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## Particularities of Bovine Artificial Insemination

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### 1. Introduction

In beef production systems a good reproductive performance is essential for the efficient management and production. The production of cattle can be divided into two sectors: dairy and meat production. In many European countries and developing countries, even the cattle is used as a source of meat and milk and are called dual fitness. Unlike in countries such as Australia, Brazil and the United States, the functions of production of meat and milk were separated and the creation of selective breeding is directed to a single feature.

The productive and reproductive performance of cattle herd is directly related to the service period, calving interval, number of service per conception and number of calves weaned. Artificial insemination (AI) has been proven worldwide and has proven to be a viable technical and economical to increase the genetic gain and increase efficiency, especially in production systems for meat and milk.

In cattle, AI despite presenting a series of known proven advantages, gradually being replaced by fixed-time artificial insemination (FTAI) because of lack of skilled labor, logistical problems in large AI programs, in failures detection of estrus; costs for implementing the program, no optimization of herd reproductive efficiency, and the difficulty of practical application in field conditions.

In this chapter discuss techniques to improve conception rates using artificial insemination, such as: improved detection of estrus, a reduction in calving interval, implementation of FTAI; calving and breeding seasons, care with the semen, body condition score of females, the female gynecological evaluation, diagnosis of pregnancy, parturition rate.

After the reading of these topics, many barriers bovine artificial insemination will be elucidated, and the artificial insemination technique is best applied in various conditions of management of cattle herds worldwide.

### 2. Improvement in detection of estrus

Worldwide there are reports that indicate low rates of service in artificially inseminated cattle, mainly due to problems in the detection of estrus. While few cows are detected in heat losses occur in significant herd reproductive efficiency, and commitment of the artificial insemination program. This commitment is even higher in *Bos indicus* cattle, whose breeding behavior has special features - heat of short duration with a high percentage of expression during the night (Galina et al., 1996, Pinheiro et al., 1998). This feature was confirmed with

the radiotelemetry system (Heat-watch) in Nelore, Angus x Nelore and Angus to the terrain under the same management (Mizuta, 2003). The results are indicative that the heat of Nelore (*Bos indicus*) and Nelore x Angus is about 4 hours less than the duration of estrus Angus cows (*Bos taurus*).

The secretion of estrogen, a manifestation of oestrus LH surge and ovulation are closely related and well known. With follicular growth, the amount of estrogen secreted increases to a peak serum concentration, triggering a preovulatory LH surge, follicular maturation and ovulation, lasting 27 hours. The goal of increased concentrations of estrogen is triggering hormonal cascade of events that includes the LH surge and a series of changes that promote follicular ovulation, and sexual behaviors associated with acceptance of mounts.

The main characteristic of estrus is the posture of immobility assumed by acceptance of the cows and ride. High producing cows milk manifest estrus of shorter duration than cows with lower production (Lopez et al., 2004). Females of childbearing age are pregnant or in the luteal phase of the cycle (under the domain of progesterone) are less likely to mount other females are in estrus. Almost 86% of females who ride other females are in estrus and proestrous (under the domain of the estrogen). Consequently, it should be kept open or barren females with other similarly to occur as much sexual behavioral interactions (Helmer and Britt, 1985). The type of flooring is essential for the expression of mounts and immobility. When you can choose, cows in estrus spend 73% of time on the ground and not on the concrete and assemble increases by 15 times in paddocks of land in relation to the concrete. Moreover, the duration of estrus and immobility also increases on gravel (Vail & Britt, 1990).

Over the years various devices have been developed to detect estrus and they were effective as an aid in visual identification, as *Bos indicus* tend to present turnover night (Baruselli et al., 2004). These devices range from the tail to paint the most sophisticated pedometers (figure 1) and tags that track electronic activity detectors and electronic pressure "HeatWatch. The pedometers have been used to measure activity or movement of the cow through a microprocessor chip and miniature device is fixed to a collar or bracelet. A cow in estrus walks about 4 times more than another that is not in estrus. These devices can be accessed manually or automatically when the cow enters the milking parlor or through receiving antennas mounted in the stalls. The information is sent to a computer and compared with individual basal activity of the same cow over a similar time interval of 2 or 3 days earlier. If the activity has increased significantly this cow, this cow is identified by a warning light that flashes on the ankle or on the computer, generating a warning report to the responsible to verify whether it is in heat and should be inseminated (Stevenson, 2001).

Using these devices in heifers, it was found that they are effective in identifying animals with short periods of estrus and few events of immobility. When compared the accuracy of heat identification of 49 heifers with synchronized estrus, with pedestrian detection by the farm, it failed to comply with estrus in 13 of 49 heifers (26%), while the electronic device identified all foodstuffs (Stevenson et al., 1999). Remembering that the aids can be used to increase the efficiency of our detection of estrus, but not to replace it.

