Sheep and Goat Management in Alberta

Reproduction

Alberta Lamb Producers

Alberta Goat Breeders Association

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Contents

1. Breeding

Optimum reproduction is the cornerstone of successful sheep and goat (small ruminant) rearing and key to the profitability of the production unit. The objective of the following text is to provide a solid understanding of what is normal, what is abnormal, and what can be done to improve herd or flock productivity.

The Breeding Season

Both sheep and goats are referred to as seasonally polyestrous, short day breeders. In other words, they demonstrate regular periods of sexual receptivity, also known as estrus or heat, during the fall. Within both of these species, there are short breeding season breeds and long breeding season breeds.

Sheep

It has been generally observed that sheep breeds developed closer to the equator show less seasonality than those developed in more northern regions. Nevertheless, even within the popular breeds developed within northern Europe, there are short and long breeding season breeds. Short breeding season breeds have a breeding season extending from September to January and include the following:

- Suffolk,
- Columbia,
- Cheviot,
- Leicester,
- Finnish Landrace,
- Hampshire,
- Corriedale.

Long breeding season breeds, which breed from July to March, include:

- Merino,
- Rambouillet,
- Dorset,
- Romanov.

Goats

Examples of short breeding season breeds, which cycle from September to February, include:

- Toggenburg,
- Saanen,
- Alpine,
- LaMancha.

Long breeding season breeds originate from tropical regions and cycle from July to April. Examples include:

- Pygmy,
- Nubian,
- Boer.

Although it is widely known that sheep and goat breeding seasons are influenced by day length, specifically the amount of light exposure, for many animals there remains an innate annual rhythm characteristic of the breed. When animals are exposed to a constant day length, the period of sexual receptivity becomes disassociated from a particular season, but will still only occur once per year. It is very important to realize this. Many producers are under the mistaken belief that breeds of sheep imported from equatorial countries will cycle year round with only minimal seasonal changes. Exceptions do exist, however, as a small proportion of ewes within each population will have longer breeding seasons than their flock mates, and many of these animals will cycle year round when living close to the equator.

Many producers are under the mistaken belief that breeds of sheep imported from equatorial countries will cycle year round with only minimal seasonal changes.

The Estrous Cycle

Ewes

The estrous cycle of the ewe is typically 16 to 17 days, with the period of receptivity lasting approximately 30 hours. Ranges in estrous cycle length from 14 to 19 days have been reported and may be influenced by the age of the ewe and the stage of the breeding season. Older ewes tend to have shorter estrous cycles. Also, cycle length is much shorter at the beginning and the end of the breeding season during what are known as transition periods.

Signs of estrus are very subtle in the ewe. The ewe in heat will seek out the ram and allow him to sniff her, often switching her tail in an effort to disseminate her scent. Ewes not in heat will move away from the ram. Very astute shepherds may also notice slight swelling of the vulva associated with estrus.

Ovulation occurs at the very end of estrus. Therefore, the optimal time for a single breeding would be approximately nine to 12 hours after the onset of estrus. This will ensure that adequate numbers of sperm are present, at the correct location within the reproductive tract, at the time of ovulation. Fortunately, this kind of attention to detail is seldom needed in most natural breeding situations as rams serve ewes multiple times during an estrous period ensuring an ample supply of viable sperm for fertilization. Appropriately timed breedings are necessary if frozen-thawed semen is deposited artificially into the ewe's uterus (artificial insemination).

The proportion of ewes that ovulate is often greater than the number that expresses estrus. This may be due to a failure to detect estrus, but more often is because the ewes fail to display estrus, or have what are commonly referred to as "silent heats". Silent heats often occur at the beginning of the breeding season.

Does

The normal length of the estrous cycle in the doe is 19 to 22 days. Pygmy goats may be more variable, with reported ranges of 18 to 24 days. Estrous cycles are more erratic at the beginning and at the end of the breeding season (transitional periods). During transition periods does commonly display very short estrous cycles of only five to seven days; some does may also display estrus during pregnancy. Does are typically receptive to the buck for 12 to 24 hours, but estrous periods ranging from 10 to 40 hours have been reported. Presence of a buck is

very important for estrus detection in does as the buck's odour is very important for stimulating the signs of estrus. In fact, most does actually prefer a buck that has not been descented over one that has. Signs of estrus in the doe are: actively seeking the buck, tail wagging (flagging), bleating, urinating near the buck and possibly some swelling of the vulva, often accompanied by the presence of a slight amount of mucus. Throughout estrus, vaginal mucus progresses from a clear colour, to cloudy, to creamy white. Milk production often declines eight hours before the onset of estrus, and is accompanied by a decrease in appetite. If a doe is in estrus, bucks are often very interested displaying a lip curl (Flehmann Reaction) after sniffing the doe's genitalia. Other behaviours follow, such as flicking the tongue in and out, striking the doe with the forefoot, snorting and other vocalizations.

Ovulation occurs 12 to 36 hours after the onset of estrus in does. If mucus has been observed it is best to breed does from the mid-point to the end of the estrous period when the vaginal mucus is cloudy. In reality, however, this kind of attention to detail is seldom practised except when limited hand mating or artificial insemination is employed. The more typical recommendation is to breed the doe at the onset of estrus (when it is first observed) and every 12 hours until the end of estrus.

Many meat goat producers allow a buck to remain with the does during the breeding season, in which case estrus detection is not important unless the buck fails to settle (impregnate) the does. Since buck scent can taint the milk, most dairy producers will use a "teaser" buck." The teaser is exposed (usually through a fence) to the does for a limited daily time period. Does showing interest in the buck, are removed from the pen for mating. Another method of detecting estrus in does, without having a buck physically present, is to use a "buck rag" or "buck jar." A rag is rubbed on a mature buck's scent glands, which are located behind the horns and towards the middle of the buck's head. The rag is then placed in a sealable container and stored in a cool area in order to maintain the odour for as long as possible—usually several weeks. After the container has been allowed to warm up, it is opened and presented to the doe(s). Those that are in estrus will be very interested in the jar, and can be taken to a buck for breeding.

Breeding Management

Ewes

Most ewes are capable of giving birth to one to three lambs. Profitability of the flock often depends on the majority of ewes giving birth to multiple offspring, with the goal of obtaining a lambing percentage in excess of 200 percent (number of lambs born / ewes exposed to rams x 100). The objective of most shepherds, when developing breeding strategies, is to ensure an optimal ovulation rate which is directly linked to lambing percentage. Factors influencing ovulation rate are as follows.

Nutrition

Animals must be well-fed if they are going to reproduce. The nutrient requirements of the reproductive system are addressed long after those of basic maintenance; in other words, poorly fed animals will focus on life preservation before life creation.

