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VETERINARY COUNCIL OF INDIA

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Continuing Veterinary Education (CVE) Programmes

Training Module

On

Reproductive Health Management in Bovines

A-Wing, 2nd Floor, August Kranti Bhawan,
Bhikaji Cama Place, New Delhi – 110 066

Training Module developed with inputs from:

1. Dr. N.K. Khurana, Principal, Haryana Veterinary Training Institute, Government of Haryana, Dhansu Road, Hisar, Haryana.

2. Dr. R.A. Luthra, Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, CCS Haryana Agricultural University, Hisar, Haryana.

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Preface

Consequent upon the decision of the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India to implement the Continuing Veterinary Education (CVE) programmes, an activity of Professional Efficiency Development Scheme, through Veterinary Council of India as its nodal agency in the country, the Council has been implementing these programmes through conducting skill based trainings on identified topics since December, 2007. The primary objective of these trainings is to upgrade the knowledge and skills of the registered Veterinary practitioners aimed at improving quality of Veterinary services in all its spheres.

Efficient reproduction in farm animals is the key to the success of gainful animal husbandry and hence, delays, failures or other problems associated with the process of reproduction would certainly affect the economics of animal production. Basically, reproductive health management consists of Veterinarian's intervention in a systematic and planned manner to rectify or check aberrations of the reproductive process to optimize its efficiency and to minimize reproductive diseases in addition to ensuring genetic merit of the progeny.

This Module for a four-day training programme developed and finalized by the experts in the subject emphasizes on the common reproductive disorders, pre-requisites and constraints in reproductive health management, and the corrective measures in bovines.

The contents of this Module are also available on the website www.vci-india.in.

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INTRODUCTION

Reproduction is a natural but complex process aimed at propagation of ones' own species to keep continuity of generations and ensure that the species does not become extinct. However, delays, failures or other problems in the process of reproduction are not uncommon which if not checked through a sound reproductive health care may adversely affect the economics of animal production. It is the responsibility of veterinarians to help the dairy farmers to make more profit. Reproductive performance has a direct bearing on the economic viability of dairy farming. In fact, production only follows the successful reproduction. A farmer invests continuously for 3 to 4 years in feeding, health care and management of a calf from the day it is born until it sexually matures and starts production after calving when the farmer may expect the long awaited financial returns to his investment. Genotype, nutrition and health are the most important pillars of the animal production system. These factors not only affect the production of the animal but also have the greatest impact on its reproduction. Healthy, well fed animals of right genotype are expected to have optimum reproductive efficiency. Body condition score is a good predictor of future production and reproductive performance. Animals in good body condition with a score of 5 to 6 (10 point scale) have an early start of cyclic activity after calving, while those with poor body condition may have a late initiation of post partum ovarian activity in addition to reduced production, weak calves and low fertility rates.

A calf represents the future of a dairy unit. Birth of a healthy and viable calf is the desired end result of successful reproduction. But a calf of good genetic merit (good production potential) is extra beneficial like icing on the cake. It requires no extra efforts or investment except for the right selection of breeding sires. A calf of poor genetic merit will lead to propagation of inferior germ plasm and financial losses to the farmer.

Basically, reproductive health management consists of veterinarian's intervention in a systematic and planned manner to rectify or check aberrations of the reproductive process to optimize its efficiency and to minimize reproductive diseases in addition to ensuring genetic merit of the progeny.

1.0 Reproductive goals

The dream of optimal fertility is to have a live, healthy, viable calf of high genetic merit from each bovine female, every 12 (cow) or 13 (buffalo) months and the first calf being born at the earliest age. Reproductive goals should be aimed at maximizing the pregnancy rate of the breeding population.

The most commonly used yard sticks of reproductive performance include inter- calving interval **(calf-a-year)** and age at first calving **(age at sexual maturity plus inseminations or services per conception).** Better performance on these fronts will narrow the generation interval on one hand and increase the rate of genetic gain in the production parameters on the other hand, provided proper selection is practised.

2.1 Age at first calving

The age at sexual maturity and conception rate at the first and subsequent services determine the heifer's age at first calving since gestation length is a fixed parameter. Continuous investment is needed to rear a heifer from its birth to calving when the non productive period ends with initiation of the lactation. Life time milk production and profits are maximized with an early age at first calving. Obviously, age at first calving has a profound effect on the economic returns. In general, heifers are bred when they have attained 2/3rd of the adult weight. Genetic makeup, calf hood management, general health, nutrition and season are likely to affect the age at puberty /calving. Breeding for early maturity should be the first step to achieve this goal. The target age at first calving should be around 3 to 3½ years for the buffalo as well as indigenous cattle and 2 to 2½ years for the exotic cattle and their crosses.

2.2 Calf-a- year

Calf a year (13 months for the buffalo) is one of the important goals of Reproductive performance as it has a significant effect on the dairy economics. However, it remains only a dream under our conditions. Post partum initiation of the ovarian activity and the number of services per conception are two important factors influencing the calving interval since the gestation length is of fixed duration. The post partum interval or the voluntary waiting period which may range from 14 days to more than a year, is regulated by genetic makeup, age, body condition score, general health, energy balance, nutrition, micronutrients, calving difficulty, suckling of calf, calving

season & lactation stress etc. It can be affected by the quality of breeding services including fertility of the bulls, involution of uterus and other factors affecting the initiation of oestrous activity after calving.

2.3 Number of inseminations/ services per conception

Since gestation length is a fixed parameter, the number of services required for each conception (conception rate) influence both the age at first calving and calving interval. The goal should be 1.5 services, however 2.0 services per conception is acceptable.

3.0 Consequences of poor reproductive performance

Reproductive performance may range from a reduced or delayed capacity (infertility) to an absolute inability to reproduce (sterility). While infertility is more common, reversible and can be treated by a qualified veterinarian, the sterility is irreversible with no cure. The direct economic losses and other consequences of poor reproductive efficiency are not difficult to imagine. These include:

(i) Reduced calf crop and future replacements.

