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Review Article

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Review on Estrus Synchronization and Its Application in Cattle

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Abstract

Numbers of estrus synchronization programmes are available in cattle based on the use of various hormones like progesterone, prostaglandin $F_2\alpha$ and their various combinations with other hormones like estrogen and Gonadotrophin Releasing hormone (GnRH). Selection of appropriate estrus synchronization protocol should be made on the basis of management capabilities and expectations of the farmer. Synchronization of oestrus can be accomplished with the injection of prostaglandin $F_2\alpha$ alone, but it needs proper detection of the ovarian status of the cows as prostaglandin $F_2\alpha$ is active in only functional corpus luteum in between 8 to 17 days of estrous cycle. Progesterone may reduce fertility up to 14 percent, but short time progesterone exposure (less than 14 days) is beneficial. Addition of GnRH in the Progesterone or Prostaglandin based synchronization programme is helpful for more synchrony in estrus as GnRH may be helpful to synchronize the oestrous cycle in delayed pubertal heifers and post partum cows (Post partum anoestrum) and further a single, timed artificial insemination is possible with this method. New methods of synchronizing estrus in which the GnRH-PG protocol is preceded by progesterone treatment offer effective synchronization of estrus with high fertility.

Keywords: *Anoestrus, Corpus leutum, Estrus, Hormone, Synchronization.*

1. Introduction

The history of estrous cycle synchronization and the use of artificial insemination (AI) in cattle is a testament to how discoveries in basic science can be applied to advance the techniques used for livestock breeding and management. Several authors described the experiments that have been conducted since the discovery of ovarian steroids and which have lead to the effective control of the length of the bovine estrous cycle and the timing of estrus and ovulation (Larson and Ball, 2002). The tools to control the timing of the onset of estrus is by controlling the length of the estrous cycle and choices of approaches for controlling cycle length are: to regress the corpus luteum (CL) of the animal before the time of natural luteolysis, and thereby shorten the cycle or to administer exogenous progestins to delay the time of estrus following natural or induced luteolysis which may extend the length of the estrous cycle. In either case, the emphasis is placed upon controlling or mimicking luteal function to control the time of estrus (Anon, 1992).

Variations on one of the two approaches to cycle control are the basis for commercially-available products which successfully synchronize estrus in the majority of cows or heifers within a 5 to 7 day period and which yield conception rates following heat detection and AI breeding that are similar to those following AI after a spontaneous estrus. Concurrent with the last few years of research on controlling estrous cycle length has been the development of a better understanding of follicular development. Methods of interrupting or manipulating the wave-like pattern of follicular growth and controlling ovulation have been developed (Prusley *et al*., 2005). Therefore:

The objectives of this seminar are:-

- ✓ To describe the current status of estrous synchronization and ovulation control programs
- ✓ To review the importance of estrus synchronization in the animal production.
- ✓ To give highlight about estrus synchronization in the animal production.
- ✓ To improve cattle producers awareness about estrus synchronization application in AI programme.
- ✓

2. Literature review

2.1 Estrus synchronization

Synchronization of estrus implies the manipulation of the estrous cycle or induction of estrus to bring a large percentage of a group of females into estrus at a short, predetermined time. Synchronization of estrus is one of the advanced managemental process through which the humane errors and managemental costs could be minimized. It is particularly beneficial in large cattle herd. Synchronization of estrus helps in fixing the breeding time within a short predefined period and thereby scheduling the parturition time at the most favorable season, when the newborns can be reared in suitable environment with ample food for enhancing their survive ability. Fertility in farm animals may be expected towards higher side as timely breeding of the animals is possible with this technique. Estrus synchronization provides more economic returns by improving the production efficiency in animals. Instead of females being bred over a 21-day period, synchronization can shorten the breeding period to less than five days, depending on the treatment regimen (Prusley *et al*., 2004).

2.2. Bovine estrus cycle

The term "estrus" refers to the point of female sexual excitement in mammals which causes ovulation. At ovulation females are most receptive to mating. This period is commonly referred to as heat period (Bridges, 2010).