Ewes with the greatest nutrient intake tend to have the highest ovulation rates at the onset of the breeding season. This effect is mediated through the direct effect of increased blood glucose on increased ovarian function, and is referred to as flushing. Typically, ewes are fed at energy levels which exceed their daily requirements for maintenance, and to be effective, flushing must begin two to three weeks before the onset of the breeding season. Flushing is most beneficial to thin ewes; it cannot be expected to generate much improvement in ewes with a body condition score (BCS) beyond 3.5 on a 5-point scale (Table 1). For thin ewes, those with a BCS between 2 and 3, the addition of grain concentrate to the ration at a rate of. 0.2 to 0.7 kg (0.5 to 1.5 lb.) per head per day will be of benefit. Flushing is most benefi-

Score	Spinous process	Rib cage	Loin eye
BCS 1 Very thin	Easy to see and feel, sharp	Easy to feel and can feel under	No fat covering
BCS 2 Thin	Easy to feel, but smooth	Smooth, slightly rounded, need to use slight pressure to feel	Smooth, even fat cover
BCS 3 Good Condition	Smooth and rounded	Smooth, even feel	Smooth, even fat cover
BCS 4 Fat	Can feel with firm pressure, no points can be felt	Individual ribs can not be felt, but can still feel indent between ribs	Thick fat
BCS 5 Obese	Smooth, no individual vertebra can be felt	Individual ribs can not be felt. No separation of ribs felt	Thick fat covering, may be lumpy and "jiggly"

Table 1 - Condition Scoring Table, from Body Condition Scoring in Farm Animals
For complete analysis of body condition, refer to Appendix 1, Body Condition Scoring on page 55 of this module.)

cial in the meat breeds and will help them reach their true genetic potential. Lambs should also be weaned prior to breeding to enable a sufficient improvement in nutrient status of the dam.

Age of Ewe

As ewe age increases so does the number of weaned lambs. Of course, mature ewes would be expected to be better mothers, having survived the cull of those that demonstrated poor mothering instincts, but older ewes also tend to ovulate more eggs. Ovulation rates are highest between three and six years of age and decline thereafter.

Breed of Ewe

Finnish Landrace ewes reportedly have the highest ovulation rates, with three to five lambs being born, on average. Other prolific breeds include the Romanov, Booroola, Merino and Icelandic sheep breeds. For the purposes of this discussion, prolific breeds are those that are recognized to routinely produce three to five lambs per lambing.

Crossbreeding

Depending on the breeds that are used, crossbreeding can result in substantial increases in ovulation rate and ewe productivity. In fact, because of their ability to produce such large numbers of lambs, many of the very prolific breeds are not practical for large scale production as purebreds; it is simply too hard to manage such large litters of lambs. However, when these breeds are used in a cross-breeding program, the effect of hybrid vigour will often increase the lambing percentage in the less prolific breed greater than the average of the two breeds. The benefits of hybrid vigour extend beyond those of reproductive performance, with influences on such things as disease resistance, milk production and survivability.

Stage of the Breeding Season

The highest ovulation rates in mature ewes are achieved during the mid-breeding season while ewes bred out of season have the lowest ovulation rates.

Ewe Lambs

Ewe lambs and adult ewes cycle slightly differently from one another. These characteristics are listed below.

Ewe lambs and adult ewes cycle slightly differently from one another.

Shorter Breeding Season

Ewe lambs usually begin cycling about three weeks after the adult ewes and will cease to cycle approximately three weeks before the rest of the flock.

Shorter Duration of Estrus

Ewe lambs display estrus for a shorter time than adults.

Differing Ovulation Rate Peak

The ovulation rate is highest in ewe lambs at the beginning of the breeding season.

Weaker Estrus

Ewe lambs are not as precocious as adults and are less likely to seek out a ram when in estrus. However, research has shown that overall lifetime productivity is improved by breeding ewe lambs.

Therefore, it is still recommended to breed ewe lambs to produce lambs by one year of age rather than to wait an additional year. Other benefits include reduced non-productive feed costs, and shortened generation intervals. Most lambs reach puberty by six to 10 months of age, but this is also dependent upon their reaching a body weight of about 68 percent of that of a genetically similar adult ewe. Ewe lambs should be fed to reach this target weight by two to three weeks prior to the breeding season. Lambs born before the summer solstice (June 21st) have been exposed to long days before being exposed to short days. These lambs are not only older than later born lambs, but have been exposed to seasonal cues and are more apt to cycle during the subsequent breeding season. Earlier born lambs are often the offspring of more reproductively efficient ewes and represent the best population from which to select replacements.

Ewe lambs of the more prolific breeds reach puberty earlier than do crossbred lambs. Female offspring sired by rams selected for large testicular size (scrotal circumference) reach puberty at an earlier age, and may also have higher ovulation rates.

Does and Doelings

Does need to be adequately fed in order to cycle properly, but nutritional flushing has no proven effect on the ovulation rate.

Doelings usually reach puberty by six to eight months of age. Nutrition and genetics also play an important role. For example, poorly fed European doelings may not reach puberty until much later in the breeding season. Some breeds, especially Pygmy goats, are capable of reaching puberty at a very young age, possibly as early as three months of age. As a general rule, breeding is usually delayed until a doeling has reached 60 percent or more of her mature weight. Breeding less mature animals may result in reduced pregnancy rate, reduced number of kids born and a higher incidence of birthing problems (dystocia).

Throughout the world there are a variety of genetically distinct types of goats, likely developed from stock capable of thriving under a particular set of circumstances. These animals tend to be maintained, as more or less pure strains, with seemingly little need to change. Therefore, the potential benefits of crossbreeding have not been explored.

In North America, dairy, meat, fibre and novelty breeds exist, but crossbreeding to improve reproductive performance in goats is not advocated in the scientific literature, presumably because of limited benefit in terms of a more productive animal.

Male to Female Ratios

Ram to Ewe Ratio

Typical, natural breeding scenarios involve one mature ram for 30 to 50 ewes. In other than a registered flock, it is recommended to have more than one ram with a group of ewes to ensure adequate coverage. Competition between rams significantly affects the ram's ability to detect estrus. Research has found that one ram with 100 ewes detected 68 percent of ewes in estrus over a given period of time compared to two rams achieving a 98 percent estrus detection rate with 200 ewes; the ram to ewe ratio between the groups was the same, but the competition between the rams became a factor (Refer to *Pasture Hierarchy in Rams and Bucks* on page 50 of this module.)

Ram lambs can potentially breed as early as five to six months of age, but should be limited to 15 to 25 ewes for their first season.

Buck to Doe Ratio

A stocking rate of one mature buck to 50 does is the usual recommendation. For best results, very high buck to doe ratios should be avoided because semen quantity and quality are commonly limiting factors. Maintaining more than one buck with the breeding herd can be problematic as bucks are prone to injury from fighting to establish hierarchy. Competing bucks are known to impair each other's ability to mount and serve does. Bucks as young as three and a half months are capable of serving does, including their mothers, so weaning should be completed before that time.

Manipulating Estrous Cycles in Ewes and Does

The ultimate aim of the various programs designed to manipulate estrus in ewes and does is to increase production by having a longer breeding season and a predictable time for breeding, thereby improving economic returns and decreasing labour. Ovulation rate is an integral component of the success of these programs because satisfactory numbers of offspring must be born in order to make the extra effort worthwhile.

The ultimate aim of the varous programs designed to manipulate estrus is to improve economic returns and decrease labour.

There are three different approaches to manipulating the expression of estrus in ewes and does.

1. Breeding outside of the normal breeding season;
2. Hastening the onset of the breeding season; and
3. Controlling the onset of estrus during the breeding season (Estrus Synchronization).

Breeding Outside an Established Breeding Season

Use Breeds with a Longer Breeding Season

One of the simplest ways to have ewes or does breed outside of the normal breeding season (spring-summer anestrous period) is to use breeds with a longer breeding season or to cross-breed with these breeds and select replacement females from the hybrids. For example, Dorset, Finnish Landrace, or Rambouillet may be used. Culling ewes that do not conceive, and early weaning, will need to be employed to improve results. (Refer to the *Star System* on page 16 of this module.)

Cross-breeding tends to be less popular amongst goat breeders for this purpose probably because of sacrifices in meat or milk production.

What is a photoperiod?

