ASC-260

Cooperative Extension Service

Controlling Reproduction in Female Yaks

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The yak (*bos grunniens*) is a member of the bovine family and plays a vital role in the life of the people of the Himalayan region (China, Mongolia, India, Nepal, etc). The Himalayas is an especially harsh region with long, cold winters and sparse vegetation for most of the year. As with all bovine, nutrient availability, both quality and quantity of available foodstuffs, and current status of body reserves or degree of fat stored in the body dictate the ability of the cow to conceive during a breeding season. Even though conception rate (probability of conception at a single estrus event), is high (70+%), pregnancy rate (probability of conception at the end of a breeding season) is typically only 40%-60% in their natural environments because a high proportion of female yaks fail to have an estrus during the breeding window. Understanding the major factor reducing pregnancy rate is important to creating and implementing management protocols to improve the reproductive ability of female yaks (Figure 1).

Anestrus

The major factor reducing reproductive efficiency in the yak is anestrus. Anestrus means "no estrus" and is the timeframe in which female yaks are not sexually receptive to male yaks. Anestrus occurs before puberty and again after each calving. In their natural environment, yaks are considered seasonal breeders because they only exhibit estrus and conceive from June-November when temperatures are more moderate, and forage is available to meet the nutritional needs of the yak. Anestrus in yaks in the Himalayas is more likely regulated by the environmental changes in nutrient supply than the length of day which is generally the controlling factor in other seasonal breeders. Our observations of female yaks in more temperate environments are that they exhibit estrous cycles throughout the year. The number of days from calving to the first estrous cycle of normal length is called the postpartum interval (PPI). Yak heifers typically go through puberty at 15-24 months of age while yak cows are anestrus 70-130 days after calving. Anestrus is a problem in female yaks and, without doubt, the key to maximizing reproductive rates in yaks is keeping the PPI as short as possible.

Keys to Reducing the Length of the Postpartum Interval

Anestrus in female yaks is controlled by two main factors: the maternal bond and body condition score. Both can be managed to keep PPI short.

The Maternal Bond

When a cow calves, the maternal bond is established and this bond, in conjunction with sucking of the calf, initiates anestrus in yak cows. Research in yaks indicates that female yaks return to estrus quickly (within two months) if their calf dies or is weaned early. Short-term weaning, separation of the calf from the cow for 48 hours, is a valid management protocol to induce estrus in anestrous beef cows but little research has been done on its application in yaks.

Body Condition Score

The length of the PPI is dramatically impacted by body condition score (BCS). Body condition score is evaluated on a 1-9 scale with 1 being extremely emaciated, and 9 being morbidly obese (see UK ASC- 255). Yak cows that calve in good body condition (BCS 5+) return to estrus nearly two months sooner than cows that calve at low BCS (< 5). Increasing nutrient supply after calving also shortens the PPI. The best management plan is to calve cows in moderate BCS and increase the nutrient supply immediately after calving.

Figure 1. Understanding the major factor reducing the pregnancy rate will help improve the reproductive ability of female yaks.