The modal length of the estrous cycle is 21 days for mature cows and 20 days for heifers. Have two distinct phases these are; 1. Follicular phase is characterized by graffian follicle are the main structure of ovary. Sometimes called estrogenic phase i.e. female is under the stimulation of estrogen (E_2). It is classified as pro-estrus and estrus stages, it is a period from regression of corpus luteum to ovulation. 2. Luteal phase is characterized by CL is the main structure of the ovary and also called progesterone phase i.e. female is under the stimulation of progesterone (P_4). It is classified as metestrus and diestrus stages. Is a period from ovulation to regression of CL (Nebel *et al*., 2004).

The cycle is divided into four periods: proestrus, estrus, metestrus and diestrus, (Figure 1); Proestrus the CL regresses (progesterone declines) and a preovulatory follicle undergoes its final growth phase (estradiol increases), Estrus; this period lasts from 6 to 30 hours, with 20 hours being the average length. During estrus, the vaginal and cervical mucus production is greatly increased and mucus may be visible hanging from the vulva or wrapped around the tail, the corpus luteum (CL) has been lysed prior to this period; therefore, progesterone production (and subsequent blood level) is very low. Luteinizing hormone (LH) spikes to a high level during estrus, which initiates ovulation and, estrogen levels are decreasing from the high levels that were reached just prior to estrus, Metestrus lasts 3 to 5 days. Ovulation occurs during metestrus, about 10 to 15 hours after the end of estrus. During this period, the CL is undergoing early development. Observant producers may notice a slightly bloody vulvar discharge from some heifers due to the rupture of small vessels in the endometrium. Progesterone levels are still low, but increasing slightly during metestrus. This is because the CL is small and does not have the capacity to produce large amounts of progesterone at this stage of development. Diestrus, the period of the CL, lasts about 12 days. The CL is producing increasing amounts of progesterone during the early days of diestrus, as the capacity for steroid production increases as the CL matures (Bridges, 2010).

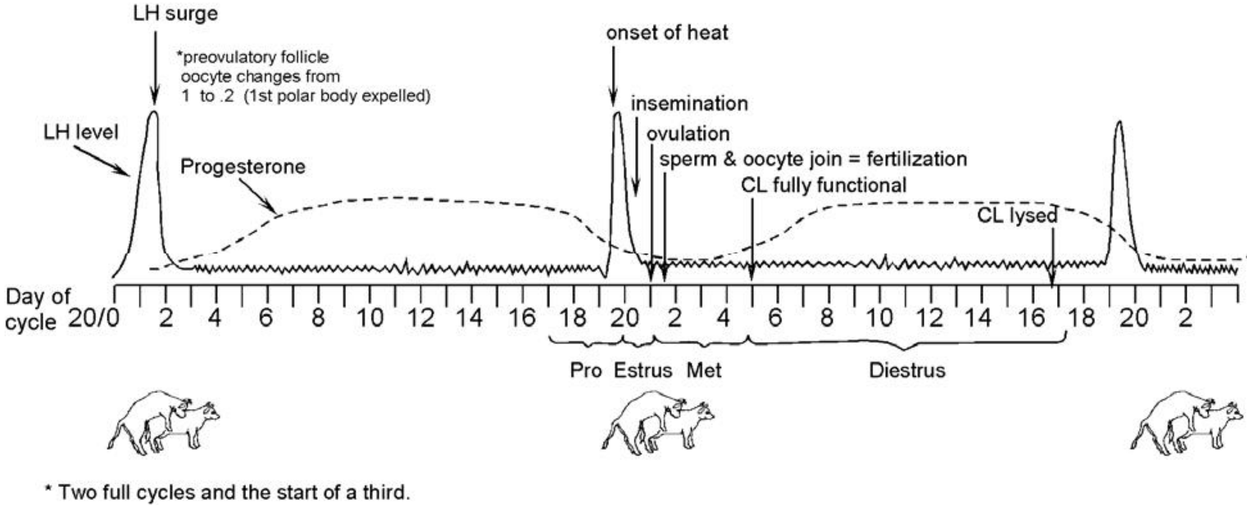

Figure 1: Schematic of stages of the estrous cycle, serum progesterone concentrations, and serum luteinizing hormone (LH) concentrations.
Source: (Sahatpure and Patil, 2008).