A photoperiod is the daylength or duration of daily exposure to light and dark periods, either natural or artificially manipulated. Sheep and goats undergo a number of biological and behavioural changes when exposed to varying day length.

Photoperiod Adjustment

Since ewes and does are short-day breeders, reducing exposure to long days can actually trick the pineal gland, which is responsible for recognizing season, into perceiving a decrease in day length. This approach is usually accomplished by locking ewes and does in almost complete darkness for a period of time in the morning and in the evening. A typical regime provides approximately eight hours of light (500 lux minimum) versus 16 hours of darkness. The difference between the long and short-day light exposure should be at least six to eight hours. Less than 10 lux of light should be present during the period of darkness. Flashes of light should be avoided as these will confuse the ewe's or doe's perception of day length.

Light can be supplied by releasing the animals outside into the sunlight at 8 a.m. and moving them to the barn at approximately 4:00 p.m. The length of exposure to decreased day length is very important. Light programs must begin at least six to eight weeks in advance of the intended breeding season. Some recommend that if the desired breeding season is June then results will be even better if 12 weeks of light control are used. For example, begin light control in March for a June breeding season. For light control to be effective, animals must be exposed to a period of at least 30 long days (greater than 14 to 16 hours of light per day) before limited light exposure begins.

Light treatment should continue throughout the breeding season and more than one estrous period will occur similar to a natural breeding season. Animals that do not become pregnant during the light-controlled breeding season will display estrus eight to 12 weeks later, during the subsequent fall breeding season. Because supplementing artificial light represents an additional expense, using natural day length and locking animals in darkness for a period of time is a more efficient way to manipulate photoperiod in sheep and goats.

Rams and bucks are also influenced by day length and will exhibit greater testicular size, improved libido and better semen quality when exposed to short days. It is therefore recommended that rams and bucks also be included in light treatment protocols.

Costs associated with constructing and maintaining light-proof facilities (ventilation fans, feed/water systems, waste removal) limit the commercial implementation of most light control programs. Recently, the exact opposite approach, light supplementation, has been ex-

perimented with in ewes, with apparent success. Ewes are exposed to 20 hours of supplementary light per day beginning on the shortest day of the year. This is equivalent to approximately eight hours of natural light plus 12 hours of artificial light. The amount of artificial light exposure is gradually decreased so that by June 21st (summer solstice) no supplementary light is needed and ewes will begin to cycle soon after. Essentially, the ewes are tricked into believing that the period of long days actually occurred during the winter and that shorter days are occurring in the summer. This approach has not been commercially employed, but has the advantage of not requiring expensive light-proof facilities. Because the period of exposure to long days is so long (six months) it would seem that this protocol would not be suitable for the accelerated lambing programs described on page 16 of this module.

In does, a practical solution for light manipulation has been to expose them to a total of 18 to 20 hours of light per day starting in early December by bringing them into a well-lit barn overnight. As with the ewe example, natural day length is supplemented by artificial light and the need for a light-proof facility is eliminated. Light supplementation must be continued for at least two months (for example until early February); after that only natural day light is used. Even though actual day length is increasing the does are tricked into believing that the days are shorter because the lights have been shut off, and they will begin to cycle in six to eight weeks (approximately early April).

Hormonal Stimulation

The use of hormones, mainly progesterone or progestogen (progesterone-like) products, to manipulate the reproductive cycle of small ruminants has by far been the most widely adopted procedure used by Canadian producers. However, at the time of this writing, no product is currently on the market in Canada. Controlled Intravaginal Drug-Releasing device (CIDR-G), pictured in Figure 1 (next page), is available in Canada, but your veterinarian will need to complete an EDR (Emergency Drug Release form) to be able to import the product from Australia. Your veterinarian must assume the responsibility for the safe use of this product. The 'G'

What is Lux?

The lux is a measure of illuminance representing the apparent intensity of light hitting a surface and can be measured with a device called a lux meter. Lux not only accounts for the power of light, but also the area over which the light is spread. One lux is equivalent to one lumen (a measure of the power of light) per square metre. The number of lumens is usually indicated on the light bulb or tube, or on its packaging. A 20,000 lumen fluorescent tube lights up one square metre with an illuminance of 20,000 lux; that same tube used to light a 25 square metre room will produce an illuminance of 800 lux (20,000 lumen / 25 m^2). A typical family living room may be illuminated at 50 lux. Five hundred lux may be typical of a well-lit kitchen or office area, but providing it will require a different number of fixtures to achieve the same effect, depending upon the area of each space.

designation stands for 'goats' to distinguish the product from the CIDR-B designed for cattle (Bovine).Each CIDR-G device contains 300 mg natural progesterone impregnated into a T-shaped silicone device and is intended specifically for use in sheep and goats. The wings that form the cross of the 'T' are designed to be bent upwards to facilitate insertion into the vagina using a specially designed insertion device, also pictured in Figure 1.

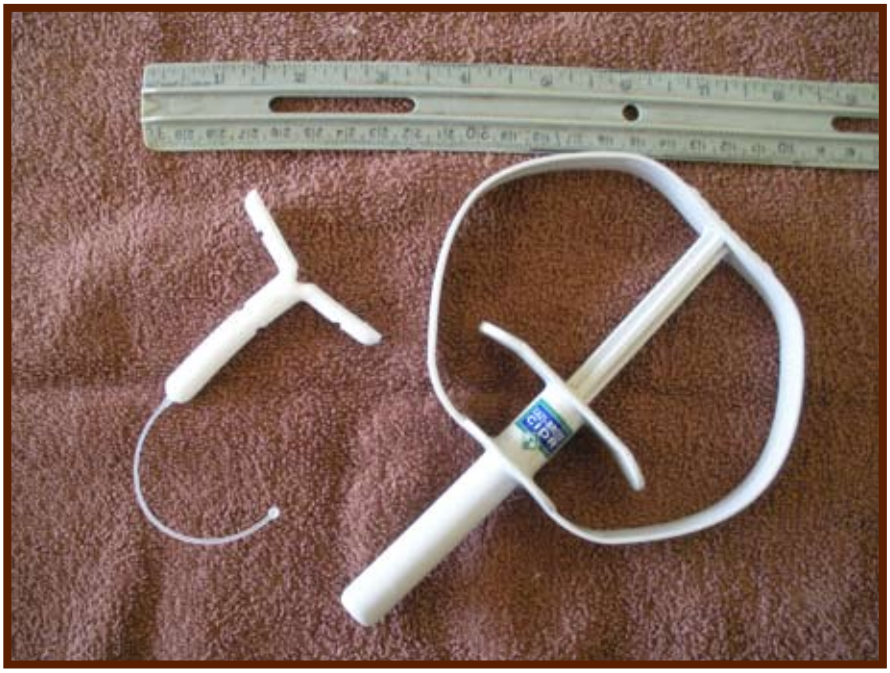

Figure 1: Controlled Intravaginal Drug-Releasing device (CIDR-G) and insertion device.

Making sure that they are inserted deeply into the vagina is an important part of reducing fall-out. Goats are very adept at pulling out their own CIDRs, owing to their flexibility and their innate sense of curiosity. This problem could be alleviated by trimming the strings. Careless insertion of CIDRs occasionally results in the string becoming entrapped in the vagina and the implant is then assumed to have fallen out. Care should be taken with vaginal implants to ensure that they have all been removed; females that have apparently lost their implants should be thoroughly examined to ensure that the implant has not been left behind.

