

Enhancing Reproductive Performance in Small Ruminants Part II: Puberty and Estrous Cycles

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This series of fact sheets has been designed to assist producers in enhancing reproductive performance in their herd so that overall production can be optimized to promote profitability. Fact sheet topics included in the Enhancing Reproductive Performance in Small Ruminants series include:

Part I. Biology of Reproduction

Part II. Puberty and Estrous Cycles

Part III. Breeding and Management Systems

Part IV. Breed/Selection

Part V. Nutrition and Health

Part VI. Reproductive Management Techniques

Puberty

From a practical point of view, puberty in females is not only when she reaches sexual maturity and exhibits estrus (6-8 months of age), but is also the age at which she can successfully support pregnancy to term (more like 8-12 months). It is recommended that replacement females are first bred when they are at target weights of 60-70% of mature adult weight for that specific breed. Breeding at weights below this recommendation can stunt growth and reduce the productive life of the female. Replacement females born earlier in the season generally reach puberty earlier because of their age and weight, while those born later tend to breed later. In addition, replacements that kid/lamb earlier will breed back earlier in the season, and this increases the productive life of the animal.

In males, puberty is not the age when the buck's/ram's reproductive organs become functional and his secondary sexual characteristics develop, but rather the age when the ejaculate contains a threshold number of spermatozoa adequate for successful fertilization. There

are a number of factors that affect the onset of puberty, and these include breed, geographic location, social structure, and photoperiod.



Figure 1. A breeding group of crossbred meat does. (Reprinted by permission from Susan Schoenian, 2007).

Estrous Cycle

The estrous cycle is defined as the period between one standing heat/estrus (period of time when the female is receptive to the male) to the next. The average duration of both the estrous cycle and estrus can vary by factors such as breed, age, season, and environment. The estrous cycle is divided into two main phases: the follicular phase and the luteal phase. The follicular phase is characterized by follicular growth and secretion of the hormone estrogen and accounts for only 25% of the cycle. On the other hand, the luteal phase starts right after release of the egg (ovulation), is characterized by the presence of the progesterone-producing corpus luteum, and accounts for 75% of the estrous cycle. Estrus detection is based on behavior/signs and typically

includes bleating, mucus discharge, interest in bucks, tail wagging, swollen vulva, and standing for mounting in does.

Estrus might not be as obvious in ewes and is mostly detected in the presence of a ram. In a ram's presence, a ewe in estrus will stand to be mounted. Anestrus — when normal cycle stops — is associated with gestation and season but also with stressors such as undernutrition, disease, and lactation. See table 1 for a list of normal reproductive traits of goats and sheep.

Table 1. Normal reproductive characteristics of sheep and goats and their age at puberty.

Characteristic	Goats	Sheep
Male	4-6 months	4-6 months
Female	5-8 months	6-9 months
Estrous cycle length (average # of days)	18-22 days (21 days)	14-19 days (17 days)
Duration of estrus	12-36 hours	24-36 hours
Ovulation	12-36 hours after estrus onset	24-30 hours after estrus onset
Length of pregnancy	146-155 days	140-159 days

Reproductive Failure in Females

There are instances when females may fail to mate, mate and not become pregnant, or not be able to maintain a pregnancy. The reasons for reproductive failure in females are hard to determine, and the possibilities are endless. A female might fail to conceive because of inadequate nutrition, stress, poor health, or abnormalities of the reproductive tract. A veterinarian should evaluate reasons for failure to mate, become pregnant, or maintain a pregnancy, and efforts should be made to correct the issue if possible so that she can be bred. However, if the exact reason cannot be determined and a female has failed to conceive in consecutive cycles, it is recommended that this female be culled from the herd/flock.



Figure 2. A single-sire Barbados blackbelly pasture breeding group at Virginia State University's Randolph Farm. (Photo by Stephan Wildeus, 2014).

Reproductive Failure in Males

Reproductive failure also occurs in males. Rams and bucks might also fail to mate, or mate without resulting pregnancy. Similar to females, there are a number of reasons for reproductive failure in males, and it is critical to evaluate any health problems or other stressors that could be responsible for this failure. To correctly evaluate if a male is mating or not, a marking harness or raddle powder is recommended. If a male is not mating, he could be too ill, too thin, too old, or have foot/leg problems, or the weather might simply be too hot. Possible diseases to check for include pizzle rot, contagious ecthyma (sore mouth) of the penis or prepuce, and lameness, making it difficult to mount comfortably.

Experience of the male should also be considered. An inexperienced male could be dominated by bigger/older females or males in the breeding group and be reluctant to breed. The male to female ratio used during breeding might also be an issue, especially if a synchronization protocol was used. The typical ratio recommended during a normal breeding season is 1 male to 30-50 females, while in a synchronized mating the ratio should not exceed 1 male to 15-20 females. The age of the male should be considered when deciding how many females a male can successfully breed. When using younger males, you should always go with the smaller number of females, considering his limited experience.

Breeding Soundness Examinations (BSE)

To help diagnose possible issues due to infertility, all bucks and rams should be evaluated by a veterinarian for breeding soundness at least one month prior to the start of the mating season. A BSE evaluation includes a physical examination, scrotal circumference measurement, and semen evaluation. The physical examination's purpose is to ensure that the male can move around freely without issues of lameness or overgrown hooves and has an adequate body condition score to breed effectively. The male should also be free from diseases such as pizzle rot and internal parasites.

Measurement of the scrotal circumference is a very helpful tool in determining fertility and breeding ability in males. There are a number of research studies that have indicated that scrotal circumference is highly correlated with sperm concentration, motility, and viability. See table 2 for the minimal scrotal circumference by age in rams. Mature bucks (more than 14 months old) should have a scrotal circumference greater than 25 cm. Please note that minimal scrotal circumference by age are recommendations and that scrotal circumference can be influenced by breed. The testicles should also be palpated for firmness and be checked for any abnormalities. Finally, a semen evaluation should be conducted. A good quality semen sample will be milky in appearance and free from contaminants, including pus, blood, or urine, and when examined under a microscope presents with a good wave motion, indicating sperm motility. Table 3 has the normal semen parameters for breeding bucks and rams.



Figure 3. Measuring the scrotal circumference of a Barbados blackbelly buck at Virginia State University's Randolph Farm. (Photo by Stephan Wildeus, 2018).

Table 2. Recommended minimal scrotal circumference by age in rams.

Age (months)	Minimal scrotal circumference (cm)
5-6	29
6-8	30
8-10	31
10-12	32
12-18	33
>18	34

Table 3. Normal semen parameters for breeding bucks and rams.

Parameters	Buck	Ram
Volume (ml)	0.5-1.0	0.8-1.2
Sperm concentration (billion/ml)	2-5	1-6
(average)	(2.5)	(2.5)
Motility* (%)	70-90	60-80
(average)	(80)	(75)
Morphology† (%)	75-95	80-95
(average)	(90)	(90)

*Motility – Sperm in progressive motion.

†Morphology – Sp

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Additional Resources

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