Intensive detection of estrus was defined as 2 h of heat detection in the mornings and afternoons and one additional hour of estrus detection around noon. The detection was defined as a casual observation of the cows in the mornings and afternoons for 30 minutes. In the same herd, cows of both groups underwent intensive observation and casual, were



Fig. 1. Cow with pedometer in previous member

synchronized with the same protocol and inseminated by the same technician. In animals with the intensive detection of estrus, the percentage of cows observed in estrus increased in 30% conception rate in 20% and pregnancy rate doubled in this group. The highest conception rates among cows intensively observed may have been the result of a more appropriate time of artificial insemination relative to ovulation (Geary et al., 2000).

Whenever is observed a cow in heat, it should be removed from the herd as soon as possible because it diverts attention from other cows are in heat in two ways. First, when are making the detection of estrus, each time a cow is in a position to accept mounts noted his number. If the cow is being mounted, has been identified previously, then get distracted and fail to see other cows. Second, there is always regarded as timid cows to avoid the pushing of estrous behavior and estrous pass through undetected. These cows may show signs of estrus when the cow in estrus ruling was removed. The only time when one considers the possibility of letting the cows are in heat in the pasture to help identify other cows in heat is when you do not make use of estrus synchronization and when it is expected that less than 5% of cows in the herd come into estrus per day (Geary et al., 2005).

All of estrus detection devices should be used cautiously and their results interpreted by trained people, since people are the most important component in any program of estrus detection and artificial insemination. The ability to detect estrus in the interpretation and common sense are key to the success of an accurate detection of estrus and this increases the rate of submission to artificial insemination.

### 3. Reducing the gap between births

Calving interval (CI) covers the period between two consecutive deliveries from a cow and a yearly calving interval is a common goal for both beef producers and for the milk. Long intervals are uneconomical because cows with extended intervals produce little milk and fewer calves per year. It is one of the main parameters to measure the reproductive efficiency of cattle.

The CI can be divided into two components: the interval from calving to conception and during pregnancy. The first covers the period from calving to the establishment of a new pregnancy and is the main determinant of CI being the parameter usually manipulated to

achieve a desirable CI. The second component comprises an average of 285 days, varying only according to the genetics of both the matrix and the player and can only be reduced by inducing premature parturition.

To get an CI for 365 days, the interval between delivery and conception should not be longer than 80-85 days. A key factor for achieving these goals is good nutrition. A study conducted in Florida stressed the importance of dry matter intake for cows in early cyclicity. Cows with higher dry matter intake returned to cycle faster and lost less weight postpartum (Staples et al., 1998). Care of the dry matter intake and body condition is essential and should begin well before birth in the last 100 days of lactation. So there will be enough time to adjust body condition and prepare all the cows in their dry period and lactation next breeding season.

The relationship between energy balance and ovulation is directly related to the pattern of LH secretion, which is the gonadotropin responsible for follicular maturation and ovulation. After delivery, there is limited secretion of LH, but as approach the time of first ovulation, the basal concentration of LH secretion increases and the pattern becomes more pulsatile. The LH pulse frequency should occur at hourly to support follicular maturation and ovulation. The first ovulation occurs two weeks after the increased frequency of LH pulses. Thus, it should provide a well balanced diet and palatable to cows to meet their metabolic needs as soon as possible after birth, stimulating consumption fractionated into four meals a day until the cows to produce milk and ovulate early, reducing the CI (Butler and Smith, 1989).

Another factor that must be considered is the diagnosis of pregnancy, IE this should be done up to 30 days after artificial insemination, and the empty livestock referred for procedures such as fixed-time artificial insemination. Resynchronization of repeat breeder cows is also an alternative to reduce the CI, because prior to the diagnosis of pregnancy can identify animals that are empty and reinseminated them, improving conception rates and shortening the CI (Chebel et al., 2006). Furthermore can mention other factors that influence the duration of the CI as appropriate handling and deposition of semen, the ability of artificial insemination, animal care not to subject him to stress management, such as abuse, also contribute a good mineralization for the appearance of fertile estrus, improvement in the design and decrease the CI.

#### **4. Application of fixed-time artificial insemination**

The fixed-time artificial insemination (FTAI) has become very popular because of reduced manpower and independence of estrus detection, since there are many difficulties to detect cows in heat, especially at night. The rates of detection of estrus and submission to artificial insemination are limiting factors due to the type of installation, which limit the expression of estrus, or lack of skilled labor for estrus detection. For artificial insemination programs are successful in herds not using hormonal intervention, the rate of estrus detection should exceed 70%. Most programs result in FTAI pregnancy rates similar to those obtained following the detection of natural estrus.

The inefficiency of reproductive cows causes great frustration and losses for farmers. Even under ideal conditions, the reproductive process is far from perfect, considering the myriad factors involved in producing a live calf. The reproductive efficiency involves not only proper management of cows, but also management of carers and inseminate. The conception rates of lactating dairy cows declined from the 50's in the USA, while the annual yield per cow increased 3.3 times (Lucy, 2001). Given the inverse relationship of milk yield



and fertility, there is a genetic antagonism between milk yield and reproductive traits manifested primarily in first lactation cows, but good management practices such as use of FTAI, can overcome this inverse correlation and allowed its acceptable levels of reproductive efficiency.