Progesterone releasing hormone devices are generally implanted for 12 to 14 days. Progesterone acts by regulating the pituitary, the principal sex hormone producing gland located within the brain, to prevent estrus and ovulation, and regulate cycling. Once the source of

progesterone is removed most animals will display full-blown estrus within two to two and a half days. When used in the non-breeding season progesterone actually stimulates the previously inactive pituitary to function as if it were the breeding season. Since several animals are often treated at once, the use of these products has the added benefit of synchronizing estrus. When these products are used out of season, pregnancy rates can be improved substantially with the incorporation of additional hormones.

Most often equine chorionic gonadotropin is injected at the time of implant removal to improve ovulation rates and, ultimately, pregnancy rates. Results tend to vary, with reports of pregnancy rates between 20 and 70 percent. Unlike light treatment, progesterone implants used during the anestrous period provide only one opportunity for females to display estrus and become pregnant. After that, nearly all of the females will return to the anestrous state. To increase success, ewes and does should be in good body condition and have lambed or kidded at least three months before, and their offspring should be weaned.

Decline in Ram Fertility

Rams and bucks are also subject to seasonal declines in fertility. There is no readily available hormone treatment to boost the sex drive and fertility of small ruminant males. Melatonin, the hormone released by the pituitary in response to darkness, can be administered in the form of a slow-release implant to improve fertility, but is often unobtainable in North America.

Mature males should be used at a rate of one male per 10 females when breeding out of season.

Weather

Temperature and humidity must also be considered when breeding outside of the normal breeding season. Ambient temperature probably does not play a role in dictating onset of reproductive cycling in ewes and does, but can influence fertility. High temperature and humidity during the breeding season have been proven to reduce embryo survival and sperm quality, with the net result being fewer offspring born in sheep and goats. Long periods of mid-30 degree Celsius days have been shown to have a similar effect in beef bulls in western Canada.

Hastening the Onset of the Breeding Season

Photoperiod

Light treatment in a light-proof facility as described earlier is one option. When used to hasten the onset of the breeding season, treatment may begin in June or July.

Ram or Buck Effect

The sudden introduction of a buck or ram to females just about to enter the breeding season is a very useful way to hasten cycling, and also synchronize estrus. It has long been considered important that for the success of this approach, ewes or does be isolated from the sight and smell of an adult male for several days before introduction. At least with ewes, and probably with does, it is now known that the introduction of a male for as few as 48 hours will induce the same effect.

In both species, ovulation will occur within two to five days of introduction, but only a portion of animals will display estrus. This occurrence of ovulation without behavioural estrus is often referred to as silent estrus. After the initial ovulation following introduction of the male, approximately half of the animals will ovulate again without estrus within three to five days, referred to as short cycling, whereas the remaining ewes and does will display a fertile estrus following a normal estrus cycle length of 17 and 21 days. Those animals that displayed a second silent estrus within three to five days will eventually have a fertile estrus—17 days for sheep, and 21 days for goats—after the second ovulation. To shorten the time lag between introduction of the male and conception, a progesterone implant may be employed for 12 to 14 days, with removal occurring just before introduction of the ram or buck. The net result will be that a higher percentage of females will exhibit a fertile estrus and will become pregnant much earlier in the breeding season.

Hormonal

The use of progesterone implants for 12 to 14 days in ewes and does has been quite effective in hastening the onset of the breeding season. As mentioned above, combining the use of a progesterone implant with male introduction may be more effective than either technique used alone. When progesterone implants are being used without male introduction, it is advisable to inject equine chorionic gonadotropin (eCG), in the past referred to as "PMSG," at the time of implant removal to ensure satisfactory results.

Controlling the Onset of Estrus during the Breeding Season

The main reason for controlling the onset of estrus during the breeding season is to synchronize a large group of ewes or does. Estrus synchronization in a flock or herd may be employed for the purposes of batch lambing or kidding, artificial insemination (AI), or embryo transfer (ET).

Progesterone Implants

As described above, progesterone implants can be used for a period of 12 to 14 days. Equine chorionic gonadotropin is not required during the breeding season when natural mating is used; however, its use will improve synchrony of ovulation and result in better pregnancy rates when AI or ET is employed.

Prostaglandin F2alpha

In a group of cycling ewes, a single intramuscular injection per ewe will result in approximately 60 percent displaying estrus in 24 to 48 hours. If two injections are administered nine to 11 days apart, over 85 percent of ewes will display estrus within 24 to 48 hours. Ewes will not respond to prostaglandin F2alpha if they are anestrous, in later stages of pregnancy, or are simply in an unresponsive stage of their estrous cycle. The two-injection protocol will help ensure that the majority of the animals are at a responsive stage of their cycle at the time of the second injection.

In does, prostaglandin F2alpha use is often avoided because of irregular estrous cycles following its use.

Prostaglandin F2alpha products are prescription drugs; therefore, they are only available from veterinarians and cannot be prescribed unless there is an ongoing working relationship between the producer and the veterinarian. Prostaglandin F2alpha products must be handled very carefully as there are serious health implications for women of child-bearing age and asthmatics. Products must also be protected from light and extremes in temperature.

Breeding Programs

It seems likely that sheep and goats, with their short gestation length, should be capable of producing more than one lamb or kid crop per year. Breeding management systems such as three crops in two years and the Star System, described below, have been designed for sheep.

Similar programs have not been designed for does; nevertheless, breeding does outside of the normal breeding season is necessary to ensure a steady supply of milk or kids. Approximately one third of the dairy goat herd should kid from October to December to maintain milk production. Light control programs are a very popular method of breeding does out of season and their effectiveness is improved when they are combined with progesterone implant programs. Does put into an out-of-season program should be at least 120 days in milk and in good body condition (Table 1) will also require at least a 60-day dry period in order to maximize milk production during the subsequent lactation.

Score	Spinous process	Rib cage	Loin eye
BCS 1 Very thin	Easy to see and feel, sharp	Easy to feel and can feel under	No fat covering
BCS 2 Thin	Easy to feel, but smooth	Smooth, slightly rounded, need to use slight pressure to feel	Smooth, even fat cover
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Table 1 - Condition Scoring Table, from Body Condition Scoring in Farm Animals
For complete analysis of body condition, refer to Appendix 1, Body Condition Scoring on page 55 of this module.)

While it is possible to have more than one crop of lambs in one year it is more feasible to attempt to have three crops in two years or five crops in three years. The latter is known as the Star system. The Star system is slightly more intensive, with a lambing to breeding interval of 7.3 months versus eight months in the 3-in-2 system.

