Reproductive Challenges in Cow-calf Operations

Mario Binelli[1], Thiago Martins[1], Gabriela Azenha Milani Soriano[1], Mariana Sponchiado[1], Felipe Alves Correa Carvalho da Silva[1], Yasser Lenis Sanin[1]

[1]UF/IFAS Department of Animal Sciences, Gainesville, FL

Introduction

The ultimate goal of cow-calf operations is to produce calves, preferably early in the calving season. Such an obvious statement hides the complexity of what it takes to attain this goal. Success in achieving pregnancy, birth and development of calves to weaning relies on adequate application and integration of principles of animal husbandry, nutrition, health, genetics, economics, among others. At the core of a successful beef cow-calf operation is reproduction. For the purpose of this paper, we will discuss reproduction in the context of the reproductive life-cycle of a female in the herd, from birth to recurring annual pregnancies (Figure 1). Progressing from each stage of the reproductive life cycle to the next, on itself represents a challenge that is measurable and usually manageable. For example, progressing from birth to puberty can be measured as the proportion of heifers on a year's crop that achieve puberty as yearlings. Existing genetic, nutritional, management and reproductive tools may be applied to influence with that proportion, according to the goals of the producer. On the present report, we focused on four reproductive challenges that are critical to cow-calf operations: delayed puberty, poor control of timing of ovulation, early and late embryonic mortality, delayed return to cyclicity after parturition. Interestingly, each of these challenges is associated with growth and ovulation of the ovarian follicle. In the context of beef cow-calf operations, addressing these challenges must be viewed in the context of the breeding season. Specifically, management efforts must be put in place so that females become pregnant early in the breeding season.

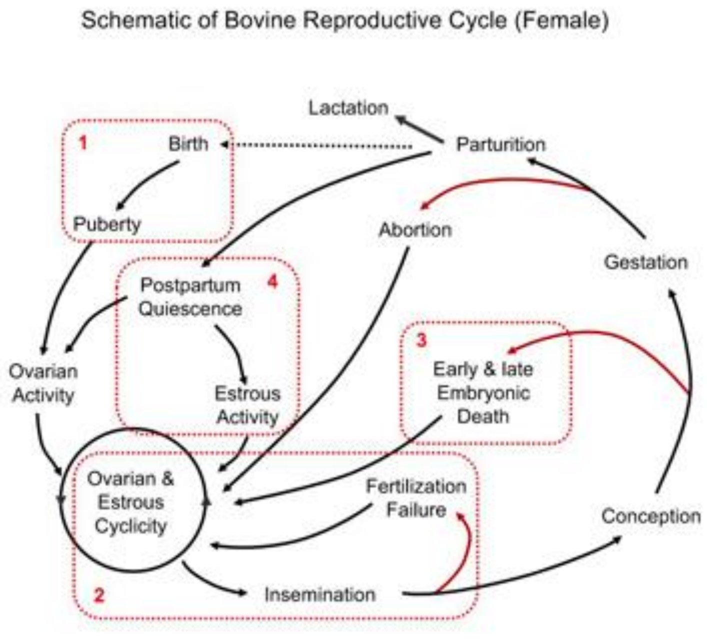

Figure 1: Schematic of the reproductive cycle of a bovine female. Challenges addressed in this report are: (1) delayed puberty, (2) poor control of timing of ovulation, (3) early and late embryonic mortality and (4) delayed return to cyclicity after parturition.

Delayed puberty

Puberty is defined as the first fertile ovulation. Ovulation occurs approximately 28-30 hours after the beginning of estrous behavior (i.e., standing to be mounted). Ovulation of an ovarian follicle is the process of release of the oocyte (a.k.a., egg) so that it may be fertilized by natural service or artificial insemination. Thus, attainment of puberty is a pre-requisite for pregnancy. Heifers that fail to attain puberty within the time limits of a breeding season will either be maintained on the ranch until the next breeding season or will be culled. Both outcomes will have economic impacts in the operation.