(ii) Decreased genetic gain because of longer generation interval.

(iii) Lower life time production due to longer non- productive periods.

(iv) Delayed and low returns to huge investments made in rearing of the female calves.

(v) Direct financial losses can be heavy. If there is a delay in breeding by just one oestrous cycle (21 days), it may cause a direct loss of more than one thousand rupees to the farmer assuming a minimum maintenance cost of fifty rupees per day for each such animal. Similarly, a delay of 6 months in calving, which is not uncommon, may cause a significant loss of nine thousand rupees to the animal owner.

4.0 Common reproductive problems

The major aberrations / problems of reproduction being encountered by the field veterinarians and the subject of discussion in this module include:

(a). Failure to exhibit oestrus **(Anoestrus)**

(b). Inability to conceive **(Repeat breeding).**

Experience shows that aberrations, delay or failure in breeding is more often a result of human error or negligence **(man-made)** than reproductive dysfunction of the cow. Man as an owner, care taker, manager or veterinarian has important role at various levels such as rearing of calf, feeding and management, heat detection, semen production, artificial insemination and providing quality breeding services.

4.1 Anoestrus

It is the principal deterrent in the process of optimization of reproductive potential and is the most common cause of infertility in buffaloes and indigenous cattle. Normally, all non pregnant adult females should have a regular sexual cycle except for a short period after calving. Anoestrus is classified into different categories such as:

- Pubertal
- Post partum
- Post service

Anoestrus is also classified into

- True anoestrus
- Apparent anoestrus

depending upon presence or absence of the functional structures on the ovaries subjected to two gynecological examinations at two weeks interval.

4.1.1 Pubertal anoestrus

It is the failure of a heifer to experience oestrous cycle after it had attained the right weight and age. The required weight and age at puberty may vary with the species and breed. Prolongation of pre - pubertal state of acyclicity, in addition to being hereditary in origin, may result from suboptimal nutrition, debilitating diseases, infections affecting ovaries (ovaritis/ atrophy) or genitalia. Some of the congenital conditions such as freemartin, hermaphrodites and aplasia of ovaries/ genitalia result into permanent sterility.

4.1.2 Postpartum anoestrus

Following parturition, ovarian inactivity for a short period is normal. During this interval, uterus undergoes involution to prepare for the next conception. If this duration of acyclicity exceeds the voluntary waiting period of 50-60 days, it becomes abnormal and is termed as postpartum anoestrus. Delayed uterine involution results from

dystocia, twinning, retained fetal membranes and metritis etc. First calvers, in general, have delayed onset of postpartum ovarian activity because of the extra demands of nutrition for continued body growth plus lactation. Uterine pathology leading to retained corpus luteum, lactation stress, suckling, negative energy balance and season of calving (particularly in the buffalo) are the other important causes of anoestrus. Post partum anoestrus is the most common cause of infertility in buffaloes.

4.1.3 Post- service anoestrus

It is a problem with serious economic consequences as many animals do not return to oestrus in spite of their failing to conceive following the service. Such animals are found to be empty at the time of pregnancy testing, 60 to 90 days after the service. True cases of post service anoestrus (non functional & smooth ovaries) are a typical problem of the Indian subcontinent and could be attributed to a number of factors including nutritional deficiency, parasitic load, and systemic diseases etc. Failure to detect oestrus, uterine pathology, early embryonic death, fetal resorption and cystic follicular degeneration may also cause the post- service anoestrus.

4.1.4 True anoestrus

Such animals have small and non functional ovaries. The repeated gynecological examinations reveal no changes in shape, size and functional activity of the ovaries. It is a complex and poorly understood phenomenon, most commonly experienced in the buffalo and indigenous cattle but rarely seen in exotic cattle or their crosses. The various causes of this condition include low plane of nutrition, deficiency of minerals/ trace elements, secondary to chronic debilitating diseases, genetic make up and seasonal influences.

4.1.5 Apparent anoestrus

These animals on rectal palpation reveal active and functional ovaries. A fully developed or regressing corpus luteum and a maturing follicle may be detected on rectal palpation. Some of these animals may be found even in oestrus (with turgid genitalia). It is not uncommon to find a small proportion of such animals either pregnant due to stray / unknown mating or with uterine pathology such as pyometra, mummification etc. leading to retained corpus luteum.

Such animals undergo normal ovarian cyclic activity but without the overt signs of heat. This may happen because of weak, silent or sub oestrus or due to negligence on part of the owner to observe heat signs i.e. missed oestrus with inter oestrus interval being in the multiples of 20-21 days. The physiological basis for the weak signs of oestrus is not known. It may happen due to insufficient secretion of oestradiol by the mature and secondary follicles or due to need of a higher threshold of oestrogen to exhibit characteristic signs of oestrus. However, the animals with sub or weak oestrus are fertile, but due to improper timing of artificial insemination or service, conception rates may be lower. Two rectal palpations at an interval of 2-4 weeks are essential if the animal is suspected to be in early pregnancy and to make differential diagnosis of uterine pathological conditions.

4.2 Repeat breeding

An animal failing to conceive after three or more fertile services is classified as repeat breeder. Technically, the oestrous cycles in such animals should be of normal duration with no clinically palpable abnormalities. Repeat breeding is quite common with incidence up to 20% under field conditions. It is one of the most poorly understood reproductive problems responsible for low reproductive efficiency. The accurate diagnosis of the cause of this problem is at once challenging and discouraging to the practising veterinarians. The basic cause of repeat breeding may either be fertilization failure or the early embryonic death which could result from the morbid uterine environment created by the invading microorganism during the critical period of pre-implantation stage. The buffalo is more susceptible to both specific and non specific infections of the genital tract, as compared to cattle. In most repeaters, the infection is generally of mild nature and escapes clinical detection. Animals suffering from endometritis have a relaxed cervix, hard and firm genitalia which may sometimes be mistaken for oestrus. Besides, there may be an increased amount of vaginal discharge which is usually cloudy and may have white flakes. Animals repeating after longer intervals of 28-35 days may suggest early embryonic death. The incidence of repeat breeding in buffaloes is generally low during the high breeding season (October to February) when they exhibit distinct signs of oestrus, while it is higher during the low breeding season comprising of hot and humid months. This higher incidence might be

due to the poor exhibition of oestrous signs and that too for a short duration, which may lead to insemination at wrong time of the oestrus or during the luteal phase, favouring genital infections. In some cases, the heat may be prolonged up to 4 days leading to asynchrony between insemination and ovulation which is delayed in such cases. Repeated inseminations at 12 to 24 hours intervals till the heat ends or an injection of gonadotrophin releasing hormone (GnRH) at the time of insemination may help to resolve the problem.