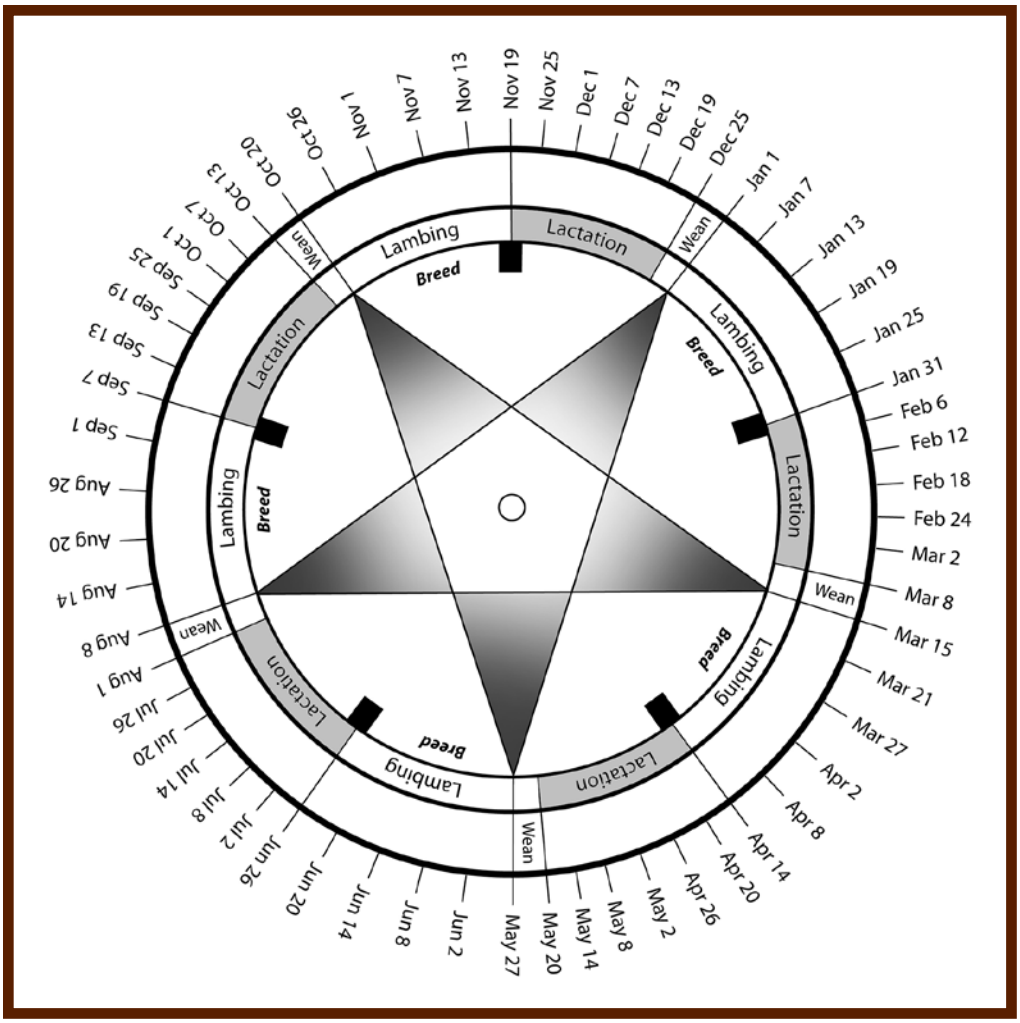

Figure 2: The Star system for managing ewes to obtain five lamb crops per year.

The Star system is illustrated in Figure 2 and was designed for managing five groups of ewes. One week intervals of the calendar year are depicted in a circular fashion, with the limbs of the star pointing to the onset of five separate lambing / breeding periods. Each of the five segments totals 73 days, approximately one-half of the length of a typical gestation period, and is further subdivided into lambing, breeding, lactation and weaning periods. According to the figure, lambing and breeding periods occur at the same time, which means one group of ewes is being bred while another is lambing. Each of the points of the star coincides with a group of ewes. If that group of ewes is being bred, then the onset of their lambing season can be found by tracing back the first limb of the star, while the second limb indicates the onset of their subsequent breeding season. Each group of ewes being bred will lamb two segments later (73 days x 2 =146 days) and be subsequently rebred at the next segment 73 days after that. Ewes are allowed 30

days to get bred and will lactate for 36 to 63 days depending on when they lamb. All lambs born within a segment are weaned at the same time regardless of age, with one week being allocated as the weaning period. Ewes that fail to become pregnant during a breeding period could be held over and enter the next breeding period 73 days later. Over time, the more productive ewes, which are capable of becoming pregnant out of season, could be selected, resulting in the majority of ewes in the flock either breeding or lambing at every third point of the star. Advantages of the Star system include:

1. Greater productivity of ewes
2. Steady supply of marketable lambs and improved cash flow
3. More efficient use of labour and facilities
4. Fewer rams needed, as the number of ewes to be bred should not exceed 1/3 of the total flock

Producers must consider several issues before proceeding with an accelerated lambing program. Three of five breedings in the Star system occur out of season and ewes bred out of season tend to have fewer lambs; this means that very fertile, long breeding season, maternal breeds will need to be used for best results. Rams are capable of breeding year round, but fertility and libido decline out of season so light treatment may need to be considered, especially when terminal type breeds are used. Because ewes will be lambing and lactating during the fall and winter months, and lambs will be weaned early, feed requirements will be greater. Therefore, to justify accelerated lambing programs producers must carefully weigh the additional costs against the expected revenue. Knowing how to effectively induce fertile estrus out of season will be crucial to the success of accelerated lambing programs.

2. Pregnancy

The average duration of pregnancy in sheep is 147 days, with a range of 144 to 151 days. Animals carrying twins and triplets will give birth sooner than those carrying singletons bred on the same day. Maintenance of pregnancy in the ewe is dependent upon ovarian hormones for approximately the first 50 days of gestation; thereafter, placental-source hormones are capable of supporting pregnancy alone. The date that the first lambs should be expected to be born can be calculated from the date that the ram was introduced. However, caution is advised as viable lambs have been born following gestations as short as 138 days.

The average duration of pregnancy in does is 150 days, with a reported range of 147 to 155 days. There is no tendency for animals carrying twins to have a shorter gestation, but those carrying quadruplets have been reported to kid three days sooner than singletons. Does tend to kid more frequently during the day.

Birthing facilities should be made ready at least two weeks before the expected arrival of the first lambs or kids. One month before lambing or kidding, bred females should receive a booster vaccination with a multivalent clostridial vaccine that is protective against *Clostridium perfringens* type C and D, *Clostridium chauvoei*, *Clostridium septicum*, *Clostridium novyi* and *Clostridium tetani*. If the animals have not been vaccinated previously, the initial vaccination should occur at least two months before lambing or kidding with a booster administered one month later. This is to ensure that the ewes and does have adequate

protection against clostridial diseases when they are most vulnerable as well as enable them to pass that protection to their offspring via the colostrum.

Pregnancy Diagnosis

Pregnancy diagnosis in the flock or herd is often not considered, but can be an important management tool. Research has shown that the maintenance cost of a single open ewe can consume the profits of several other productive ewes. The main reason that pregnancy diagnosis has been underutilized is that until very recently, there has been no practical and economical method of diagnosing pregnancy in small ruminants. Several methods of pregnancy diagnosis are listed below.

Ram / Buck with a Marking Harness / Return to Estrus

For registered flocks (sheep) or herds (goats) there must be an interval of at least 17 or 21 days, respectively before the introduction of another male to keep pedigrees straight. Generally, a vasectomised ram or buck would be best utilized here so that the integrity of the pedigrees and the restrictions of the breeding season can be maintained.

A ram with a crayon marking harness is placed with the ewes towards the end of the breeding season. This method is useful for determining the fertility of, for example, another possibly questionable ram, or to gain some idea of the pregnancy rates for the season. This method tends to be unreliable because some open ewes may not be detected in estrus, and aggressive rams may mark pregnant ewes, with up to 30 percent of pregnant ewes actually standing to be mounted by a ram as if they were in estrus.

Since goats often display more overt signs of estrus, exposing them to an intact buck and observing the response may be quite effective, but not perfect. Many does will display signs of estrus when pregnant and non-pregnant does will not display estrus behaviour during the anestrous period.

Abdominal Palpation (Ballottment)

Ewes are placed in the sitting position and the lower abdomen is palpated for the presence of fetuses, including an attempt to assess the number of fetuses. With does, palpation is best performed on the standing animal. In both species, fetuses can usually be palpated after about 120 days of gestation, but skill in this procedure requires experience and even then is difficult to perform on fat animals or animals with very full abdomens.