The best current method to determine the pubertal status of a heifer is to conduct an ultrasound-assisted exam of the reproductive tract and assigning a Reproductive Tract Score (RTS). RTS is attributed after evaluating the development of the uterus and determining the ovarian status for size of follicles and presence of a corpus luteum (i.e., sign of an ovulation). RTS ranges from 1 to 5, 1 being an infantile reproductive tract and 5 a pubertal heifer. An experienced technician, usually a veterinarian, is needed to perform this evaluation. Evaluation of RTS is a tool to direct reproductive management of heifers and should be conducted just prior to the beginning of the breeding season. Heifers with RTS 2 and 3 may not develop in time to enter the breeding season. Our group is conducting tests currently to evaluate response to supplemental progesterone (i.e., CIDR) as a mean to induce puberty. Preliminary results indicate that exposure to supplemental progesterone increases the proportion of heifers bred in the beginning of the breeding season.

As expected, there are both genetic and environmental components of attainment of puberty. In general Brahman and Brahman-influenced cross-bred cattle tend to achieve puberty later than Bos taurus type cattle. However, traditional and genomics-based marker-assisted selection has been used to select populations of Bos indicus heifers that cycle earlier. Nutrition plays a determining role in puberty attainment. Cost-effective feeding strategies are necessary to promote growth rates compatible with puberty.

In summary, work is under way to select and manage for puberty. Evaluation of RTS prior to the breeding season will help to direct heifers to induction strategies.

Poor control of timing of ovulation

Protocols for estrous synchronization and timed-artificial insemination (TAI) consist of a strategic sequence of hormonal treatments. Protocols aim to program reproductive events in the animal, with the ultimate goal of timing the moment of ovulation**.** Protocols are very useful tools, used extensively in many production systems that achieve around 50% of pregnancies after a single insemination. In natural breeding systems, use of protocols will increase the proportion of females conceiving early in the breeding season. However, there are many different protocols and they are sometimes confusing to understand and tricky to implement. It is very common to find producers reporting poor pregnancy rates after using such protocols. Word of advice: if you are that producer, I guarantee you will get better as you try and fail a few times! There are multiple explanations for not achieving satisfactory pregnancy rates. There are reasons intrinsic and extrinsic to the protocol. For example, semen quality, inseminator skill, facilities, nutritional and health status of animals, lack of compliance with the schedule of treatments are extrinsic reasons. These must be adjusted by the producer before success is expected from a protocol! Intrinsic limitations of protocols are related to the ability to control timing of ovulation. Specifically, there is a natural dispersion among animals in the response to treatments to synchronize ovulations. Such dispersion will limit success of TAI, but will have less of an effect to AI based on heat detection. Indeed, the old-fashion heat detection became much more practical lately, with the use of heat-detector patches. Importantly, fertility to AI based on detected heat is associated with conception rates around 50-60%.

Early and late embryonic mortality

Embryonic mortality after natural breeding or artificial insemination is about 30-40% in the first 30 days. Reasons for mortality are beyond the scope of this report. Management practices to prevent mortality are an active subject of research currently. In contrast, tools to detect pregnancy losses 20 days after insemination are available. Early pregnancy tests are based on molecular analysis of blood samples and on Doppler ultrasonography. Early pregnancy diagnostics can be coupled with resynchronization strategies that allow ovulation and rebreeding by AI or natural service as early as 24 days after the first AI. Using a re-synch program, it is possible to achieve a 60-70% pregnancy rate in the first 30 days of the breeding season.

Delayed return to cyclicity after parturition
After parturition, cows need an approximately 30-day period to undergo proper involution of the reproductive tract before they are able to sustain another pregnancy. At the same time, ovulations are suppressed because of the long-term exposure to pregnancy hormones. Resumption of estrous cyclicity, and consequently ovulations, is influenced by many factors, including body condition score, milk production, nutrition and breed composition. Indeed, Bos indicus and Bos indicus-influenced cattle undergo a post-partum anestrus of longer duration than other breeds. Enrollment of cows in synchronization protocols involving progestagen supplementation (e.g., CIDR or MGA) effectively stimulates a fertile ovulation and pregnancy following AI or natural service. This practice is desirable to achieve the goal of getting cows pregnant in the beginning of the breading season.

Conclusions
Reproductive challenges must be recognized in the context of the reproductive life cycle of the female, that is, according to the female categories in the herd. Furthermore, challenges must be addressed with the objective of maximizing attainment of pregnancy early in the breeding season. Specific strategies have been developed and applied successfully to mitigate each challenge. Continuous research and extension efforts are needed to improve current knowledge, generate newer, better and more accessible technologies and ensure education and implementation by producers.