

# Turkish Journal of Agriculture - Food Science and Technology

Available online, ISSN: 2148-127X | www.agrifoodscience.com | Turkish Science and Technology

## Effects of Seasonal Factors in The Goats' Reproductive Efficiency

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### ARTICLE INFO

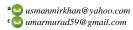
### ABSTRACT

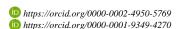
Review Article

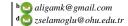
Received: 17/08/2019 Accepted: 30/09/2019

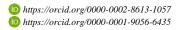
Keywords: Goat Seasonal factors Reproductive performance Animal Sheep

Interest in goat farming is at its peak since the last decade of 20th century because the role of goat is well established in animal protein as well as in economic uplift of poor masses in the tropics and subtropics, but also constitutes an important component of traditional farming systems. Goat is a better option as farm animal in the tropics and subtropics as it can withstand dehydration and has better browsing habit which enables it to survive where cattle and sheep farming is difficult. Reproductive performance of does is of immense importance as contributing factor towards increased meat production and in finding out more prolific animals. This is the main factor affecting productivity of goats. Therefore, an improved reproduction rate will be an approach to increase in numbers. Reproductive seasonality represents a natural adaptation that provides important advantages for birth and offspring survival and development, as lambing/kidding coincides with good weather and maximum availability of forage. It is believed that photoperiod is the environmental factor other than food availability that determines the sexual activity in sheep and goat. This review paper focuses on the general aspects of seasonal factors influencing the goat's reproductive efficiency.











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## Introduction

Goats are found in almost all ecological zones of tropics and subtropics i.e arid, semiarid, humid and sub humid but major population of goats is found in dry tropical and subtropical areas mainly due to poor agricultural production (Jahnke, 1982; Peters, 1988; Lebbie and Ramsay, 1999; Morand-Fehr and Boyazoglu, 1999 and Iniguez, 2004). The increased efficiency of small ruminants is defined as an increased ratio of output (lifetime production) to input (labour, feed, and management costs). Life time production is measured in terms of main products from goats viz. meat, milk and fiber in case of some special breeds. High reproductive rate has significant impact on efficiency of production, which means more animals for sale as meat and a higher selection differential leading to a faster response to selection. The most important tool for enhanced reproductive efficiency is accelerated kidding which can be defined as three kidding in two years or five kidding in three years. Management conditions, in which the animals are reared, are also important factors to govern the success of accelerated kidding. The goats planned to kid thrice in two years through synchronization, importantly result in higher meat production particularly during anestrus (Schneider and Stanko, 2005). Seasonal breeding is one of the obstacles for year round continuous supply of goat and goat products. Many breeds of goats show a distinct breeding pattern during a year (Restall, 1992; Delgadillo et al., 1999; Rivera et al., 2003). Reproductive seasonality represents a natural adaptation that provides important advantages for birth and offspring survival and development, as lambing/kidding coincides with good weather and maximum availability of forage (Ungerfeld, 2003). Food availability controls the timing of the annual ovulatory period in subtropical and tropical latitudes (Bronson, 1989; Asher et al., 1999; Walkden-Brown and Bocquier, 2000). However, the female goats reared indoors with wellnourished conditions still exhibited seasonality in reproduction (Restall, 1992; Rivera et al., 2003; Duarte et al., 2008). It is believed that photoperiod is the environmental factor other than food availability that determines the sexual activity in sheep and goat (Delgadillo et al., 2004; Malpaux, 2006; Chemineau et al., 2004; Duarte et al., 2010; Delgadillo et al., 2011). A trial was designed to find out wheither or not exogenous gonadotropin releasing hormone (GnRH) improves the onset of estrus in dwarf goats. It was found that GnRH had non-significant effect on the onset of estrus. Moreover, treatment by GnRH improved the synchrony of the surge (Pierson et al., 2003). In dairy Awassi ewes, synchronization protocols were used during out of breeding season. It was observed that gonadotropin releasing hormone, prostaglandin F2 alpha and gonadotropin releasing hormone (GPG) protocol could only be effective when used near to the natural breeding season (Faigl et al., 2008). It was concluded that progestagen supplement could be safely used to improve reproductive performance of ewes being bred out of season (Husein and Abahneh, 2008). The injection of PGF2 alpha in Awassi ewes reduced the induction of estrus-onset and estrus-end time gap with progestagen-PMSG (Turk et al., 2008). Super ovulation was induced in Nubian and Nubian crossbred dairy goats with follicle stimulating hormone (FSH) and prostaglandin. It was concluded that GnRH is effective for super ovulation in conjunction with FSH (Krisher et al., 1994). While studying stimulation of estrus behaviour in goats by continuous or discontinuous exposure to males, the results indicated that while at grazing conditions, the anestrus goats may show estrus behaviour when opened to a buck treated with artificial long days (Rivas-Muñoz et al., 2007). It was found that Sarda ewes responded to the ram effect and 80% of ewes in one group were conceived at first ovulation. It was concluded that priming of lactating Sarda ewes in spring with progesterone (P4) + PMSG before ram effect, is an effective way to induce fertile ovulations (Todini et al., 2007). However, the age of ram is an important factor to be kept in mind while studying the ram effect. It was investigated that yearling rams which were used previously for breeding proved better than unused yearling rams (Kenyon et al., 2007). The reproductive performance in an accelerated lambing system of 3 lambing in 2 years was evaluated. The ewes in each group were kept under study for three reproductive cycles. They observed that the fertility rate in the ewes treated with photoperiod was 91.6%, which is quite similar with the fertility as observed in natural breeding season. It was pointed out that ewes kept under the photoperiod schedule gave 1.38 lambing / year and 69% of these ewes lambed three times in two years (Cameron et al., 2010). Reproductive performance of does is of immense importance as contributing factor towards increased meat production and in finding out more prolific animals. This is the main factor affecting productivity of goats. Therefore, an improved reproduction rate will be an approach to increase in numbers. The reproductive efficiency means the net kid crop reared up to weaning. The lambing season and effect of environment on ewe performance in accelerated (January, May and September) or annual (April) lambing were analysed. It was reported that fertility for annual April was found to be on higher side as compared to accelerated May or January and it was slightly low for September lambing. During the month of April, the litter size noted was 1.9 as compared to January i.e.1.8, or May 1.7 and 1.4 for the month of September along with lower mortality % in young kids. However, the mean weaning weights were decreased in the larger April and May kids. The weights of lambs weaned/ewe exposed were increased for annual April as compared to May and January lambing and found to be lower for September lambing. When the ewes were treated with hormone for September lambing, the fertility was increased from 16% to 44% along with litter size from 1.6 to 1.8 (Fogarty et al., 1984).