2.3. Estrus signs

A cow will not be detected to stand if no other cow is available to mount. Mounting activity is stimulated strongly by estrogen and inhibited by progesterone (Allrich, 2004). Thus, mounting frequency is considerably greater for cows in proestrus or estrus than for cows that are out of estrus or in midcycle with a functional CL. Once four or more sexually active animals are in estrus in the same pen, standing and mounting activity normally will be maximized and should increase efficiency of detected estrus. Cows that have foot problems show less mounting activity regardless of whether the problem is structural, subclinical, or clinical (Leonard *et al*., 1994).

The best indicator of a cow or heifer in estrus, or heat, is when she allows other herd mates to mount while she remains standing. Usually the animal in heat is restless and will ride other animals in the vicinity; however, cows that mount or ride others may not necessarily be in estrus (Pecsok, 1994). Only animals that remain standing for mounting are in estrus. Secondary signs of heat that a producer may observe to determine whether an animal is definitely in heat include:- roughened tail-head; if a cow has been ridden by other animals, the hair on her tail-head could be standing up or completely missing, dirty streaks and marks on lower hips, sides, or shoulders; the cow may bawl and travel long distances in search of a bull, and it may ride or mount other animals grouping together; some animals in heat will have a clear, thick mucus discharge from her vagina; check the vulva lips for swelling, reddening (bright cherry pink), and mucus discharge as an indicator for estrus a bloody discharge at the end of estrus usually indicates a missed heat; observe this animal for return to heat in 18–24 days (Stevenson, 2000).

2.4. Detection of estrus

The greatest limiting factor to successful fertilization is detection of estrus. One might be quite accurate in detecting cows in estrus but still have a major estrus detection problem because too many estrous periods go unobserved. Problems are caused by a lack of diagnostic accuracy and a lack of efficient detection of all periods of estrus (Hurnik *et al*., 2009). For heat-detection program success, implement an animal numbering system or other identification code to be able to track individual animals throughout their life cycle. Develop a good recordkeeping program and update information frequently. Establish standard operating procedures (SOP). Designate someone to be in charge of the heat-detection program and record information including animal identification, time of observation- and location of all mounting activity. Conduct visual observation for heat at least two to three times a day for a minimum of 30 minutes early morning, noon, and early evening. Watch for animal grouping activity. Cattle approaching heat usually alter their normal behavior when entering estrus and commonly congregate together. The use of hormone treatment increases the probability of detecting cycling cattle. Develop a program to catch the animals that return to estrus 18–24 days later. Treat sore feet immediately. Lame cattle will not mount or permit herd mates to ride them, decreasing your chances of detecting their heats. Always follow herd protocol and document all activities (Britt *et al*., 2007).

Table: 1. the effect of estrous detection rate and conception rate on pregnancy rate in cattle.

Estrus detection rate	Conception rate	pregnancy rate
95%	70%	67%
75%	70%	53%
95%	50%	48%
75%	50%	38%

Source: (Cooke, 2010).

2.5. Methods of estrus synchronization application

Knowledge on the hormonal profile and functional structures present in the ovaries at various stages of estrous cycle is very much important for the selection and successful implementation of the estrus synchronization programmed (Patterson *et al*., 2002). Basic approach is to control the timing of the onset of estrus by controlling the length of the estrous cycle. The various approaches for controlling cycle length are: Administration of Prostaglandin to regress the corpus luteum (CL) of the animal before the time of natural luteolysis, or Administration of Progesterone or more commonly synthetic progestin to temporarily suppress the ovarian activity, or a newer way of creating estrous synchrony is by using Gonadotropin-releasing hormone (GnRH) or an-analogue, which causes ovulation of a large follicle (Ozill *et al*., 2011).