Does with an enlarged uterus due to hydrometra may be falsely diagnosed as pregnant. (Refer *Pseudopregnancy* on page 44 of this module.)

Blood Tests

Progesterone

During the breeding season measurement of progesterone concentrations is not very useful unless accurate breeding dates are known. Each time an animal has an estrous cycle progesterone concentrations will increase regardless of pregnancy status. Therefore, in ewes, progesterone would be most useful between days 20 to 25 following estrus. Outside of the breeding season progesterone will remain elevated in some animals even if they are not pregnant.

With does, progesterone may be useful if the day of breeding is known and blood progesterone levels are assessed 20 to 24 days later. Progesterone levels in does may also change in accordance with the estrous cycle regardless of pregnancy status. Accuracy of progesterone tests for pregnancy range from 70 to 80 percent.

Estrone Sulfate

In ewes, this test is most accurate from 70 days of gestation onward but cannot predict the number of fetuses. In does, estrone sulfate may be used to determine pregnancy status from 40 to 50 days of gestation onward.

Pregnancy-Specific Protein B

Pregnancy-specific protein B (PSPB) is produced by the fetus of all ruminant species. This is a new test, in terms of pregnancy diagnostic techniques, and not all laboratories will be able to perform it. This test never missed a pregnancy when used to evaluate ewes between 26 and 106 days of gestation, but unfortunately also classified 17 percent of open ewes as pregnant. As a result, it cannot be considered to be an accurate test. With does, PSPB has been used to diagnose pregnancy from 21 days post-breeding onward. Non-pregnant and pregnant does may be misclassified with this test.

Ultrasonography

Real-time, B-mode ultrasonography, where the fetus can actually be visualized moving about on a black and white screen, has essentially replaced the much older A-mode systems, which were based on sonar or Doppler sound technology. B-mode systems rely on the emission of high frequency sound waves emitted from the hand held component, called the transducer, and represent the best overall method of pregnancy diagnosis in sheep and goats.

The basic principle of these systems is that sound waves emitted from the transducer bounce off various tissues back towards the transducer, are ultimately received and interpreted by sophisticated electronics within the control unit, and an image is generated. The lower the frequency of the ultrasound wave, the greater the depth of penetration through multiple layers of tissue, but there is a cost of a loss in resolution, or fine detail. Transducers come in two basic types, linear array and sector. Linear array transducers are by far the most versatile and popular style in use by veterinarians. Linear array transducers emit sound waves perpendicular to their flat surface and produce rectangular images, whereas sector scanners emit sound waves at angles and produce pie-shaped images. Linear array transducers are useful for both intrarectal and flank scans. Sector scanners are not useful for intrarectal scanning, but are the preferred format for flank scans as they enable viewing of a much greater area of the abdomen at one time making it easier to count fetuses. Two approaches to determining pregnancy in small ruminants are described below.

Intrarectal Scanning

Intrarectal scans can be useful for diagnosing pregnancy from approximately day 19 or 20 to approximately 100 days of gestation using a linear array transducer. Most operators attach the transducer to a short piece of plastic pipe to enable its insertion into the rectum. Sector scanners are often too large to insert into the rectum and by design are nearly impossible to direct towards the area of interest via this approach. An ideal window for diagnosing pregnancy by intrarectal ultrasonography in small ruminants is 35 to 55 days post-breeding as it is very easy to visualize the pregnant uterus and most operators will be capable of examining several animals in a short period of time. After 100 days, the uterus has often descended too far into the abdomen, beyond the depth of penetration of the sound waves, and a flank scan will be necessary. The ability to count fetuses with a linear array transducer is limited because of a relatively narrow field of view compared to a sector scanner.

Flank Scanning

Flank scans can be performed with a linear array transducer, but are best performed with a sector scanner. Wide-angle, low frequency sector transducers enable visualization of nearly the entire uterus, enabling an accurate assessment of pregnancy status and fetal numbers. Flank scans with a low frequency transducer can be performed from 45 to 50 days of pregnancy onward, with the most accurate

fetal counts occurring with scans performed between 45 and 90 days. Because of the reduced image quality characteristic of low-frequency transducers it can be difficult to visualize the non-pregnant uterus, but this is seldom an issue. Given adequate facilities, skilled operators have scanned up to 300 ewes per hour. Individual ewes can be restrained on their hind end, but this tends to increase the workload and slows progress when many animals need to be checked. Does will usually not tolerate any other position except standing. With both species, the ultrasound operator must have easy access to the right side of the abdomen just ahead of the udder.

Good facilities and careful handlers are the keys to a successful outcome. The operator will be unable to view the image in the bright sunlight so some method of shrouding the operator and the ultrasound machine must be accomplished. A small chute with a head gate located within a darkened enclosure works well for ultrasounding sheep and goats and has the added effect of calming the animals. (Figure 3.) Many operators performing flank scans prefer to be seated and have the animals standing adjacent to them in an elevated chute. Such a system can be easily constructed, employing small ramps at either end of the scanning chute. Remember that the ultrasound operator will need to work on the right side of the animals when performing flank scans. Ultrasound operators should be contacted well in advance of their arrival at the farm to determine what will be needed.

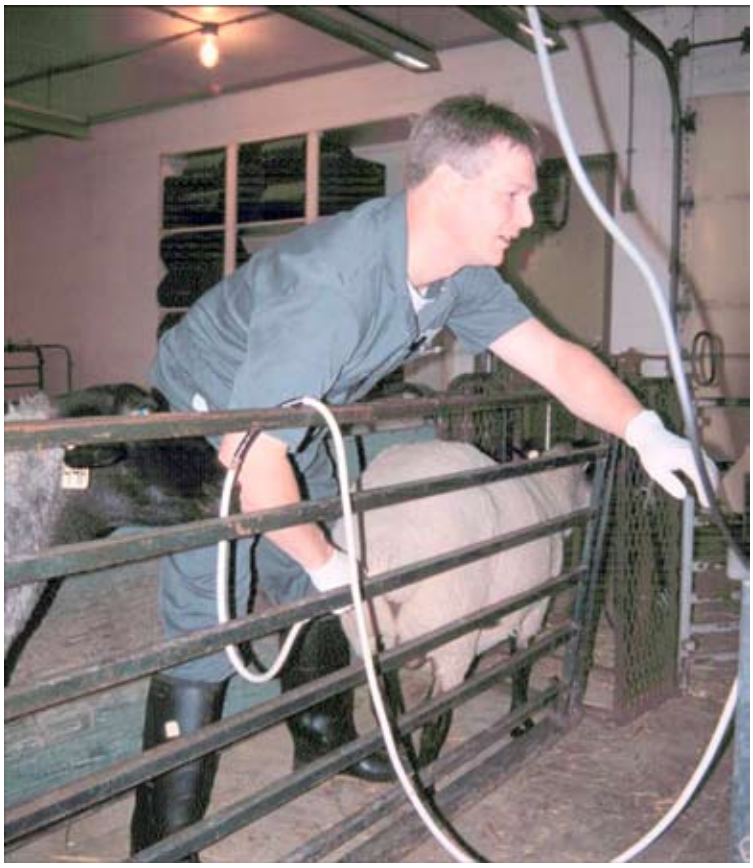

Figure 3. Chute designed to enable transrectal ultrasonography in ewes.

