

Effect of environment on reproductive traits in yaks

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Yaks are multipurpose, domesticated strong and hardy animals, which survive in a very harsh high altitude environment, including seasonal nutritional deficiencies (Zhang 2000). They are seasonal breeders with mating and conception restricted to the warm part of the year. The onset and end of the breeding season are affected by climatic factors such as ambient temperature, relative humidity, availability of feed and fodder, latitude and altitude (Shreshta 1998). However, the information related specifically to yak reproduction is insignificant compared to other domestic animals. Hence, the present experiment was planned to study the reproductive traits of female yaks at high altitudes.

The study was carried out at the National Research Centre on Yak, and healthy female yaks (70) belonging to the yak farm located at 2 750 m above mean sea level (msl) on 91°4' East longitude and 27° North latitude in Nyukmadung area of West Kameng district of Arunachal Pradesh, India, were

utilized in the study. They were maintained under semi-extensive system of management. The female yaks were closely monitored every day round the year for display of estrous and its behavioural signs. The ambient temperature and relative humidity of the farm were collected continuously using weather station.

Yaks exhibited estrous almost round the year but mating and conception restricted to warm part of the year (Table 1). The breeding season starts in July and reaches its peak from September to November at an altitude of 2750 m above msl on 94°4' East longitude and 27° North latitude, when temperature is at its highest and grass growth is at best. Thereafter, the estrous frequency was reduced but very few animals showed estrous symptoms even after November. The animals coming to estrous were reduced after November because the pasture quality and quantity declined along with ambient temperature. Present results are in line with the observations of Zhang (2000) and Sarkar *et al.* (2006). The

Table 1. Seasonality of estrous in yak at NRC on Yak Farm along with environmental conditions

Month	Ambient temperature (°C)	Relative humidity (%)	No. of females exhibited estrous	Percentage (%)	No. of animals conceived	Percentage (%)
January	3.40±0.34	76.33±1.96	2	2.86	1	1.43
February	5.11±0.23	77.52±2.98	1	1.43	—	—
March	6.80±0.39	77.67±2.88	1	1.43	—	—
April	9.80±0.36	78.63±1.47	1	1.43	—	—
May	11.57±0.20	88.81±1.00	—	—	—	—
June	13.79±0.20	94.27±0.57	—	—	—	—
July	14.05±0.10	93.16±1.30	5	7.14	3	4.29
August	14.79±0.20	83.63±2.56	9	12.86	8	11.43
September	13.26±0.14	810.88±3.39	12	17.14	11	15.71
October	10.42±0.40	88.97±1.05	15	21.43	15	21.43
November	6.52±0.28	80.90±1.71	21	30.00	21	30.00
December	3.14±0.18	71.27±2.20	3	4.29	1	1.43
Total			70	100	60	85.72

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exhibited estrous and the conception rate were highest (68.57% and 67.14%) during September to November. Those

animals exhibited estrous during non-breeding season again displayed estrous (43.29%) during warmer months. The conception rate was positively correlated with body condition and nutritional status of the female yaks (Zhao 2000). The conception rate was very low for those animals which came to estrous after November.

Estrous: The average length of estrous cycle varies to a great extent in yaks with an average of about 18–22 days. The main reasons could be silent or unobserved estrous, which is greatly influenced by the environmental factors. If the weather is unfavorable, the onset of estrous is delayed and under favorable circumstances the onset of estrous is advanced. Majority of yaks showed their estrous signs during the early cool morning or in the evening and very few only during other parts of the day. The duration of the estrous was not easily determined because the signs of estrous are not always clear (Zhao 2000) and during cool weather the duration was higher as compared to warm weather. The changes in the appearance of the reproductive organs are more obvious than behavioral changes. The vulva becomes swollen, vagina reddens, majority of females showed mucus discharge from the vulva and they tend to raise their tail and urinate frequently (Cai and Gerald 2003). Similar to cattle, yak females on heat search out and ride other females and liked to be approached by male yaks. However, these signs are less pronounced than in cattle. The most pronounced signs of estrous are following and mounting by mature bulls, swollen vulva, reddening of vaginal mucosa and mucous discharge (Mahanta *et al.* 2008).

Effect of cold weather on yak female reproduction: During colder period yaks increase their metabolic rate to maintain their body temperature. In general, during winter there is shortage of feed and fodder. Therefore, the intake of natural forage does not meet their nutritional needs and they have to use their stored reserves. Thereby the body weight decreases by 17 to 25% during the cold season at field conditions (Zhang 2000). Whereas, at the NRC on Yak farm the reduction in the body weight was around 5.84% because they were supplemented with tree leaves and concentrate during winter (Krishnan *et al.* 2009). The temperature and relative humidity started to rise from May and the grasses begin to grow at the same time. Hence, the body condition of yaks improved around July and August following their long period of deprivation and weight loss over the winter. Those females gained their body weight started to exhibit estrous signs in July and it continues up to November, which supports the results of Zhang (2000) and Zhao (2000).

Effect of environment and nutrition on estrous: Estrous was showed almost year-round if feed and fodders are available but mating and conception restricted to warm part of the year and also influenced by environment and nutrition. Present results are in agreement with the observations of

Zhang (2000) and Zhao (2000). Yaks reared under semi-extensive system exhibited estrous mostly during July to November, when the pasture quality and quantity were at the best at an altitude of 2 750 m above msl. The highest incidences (about 68.57%) of estrous were detected from September to November. However, postpartum milking cows required a longer duration to regain their body condition and they were detected in estrous from September to November. Cows that calved late in the season usually failed to exhibit estrous during that same year (Zhao 2000). The pasture quality and quantity were declined after November and those yaks that have not conceived (14.29%) became anestrus until the next summer. The reproductive traits in yaks were highly influenced by the environmental factors and nutrition.

SUMMARY

The present study was carried out on 70 healthy female yaks belonging to NRC on Yak. They were maintained under semi-extensive system of management. The female yaks were closely monitored for display of estrous and its behavioral signs round the year. The breeding season starts in July and reaches its peak from September to November at altitudes of 2750 m above msl. The exhibited estrous and the conception rate were highest (68.57% and 67.14%) during September to November. The average length of estrous cycle in yak is 18–22 days and the most pronounced signs of estrous were following and mounting by mature bulls, swollen vulva, reddening of vaginal mucosa and mucous discharge. The yaks not conceived during particular breeding season became anestrus until the following summer.

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