2.5.1. Prostaglandins based protocol approach

Prostaglandin (PG) is a naturally occurring hormone. During the normal estrous cycle of a non-pregnant animal, PGF is released from the uterus 16 to 18 days after the animal was in heat. This release of PGF functions to destroy the corpus luteum (CL). The CL is a structure in the ovary that produces the hormone progesterone and prevents the animal from returning to estrus. The release of PGF from the uterus is the triggering mechanism that results in the animal returning to estrus every 21 days. Commercially available $PGF_2\alpha$ (Lutalyse, Estrumate, Prostamate) gives the herd owner the ability to simultaneously remove the CL from all cycling animals at a predetermined time that is convenient for heat detection and breeding (Patterson *et al*., 2003).

The major limitation of $PGF_2\alpha$ is that it is not effective on animals that do not possess a CL. This includes animals within 6 to 7 days of a previous heat, pre-pubertal heifers and postpartum anestrous cows. Despite these limitations, prostaglandins are the simplest method to synchronize estrus in cattle. Synchrony of estrus and fertility with these products is good with cyclic females, such as virgin heifers, but cannot induce estrous cycles in non-cycling cows (Bader, 2003).

***One shot prostaglandin*:** A single injection of prostaglandin is given to cyclic females, and then these females are bred as they express estrus. The disadvantage of this program is that one-third of the females do not respond to the injection. The programme may be modified first with the detection of estrus in the cows of the herd for 5 days and inseminated the cows showing estrus and only rest of the cows are given a single injection of Prostaglandin. This represents the greatest savings in cost and labor associated with treatments because only one injection is given and not all the cows need it (Bader, 2005)**.**

***Two shot prostaglandin*:** Two injections of prostaglandins are given at an interval of 10 to 14 days once stage of estrous cycle in the cows is unknown. Detection of estrus is not required before or between injections. All cycling cows should respond to the second injection regardless of what stage of the estrous cycle they were in when the first injection was administered. The programme may be modified with the breeding of all females exhibiting estrus subsequent to the first $PGF_2\alpha$ injection. Then the second injection is given only to the females that were not bred. This option lowers expense and handling, but results in two synchronized groups instead of one and a longer breeding period (Sahatpure and Patil, 2008).

2.5.2. Progesterone Base Protocol Approach

Synchronization of estrus with progestogens maintains high levels of progesterone in the female's system, even after the regression of the corpus luteum. Synchrony of estrus occurs 2 to 5 days following progestin removal. Commercial products that fall into this category are melengesterol acetate (oral feeding), Syncro-Mate-B (Ear Implant) and CIDR (Intra-vaginal device). Estrus was synchronized in only 48% of the cows treated on day 3, but the synchronization was 100% when treatment began on day 9 of the estrous cycle. In general, the longer the progestin was administered to cattle, the higher rate of estrous synchronization, but the lower the fertility of the synchronized animals (Moreira, *et al*., 2000).

This treatment régime was the basis for the commercial product syncro-mate B marketed, as well as the PRID (Progesterone releasing intravaginal device) and CIDR (Controlled intra vaginal drug release device. Development of the persistent follicle is caused by increased pulsatile secretion of gonadotropin during the period when the exogenous progestin is inhibiting estrus, but the corpus luteum has regressed (Kojima *et al*., 2002).

The low fertility of cows bred at the synchronized estrus following long-term administration of progestin is due to premature resumption of meiosis of ova or abnormal development of embryos derived from ova of persistent follicles. Treatment of cattle with progestogens for less than 14 d was reported not to reduce conception percentage. In addition, short-term exposure to progestogens causes some anestrus (postpartum or pre pubertal) cattle to begin cycling. However, for these short-term progestogen systems to be effective in synchronizing estrus, a luteolytic agent must be incorporated (Revah and Butler, 2006).

Techniques of Progesterone protocol are the following

Melengesterol acetate (mga) feeding

Option I: MGA is added to feed such that females receive 0.5 mg per head per day for 14 days. Upon removal of MGA from the feed, cyclic females begin to show estrus. This estrus is sub-fertile, and it is not recommended to breed. Females should be bred on the second estrus following MGA removal. The administration of MGA at the recommended daily rate of 0.5 mg prevents the expression of behavioral estrus, blocks the preovulatory surge of LH, and ovulation (Imwalle *et al*., 2002).