Despite the visualization of positive signs of pregnancy, not all ewes will lamb. Loss of a pregnancy or a twin, especially before 40 to 50 days of gestation, can and does occur frequently. Similarly, losses occur with does. Losses occurring around the time of pregnancy diagnosis can be reduced by minimizing stress on the animals. For other causes of early pregnancy losses, refer to the health module of this manual.

Late Gestation Problems

Prolapsed Vagina

Prolapsed vagina occurs in the later stages of pregnancy in mature ewes and does. It usually appears as a cherry-red, fist-sized ball just below the anus, and essentially is the vagina literally turned inside out (Figure 4).

Figure 4: Prolapsed vagina in a ewe

Factors that influence the occurrence include:

1. **Breed**—Genetic predisposition is the most important risk factor in both sheep and goats. The incidence is highest in the coarse wool breeds of sheep, whereas strict culling has helped to virtually eliminate the condition from several of the fine wool breeds.

   In goats, it has been claimed that this condition is most often seen in Saanens.

2. **Feed**—Hay or pasture, containing a high percentage of alfalfa or other legumes, has been implicated as a cause due to plant estrogens. The real significance of plant estrogens in these feeds is unknown and probably minimal. High-fibre diets that lead to more frequent defecation and drier manure have also been suggested as a cause. Feeding better quality feed or slowly increasing the quantity of grain in the diet may help.

3. **Condition**—Overweight (obese) animals and animals carrying multiple offspring are predisposed to this condition. Animals kept in confinement and unable to exercise may also be more susceptible.

4. **Standing Vertically**—Ewes and does forced to stand on their hind legs to feed out of hay racks during late gestation may have a higher incidence of prolapsed vagina. Routinely standing at angles less than 45 degrees, a common situation in goat milking parlours, is not known to affect the incidence of prolapsed vagina. (Very late gestation does should have been dried off and, therefore, will not be entering the milking parlour anyway.)

Vaginal prolapses should not be ignored. Early cases may only appear when the animal is lying down and these should be monitored for progression. Complete prolapses involve more swelling of the vaginal tissue and the prolapse remains even when the animal is standing. Generally, it is advisable to have complete prolapses corrected within 24 hours of their appearance so as to prevent excessive straining and permanent damage to the vagina. Continued straining will often lead to prolapse of the rectum and ultimately death of the ewe or doe. Many ewes and does with prolapses are unable to urinate properly because of involvement of the urethra and bladder and can become sick because of a failure to urinate.

Several options exist for correction of prolapsed vagina. The most consistently effective approach is to have a veterinarian replace the prolapse and suture the vulva closed. Once this has been done the female must be watched closely for signs of birthing and the suture untied when lambing or kidding is imminent. If the female does not lamb when expected the suture can often be retied and close observation should be continued. Another popular option is to insert a prolapse paddle (Figure 5), designed for ewes, into the vagina.

Once inserted, the external portion can be tied to the wool to hold it in place. Ewes are supposed to be able to lamb with the paddle in place; however, very often the fetus becomes entrapped by the paddle. Paddles are also prone to falling out and are less effective in does. A number of different harnesses have also been designed, with varying success, to hold prolapses in place.

Figure 5. Prolapse paddle 'Bearing Retainer'

Control of prolapsed vaginas should be based on culling affected ewes and does after weaning and not keeping any of their offspring as replacements. This disease is highly heritable, from both the maternal and paternal sides. Animals have a tendency to prolapse repeatedly. Careful feeding management may also be part of a prolapse management program.

Hypocalcemia

Clinical cases tend to be limited to situations where only grass hay is fed or the animals have been deprived of feed.

Hypocalcemia or low blood calcium is a relatively rare condition in ewes, but is more common in dairy does. Hypocalcemia may also occur in very high producing dairy does after kidding where it is commonly called milk fever. Most legume feeds contain adequate levels of calcium; therefore, clinical cases tend to be limited to situations where only grass hay is fed or the animals have been deprived of feed.

Feeding high calcium levels before parturition has been implicated as an inciting cause of milk fever in cattle, sheep and goats, but recent research in dairy cattle indicates that the dietary acid-base status expressed as the cation-anion difference may be the real cause. Nowadays in dairy cattle it is very common to feed mineral supplements fortified with the anions chloride and sulfur during the last 10 to 14 days of gestation to achieve the proper balance with the cations sodium and potassium. Avoiding feeds containing excessive levels of potassium, or neutralizing the high potassium feeds by preparing a blended ration using other low potassium feeds, is also critical.

It is important, especially in dairy goat operations that the nutrient content of the various feeds be determined and a proper ration developed to optimize performance. Achieving the right cation-anion balance will stimulate the absorption and mobilization of calcium and will prevent the occurrence of milk fever. Research in sheep and goats has shown that cation-anion difference has a similar effect on calcium metabolism. Fortunately, even in dairy does, hypocalcemia occurs much less frequently than in cows, but if problems are being encountered a ruminant nutritionist should be consulted and perhaps the dietary cation-anion difference can be adjusted. Hypocalcemia is considered a management disease. Careful attention to feeding management of small ruminants late in gestation and in early lactation is critical to both the prevention and management of this disease.

Initially, affected ewes and does appear agitated and may exhibit muscle tremors. As the condition progresses the animal will be unable to stand and will often lie with her legs outstretched and may appear

to be comatose, or in some cases exhibit convulsions. Treatment will involve the careful administration of calcium, and the condition can be prevented by feeding more alfalfa or providing a calcium-containing mineral supplement suitable for sheep and goats. Hypocalcemia may also occur secondary to pregnancy toxemia in goats.

Pregnancy Toxemia

Pregnancy toxemia (pregnancy ketosis) usually affects ewes and does in late gestation... poor feed quality and multiple fetuses are typical precipitating causes.

Pregnancy toxemia (pregnancy ketosis) usually affects ewes and does in late gestation and occurs when there is insufficient energy in the form of glucose (blood sugar) to supply the needs of the mother and the fetuses. A similar condition may also occur in dairy does during the first four weeks of lactation and is called lactational ketosis if there is insufficient energy in the diet to support milk production.

In late gestation, fetuses are growing very rapidly, and if the amount of energy available in the diet is not sufficient to meet these needs, pregnancy toxemia is likely to occur. Ruminants are generally very efficient at converting plant energy into glucose, largely through the efforts of rumen microbes. However, poor feed quality and multiple fetuses are typical precipitating causes. When energy demands outstrip supply then stored body fat is used, which will lead to the production of ketones. Excess ketones in the body (ketosis) depress appetite which tends to further complicate the situation, leading to a downward spiral in clinical status. Some ewes are more prone than others to developing toxemia following feed deprivation, but a breed predilection has not been reported. Usually, the first sign of trouble is that the ewe or doe is not eating properly and is off by herself. Most of these animals are dull and depressed. Sometimes affected animals appear blind.

As the condition worsens, muscle tremors, weakness, uncoordinated movement, teeth chomping and foaming at the mouth are followed by an inability to stand and a near comatose appearance. Animals displaying any of these signs should be examined by a veterinarian as similar signs may occur with other diseases including hypocalcemia and polioencephalmalacia.

Does experiencing lactational ketosis usually have a poor appetite and weight loss. Some does may also appear to be irritable, but the condition rarely progresses to the severity seen in pregnant animals.

Prevention of pregnancy toxemia is based on proper feeding of ewes and does in late pregnancy. Expectant mothers carrying multiple fetuses require over twice as much feed energy as those carrying single-

tons. Ultrasonography may be used to determine which animals are carrying multiple lambs; an alternative is to feed all animals as if they were carrying multiple offspring. Efforts should be made to ensure that all pregnant females have adequate body condition as they enter late gestation (3 to 4 on a 5-point scale). For complete analysis of body condition, refer to Appendix 1, Body Condition Scoring on page 55 of this module.).