Other important causes of repeat breeding include:

- Retained fetal membranes
- Unhygienic handling at the time of calving leading to uterine infections
- Quality of semen including its mishandling at any stage of storage, transfer, retrieval, thawing or deposition into the female genital tract
- Bull infertility
- Genetic, congenital or acquired defects of tubular tract causing obstruction of the passage (salpingitis) and thereby preventing meeting of the sperm and ovum
- **There may be no known cause in many cases.**

5.0 Pre-requisites for reproductive health management

Proper management strategies are more likely to be successful in improving the reproductive efficiency than most therapeutic agents. Effective corrective measures may be more difficult since the exact cause of the problem in many cases is not known. The essential pre- requisites include:

(i) Skilled rectal palpation

In large animals, the veterinarian has an added advantage of direct access to genitalia through the rectal wall. He should be highly skilled in rectal palpation to appreciate the changes in shape, size, consistency and structure of uterus and ovaries accompanying different reproductive states such as stages of oestrous cycle, pregnancy and uterine pathology etc. The half of the job of reproductive health care may be considered as accomplished, if the veterinarian had mastered the palpation skills and had become **'good at feel inside'.**

(ii) Efficient heat detection system

It is the backbone of any breeding system. The golden period of 10-12 hours, during which the ovum can be fertilized comes only once in a cycle of 21 days. There has to be a good synchrony between the ovulation (10-12 hrs after end of the oestrus) and the insemination / service (between mid and end of the oestrus) to increase chances of the ovum being fertilized. Improper or inefficient detection of heat may result in many of the heats either being missed or leading to wrong time of service, an important cause of low fertility. Heat detection may be more difficult in stall fed animals or those with restricted physical mobility. Pertinent signs of behavioural oestrus may be either absent or a few particularly in the buffalo. Even if an animal is showing a few or weak signs of oestrus, it needs to be checked per rectum to ascertain the stage of oestrous cycle and to improve the reproductive efficiency. Observation of animals at least four times a day for the signs of heat, beginning as the first job in morning and the last activity in evening before going to bed, in addition to 2 to 3 observations during day time may help to catch most of the animals in heat.

(iii) Identification and record keeping

Proper record keeping and permanent identification of each animal are vital to the success of any breeding programme. The record of individual animals may be kept in the form of a special health care card or a booklet. The records can be computerized if the number of animals is large. Detailed records of age, pedigree, calving problems, oestrous cycles, intensity of oestrous signs, heat detection, veterinary examinations, vaccination and dewroming etc. may help the veterinarian to diagnose and resolve the problem without any loss of time.

(iv) Good husbandry and feeding practices

Most reproductive failures can be attributed to improper or inadequate nutrition, negative energy balance and low score of body condition. A body condition score of 5 to 6 on a 10 point scale is the minimum to achieve optimum reproductive efficiency. Providing balanced feed and fodder of good quality should help to keep the animals in good body condition and healthy state.

Animals should have comfortable housing. The housing should be airy and well ventilated. The floor should be non slippery with a provision for dry bedding. It should protect the animal against extremes of weather and direct winds. Fresh, clean water for drinking should be available at all times. A healthy and well looked-after animal is likely to have minimum reproductive problems.

(v) High quality breeding services

Occurrence of oestrus is a random process regardless of the time of the day, week end or a public holiday. Provision of round the clock availability of good quality breeding services either through artificial insemination using frozen semen or natural service with bulls of high genetic merit and tested for their breeding soundness is vital to achieve better reproductive efficiency.

(vi) Mass Awareness

A majority of our animal owners is illiterate, casual in approach and not good at book keeping. They are mostly unaware of gravity of the economic losses being caused by poor reproduction of their stock. A mass awareness programme using the available communication means (as per the local conditions) including published material, press, radio, electronic media, infertility camps, calf rallies, door-to-door personal contact etc. can go a long way in achieving the goals. Veterinary institutions spread all over the country have an important role and responsibility is this regards.

6.0 Constraints in reproductive health management

Except for a few organized animal farms, the concept of reproductive health management is altogether missing at the farmer's level. There are several constraints including:

(i) Bovine population is spread into millions of tiny units of 2-5 animals. Most of the rural households own one or two dairy animals. Feeding and management practices differ from house- to- house depending upon social, economic and educational status of each family. This system is unique to our country and there is no role model to follow. It is difficult to evolve a uniform package of practices applicable in a wider area.

(ii) Stray bulls roaming free in the streets are a major hindrance to organized breeding on scientific lines. Due to socio- religious reasons, we have been unable to check this menace.

(iii) Lack of modern diagnostic tools such as ultra-sonography and radio-immunoassay for reproductive hormones. and shortage of animal reproduction experts are the other recognized constraints.

(iv) Veterinary services in India are mostly Govt. owned and are almost free. Being a Govt. service, the efficiency is much to be desired with hardly any arrangements for off hours and holidays. The inherent low priority for human resources development and mid career skill upgradation in this important sector had further slowed down adoption of modern technologies.