The programmed insemination is a method that plans and manages a program of artificial insemination of a herd. This lineup of estrous cycles has some advantages such as convenience of scheduling tasks and use of manpower, control the occurrence of estrus, ovulation, or both, and knowledge of the estrous cycle and reproductive status of females in the herd. The categories of reproductive status are scheduled to open cows at first artificial insemination, cows inseminated to be subjected to pregnancy diagnosis, cows scheduled to open re-insemination; open cows destined for disposal (will not be inseminated) and cows confirmed pregnant. Thus, the programmed insemination can be applied in two distinct groups: cows that are scheduled for their first insemination and cows confirmed to be opened after diagnosis of pregnancy and scheduled for re-insemination. The programmed insemination involves hormonal timing of estrus, ovulation, or both. In the USA, FTAI programs are used in 90% of herds, with 86% of synchronizing first services, 77% of re-synchronization of repeaters and 59% of treatments for cystic cows in anovulatory or anestrus (Caraviello et al., 2006).

The best program is the simplest and easiest to apply, varying with the level of training of officials of the farm. In this case, simplicity means lower number of manipulations in cows during the implementation of a protocol. Employees should be trained to take a disciplined approach and comprehensive programs work, i.e., the implementation of the protocols should be approximately 100% to achieve a greater number of pregnant cows and fewer discharges of pregnant cows.

Some studies have evaluated the cost-effectiveness of fixed-time artificial insemination protocols. One study estimated the value of a pregnancy in a flock where half of the cows were inseminated only after the detection of natural estrus, compared to the application of FTAI the other half of the cows. In herds with low estrus detection, the cost of pregnancy was significantly reduced with the use of FTAI compared detection only. In herds with high rates of detection of estrus, the cost of pregnancy was higher with the use of FTAI, but there was a better reproductive performance of cows treated. The highest costs of pregnancy were associated with damage resulting from longer periods opened and account for up to 83% of total costs (Tenhagen et al., 2004). Thus, the use of a system of FTAI is considered a profitable alternative for large commercial flocks in the estrus detection rates are low.

## 5. Breeding seasons and calving

The breeding season or insemination consists of a period of the year in which breeding females are exposed to males or are inseminated, and calving season is closely correlated, because the births are concentrated in a pre-determined by the breeding season or insemination. It is a strategy for increasing productivity in terms of number of weaned calves, zero cost, rationalizing the reproductive activity of animals with the concentration of deliveries, facilitating and regulating the management of livestock.

The most widely used method of breeding in central Brazil is one where the bull stays with the herd throughout the year. As a result, births are distributed throughout the year, despite a higher concentration during the months from July to September. The occurrence of births at times inappropriate affect the calves, due to higher incidence of diseases and parasites, or

the lower availability of pasture for sows during the lactation period. The biggest drawback, however, that limits the use of rides throughout the year, concerns the difficulty of controlling the health of livestock and livestock due to lack of uniformity (age and weight) of animals. These factors ultimately affect the selection of cattle for increased reproductive potential, rather than female fertility (Embrapa, 2011).

The advantages in adopting the breeding season are many and are related to the calves, the matrices and the production system. With regard to calves, they will be born in more favorable time of year with a lower incidence of ectoparasites and endoparasites, with proper nutrition will have a greater supply of fodder, assist in the formation of more uniformity, reduced mortality, increased weaning weight and easy of recreating. Concerning the matrices, the mating season coincides with the increased availability of forage providing suitable conditions for the restoration of reproductive activity with higher pregnancy rates, select arrays to better reproductive efficiency after the breeding season and diagnosis gestation selecting the best females, and lactating occurring over a period of good supply of food. The advantages to the production system is characterized in rationalization of manpower, purchase of inputs less frequently, and much lower price, and ease of adoption of other practices such as early weaning, supplementation of calves, estrous synchronization and artificial insemination of matrices (Santos, 2003).

The choice of the breeding season depends on several factors such as climatic conditions, availability of pasture land, labor, adequate time for the birth of calves and purpose of production, i.e., commercial or purebred animals. Based on these facts, it is much easier to work towards the establishment of a nature to breeding season in the property, aiming to streamline the reproductive activity in both the biological and practical.

When the producer chooses to adopt the breeding season of short duration (2-3 months), replacing the system where there insemination of cows throughout the year, we recommend a gradual reduction in the period of insemination, eliminating every year one to two months to reach the optimal duration, so there is no reduction in fertility. For heifers, it is recommended to advance the breeding season in 30 days than cows, so they have more time to restore their reproductive activity when they become primiparous. Adequate protein supplementation of females during the breeding and supply of mineral throughout the year contribute to elevation of the reproduction of the herd.

