

**Review Article**

# Review of Reproductive Performance and Selection Criteria of Goats

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## ABSTRACT

Goats are small ruminants that have a vital role in the livelihood of the Ethiopian community. Their prolificacy and fecundity, short generation interval, adaptation to harsh environments, and their ability to thrive under limited feed resources, all make them favorable as an investment and insurance. Reproductive performance is one of the most important economic traits in terms of goat production. Reproductive performance determines several aspects of goat production and their reproduction and is thus important for flock expansion and replacement. The reproduction efficiency of an animal helps in evaluating the strength and weaknesses of the genotypes across different production environments. Therefore, optimum reproductive efficiencies in the flock are fundamental to the success of any production system. The trait influences the overall productivity of the flock. Reproduction failure is the first indicator of the low profitability of the flock. The reproductive efficiency of goats is an accumulation of several correlated traits. The reproductive traits of goats are age at puberty, age at first kidding, post-partum heat period, kidding interval, litter size, parity order, and service per conception. In Ethiopian communities the phenotypes of the goats have an important influence on socio-cultural and economic values; as a result, most farmers pay special attention to the shape of the horn, presence/absence of wattles, color of the eyes, shape of the udder, coat colors and body sizes.

**Keywords:** Reproductive Performance, Goat Selection Criteria, Ethiopia

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## Introduction

Small ruminants (sheep and goats) are an integral part of the livestock sub-sector in Ethiopia (Zewdie and Welday, 2015). They constitute around 33.14 % of the total livestock population of the country (CSA, 2018). They are an avital part of the livelihood systems among the agrarian and pastoral communities by contributing to the socio-economic wellbeing of their rearers (Markos, 2006; Tsigabu, 2015). Their prolificacy and fecundity, short generation interval, adaptation to the harsh environment, and their ability to thrive under limited feed resources, all make them favorable as an investment and insurance (Tsedeke, 2007). Small ruminants also serve as sources of foreign currency and are exported in large numbers to the neighboring countries (Berhanu *et al.*, 2006). It has also been reported in a study by Zelalem and Fletcher (1993) that, small ruminants serve as a source of wealth for the resource-challenged members of the society who are unable to invest in large ruminants. The reproductive performances of small ruminants are important factors influencing flock productivity (Marian, 2009). The reproductive efficiency of goats is an accumulation of several correlated traits. According to Rume *et al.*, (2011), the reproductive traits of goats are age at puberty, age at first kidding, post-partum heat period, kidding interval, litter size, parity order, and service per conception. In Ethiopian communities the phenotypes of the goats have an important influence on socio-cultural and economic values; as a result, most farmers pay special attention to the shape of the horn, presence/absence of wattles, color of the eyes, shape of the udder, coat colors and body sizes (Zewdei and Welday, 2015).

## Reproductive Performance of Goats

The reproductive performances of small ruminants are important factors influencing flock productivity (Marian, 2009). All forms of output including milk, meat, and skin depend on these factors. The factors vary both between breeds and even within flocks in a given population (ILCA, 1990). Considering reproductive parameters in the selection and crossbreeding programs will directly influence the efficiency of milk and meat production and the rate of genetic progress (Mukasa-Mugerwa and Azage, 1991), and the size of the replacement stock. These factors are influenced by several factors viz. genotype, nutrition, diseases, and other management practices (Kidus, 2010).

The reproductive efficiency of goats is the accumulation of several correlated traits. According to Rume *et al.*, (2011), the reproductive traits of goats are age at puberty, age at first kidding, post-partum heat period, kidding interval, litter size, parity order, and service per conception. Similarly, a study by Song *et al.*, (2006) indicated that the reproductive efficiency of goats is determined by age of goats at first kidding, kidding interval, and birth type (litter size). Information regarding reproductive performance is very important to undertaking any breed improvement work in a particular area. The

trait varies both across the different goat breeds and among goats of a particular breed (Ibrahim, 1998).

### Age at puberty and sexual maturity

Puberty is the stage of sexual development at which the goats become capable of breeding (first ovulation in the female and first spermatozoa in the ejaculate of the male), however, this may or may not correlate with their maturity (Kanbhar *et al.*, 2016). In both the males and does, puberty may be often reached without adequate physical growth to support reproduction, and in the does, the first ovulation may not necessarily coincide with the first estrus (Girma, 2008). The age at puberty of some goat breeds were presented in Table 1 below. The observed variations of puberty age are due to the influences of factors like nutrition, body weight, breed, season of birth, and growth rate (Girma, 2008).

**Table 1: Age at puberty and sexual maturity of some goat breeds**

Breed	AP	Age at sexual maturity	References
Tropical goats	Male 97 days Female na	132 days 120-180 days	Payne and Wilson (1999)
Ethiopian indigenous goats	7-15 months 7.4 months	Na Na	Solomon <i>et al.</i> , (2014) Girma (2008)
Arsi bale	Male 7.6 months Female 7.9 months	Na Na	Belete <i>et al.</i> , (2013)
Horo Breed	Male na Female na	9.8 months 7.11 months	Ahmed <i>et al.</i> , (2015)

AP= Age at puberty, na= not available

**Table 2: Age at first kidding of some goat breeds**

Breed/ecotype	Age at first kidding	References
Indigenous Ethiopian goats	12-20 months 12-24 months	Solomon <i>et al.</i> , (2014) Girma (2008)
Arsi Bale	437.1 -445.5 days	Tesfaye (2009)
Southern Ethiopia goats	358.5 days	Deribe (2009)
Keffa	12.9 months	Belete (2009)