7.0 Investigation of poor reproductive performance

It is essential to investigate each reproductive problem to know its exact cause/s so that appropriate corrective measures or therapeutic means could be taken to resolve the same to protect the animal owners from further economic losses. However, investigation of reproductive problems is time- consuming, difficult, expensive, unsuccessful and often frustrating to the practising veterinarians since most of the problems are complex with multiple causes. The following tips may be of some help in the process of investigation:

(i) Identify the type of problem: Normally the owner describes the broad type of problem in his complaint such as anoestrus or repeat breeding etc. However, obtaining detailed history and proper investigations as given below would help to find out the exact nature and causes of the problem.

(ii) Detailed history and records regarding age, pedigree, previous breeding performance, calving difficulties, discharge of lochia, twinning, oestrous cycle length, intensity of oestrus, heat detection efficiency, quality of breeding services and stress from lactation, suckling, vaccination, deworming etc. should be collected.

(iii) Find out if the problem is localized affecting an individual or a small group of animals (belonging to the same owner) or wide spread over a region, area, village etc. It may indicate some deficiency in the soil.

(iv) Exclude infectious, nutritional and venereal causes one-by-one.

(v) Role of bull, semen and inseminator may be ascertained by analyzing conception rate and other relevant data.

(vi) General examination of the animal and evaluation for body condition score, weight/ size, energy balance, feeding of micronutrients / trace-elements, physical mobility (stall fed/ grazing) may help in assessing the situation correctly.

(vii) Detailed gynecological examination, twice at 12-14 days interval, by a skilled person or an expert to exclude pregnancy and to judge functional/ pathological status of the genital organs including cyclic structures on the ovaries may be helpful. If essential, vaginal examination should also be conducted.

8.0 Corrective measures

Any measures for improving the reproductive efficiency should result in early revival of the post partum ovarian activity, reduced calving interval and early maturity of heifers. In general, the technology evolved for cows, is also being applied as such in the buffalo assuming it as a **"Black Cow"**. However, it is well accepted that the buffalo differs from the cow in several respects. The research workers should make concerted efforts to further our knowledge in the field of buffalo physiology, endocrinology, reproductive biology, nutrition and behaviour etc. so that buffalo-specific improvement programmes become a reality. Sound reproductive health management protocol is likely to yield better results in terms of higher reproductive performance. It appears to be a better, cheap and preferred alternative to the use of therapeutic agents including hormones which are not only expensive but less rewarding too.

8.1 Reproductive Health Management (prophylactic measures)

Some of the desired practices for an effective reproductive health care are listed below:

(a) Proper attention at the time of parturition and subsequent expulsion of placenta is a must. In case of difficult birth, lay assistance or interference of any kind should be avoided. Expert advice and help of a veterinarian at this time pay rich dividends in future in the form of good fertility rate and more milk production.

(b) Normal discharge of lochia (post-calving vulvar discharge for several days) is essential for proper involution of the genitalia. The lochia may be specifically noted for presence of pus flakes or foul smell indicating metritis. In a normal course of events, an animal should exhibit oestrus within 60 days of calving. If it comes in heat earlier, the service may be withheld. Those failing to come in heat within the specified period, should undergo gynaecological examination by a veterinarian and subjected to a regular sexual health programme till they conceive.

(c) For the success of any breeding or a sexual health programme, each breeder shall have to maintain record in the form of a special health card or a booklet indicating the date of calving and subsequent events. The veterinarian should record his findings and advice at each examination in that booklet for a meaningful follow-up programme.

(d) The owner must be familiar with the common oestrous signs such as bellowing, frequent urination, mucus discharge from vulva, raising of tail, mounting or allowing to be mounted, if let loose, and restlessness etc. It should be kept in mind that one or other signs of oestrus might be missing. Special attention has to be given to small mucus droppings behind the animal, sitting and resting normally. In buffaloes, oestrus may be of short duration with either poor or altogether missing external signs.

(e) Efficient heat detection system is essential for better results of any breeding programme. Improper detection of oestrus resulting in wrong timing of service, is an important cause of low fertility. Accurate breeding records and skilled rectal palpation are of considerable help in preparing heat expectancy charts. Similarly, animals having problems of sub, weak or silent oestrus can be successfully bred by evolving heat expectancy charts for these animals.

(f) HEAT EXPECTANCY CHART is a highly innovative tool but simple to maintain at the farmers' level. The modal value for inter-oestrus period is 20 – 21 days. When an animal is detected in oestrus (whether served or not), it should be marked on a calendar or diary on the date it is expected

to return to oestrus. For example if an animal comes in heat on Ist January, it should be marked on 20th and 21st January for special observations of heat signs. This practice would prevent any animal from being overlooked or missed during heat detection because of special attention to the animal given on the day it is expected to experience heat. Similarly, if the owner happens to observe met-oestrus bleeding (heat missed), it may be marked after 18 and 19 days for detection of heat. When a veterinarian, highly skilled in rectal palpation, examines the animal for functional structures on the ovaries and condition of the genitalia, he may predict the expected date of next oestrus which may be recorded in the diary/ calendar.

(g) There is a wide gap between the non return and the actual pregnancy rates under field conditions. This gap can be reduced with the help of heat expectancy charts particularly between days 19 and 22 and similarly between days 40 and 42 after service when the animals who have failed to conceive are likely to experience oestrus.

(h) Other than the need based gynaecological examinations, routine rectal evaluation on day 7, 30, and 45 post partum of all animals and after every two weeks of those animals which are either non pregnant or have any other reproductive problem may pay high returns in the form of improved reproductive performance through early detection of problem cases.

(i) Buffaloes, exotic cattle and their crosses need extra protection against heat and sun. They should be provided with cold and fresh water for drinking. Easy access to pond with clean water for wallowing is highly beneficial for buffaloes as they have an inherent predilection for water.

(j) The value of feeding good quality green forage and concentrate ration as per milk production along with regular supply of quality mineral mixture (improved plane of nutrition) can not be undermined. An animal losing weight or being underfed (body condition score less than five) is not likely to exhibit oestrus or conceive on time.

(k) Pregnancy ration in the form of concentrates should be given at least after mid-gestation to get healthy calves of right weight. Heavy milkers should preferably be slowly dried but not later than 2 months of the expected date of calving.