## 6. Care of semen

The canister is an insulated container with vacuum insulation, for the preservation of semen, and for that he should receive liquid nitrogen, which preserves the doses of semen frozen at a temperature of  $-196^{\circ}\text{C}$  (one hundred ninety-six degrees Celsius) indefinitely, provided they maintain a certain level, supplying them periodically. It should be handled with the utmost care to avoid damage that may result in losses. To lessen the risks to the canister, it is advisable to build a wooden box for packaging, avoiding shocks, movements are too fast, and overturn spilling its entire contents.

The liquid nitrogen evaporates constantly, and the inseminator is alert to prevent loss of semen due to lack of nitrogen. To do so, you should always measure your level with appropriate meter; never letting the level below 15 cm. High consumption of nitrogen can indicate problems with the canister as well as the formation of frost or condensate on any external surface may also indicate defects.

The thawing of semen at appropriate temperatures, according to the recommendations of the supplier is required to maximize post-thaw survival and motility of sperm. The cold shock can be avoided by maintaining the temperature, because when the straw is exposed for 30 seconds at room temperature, the temperature drops to 35°C to 23°C. Heating the artificial insemination pipette and maintenance of the temperature of the semen to its insertion into the vagina prevents thermal shock. Only straws should be thawed enough to inseminate cows in 10 minutes. All equipment must be kept artificial insemination extremely clean.

The deposition of semen in inadequate reproductive tract may be a limiting factor when the technician is not sure of the location of the pipette tip. Surveys show that less motile sperm reaching the oviduct when the semen is deposited in the cervix. Insemination, the goal is to reach the body of the uterus. When in doubt, it is better to deposit the semen in one or both uterine horns and fertility will be less compromised than if the semen is deposited only in the cervix. As 85 to 90% of the semen is expelled from the female reproductive tract by retrograde flow, it is essential that the total dose is deposited in the uterus.

The use of sexed semen has become common, but it is important to remember that it is different from the conventional. To achieve 90% purity of a specific sex, sperm are treated with fluorescent dyes and X and Y chromosome sperm are separated by a cell separator (flow cytometry) based on fluorescence intensity after exposure to the laser beam. There are many data Dairy Heifers, describing a design with sexed average, around 70% to 80% of the design of conventional semen used in the first service. The specific reason for this drop in fertility in artificial insemination with sexed semen, as compared to conventional, is still unknown. Nevertheless, given the potentially negative effects of the procedures for sexing, of course it is very important to the careful handling of sexed semen to optimize fertility.

Sexed semen for commercial use, is currently stored in straws thin (0.25 mL), containing 2.1 million sperm. Although 0.25 mL straws were handled similarly to 0.5 mL, the smaller diameter makes them more sensitive to errors in handling semen. The deposition of sexed semen in the uterus of the heifer must be as fast as possible, not exceeding 5 minutes. Fertility variations found after the use of sexed semen are quite large and are determined by several factors, including error handling and storage of semen. Handle carefully sexed and consider the ongoing evaluation of procedures, because every successful artificial insemination program starts with good handling practices Semen.

## 7. Body condition score of females

The estimate of the nutritional status of ruminant livestock of interest by assessing body condition (BC) is a subjective measure based on the classification of animals with the coverage of the muscle and fat mass. Therefore, the body condition score (BCS) estimates the nutritional status of animals by means of visual assessment and / or tactile and represents an important tool of management. The method is fast, convenient and cheap; it reflects the energy reserves of the animals and serves as an aid in the identification of practices to be adopted in the nutritional management of the herd.

The assessment of body condition or its variation to estimate body reserves is more appropriate than the measurements of body weight, for its analysis independent of the size and physiological status of the animal. The importance of body assessment scores stems from the knowledge about the partition of nutrients according to the priority needs of the animal. The premise is to maintain life and then to preserve the species. Thus, Adams and Short (1988) proposed the following order of partition of energy nutrients: 1. basal metabolism, 2. mechanical activities, 3. growth, 4. set of basic bodily reserves of energy, 5.