### Age at first kidding

Age at first kidding is the age at which does parturite for the first time (Girma, 2008; Rume *et al.*, 2011; Hulunim, 2014). It is a function of puberty, age at first breeding and conception, and successful completeness of pregnancy (Kumbhar *et al.*, 2016). Age at first kidding varies both across breeds and management within breed (Girma, 2008). Age at first kidding is an indication of the overall flock productivity (Tesfaye, 2009). The lifetime production can be increased by decreasing the first kidding age. A wide range of 375 to 854 days of age at first kidding was reported in different management and breeds of Ethiopian goats which are influenced by genotype, management, season, and type of birth (Kebede *et al.*, 2012)

### Kidding interval and litter size

The kidding interval refers to the number of days between successive parturitions (Alexandre *et al.*, 1999; Rume *et al.*, 2011). It is an important predictor of lifetime productivity (Awemu *et al.*, 1999). The prolonged kidding interval is responsible for a decrease in the productivity of goats (Awemu *et al.*, 1999). Litter size means the number of kids born per doe per kidding (Akpa *et al.*, 2011). Findings of a study by Solomon *et al.*, (2014) indicated that the average litter size of goats raised on station and on-farm conditions ranged from 1 to 1.7. The litter size is largely influenced by the ovulation rate. The ovulation rate is correlated to the type of breed and improvement could be achieved through selection (Ibrahim, 1998).

**Table 3:** Kidding interval and litter size of some goat breeds

Breed	Kidding interval	References
Tropical goat	2 years	Rume <i>et al.</i> (2011)
Ethiopian goats	8 months/245 days	Girma (2008)
	6 - 8 months	Solomon <i>et al.</i> , (2014)
Arsi Bale	8 months	Belete <i>et al.</i> , (2015)
Breed	Liter size	References
Nigerian goats	1-4 (Mean 1.7)	Akpa <i>et al.</i> , (2011)
Ethiopian goats	1.06 - 1.75	Solomon <i>et al.</i> , (2014)
Arsi Bale	1.33	Belete <i>et al.</i> , (2015)
	1.6	Hailu <i>et al.</i> , (2008)
	1.77	Ahmed <i>et al.</i> , (2015)

### Selection Criteria of Goats

In Ethiopian communities the phenotypes of the goats have an important influence on socio-cultural and economic values; as a result, most farmers pay special attention to the shape of the horn, presence/absence of wattles, color of the eyes, shape of the udder, coat colors and body sizes (Zewdei and Welday, 2015).

According to the study by Tegegn and Askale (2017), most of the farmers in the southwestern part of Ethiopia give more attention to the selection of breeding rather than that of the bucks. However, studies by Maria (2009) have indicated that “Bucks” are half the flock, and the selection of a good buck ensures the above-average productivity of the flock. Bucks with large and good conformation (tall, upright standing, strait back profile etc) usually have higher productivity (Misbah, 2015). The preference for body size might be because larger animals, in particular, get better market prices, had better growth rates, and reached market weight sooner and such animals can walk long distances (Netsanet *et al.*, 2016).

The effectiveness of any selection program depends on the heritability of the trait (Yaekob *et al.*, 2015). According to Girum *et al.*, (2013), the pastoralists in Ethiopia generally select their breeding flock based on the body condition, growth, pedigree, and lacteal characteristics.

Findings of a study by Seifemichael *et al.*, (2013) showed that the morphological/skeletal traits are highly heritable and therefore selections based on these traits are mostly successful. However, most of the reproduction and production traits viz. age at first mating, conception rate, milk yield, etc. are mostly moderately to lowly heritable; therefore, these traits are mostly improved through improved proper husbandry practices. Findings of a study by Ahmed *et al.* (2015) indicated that in the western part of Ethiopia breeding does are selected based on their litter size followed by their growth rate and age at first kidding.

The traits selected by the goat rearers in the midlands are their prolificacy, body conformation, survivability of the kids, and coat colors. The does are selected based on their good mothering ability, short kidding interval, longevity, and early maturity (Tegegn and Askale, 2017).

Goat rearers in the highlands select the does base on their body conformation, adaptation to cold climate, coat color (long hair and black) survival of the kids, good mothering character, prolificacy, short kidding interval, and low age at first maturity, besides the longevity of the doe themselves (Yaekob *et al.*, 2015). Black-coated goats, however, are believed to have superior adaptation to seasonal cold weather or cold nights as the dark pigment helps them to warm-up earlier than goats with other coat colors (Robertshaw, 2006). On contrary to the same, the breeding bucks are selected based on their higher growth rate, and appearance besides their coat color (Belete *et al.*, 2015).

Furthermore, findings of a study by Yaekob *et al.* (2015) indicated that in all agroecology the traits which were similar in selecting the does were body conformation, adaptation, coat color, early maturity, and prolificacy. The bucks were however selected based on their pedigree, and own performance besides other criteria of traditional systems (Girum *et al.*, 2013).

## CONCLUSION

The reproductive efficiency of goats is an accumulation of several correlated traits. The reproductive traits of goats are age at puberty, age at first kidding, post-partum heat period, kidding interval, litter size, parity order, and service per conception. The better reproductive performance of the goat determines its productivity and the economic significance of the goat breeds. Selection is the prerequisite to replacing stocks by considering their own morphological and production characteristics. Bucks are selected based on physical appearance while females have based on a reproductive trait-like age at first puberty, litter size, kid growth, and kidding interval. This review

## CONFLICT OF INTERESTS

The author declares that there is no conflict of interest.

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