It was found that the polled Dorset ewes which were separated from rams in late winter/early spring showed a decreased proportion of ewes ovulating from September to November, showed a high proportion in December, without changing the ovulation rate. They concluded that the variation in reproductive measures during spring season indicates a scope for selection and improvements in spring joining results due to ram effects in Dorset ewes may be possible (Hall et al., 1986). When the breeding performance of Damascus goats was evaluated, it was concluded that supplemental feeding was required to increase production of goats in arid or semi-arid environment. It was found that kidding percentage and birth weight of kids didn't differ significantly among groups. Moreover, the number of kids weaned/doe kidding and weight of kids weaned/doe kidding were significantly higher for group of animals fed bar seem clover hay. However, mean body weight of kids at birth and at weaning were found significantly less for control group (Shetaewi et al., 2001). When the reproductive performance was checked in estrus-induced nulliparous Saanen and Alpine dairy goats, it was found that rate of parturition, litter size and gestation period were similar in goats treated with different treatments, also breeding did not considerably improve reproductive performance (Fonseca et al., 2005). Weekly growth curve was determined and it was found that lambs borne in dry season were the heaviest. However, the single as well as male lambs were also heavier. Moreover, it was noted that the ewes in 3rd and 4th parity produced heavier lambs, growing with averagely higher daily gains (Gbangboche et al., 2006). It was found that litter size was increased with age and parity. However, lamb birth weight was affected by the season (Ali et al., 2009). The research was carried out for a period of one year to investigate the productive and reproductive performance of Malpura ewes. Allometric parameters were taken in this research period. It was found that BCS has strong positive impact on allometric measurements and reproductive parameters (Sejian et al., 2009).

It was reported that the mortality rate was 4, 15.3, 19.4 and 28% in goats (Mellado et al., 2008), in Norwegian goats (Engeland et al., 1999), in kids (Borde et al., 2006) and kids (Abubakar et al., 2008), respectively. Two accelerated lambing systems were compared, in which early lambing was found to be associated with higher rates of perinatal mortality (P>0.05) (Iniquez et al., 1986). It was found that the preweaning lamb mortality was 37% in Javanese thin tail ewes (Chaniago et al., 1988), respectively.

#### Conclusion

Reproductive seasonality represents a natural adaptation that provides important advantages for birth and offspring survival and development, as lambing/kidding coincides with good weather and maximum availability of forage. It is believed that photoperiod is the environmental factor other than food availability that determines the sexual activity in sheep and goat.

## Acknowledgements

The authors are grateful to Department of Dairy Technology Postgraduate Laboratory of University of Veterinary and Animal Sciences, Pakistan for providing research facilities and their excellent technical assistance.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Availability of data and materials

All data are included in the article.

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