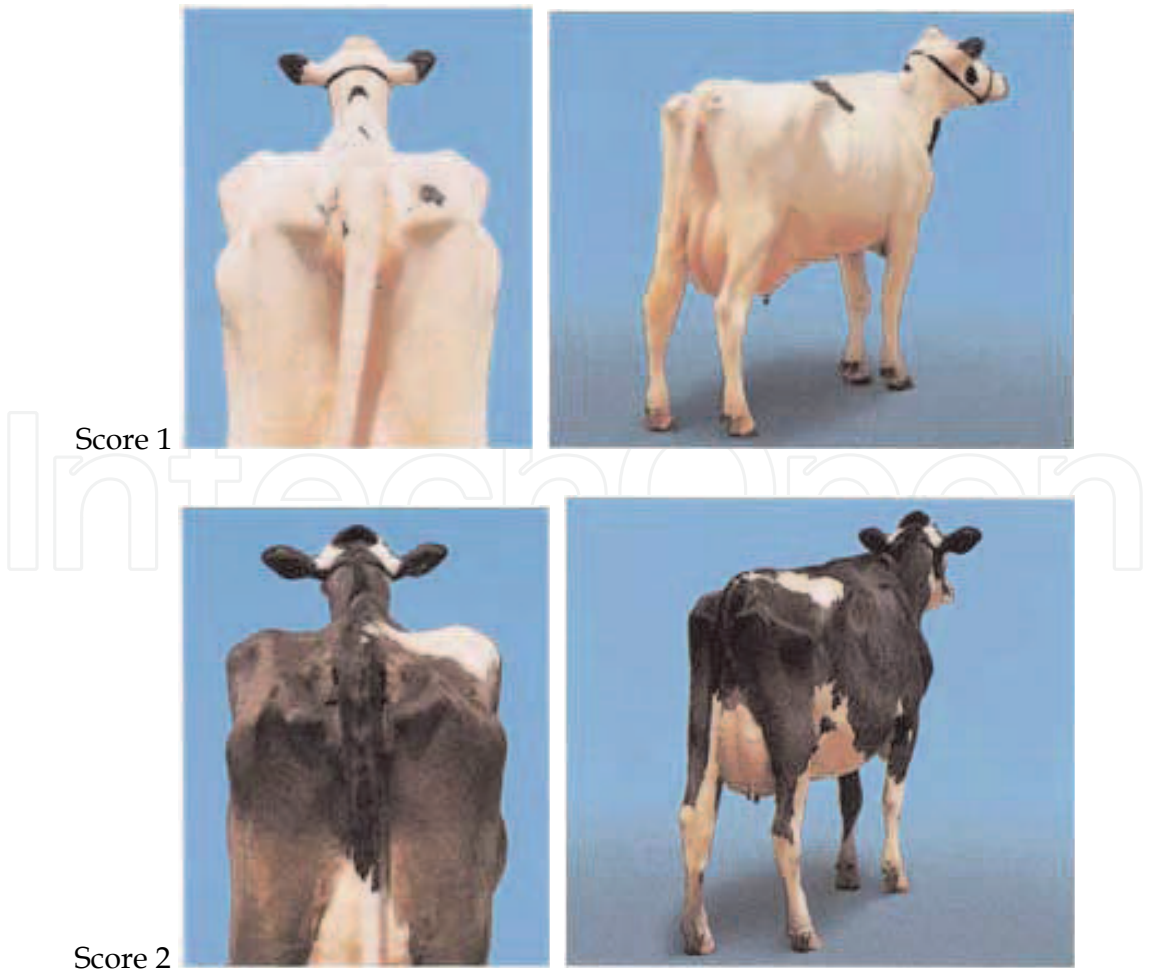


ongoing maintenance of pregnancy, 6. lactation, 7. extra reserves of energy, 8. estrous cyclicity, ovulation and early pregnancy, and 9. excess reserves. Therefore, the reproductive functions, in terms of partition of nutrients, are not priorities for the animal economy (Wright & Russel, 1984).

Knowledge of body condition score herd contributes to decisions on measures of impact on production and costs of livestock development. In fact, you can set times to wean the calves or to define when and how to supplement the diet of breeders, aiming to reduce the period of postpartum anestrus (Moraes et al., 2007). Furthermore, knowing the body condition score is useful even in the prediction of productive performance (Short et al., 1996) and reproductive performance (Dunn & Moss, 1992).

The score is obtained by the visual and tactile (palpation) of the animal by a trained professional. There are scores of different scales, which vary in concept, the topology of the points of observation and animal species for which they are applied. The notes are given to animals in accordance with the amount of tissue reserves, especially fat and muscle in certain areas of the body, often associated with specific anatomic landmarks, such as certain bony protrusions, ribs, spinous processes of the spine, processes transverse spine, flank, tip of the ileum, above the tail, sacrum and lumbar vertebrae. Extreme scores 1 and 5 (obese and cachectic) are undesirable in any scale and in any animal species studied (figure 2).

The monitoring of changes in the body condition score and body weight provides information on the reproductive potential of the cows (Dunn & Moss, 1992), which is



