

Reproduction in Female Yaks

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The yak (*Bos grunniens*) is a unique domestic animal. These animals were developed in the extreme environment of the Himalayas, where food resources can be extremely limiting. The yak provides food (meat and milk), fiber (hair), and are beasts of burden (used for pack, transportation, plowing, etc.) for the local populations. The number of yaks in the world is limited, creating a need to understand and control reproduction in the yak to improve genetic diversity (Figure 1).

Reproductive Tract

The reproductive tract in the female yak is similar to beef and dairy cows. The cervix, uterus, and ovaries are smaller in mature female yaks compared to beef cattle. Although female yaks are much smaller in size (600-750 pounds) than a mature beef or dairy cow (1,200-2,000 pounds), the reproductive tract in a yak is easily palpable via rectal palpation. The cervix in yaks has three rings and is typically 5 cm in length and 3 cm in diameter. The uterus horns are about 18-24 cm in length and 3 cm in diameter.

The ovaries in female yaks are smaller, but the morphology of the ovaries is like that found in beef and dairy. Primordial, growing, and atretic follicles were found in female yaks ranging from one month to 10 years of age. Although follicle growth patterns have not been reported, estrogen concentrations fluctuate three times during the estrous cycle indicating that female yaks may have two to three waves of follicle development. Yaks ovulate approximately 12-24 hours after the end of estrus, which is later than beef and dairy cows. The formation and function of the corpus luteum in female yaks is similar to beef and dairy cows.

Estrous Cycle

The estrous cycle length of female yak is 18-22 days. The length of the estrous cycle has not been easy to determine because estrous behavior in the yak is often silent and difficult to detect. Several reports indicate that estrus typically lasts 12-16 hours in yak although about 20% of female yaks were observed in estrus longer than 24 hours. Estrus in yaks is characterized by swollen vulva, mucous discharge, increased frequency of urination, and riding. Like other bovine, yak will congregate into a sexually active group and will seek out and ride other female yaks that are in estrus. Most of this research was conducted in their native environments. In more temperate climates, estrus is difficult to determine.

Female yaks in estrus will be more active than non-estrous female yaks, the vulva will swell but mounting behavior is not observed as frequently. The limited expression of estrus in female yaks decreases the efficacy of artificial insemination and hinders the adoption of this technique.

Gestation

The gestation length of yaks is 250-260 days. Yaks appear to undergo typical behaviors during parturition including seclusion,



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restlessness, etc. Almost all births occur during daylight hours and very little incidence of dystocia (calving problems) have been reported. Yaks will interbreed with other cattle and dystocia is more common when yak cows are calving hybrid calves (ex. Angus bull x yak cow). Twins are rare in yak (0.5%). Stage three labor (passing the placenta) can take up to 6 hours but typically occurs within 30 minutes after expulsion of the calf. Like beef cows, longer, more difficult parturition results in weaker calves at birth. Several reports and conversations with yak managers indicate that yak cows are extremely protective of their calves at birth. People should be cautious when approaching a dam immediately after calving.

Anestrus

The word “anestrus” means “no estrus” and is the biological state in which a female yak is not exhibiting estrus regularly. The time frame that female animals are in anestrus is called the “anestrus period.” Female bovines are anestrus before puberty and after each calving event. The timeframe from birth to the occurrence of puberty is called the prepubertal period with puberty defined as the first estrus followed by an estrous cycle of normal length. The number of days from calving to the resumption of estrous cycles of normal length (18-22 days) is called the postpartum interval (PPI).

Yaks are considered by most scientists to be seasonal breeders. However, it is not firmly established whether they are biologically seasonal like sheep and horses or if they are environmentally seasonal due to severe nutritional stress. In their natural environment of the Himalayas, nutrient availability becomes extremely limited during the long, cold winter months. Many yak lose considerable weight during this time and their body condition scores (BCS) often fall dangerously low (BCS 2 or less). Weight loss during these long periods of nutrient restriction delays the occurrence of puberty and postpartum estrus.

Female yaks that calve thin (BCS < 4) often have very long postpartum anestrus intervals. The average PPI for yaks has been reported to be 110-130 days but resumption of estrus was highly variable and dependent mostly on nutrient availability and the BCS of the female yaks at calving and from calving to rebreeding. Cows that calve in a higher BCS have shorter PPI (about 70 days) compared to cows that calve in lower BCS (about 130 days). The PPI is so long for many native yaks that they fail to breed the year after they calve. The calving interval (time between subsequent calvings) is about 1.5 years for yaks in their natural environment.

Puberty is anestrus that occurs prior to the first observed estrous cycle of normal length and many of the same factors that regulate postpartum anestrus impact the age of puberty. In their natural environment, yaks do not begin normal periods of estrus until 2-3 years of age. However, the attainment of puberty is more related to BCS than age. Timing of birth can influence age at puberty. Cows that are born early in the calving season are more likely to go through puberty and conceive than cows born later in the calving season.

Experience with yaks in the United States suggests that, outside their natural environment, female yaks are significantly less seasonal. Female yaks in the United States appear to be biologically capable reaching puberty at 15-18 months of age and mature cows can have short (60-70 days) PPI if managed according to their BCS. If BCS is managed correctly, female yaks could calf annually. The key, it seems, to a yearling calving interval in the yak is management of cows to calve and rebreed in a BCS of 5-6.

Fertility

Conception rate is defined as the probability a female yak will conceive after a breeding event to a single estrus. A simple example is if 10 cows are in estrus and are bred today and six conceive to that single breeding, then conception rate is 60%. Pregnancy rate is the probability that a female yak will conceive at the end of the breeding season. So, if the bull is left with the same 10 cows above for 70 days and nine of the 10 conceive then the pregnancy rate is 90%.

Conception rate in the yak appears to be quite high. Most research has indicated that conception rates typically exceed 70% after breeding especially when the cow's BCS at calving and breeding is 5 or greater. High conception rates lead to high pregnancy rates in short time periods. Much of the research from the Himalayan region reports pregnancy rates greater than 95% over a 70- to 90-day breeding season.

Abortion

Unfortunately, yaks appear to be more susceptible to abortion early in pregnancy than other bovine (Figure 2). These abortions appear more related to the environment (low nutrient availability and extreme hot or cold temperatures) than to disease. Early term abortion rates of 20%-25% have been reported in the literature.

Most researchers attribute the pregnancy loss to the extreme weather and undernutrition typical of the Himalayan region at the time when most female yaks are pregnant.



Figure 2. Aborted yak fetus.



Figure 3. Yaks have the potential to reproduce at high rates.

Calving Rates

Even though conception rate is exceptionally high in female yaks, their reproductive efficiency is low due to the long PPI and the high early term abortion rates observed in yaks in their native environment. The potential for high reproductive rates exists for yaks. Female yaks that calve in moderate BCS and maintain this score through breeding have an excellent opportunity to conceive in a short window (Figure 3). Further, fewer female yaks are likely to abort if they are pregnant in more moderate climates. The low rates of dystocia and high rates of calf survival give yaks the potential for excellent reproductive efficiency in less harsh environments.

Conclusion

The yak is a fascinating member of the bovine family. With proper management, high reproductive rates should be possible. The limited gene pool of yak makes artificial insemination an important tool for use in the yak. The biggest hurdle for yak breeders to overcome for implementing artificial insemination is the “silent” or weak expression of estrus observed in most female yaks. Some work has been done on bull collection, semen processing, and AI by researchers in Asia, but more work needs to be done to better characterize reproduction in yaks and to improve methods that result in successful AI in yaks.

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