(l) The old and unproductive animals need to be replaced gradually but regularly with high quality (fresh) first calvers.

(m) Sexual rest for one or more cycles may result in spontaneous recovery of cases with mild genital infections.

(n) While several interventions including massage of genital organs, herbal preparation, administration of mineral mixture / trace elements, feeding extra grains / concentrate ration and injection of small doses of gonadotrophins seem to work in many anoestrous animals (perhaps borderline) but nothing is effective in some of the other similar cases.

8.2 Controlled breeding

The main objective of controlled breeding is manipulation of reproduction to time and plan the breeding process. Oestrus and ovulation can be induced and synchronized by using various protocols involving progestogens, gonadotrophin releasing hormone, prostaglandins and their combinations. These agents either prolong or shorten the life span of corpus luteum. A protocol to be effective in all animals must:

(i) Induce luteolysis / regression of corpus luteum

(ii) Stimulate and control follicular growth

(iii) Induce and synchronize oestrus and ovulation in all types of animals whether border line cases that are nearing the spontaneous resumption of oestrous cycle ("shallow"), apparent anoestrous or true anoestrous ("deep") animals that are not likely to experience oestrous cycle in the near future.

One of the pre requisites for success of any protocol is adequate nutrition and good body condition score. Most cases of anoestrus may eventually resolve themselves without any intervention, but this may take long time and cause high economic losses.

8.2.1 Prostaglandins (PG)

PGF_2 alpha natural or its synthetic analogues is the drug of choice and the most significant invention in the field of reproduction during the last four decades. It synchronizes oestrus by causing regression of corpus luteum. It is not effective in the cows that have yet to begin cyclic activity (true anoestrous animals). Similarly, prostaglandins are not effective during the first 4 to 5 days and last 3 to 4 days of the oestrous cycle. As prostaglandins do not regulate growth of follicles, they are unable to tightly synchronize the onset of oestrus since cycling animals are likely to be at multiple stages of development of the follicular waves.

8.2.1.1 Indications

PG is useful for induction and synchronization of oestrus in cases of suboestrus, silent/ weak oestrus, missed oestrus and apparent anoestrus, in addition to treatment of uterine pathology such as pyometra, metritis and mummification etc.

8.2.1.2 Dose

Intramuscular injection of

Natural PGF_2 alpha = 25 mg

Synthetic analogues of PGF_2 alpha = 500 mcg

Dose can be reduced if given through intra-uterine or intra-vulvo -sub mucosal routes but the intramuscular route is most commonly used due to convenience and ease of administration. One should always follow the manufacturer's instructions.

8.2.1.2.1 Single Injection protocol

All non-pregnant animals are injected with PG and checked for heat for 3 to 4 days. Animals found in heat are inseminated 12-16 hrs after the onset of oestrus. Assuming that all animals are cycling, oestrus will be induced in hardly 60% of the cases as PG is effective only between days 5 and 17 of the oestrous cycle.

8.2.1.2.2 Double-injection protocol

Two injections of PG, 11 days apart are administered. The animals which were either in the non- responsive stage of oestrous cycle at the time of first injection or had responded to the first injection, would fall in the responsive stage at the time of the 2^{nd} injection. If man power and time permit, animals can be noted for oestrus after first

injection and only those not responding may be given the 2nd injection to save expenditure on drug. Animals are inseminated either at the observed heat or at a fixed interval of 48 and 72 hrs after the 2nd injection (**Figure 1**).

8.2.1.3 Advantages and limitations

PGF_2 alpha is a quite safe drug with high efficacy and no reported side effects in bovines. However, it may cause abortion in pregnant animals. It is not effective in animals with smooth, non functional ovaries. It is not effective during the entire duration of the oestrous cycle as explained above.

8.2.2 Progestogens

Progestogens in various forms such as oral preparations, ear implants, intra- vaginal devices etc. can be used in both cyclic and acyclic animals for induction and synchronization of oestrus. Progestogens have not been extensively applied and standardized for use in our indigenous cattle and buffaloes except for a few trials, involving a small number of animals. Exogenous administration of progestins work by preventing the release of gonadotrophin releasing hormone which is turn results in reduced release of gonodotrophins so that oestrus and ovulation are prevented until progestin is withdrawn. Upon withdrawal of progestin which serves as an artificial corpus luteum, the reverse process starts leading to release of GnRH and gonadotrophins with oestrus occurring 2-6 days later. Progestins have been used alone or in combination with other hormones.

8.2.2.1 Melengestrol acetate (MGA)

It has been one of the most common progestins used to synchronize oestrus in heifers and non lactating animals. MGA is an orally active, synthetic progestin that suppresses oestrus when fed at a rate of 0.5 mg/ animal daily. Progestins do not regulate the growth of follicles on the ovaries. In cyclic animals, MGA can cause short term, temporary infertility by extending the oestrous cycle interval. The treatment with MGA is of long duration (14-21 days) and fertility is generally poor at the induced oestrus. Although, the exact basis for this poor fertility is not known but it may be attributed to:

(i) Altered follicular dynamics.

(ii) Problems with sperm transport.

(iii) Increased number of atretic follicles.

(iv) Retarded embryonic development.

8.2.2.2 CIDR Protocol

The controlled internal drug releasing (CIDR) device is a source of natural progesterone used for induction and synchronization of oestrus. In limited trials, it has been successfully used for induction of oestrus in anoestrus buffaloes and indigenous cattle.

CIDR is a T-shaped device made of soft pliable plastic, coated with progesterone. It is inserted into the vagina with the help of the applicator taking necessary sanitary and hygienic precautions. The tail of the device should point downwards. A CIDR device should not be reused as it can cause vaginal infection and reduced fertility.

CIDR device is inserted into the vagina on the first day of treatment. Progesterone from the device is released into the blood stream at a controlled rate. Six or seven days later PG is given, if the animal is cycling. The CIDR device is removed after seven days of insertion and animals are observed for oestrus for 4-5 days and inseminated on the observed heat **(Figure 2).** Synchronization is generally not very tight and yields poor results if timed A.I. is adopted.