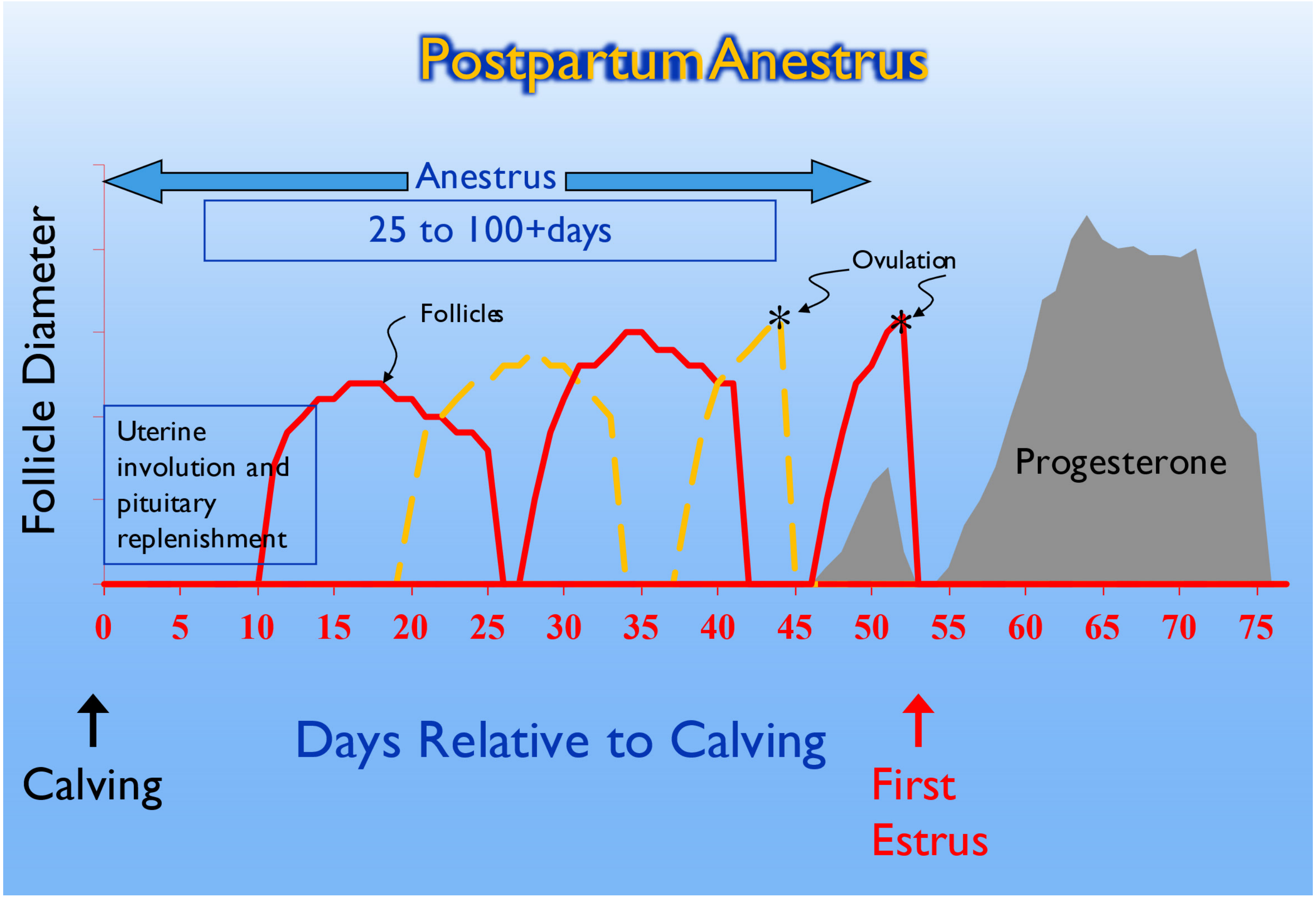

Figure 2. Transition from anestrus to estrous cycles.

The Transition from Anestrus

Like other cattle, the transition from anestrus to cyclicity in yak cows is gradual (Figure 2). The reproductive system is quiescent for the first two to three weeks after calving. During this time the uterus involutes and returns to its normal size and the reproductive system in the brain replenishes its hormone supply. Hormone release from the brain and pituitary gland dictates the growth and hormone production of the two structures on the ovary: the follicle and the corpus luteum (CL). In general, the follicle begins pregnancy by synchronizing sperm deposition with oocyte release (ovulation). The follicle accomplishes this complex task by producing the hormone estrogen which stimulates estrus, resulting in sperm deposition, and rupture of the follicle and subsequent release of the oocyte (egg). Subsequently after fertilization, the CL is responsible for maintaining pregnancy by producing the hormone progesterone. During anestrus, the brain's production of hormones is reduced, preventing adequate follicle growth and production of estrogen. Factors such as the presence of the calf, nutrient status, and nutrient availability all impact the hormonal cascade involved in follicle growth and the estrous cycle. Over time and as nutrient supply and status improve, hormone production increases resulting in an increase in follicle growth and production of estrogen. Ultimately, the follicle produces enough estrogen to stimulate its own rupture and the formation of the first CL. Often, this first ovulation is "silent" and is not associated with an observable estrus. After formation, the CL produces progesterone and progesterone production increases dramatically for the first seven to 14 days. However, the reproductive system has not completely recovered so this first CL regresses early and progesterone production declines. This first cycle is called the short cycle, which occurs in nearly every animal that transitions from anestrus to cyclicity.