Option II: An injection of prostaglandin is given 15-19 days after removal of MGA from the feed (Brown *et al*., 2008) developed a system in which MGA was fed for 14d This system was designed to place cattle in the late luteal phase of the estrous cycle at the time of $PGF_2α$ administration. This system initially synchronizes estrus within the 7d following the last MGA feeding the administration of $PGF_2α$ to occur after day 10 of the estrus cycle in the majority of cattle and thus the estrous response and fertility of cattle are expected to be maximized as PGF2a is more effective during the late luteal phase (d10 to 15) than during the early luteal phase. The rate of synchronization of estrus following MGA-$PGF_2α$ is usually greater than that following the use of $PGF_2α$ alone (Patterson *et al*., 2002**).**

Option III: Two injections of prostaglandin are given; one at the time of MGA removal from the feed and another 15 days following removal. This further reduces time spent in estrous detection and breeding and provides more concentrated synchrony (Patterson *et al*., 2002).

Syncro-mate-B (ear implant)

SMB treatment late in the estrous cycle (> d 14) in cow gives lower conception rates. The optimum time for SMB treatment to begin is between d 8 and d12 of the estrous cycle to maximize estrus response (Ravikumar and Asokan, 2008).

Application of CIDR

This controlled, internal vaginal drug- releasing (CIDR) insert for cattle is made by molding a thin layer of silicon and progesterone mixture around a nylon spine under high temperature. The CIDR contains 1.38 gram progesterone and is designed to maintain elevated blood concentrations of progesterone at least 2 ng/ml for up to 10 days. Being relatively thin, the CIDR is easily inserted into the vagina and has good retention capacity (2.5% loss rate is normal). A flexible nylon tail is attached to the device to allow for easy removal. The CIDR Cattle Insert provides an exogenous source of the hormone progesterone during the 7-day administration period. Removal of the CIDR Cattle Insert on treatment day 7 results in a rapid fall in plasma progesterone levels, which results in synchronization of estrus in those animals responding to treatment **(**Moody and Lauderdale, (1997).

General hypothesis that progestin treatment prior to the GnRH-PG estrus synchronization protocol would successfully: 1) induce ovulation in anestrous postpartum beef cows and per pubertal heifers; 2) reduce the incidence of a short luteal phase among anestrous cows induced to ovulate; 3) increase estrous response, synchronized conception and pregnancy rates; and 4) increase the likelihood of successful fixed-time insemination (Lucy *et al*., 2001).

2.5.3. GnRH – Based Protocol Approach Synchronization Systems

Synchrony of estrus by administration of GnRH during the bovine estrous cycle causes regression or ovulation following treatment (Pursley *et al*., 2005). Artesian or ovulation of the dominant follicle and initiates the emergences of a new wave of follicular growth an average of 2.5d ovulation of the dominant follicle depends on the status (growing, static or regressing) of the dominant follicle at the time of GnRH injection (Silcox *et al*., 1993; Twagiramungu *et al*., 1994). Ovulation of a growing dominant follicle occurred 100% of the time following GnRH administration, however, ovulation of dominant follicles in the static or regressing phases occurred 33% and 0% of the time, respectively (Helmer and Britt, 2005).

2.5.4. GnRH– PGF$_2$α System:

This combination represents the simplest GnRH – PGF$_2$α based system. A common name for the GnRH - PGF$_2$α system is "Select Synch". Select-Synch; Single dose of GnRH and Prostaglandin were injected on day 1 and day 8, respectively. Some cows exhibit estrus up to 48 hours before PGF (d 6). The "early" heats are fertile and cows can be inseminated 12 hours after detection. The peak estrous response occurs 2-3 days after PGF$_2$α with a range of days 1–5. With this system, a minimum of 5 days of estrus detection after PGF$_2$α and 2 days preceding PGF$_2$α is required to detect most heats. The four systems for synchronization of estrus with GnRH - PGF$_2$α combinations (figure 2) are; ovulation synchronization (Ovsynch), combination synchronization (co synch), select synchronization (select synch) and hybrid synchronization (hybrid synch) (Patterson *et al.*, 2003).

