between the first GnRH and the $PGF_2\alpha$ treatment. In one experiment performed by Steveson *et al.* (1999) the cows were evaluated for cycling states and treated with either a double injection with $PGF_2\alpha$ 14 days apart or with a modified ovsynch protocol that contained a norgestamet implant between the GnRH and $PGF_2\alpha$ treatment. The two treatments had similar pregnancy rate in those cows that were cycling prior to starting treatment. In contrast the norgestamet/GnRH treatment was superior in non cycling cross as compared to the program with $PGF_2\alpha$ and oestrus, detection (Milo, 1998).

Table 3: Composition of MGA+PG system to SMB for synchronization of heifers

Treatments	Oestrus response (%)	Conception rate (%)	Pregnancy rate (%)
MGA+PG	83	69	57
SMB	90	41	37

Adopted from Brown *et al.* (1988) Therigenology, 30: 1-5

Table 4: Results of alternative strategies for timed insemination of cycling cows

Treatments	Timed A.I. (h)	Pregnancy rate (average) (%)
EAS1-BREED protocol	48-54	51-66
PRID- protocol	72-80	59
MGA-PG system	Heat detection	50-70
MGA-select	72-80	55-65
PG-Two shorts protocol	72-80	56
Target breeding	Heat detection	56
Modified target breeding	72-80	56
Ovsynch	Heat detection	30-40
Heat synch	72-80	35-51
Presynch	10-20	50
Select synch	72-80	45-50
Co synch	48-64	40-50

Adopted form (Brown *et al.*, 1998; Patterson, 1990: Drost and Thatcher, 1992; Steveson *et al.*, 1997; Milo, 1998; Geary *et al.*, 1998; O'Connor, 1998, O'Conner, 2001; Geary *et al.*, 2001; Patterson *et al.*, 2001; Lamb *et al.*, 2001, 2003; Lucy *et al.*, 2001; Moreira *et al.*, 2001; Stegner *et al.*, 2003, 2004; Dejarnette *et al.*, 2004)

Since, good pregnancy rates can be achieved in cows by combining a progestin with a follicular synchronization and ovulation synchronization scheme. Anoestrus cows can be effectively treated with a regular ovsynch protocol (GnRH-7d-PGF-2d GnRH-16H-A,I). This is because many anoestrus cows have follicles of sufficient size and ovulatory capacity but for some reason do not have an L.H. surge. In a study done on anoestrous dairy cows (McDougall *et al.*, 1995) showed that 9 of 10 (90%) GnRH treated cows ovulated after the short cycle that followed this first postpartum ovulation. Thus, anoestrus cows should not be treated only with single GnRH injection but the full ovsynch protocol is appropriate.

POTENTIAL ADVANTAGES OF CONTROLLED BREEDING PROGRAM

- To improve the efficiency of heat detection.
- Achieve more timely first service.
- Reduce the variation in calving intervals among cows.
- Possibly reduce involuntary culling for reproductive reasons.
- Concentrate labour for reproductive management to specific period.
- Improve the pregnancy rate.

REQUIREMENT OF CONTROLLED BREEDING PROGRAMS

- A high percentage of the cows must be cycling normally. Nutritional, environment, or disease factor that cause anestrous or repeat breeding must be corrected before starting a controlled breeding program.
- Although the presynch and ovsynch program will induce some anestrus cows to ovulate, pregnancy rate will significantly increase in relation to the percentage of cows that are cycling at the onset of the program.
- Research has shown that pregnancy rate for the ovsynch and presynch program, are significantly higher for cows with Body condition scores (BCS) 3-4 compared to cows with BCS. 2-2.5
- Herd managers and veterinarians must make a commitment to the oestrus synchronization program. Accurate records must be kept. A list of eligible cows must be updated regularly.
- Efficient and accurate heat detection for the specified days is essential when using the PG program.

CONCLUSIONS

The approval of progesterone and prostaglandin for use in livestock industries and the development of schemes for their use in various managements systems have been of value to veterinarian and the livestock farmers they serve, but the full potential of these drugs and their analogue have been probably not yet been realized. For instance, labour is a major limiting resources in most livestock enterprises in major livestock industries, but the full potential of progesterone and prostaglandin for the reduction of labour input in oestrus detection have develop strategies for the delivery of this technology to livestock farmers and its use and limitations.

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