Inducing Estrus

Since anestrus is the rate-limiting factor governing successful pregnancy, it makes sense to implement management protocols to stimulate estrus early in anestrous cows. Producers can do this by mimicking the natural transition and simulating the short cycle by administration of progesterone.

The CIDR Device

The CIDR device (Controlled Internal Drug Release) is a T-shaped plastic device (Figure 3) that is coated in 1.36 g of progesterone. To deliver the progesterone, the CIDR is placed into an applicator, inserted into the vulva, and deposited into the anterior vagina (Figure 4). The blue tail protrudes from the vulva. Once inserted, the progesterone mixes with body fluids and is absorbed into the bloodstream resulting in circulating levels similar to the natural levels found with a CL present (3-6 ng/ml). Insertion of the CIDR device effectively simulates the CL mimicking the luteal phase of the estrous cycle.

To induce estrus, a CIDR is inserted and remains in the female yak for approximately seven days. After seven days, the CIDR device is removed by pulling on the blue string and the female yak can be exposed to a bull for natural service. The CIDR device was originally designed to induce estrus in anestrous beef and dairy cows and is also a staple of most modern estrous synchronization protocols used prior to artificial insemination (AI). Exposure of anestrous beef cows results in estrus in 80% of the cows. The CIDR has also been shown to effectively (>80%) stimulate estrus in anestrous yak cows that were only 60-110 days postpartum.

Figure 3. A CIDR device.

Figure 4. Yak producer inserting a CIDR.

Estrous Synchronization and AI (ESAI)

Artificial insemination (AI) has hastened genetic improvement in beef and dairy cattle and has great potential in yaks (Figure 5). In the United States, yak numbers are small, and the gene pool is limited, so development of effective methods of AI is even more important especially to maintain heterogeneity (see ID-273). One factor that markedly impacts the use of AI is that female yaks show little signs of estrus, being mounted and standing, even in their natural environments in the Himalayas. Methods to synchronize expression of estrus have been studied and combining estrous synchronization with AI is vital.

Yaks respond favorably to modern methods of ESAI. Research from the University of Kentucky and others has shown estrus can be controlled using a CIDR device and an injection of prostaglandin (Figures 6 and 7). Insert the CIDR device for five to seven days and, at removal, inject prostaglandin. Estrus occurs two to five days later, with most female yaks showing estrus 60-84 hours after CIDR removal. The optimal time for the fixed-time insemination appears to be 70-72 hours after CIDR removal. Female yaks that are time-inseminated also receive an injection of GnRH (200 ug) at the time of breeding. In a recent publication from Asia (Zi et al., 2022), exceptional conception rates to ESAI occurred when estrus was synchronized using either protocol. The five-day protocol resulted in the highest overall pregnancy rates to AI (79.5%).

Figure 5. Yak cow with an AI calf.