The initial GnRH injection (day 1; GnRH) is used to program follicle growth in cyclic females and to induce ovulation (to provide progestin pre exposure) in anestrous females. The PGF$_2$α (PGF$_2$α; day 8) induces regression of CL that are present to cause a decline in progesterone. The second GnRH given on day 10-11 induces ovulation of dominant follicles that have been pre programmed by the first GnRH treatment (Savio *et al*., 2003).

2.5.5. GnRH – PGF$_2$α + GnRH System

This system is GnRH – PGF$_2$α system that includes a second GnRH injection (GnRH) given to all, or some cows between 48 and 72 hours after PGF$_2$α (day 2 to 3), with timed AI on all or a portion of the herd. Several variations of this system are being used.

Ovsynch: The Ovsynch program is comprised of an injection of GnRH on day 1, an injection of prostaglandin on day 8, a second injection of GnRH on day 10 and then timed insemination on day 11 indicated that pregnancy rates varied when cows were timed inseminated at 0, 8, 16, 24 or 32 h after the second injection of GnRH in the Ovsynch program and the highest pregnancy rate (45%) was achieved when insemination was done 16 h after the second GnRH injection. The first GnRH injection alters follicular growth by inducing ovulation of the largest follicle (dominant follicle) in the ovaries after the GnRH injection to form a new or additional CL. Thus, estrus usually does not occur until a PGF$_2$α injection regresses the natural CL and the secondary CL (formed from the follicle induced to ovulate by the first GnRH injection) (Vasconcelos *et al*., 1999).

CO-Synch: The CO-Synch program is comprised of an injection of GnRH on day 1, an injection of prostaglandin on day 8 and then a second injection of GnRH with breeding on day 10. The advantages are tight synchronization of estrus, most females respond to the program and it encourages estrus in non-cycling cows that are at least 30 days postpartum (Harrison, 1990).

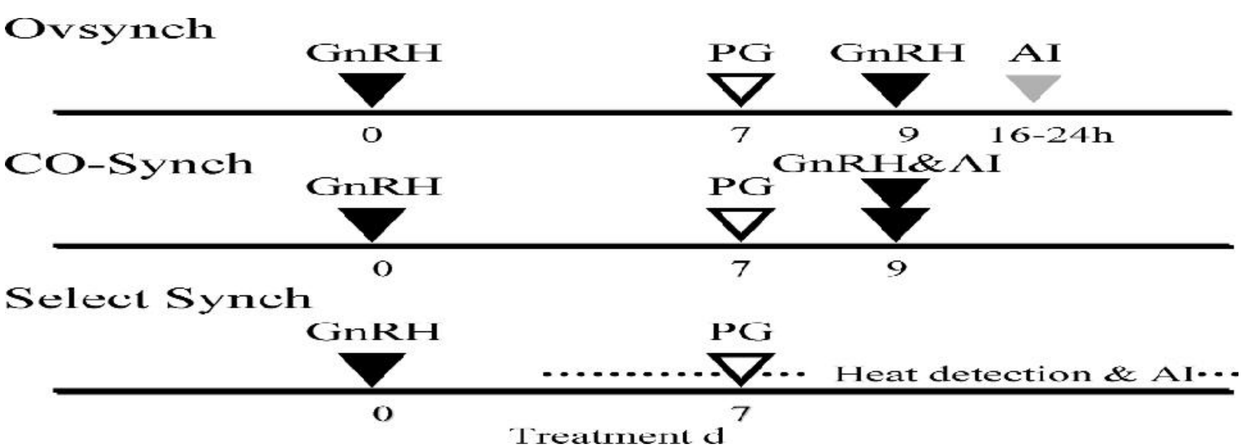

Figure: 2. Methods currently is used to synchronize ovulation in postpartum cows: Ovsynch, CO-Synch and Select Synch.
Source: (Patterson *et al*., 2002).