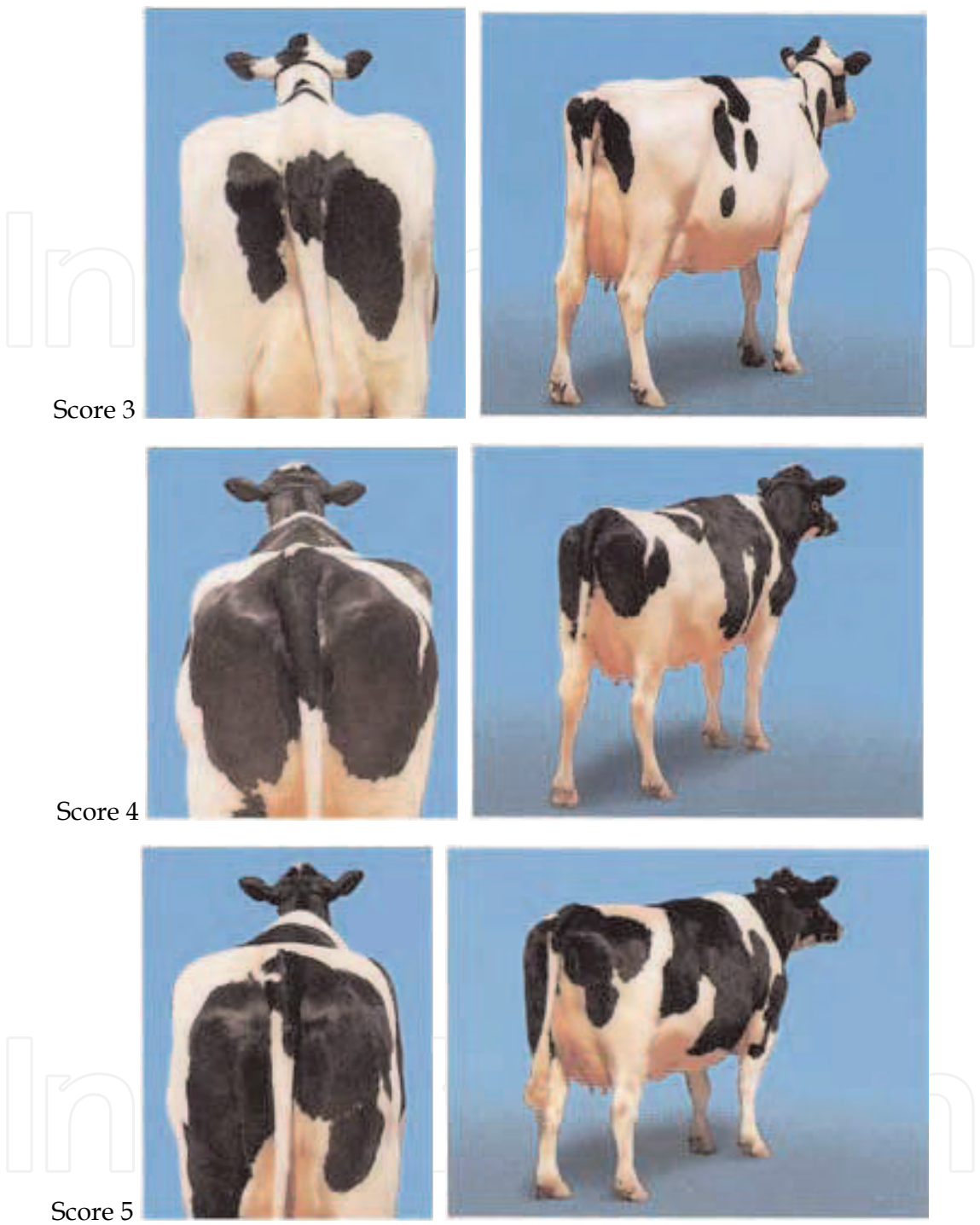


Fig. 2. Body condition score of dairy cows.

directly related to nutrition in the pre-delivery and postpartum period. Kunkle et al. (1994) found that body condition score at calving and during breeding season is closely related to the interval between births, the proportion of cows not pregnant at the end of the breeding season, milk production and cow weight at weaning. Cows with body condition at calving cycle more rapidly than those with body condition score.

In cows of high milk production is expected high demand for nutrients and thus mobilization of reserves in the first three to five weeks postpartum. This phenomenon is

accompanied by rapid weight loss and BCS, which submits the ovarian follicles to large metabolic changes. Such variations affect the normal development of follicles and lower levels of progesterone. This scenario is associated with reduced fertility (Butler and Smith, 1989). Indeed, Walters (2000) found that the decrease in BCS after delivery decreased by 42% the quality of oocytes collected by follicular aspiration from Holstein cows.

Vizcarra et al. (1998) inferred that the nutritional status influence postpartum luteal activity and concentrations of glucose, insulin and saturated fatty acids, which are high in cows with high body condition score at calving. According to Walters (2000), this framework explains why the delay of first ovulation in postpartum cows with negative energy balances. In fact, low plasma levels of glucose, insulin, non-esterified fatty acids and growth factor type 1 insulin are associated with inhibition of pulse frequency of luteinizing hormone and estradiol production by the dominant follicle (Walters, 2000). In cows that consume adequate dry matter during this period, follicular development is apparently normal (Staples et al., 1991). Already decreased by 1.0 point in the body condition score in these first five weeks postpartum resulted in lower fertility at first service (Britt, 1992). In contrast, over-conditioning, ie very high body condition score cows at the end of the pre-delivery caused an increase in service period and embryonic mortality (Flipot et al., 1988).