The CIDR device has also been used along with GnRH-PG protocol. This system is more effective in inducing and synchronizing oestrus in acyclic animals. On the first day of treatment, the CIDR device is inserted and 100 mcg of GnRH injected. On day 7, the CIDR is removed and PG is given. Most of the females are in heat within 48 to 60 hours after removal of the CIDR **(Figure 3).** If insemination by clock is to be used, GnRH can be injected at the time of insemination i.e. 48 hours after the CIDR removal **(Figure 4).** Generally, CIDR is used without its capsule containing oestradiol due to disadvantages and side effects involved with use of the oestrogens. The CIDR has also been used in combination with 500 I.U of Pregnant Mare Serum Gonadotrophin administered at the time of its removal.

8.2.2.2.1 Contraindications of CIDR

Inserts are not suitable for

- Animals with abnormal vagina.
- Animals with abnormality in other parts of the genitalia.
- Animals suffering from vaginitis or genital infections.
- Animal with poor health condition.

8.2.2.3 Ear implants

Progestogens have also been used in the form of ear implants. This treatment consists of two components: An injection containing norgestomet and oestradiol valerate and ear implant impregnated with highly potent synthetic progestogen norgestomet. This protocol can be used for oestrous induction and synchronization in cyclic and acyclic animals. The implant is inserted sub-cutaneously on the external surface of ear lobe with the help of an applicator taking necessary hygienic precautions. The injection is given at the time of insertion of the implant. The implant is removed after day 9 to 10 and insemination is done 48 and 72 hrs after removal of the implant or at the observed oestrus. Ear implants have been successfully used in heifers and non lactating animals.

8.2.3 Ovsynch protocol

It is one of the most recently developed system for synchronizing oestrus in post partum animals. It uses combination of GnRH and prostaglandins. The GnRH induces ovulation or luteinization of large, developing follicles. In addition, it also synchronizes the recruitment of a new follicular wave. Administration of PG induces the regression of corpus luteum which is followed by occurrence of oestrus. This protocol has been used in different variations.

An injection of GnRH (100 mcg) is administered on the first day followed seven days later by PG. Animals are detected in heat and inseminated 12 hours after the onset of oestrus **(Figure 5).**

A variation, called co-synch, allows to use fixed time insemination. In addition to the above protocol, a second injection of GnRH is given 48 hrs after PG **(Figure 6).** All animals are inseminated at the time of 2nd injection of GnRH and re-inseminated 12 hours later. Another variation uses a combination of above two protocols

(**Figure 7).** It involves injection of GnRH followed seven day later by PG. Oestrus is detected and animals are inseminated 12 hrs after the onset of oestrus. Animals not observed in heat up to 72 hours of PG injection are given 2nd injection of GnRH (at 72 hrs) and time- inseminated at the time of 2nd injection.

9.0 Genital infections

Genital infections are among the most common reproductive disorders affecting dairy animals. The uterus is normally protected from bacterial contamination by the vulva, vestibular sphincter and cervix. These mechanical barriers are breached during and immediately following parturition and uterus may be invaded by a variety of microorganisms. Most of these bacteria are transient and are promptly eliminated by the uterine defense mechanism during involution of uterus. However, in some cases, the pathogens persist in the uterus and cause disease. Low grade infection is an important cause of repeat breeding.

The pre-disposing factors for genital infections are:

(a) **Early post partum period**

- Unsanitary calving conditions.
- Dystocia, twinning.
- Traumatic obstetrical procedures particularly if lay assistance is provided.
- Retained fetal membranes which work as a wick between the uterus and the outside environment for travel of microorganisms into the cavity.

(b) **After the early post partum period**

- Unsanitary examination of genital organs.
- Unhygienic artificial insemination or using contaminated A.I. sheath or other equipments.
- Using infected semen for AI.
- Injury at the time of service / A.I
- Infusion of irritants into the genitalia.
- Generalized/ systemic diseases.

The infections can be specific or non specific and may vary in intensity from acute / sub acute to chronic. It may involve superficial or deep tissues of the uterine

wall. The infection may not be clinically detectable in some cases. The incidence and intensity of uterine infections is influenced by calving management, general sanitation, nature of pathogenic organisms, endocrine factors, lactation, nutrition, veterinary care facilities and environmental stress factors etc.

Endometritis involves inflammation of the superficial layer of uterine wall lining the cavity. It is generally low grade and makes the environment unsuitable for nourishing the early pre-implantation embryo causing its death and the resultant repeat breeding. The offending microorganisms are usually eliminated after the animal experiences a few oestrous cycles. However, metritis is more severe, characterized by inflammation of deeper layers of the uterine wall. The condition may be complicated by septicemia or toxemia.

The other common pathology of uterus is pyometra characterized by accumulation of variable amount of pus within the uterine cavity accompanied by retained corpus luteum and the absence of oestrous cycles. Progesterone continues to dominate the uterus and suppresses the uterine defense mechanism. Pyometra is also a typical clinical sign of trichomoniasis, a venereal disease.

9.1 Diagnosis

Clinical signs, skilled rectal palpation, vaginoscopy, ultrasonography and haematology are useful in diagnosis of the problem.

The abnormal lochia, or purulent, fetid serosanguinous vaginal discharge is the first sign which draws attention of the owner. The milk production may be reduced. Fever, depression, anorexia, laminitis may accompany toxemia or septicemia. Skilled rectal palpations to find the enlarged, hard and thickened uterus with or without fluid in the cavity and finding of purulent exudate in the vagina help in correct assessment of the problem. Facilities of blood testing and real time ultra-sonography, if available, should be utilized to confirm the diagnosis and correctly evaluate the gravity and prognosis of the problem.

9.2 Treatment of genital infections

Antibiotics have been traditionally the drug of choice for treatment of genital infections. But due to increasing awareness regarding bacterial resistance, undesirable effects on the natural defense, risk of residues in milk and frequent failures

have increased interest in the alternative therapeutic agents. Local use of disinfectants and the drugs/ hormones capable of stimulating uterine contractions are the other possible approaches.