Hybrid-Synch: The Hybrid-Synch program is implemented with an injection of GnRH on day 1, an injection of prostaglandin on day 8 and then estrous detection and breeding from day 7 to 10.days. Females not observed in estrus from day 7 to 10 are bred on day 10 and given a second injection of GnRH. This program has a lower cost and less handling compared with Ovsynch and CO-Synch but more than Select-Synch. The primary advantage is that Hybrid-Synch appears to have the highest conception rates among all GnRH – $PGF_2\alpha$ programs (Ravikumar and Asokan, 2008).

2.5.6. CIDR to GnRH Based Protocol

Failure to appropriately synchronize cyclic animals or to induce a potentially fertile ovulation in anestrous females can have major influences on the success of a synchronization program. The addition of a CIDR to GnRH – based programs has the potential to reduce losses in each of these areas. The most common use of the CIDR the GnRH based system involves insertion of the CIDR on day 1 and withdrawal of CIDR on day 8. An injection of GnRH is given on day of CIDR insertion. The CIDR is kept in situate for seven days. On the day of CIDR withdrawal, an injection of prostaglandin is given. The second GnRH injection is given after two days of prostaglandin injection. The primary benefit of inclusion of the CIDR in GnRH-based programs is that it guarantees that females will be exposed to progesterone during the period between day 1 and day 8 (Fonseca *et al*., 2004).

A second benefit to inclusion of the CIDR in GnRH-based programs is that the early heats (days 6 to day 9) that are inherent to these systems are prevented. The progesterone released by the CIDR, will prevent estrus and ovulation between days 1 and 9 (Fonseca *et al*., 2004).

MGA-GnRH-PG protocol: MGA is administered to the cows orally for 14 days. Ten days after the withdrawal of MGA an injection of GnRH is given. Seven days after the GnRH injection an injection of PGF2a is given. 80 % of the cows showed estrus within 48 to 96 hours after PGF2a injection (Fonseca *et al*., 2004).

2.6. Factors important to achieving success with synchronization programs

A high percentage of the cows must be cycling normally. Nutritional, environmental, or disease factors that prevent cows from cycling (anestrous) or cause low conception must be corrected before starting a synchronization program. Although the presynch and Ovsynch programs will induce some anestrous cows to ovulate, pregnancy rates will significantly increase in relation to the percentage of cows that are cycling at the onset of the program. Pregnancy rates are significantly higher for cows with Body Condition Scores (BCS) > 2.5 compared to cows with BCS<2.5 (Michael, 2007).

Herd managers and employees must make a commitment to the estrous synchronization program. Accurate records must be kept. A list of eligible cows must be updated regularly. A calendar or electronic record system should be used so injections, heat detection and inseminations are performed on the correct days specified for the system. Appropriate personnel should be available to perform these tasks correctly. Standard operating procedures (SOP) should be posted and understood by everyone (Bader *et al*., 2005).

Efficient and accurate heat detection for the specified days is essential when using the synchronization programs that require heat detection. Heat detection must be intensified on the days when cows are likely to exhibit heat. Use of heat detection aids is recommended. To maximize the effectiveness of any system, post breeding heat detection (detection or return heats) must be high, Herd managers and employees must adhere to the time schedule for injections, heat detection, insemination and pregnancy examinations, the proper amount of hormone must be given in the correct location. GnRH and PG should be injected into the muscle, so use the appropriate size needle for the area where the muscle is located. Pregnancy examinations must be scheduled routinely so non pregnant cows are identified and scheduled back into the synchronization program. Successful reproductive management depends upon team work. Herd managers should consult with the veterinarian, artificial insemination personnel and employees so everyone is working toward the same objective (Bader *et al*., 2005).

2.7 Commonly used commercially available hormones

2.7.1. Cystorelin®, Factrel®, and Fertagyl® - GnRH

They act to increase the release of FSH and LH from the anterior pituitary gland. The increased LH concentration causes ovulation and luteinization of most dominant or large growing follicles. As a result, a new follicular wave is initiated in all cows about 3 days after the injection (Cartmill *et al*., 2001).