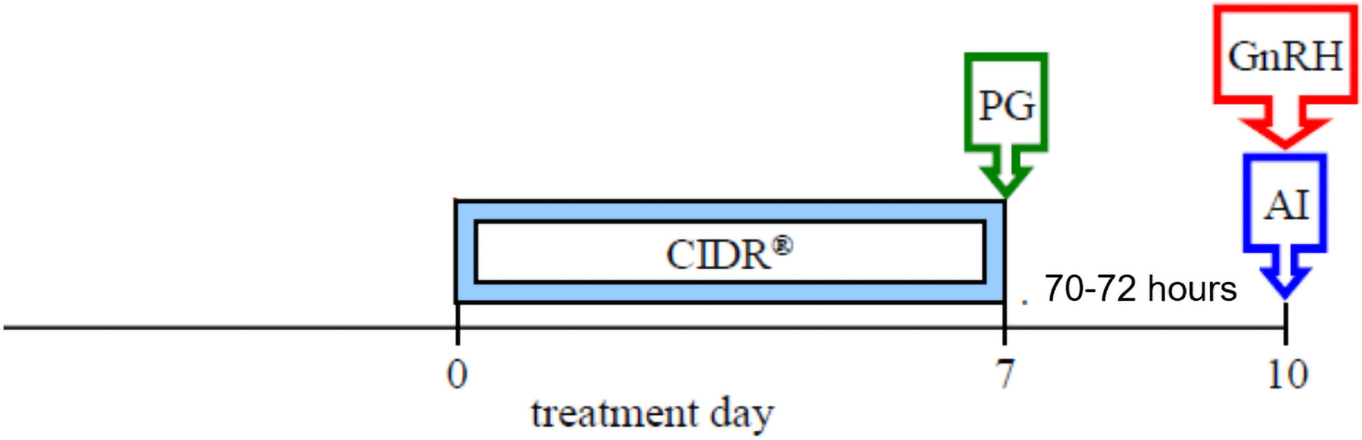

Figure 6. Seven-day CIDR protocol for yak females: Insert the CIDR device; seven days later remove the CIDR and give prostaglandin.

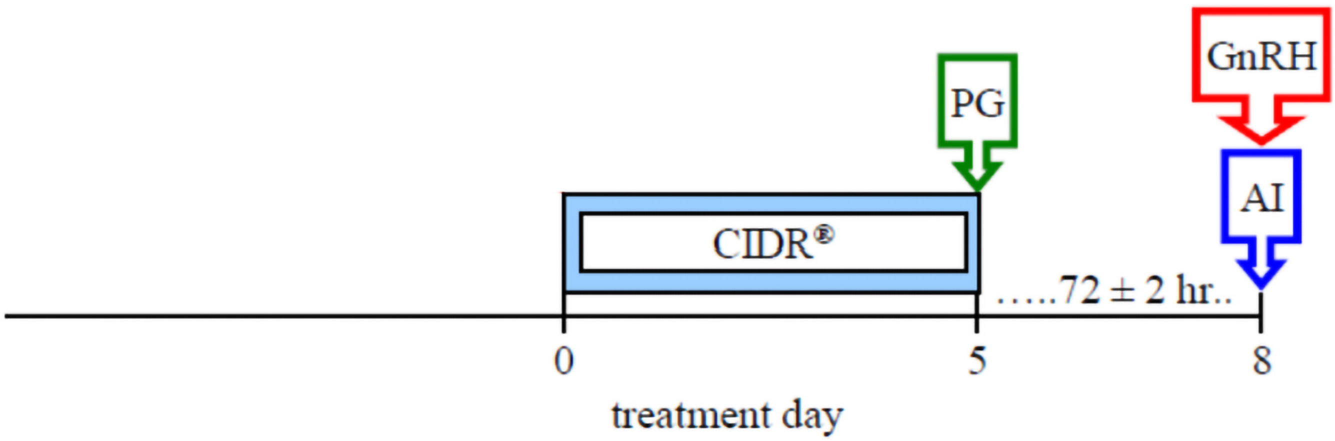

Figure 7. Five-day CIDR protocol for female yaks: Insert the CIDR device; five days later remove the CIDR and give prostaglandin.

Summary

The length of anestrus drastically limits the reproductive efficiency of yaks. Estrus can be effectively induced in anestrous yaks by insertion of a CIDR device for five to seven days. Induction of estrus in anestrous yaks greatly improves pregnancy rate. The CIDR device can also be used to control estrus prior to AI. Estrus is initiated in yak cows after five to seven days of exposure to a CIDR device and an injection of prostaglandin at CIDR removal. Estrus is controlled adequately to support high conception rates to AI even if female yaks are time-inseminated. The use of AI will enhance the rate of genetic improvement in yaks and increase the heterogeneity of the yak herd in the United States.

References

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