9.2.1 Antibiotics

A variety of antibiotics depending upon the type of microorganisms has been used by two routes :

(i) Systemic (I/M, I/V, S/C)

(ii) Intrauterine (I/U)

Diffusion of compounds from blood to genital tissue (systemic administration) or from uterine lumen into the genital tissue and blood (I/U administration) is regulated by several properties and nature of the drug such as absorption, distribution, metabolism, excretion, plasma protein/ tissue binding, pH, local environment, molecular size and lipid solubility etc.

When deciding between systemic and I/U routés of administration, it is significant to locate the primary focus of microbial growth. Mild localized infections can be effectively and economically treated by I/U route. The volume of diluents for I/U administration should be enough to achieve distribution throughout the uterine cavity. Large quantity of infusion may rupture the endometrium or the fluid may escape into the fallopian tube causing permanent damage. In general, the volume of intrauterine infusion should be 50 to 150 ml for an involuted uterus and 1000-2000 ml for an early post partum uterus. Systemic antibiotics are more effective in extensive or chronic infections including those accompanied by general signs of illness. Additionally, effective concentrations are reached in the often neglected portions of reproductive tract: the oviducts, ovaries, cervix and vagina only through systemic route. A combination of both I/U and systemic routes has also been used successfully by many clinicians.

9.2.1.1 Culture sensitivity

Under normal circumstances, field veterinarians treat genital infections based on their experience and following **“hit and trial”** method. They do not have in routine, access to the modern facilities of microbiological examination and culture

sensitivity tests. Such tests can help in selection of an appropriate antibiotic for the treatment, thus saving time and money. However, it is not easy to collect the sterile samples of uterine secretions and tissue for testing under the field conditions. Similarly, the results of culture sensitivity tests have to be considered carefully keeping in view the pharmacokinetics of the recommended drug and its efficacy in the uterine environment. Routine bacteriological examination of the samples from early post partum, infertile and repeat breeding animals can provide useful information regarding incidence and type of microorganisms to devise suitable prophylactic measures.

9.2.2 Non antibiotic drugs

The drugs, which are capable of stimulating uterine contractility during the early post partum period and help in expulsion of fetal membranes and exudates, have been used as an alternative approach with encouraging results. There is a view that local use of antibiotics and disinfectants during this period may adversely influence the uterine defense mechanism. Some of the drugs in this category include oxytocin, PG, Ergonovine, GnRH and oestrogens etc.

Oxytocin 20 I.U., given I/M immediately following calving and preferably repeated 2 to 4 hours later reduces incidence of retained fetal membranes. The effect is more pronounced on a uterus sensitized by oestrogens. The oestrogens increase the natural defense i.e. stimulate phagocytosis and have uterotonic effect. A dose of 3-10 mg of oestradiol benzoate, valerate or cypionate given I/M is successful in treating mild to moderate postpartum infections.

One or multiple injections of PG during the first 15 days of post partum period help in cases of delayed ovulation and post partum metritis. Administration of 100 mcg of GnRH I/M to postpartum cows or repeat breeders at the time of 3rd A.I. improves the conception rates. Ergonovine 2 to 5 mg or ergometrine maleate 5 to 20 mg are frequently given to large animals as uterotonic agents. They may be more useful in cases of uterine atony.

9.2.3 Local use of disinfectants

Intrauterine infusion of various disinfectants is commonly employed for treatment of the postpartum infections. The disinfectants used are dilute Lugol's

iodine and chlorhexidine. This irritant solutions cause necrosis of endometrium which is regenerated by day 11. Depending upon the day of oestrous cycle on which the infusion is administered, the length of oestrous cycle may either be shortened or prolonged. The premature oestrus is induced by endogenous release of PGF_2 alpha during endometrial regeneration. This regimen has also been used in the treatment of repeat breeders in which no or very mild symptoms of endometritis exist. With the increasing evidence that IU infusion of disinfectants suppress the natural defense mechanism, a general use of this alternative is not the preferred approach.

10.0 Hormones- the double edged weapon

A variety of hormones including PG, oxytocin, GnRH, oestrogens, progestins, androgens and gonadotrophins etc. are used to manipulate the reproductive process. However, it remains an admitted fact that the clinical uses of reproductive hormones have been discovered through "trial and error" often without consideration of the intricacies of mechanism of action and the underlying physiological factors.

Prior to deciding for hormonal intervention, which should not be a preferred choice, a thorough knowledge of the endogenous profile and the chemical and biological characteristics of the hormonal preparation intended to be used, is essential. User must be familiar with the undesirable side effects of each preparation. In many instances, there is a narrow margin or border between the proper use and misuse/ overuse of a preparation. Dose may vary from animal to animal, severity of the condition and the route of administration. It is not easy to evolve uniform guidelines for judicious use of these hormones. The major side / adverse effects of some of the commonly used hormonal preparations include:

PG:	Abortion in pregnant animals.
Progestins:	Infection, anoestrus and infertility.
Oestrogens:	Pre- mature puberty, mammary development, infertility and drop in milk yield.
Androgens:	Atrophy of gonads in both sexes.
Gonadotrophins:	Anoestrus, luteal cyst and cystic ovarian degeneration.

Residues of the administered hormones in the milk or other animal products, as a public health hazard, is the other major disadvantage. Obviously, hormones are double edged weapon and should be used sparingly after a thorough consideration of all relevant aspects.

11.0 Best approach in an individual case

Nothing can match the experience of a veterinary clinician to decide the most suitable approach for management/ treatment of a problem in an individual animal. He must analyze the various options/ tools available with him keeping in view the cost, local conditions, ease of administration and the benefits expected. There may be spontaneous recovery in the most of the cases of uterine infections. Similarly, many anoestrus cases may eventually resolve but not without economic losses in the form of prolonged calving interval. Management strategies may be more beneficial than the use of therapeutic agents in many situations. A practitioner needs to evaluate the whole situation thoroughly and adopt the best option keeping in view the interest of the owner, the animal and the professional ethics.