2.7.2. PMSG: Pregnant Mare Serum Gonadotropin (ECG)

It is produced by the deciduate cells of the equine placenta. This hormone exhibits predominantly FSH activity but also some LH activity, and is used in the superovulation of cattle. hCG: Human Chorionic Gonadotropin Produced by chorionic epithelial cells of the human placenta. This hormone exhibits predominantly LH activity but also some FSH activity, and is used in the superovulation of cattle (Cartmill *et al*., 2001).

2.7.3. Norgestomet - component of Synchro-Mate B® - a synthetic progestogen

It administered in a controlled-release ear implant that releases norgestomet over a 9-day period. After 9 days the implant is removed. The norgestomet acts like natural progesterone from the CL: it prevents the decrease in blood levels of progestogens after the CL is lysed naturally on day 17 of the cycle, thereby preventing the increase in LH and estrogen that cause maturation of the ovulatory follicle, ovulation, and estrus (Cartmill *et al*., 2001).

2.7.4. Melengestrol acetate - MGA® - a synthetic progestogen

This synthetic progestogen mimics progesterone produced naturally by the CL. It does not affect the lifespan of the CL. In other words, the CL is still lysed naturally on day 17 of the estrous cycle. However, as long as MGA is present in the feed, the blood level of progestogen is high enough to prevent the spike in LH necessary to initiate ovulation and to prevent estrogen concentrations to increase to the level necessary to initiate estrous behavior (Custer *et al*., 2004).

2.7.5. Lutalyse® and Estrumate® prostmate® - Prostaglandin $F_2\alpha$

These products are used primarily to synchronize estrus in cattle and to abort feedlot heifers. They act by lysing the CL (only during diestrus), which causes a rapid decline in progesterone production by the CL (Custer *et al*., 2004).

2.8. Advantages of estrus synchronization

Synchronization program is to breed a high percentage of the females in a given group of heifers or cows in a short period of time, using either artificial insemination (A.I.) or natural service (bulls).There are advantages of being able to synchronize the timing of estrus and ovulation in livestock. Synchronization techniques result in a uniform animal crop and labor can be concentrated at parturition. Estrous synchronization technologies are costly, laborious; generally yield lower rates of conception than natural service and other advantages of systematic breeding programs are; improve the efficiency of heat detection, Achieve more timely first service, by improving the pregnancy rate there will be a reduction in the variation in calving intervals among cows, Possibly reduce involuntary culling for reproductive reasons, concentrate labor for reproductive management to specific time periods, Improve the overall reproductive performance of the herd and also used for silent heat and ovarian cyst treatment (Cartmill *et al*, 2001).

3. Conclusions and Recommendations

Estrus synchronization is the most important and widely applicable reproductive biotechnologies available for cattle. The major factor limiting optimum reproductive performance on many cattle farms is failure to detect cows in heat in a timely and accurate manner. Poor heat detection results in excessive number of days not pregnant (days open) which causes long calving intervals. The newer systems, termed timed breeding or appointment breeding or estrus synchronization programmed are designed so both the onset of heat (estrus) and ovulation are induced so cows can be inseminated at a specific time without heat detection. This programme is done based on various hormones either natural or artificial like progesterone, prostaglandin $F_2\alpha$ Gonadotropin Releasing hormone (GnRH) for deferent protocol methods. Generally there are significant benefits to genetic improvement and reproductive management that can be gained from the implementation of estrus synchronization. Based on the above conclusions the following recommendations are forwarded:-

- Improvement the awareness of public in the use and effectiveness of estrus synchronization in livestock production.
- Herd managers should consult with the veterinarian, artificial insemination personnel and employees of animal health to have high reproductive performance through application of estrus synchronization system.
- Herd managers and employees must make a commitment to the estrus synchronization programme.

- Skilled manpower should be available to perform estrus synchronization programme as good manner.
- For production of hormone and detection of estrus phase sophisticated machine and techniques should be required.

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