The productivity and profitability of farms are closely related to achieving high reproductive rates, which are only achieved through the adoption of certain management practices. Among these, science-based nutrition should provide the matrix of metabolic conditions ideal to meet certain strategic moments of the production cycle, such as the breeding season, the season of birth and lactation season. In this context, the body condition score is a useful tool in assessing the nutritional status of the animal and therefore has strategic application in reproductive management of herds that are artificially inseminated.

## 8. Evaluation of female gynecological

All females of reproductive age in a herd must be submitted to gynecological examination for selection of suitable animals for artificial insemination program. This is an internal examination by rectal palpation, ultrasound and vaginoscopy and can be complemented by laparoscopy and biopsy. On rectal palpation and ultrasonography are checked the size, consistency and contraction of the uterus, uterine horns and symmetry. In the ovaries are observed consistent form and size of follicles, cysts and persistent corpus luteum. Vaginoscopy complements rectal palpation and ultrasonography, because it turns out the shape of the vaginal portion of cervix, the opening degree of the cervical canal, mucosa color, moisture content and characteristic vaginal and cervical mucus.

The pelvic examination should be thorough, seeking to know and understand the best possible animal's reproductive status, either for a simple confirmation of pregnancy or to identify diseases or reflection of management that is harming their reproductive efficiency. Gynecological examination involves a complete evaluation of all components of the external and internal genitalia, with emphasis on the ovaries, combining the findings of the examination with a score of animal body, with its history and with the herd.

For purposes of gynecological evaluation should consider the following groups of animals: from 20 to 30 days postpartum, postpartum with abnormal vaginal discharge, irregular estrous cycles, not seen in estrus 60 days postpartum; covered or inseminated by two or more times, and that return to estrus 45 days after artificial insemination. In the historical survey of the animal should always consider the age, number of childbirths and their conditions and cyclicity observed, as these factors may reflect the ovarian function and

reproductive efficiency. Are essential, too, about the coverage, treatment for retained placenta and uterine infection, drugs and dosages, treatment outcome, nutritional program for the animals used in pre-natal and post partum, body condition at calving, stage lactation, milk production and herd health program.

It is crucial at the end of gynecological examination, classify the animals examined according to their reproductive status in pregnant and not pregnant, the latest being identified as normal or with any individual or reproductive problems reflecting a management problem. The results of gynecological examination of different groups of animals held in a coherent and detailed by a veterinarian, provides a satisfactory understanding of the breeding herd during the exam, allowing them to be defined and adopted measures to keep the reproductive efficiency of flock.

## 9. Diagnosis of pregnancy

Pregnancy diagnosis is an important tool for the management of rural property. This must be done by a veterinarian trained at around 28-30 days after artificial insemination by rectal palpation and / or ultrasonography. There are other methods that can be used for diagnosis of pregnancy such as: no return to service, measurement of progesterone, pregnancy-specific proteins, estrone sulfate, breast enlargement and abdominal distension. The accurate diagnosis of pregnancy is important in establishing and maintaining optimal reproductive performance. The producer should know as early as possible if the female is covered or not pregnant for it to be inseminated again.

A cow is diagnosed not pregnant if she has been observed in estrus approximately 21 days after artificial insemination. The percentage of cows not observed in estrus around this period is known as the rate of no return and is not a method to estimate pregnancy rates. As the percentage of cows ovulating truly seen in estrus is often low, the rate of return not overestimate the rates of pregnancy. If a cow is in estrus detected three weeks after artificial insemination, it can still be pregnant and her artificial insemination can cause miscarriage. One must be careful to confirm that it is true and not in heat pregnant through other methods of pregnancy diagnosis.

The detection of pregnancy by measurement of hormones, especially if they occur in milk has advantages when interference is minimal with the cow and risk-free pregnancy. The measurement of progesterone to verify pregnancy also offers the possibility of diagnosing the twenty-first day. In pregnant cows, progesterone concentrations in milk and blood remain high between the twenty-first and twenty-fourth day after ovulation, when they would be basal in the animal not pregnant. The simplest procedure is to obtain a sample of milk from the cow 21 days after artificial insemination. If the progesterone level is low, the cow is not pregnant. If the progesterone level is high, the cow may be pregnant.

The factor of early pregnancy is a gestation dependent protein complex that has been detected in the serum of various species. It is detected using an immunological technique, the rosette inhibition test. It is expected that this substance appear in the serum soon after conception and disappear very quickly after embryonic death. Two additional proteins, protein B pregnancy specific bovine and bovine pregnancy associated glycoprotein, can also be measured during early pregnancy in the cow.

The availability of ultrasound has been a major advance in the diagnosis and monitoring of pregnancy reproductive taking the advantage of not being invasive. The baby begins to fill the uterine horn near the seventeenth day of gestation and can be seen as an non-echogenic area. In the nineteenth day, the amniotic sac has expanded considerably and the lumen of



the uterus can be observed. In the twenty-second day you can hear the heartbeat with the thirtieth day embryo and fetus is very visible.