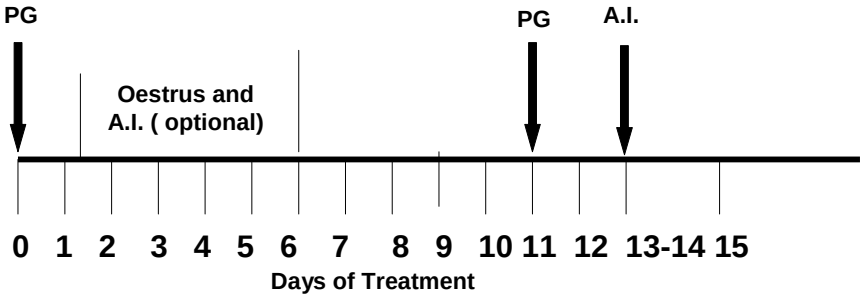

Fig 1. Prostaglandin--Double Injection Protocol

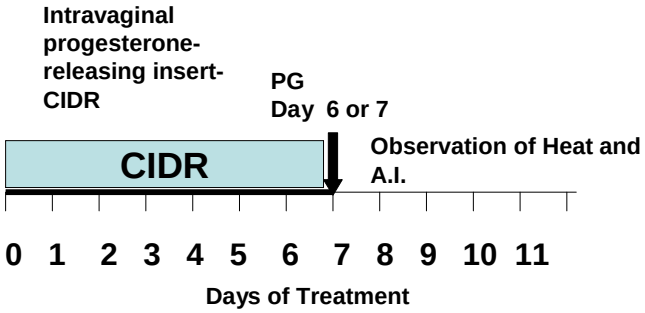

Fig 2. CIDR Protocol

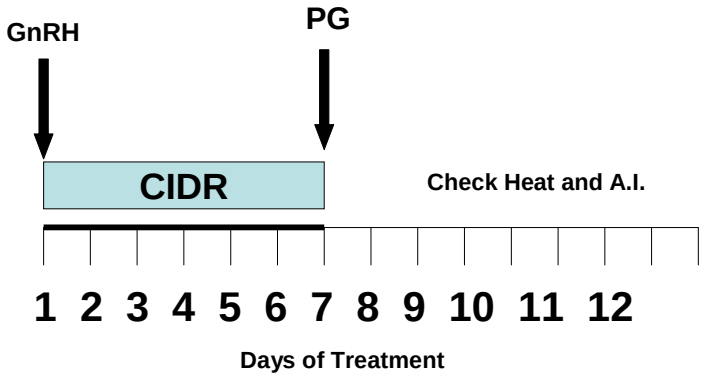

Fig 3. Modified CIDR Protocol

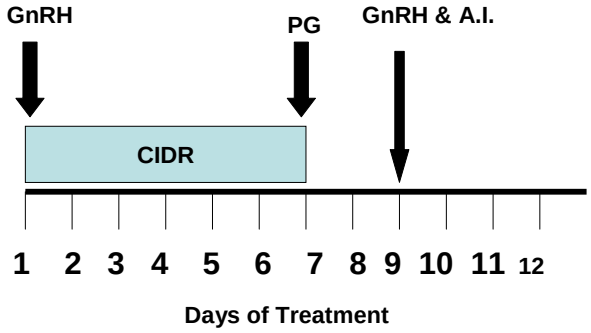

Fig 4. Modified CIDR Protocol- Fixed Time A.I.

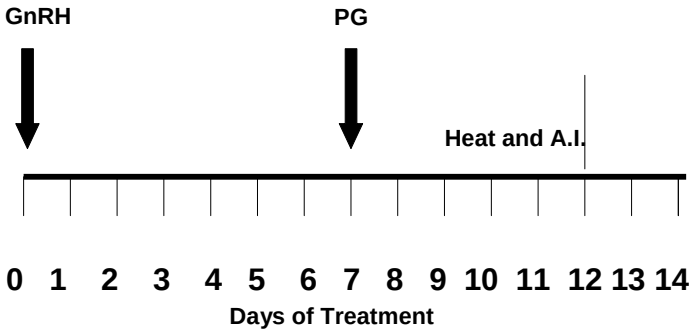

Fig 5. Ovsynch Protocol

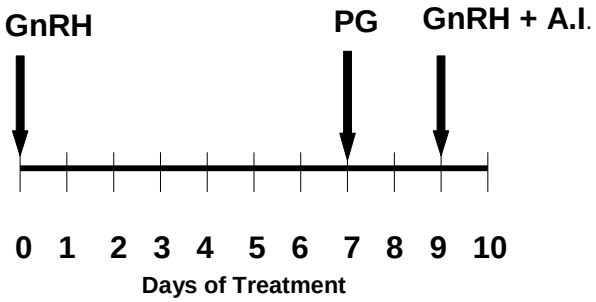

Fig 6. Modification of Ovsynch Protocol (Co- Synch)

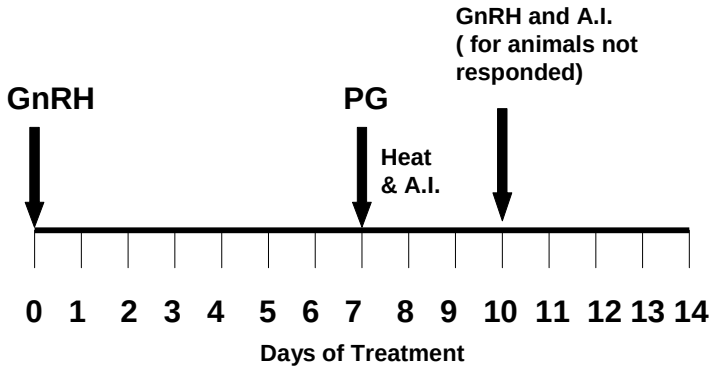

Fig 7. Modified Ovsynch Protocol (Hybrid)