Rectal palpation of the fetus relies on the ability to detect the presence of a fetus growing in one of the uterine horns by inserting the arm into the rectum of the cow. This can be a dangerous procedure, since trauma can be generated in both the cow and the fetus and must therefore be done by a trained examiner. In non pregnant animal and the animal in early pregnancy, the uterine horns can be felt in size and approximately equal diameters. It is possible to detect a difference in the size of the two uterine horns from 35-40 days of gestation forward.

The identification of components produced by the fetus, rather than the mother, has advantages in the diagnosis of pregnancy. Estrogens are produced by the bovine fetus and the concentrations of estrone sulfate in maternal plasma increases from the seventeenth day of gestation. The content of estrone sulfate in milk reflects the plasma and estrone sulfate test positive at 15 weeks of gestation provides 100% effective diagnosis of pregnancy. In most cases, detection of non-pregnancy at this late stage is of little value in reproductive management, but can be used as a confirmatory test after diagnosis of early pregnancy.

The mammary gland development as a result of pregnancy can be detected in heifers as early as four months of pregnancy. Promoters like growth steroids can stimulate similar changes which may be a confounding factor. It is only during the last days of gestation, when the udder is distended with colostrum, the breast development may be regarded as accurate diagnosis of pregnancy.

The abdomen of the pregnant animal is getting distended around the seventh month of pregnancy. If a hand is pushed firmly against the right side of the abdomen, the fetus can sometimes be felt rebounding against the hand. It is not a reliable indicator of pregnancy. Pregnancy diagnosis is a vital aid for reproductive management and must be sought the best combination of earliness and accuracy.

## 10. Calving rate

Cows get pregnant has always been and will remain the major challenge of cattle. Over the years many methods evaluation were developed, but, unfortunately, with the interval between data calving, days in milk at first AI, percentage of pregnant cows on visit the veterinarian and the first AI conception do not tell the whole story, that is, do not reflect reality.

Averages can leave much to be desired, especially when analyzing calving interval. Two herds may have intervals of 13 months births, but in the herd A the cows were pregnant in the early part and the remaining lactation and late lactation and few between. While in herd B pregnancies are distributed during lactation, and the vast majority of cows becomes pregnant at the beginning of lactation and the rest evenly distributed during lactation. Herd B has a performance reproductive better, but the average interval between births of the two herds is equal. The most reliable measure that reflects what is happening in the herd and has resulted in the birth of calves is the calving rate.

The calving rate is the percentage of cows calved in the total of pregnant cows at the beginning of the breeding season. Even under ideal conditions with 100% of normal cows and 100% efficiency in detection of estrus, farrowing rates will fail to reach 100%. Only 60-70% of inseminated cows produce a calf born alive and the great majority of failures occur before the second half of pregnancy. This is partly due to the failure of design and partly of embryonic or fetal death. The proportions of embryonic or fetal death are far greater than the failures in the design and the vast majority of these occurred probably by genetic



abnormalities in embryos, but this hypothesis has never been proven. The cause is probably multifactorial, involving interactions between genetics, environment and management.

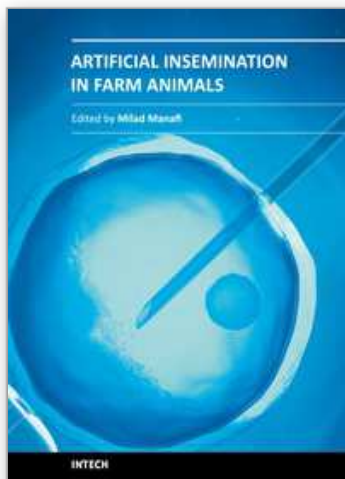
## 11. Conclusion

The importance of reproductive efficiency in cattle production systems is directly tied to the success of a program of insemination with calving and breeding seasons predetermined. The records of fertility are complex, but must be done and constantly updated so that all steps of the breeding program of the property are met and at the end of the breeding season, is to obtain good rates with many calves born alive. This chapter dealt with the main steps for the success of a program of artificial insemination, and if they are properly followed, the breeding season will be profitable.

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## **Artificial Insemination in Farm Animals**

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Artificial insemination is used instead of natural mating for reproduction purposes and its chief priority is that the desirable characteristics of a bull or other male livestock animal can be passed on more quickly and to more progeny than if that animal is mated with females in a natural fashion. This book contains under one cover 16 chapters of concise, up-to-date information on artificial insemination in buffalos, ewes, pigs, swine, sheep, goats, pigs and dogs. Cryopreservation effect on sperm quality and fertility, new method and diagnostic test in semen analysis, management factors affecting fertility after cervical insemination, factors of non-infectious nature affecting the fertility, fatty acids effects on reproductive performance of ruminants, particularities of bovine artificial insemination, sperm preparation techniques and reproductive endocrinology diseases are described. This book will explain the advantages and disadvantages of using AI, the various methodologies used in different species, and how AI can be used to improve reproductive efficiency in farm animals.

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