Ewes and does should be observed carefully during the last 30 to 40 days of gestation. Those ewes with large, very full looking abdomens are probably more likely to be carrying twins or triplets and should be separated from those with slimmer bellies and fed 0.1 to 0.2 kg (0.25 to 0.5 lb.) of grain per day in addition to good quality hay. Animals should also never have restricted access to water, especially in late gestation, as this will negatively affect feed consumption.

3. Parturition

Preparation

Prior to parturition, any excessive wool or hair should be sheared from the udder and perineal regions of the ewes or does. This procedure will aid hygiene and allow you to visualise any dystocias.

Furthermore, lambs and kids receive better nutrition when they can easily nurse and are not sucking on wool or hair

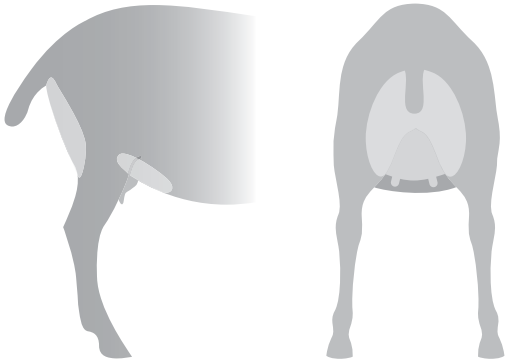

Figure 6: Shear off any excessive wool or hair.

Signs of Lambing

Ten days before lambing the udder begins to fill and the teats become swollen with colostrum. Progressive swelling of the vulva continues from approximately 10 days before right up until lambing. Body temperature declines approximately 0.5°C in the last 48 hours before birthing and is associated with a decline in progesterone. On a practical basis, rectal temperature can be monitored twice daily in an otherwise healthy ewe and when it falls below 39.2°C, most ewes will lamb within 48 hours. In the last few hours before lambing, ewes stop eating and

separate from the rest of the flock. If watched closely, the ewe may be seen to raise her head and purse her lips occasionally in conjunction with periodic uterine contractions. As the contractions become more frequent and intense the ewe may be seen to strain forcibly. Usually, the most obvious sign of lambing is the appearance of the chorioallantois or water bag. Occasionally, the water bag will have broken within the vagina in which case the fleece will appear wet. The normal birthing presentation is for the lamb to be positioned upright with the forelimbs extended and the nose appearing shortly after the feet (Figure 7).

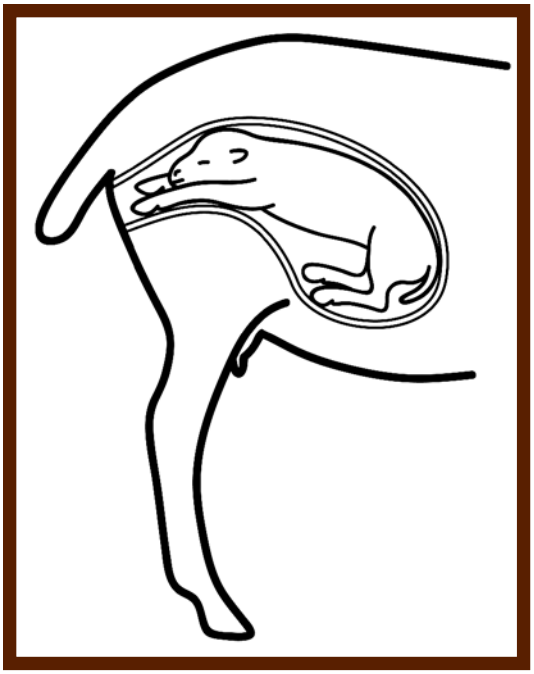

Figure 7. Typical anterior, upright presentation of a fetus

Delivery should only take a few minutes and should be complete within 30 minutes at the most. The first lamb born, especially if is a singleton, may take the longest amount of time, with subsequent lambs being born more quickly. Maiden ewes generally require more time to give birth than older ewes, and up to a one hour delay between lambs is not uncommon.

Signs of Kidding

Does demonstrate relaxation of the pelvic ligaments, usually accompanied by swelling and elongation of the vulva, four to 10 days before giving birth. The udder typically enlarges greatly in the last several days of gestation, but may become severely engorged weeks before, requiring milking to relieve stress (remember to save the colostrum for the kids). Most does experience discomfort in the last few hours before delivery, displayed as restlessness and lying down and getting up frequently. The water bag is the first sign that delivery is imminent and the doe will have uterine contractions, evidenced by an abdominal press. Delivery of the kid should take no more than 30 minutes, with multiple kids being delivered all within two hours.

Birthing Problems (Dystocia)

Fortunately, the vast majority of lambs and kids are born without incident. Intervention may be required for any one the following circumstances:

1. The ewe or doe has been straining for more than 30 to 40 minutes without progress.
2. The water bag is visible and no progress has been made after 30 minutes.
3. A limb or tail appears alone and no progress is being made after several minutes of straining.
4. The lamb appears to be stuck. There has been no progress for several minutes since the limbs have appeared.
5. The head of the fetus is visible with no limbs present.

To prepare for possible intervention the following should be available:

- Soap—one that is safe for obstetrical use, such as Betadine scrub
- Obstetrical lubricant
- Shoulder length, plastic, disposable obstetrical sleeves
- Lamb snare, soft rope, or rolled gauze
- Clean towels
- Clean, warm water in a clean (obstetrics only) pail
- Halter to retrain the ewe or doe

The use of chlorhexidine scrubs and very strong iodine-based disinfectants should be avoided as these can be very irritating to the vagina and uterus and may cause irreparable damage to the uterus. Obstetrical lubricants containing polyethylene polymer, for example J-Lube®, should not be used, as leakage of these products into the abdomen, as a result of a uterine tear or caesarean section, may result in death of the ewe or doe. K-Y jelly is preferred.

The use of OB sleeves is always recommended as they are cleaner than most bare arms and protect the operator from several diseases transferable from sheep and goats to humans. Obstetrical sleeves are

always to be discarded after each use; do not save them to use between birthing females. It is essential that they are securely discarded (such as immediately placing in a burning barrel) so that dogs and sheep/goats cannot be exposed to them later.

Two-inch rolled gauze can be easily transformed into a soft rope for providing traction on limbs and should be discarded after a single use. (Gauze has the added benefit of being available in a sterile package.) One loop of the rope must be placed above the fetlock and the other below. This is done to protect the newborn's joints from the traction placed on the leg during delivery. One separate rope is to be placed on each limb.

In many cases it is possible to obtain a suitable grip, especially around the head, just with a sleeve-covered hand.

Rules

- ***Cleanliness***
- ***Gentleness***
- ***Be aware of your limitations***

Rule # 1 Cleanliness

Cleanliness should be utmost in the mind of the operator who is preparing to intervene. Poor hygiene can lead to a severe infection of the uterus and death of the patient. The ewe or doe must be suitably restrained. Tying with a calf halter often works well in most circumstances, and having an assistant to hold the animal and prevent excessive movement generally makes the whole process much more pleasant. The area around the anus and vulva should be washed clean of any feces or blood. Any excessive water should be dried away using either paper or cloth towels, so that dirty water is not dripping from the wool and being carried into the reproductive tract by the operator. A fresh, clean sleeve should be put on and lubricant applied generously to the finger, hand, and forearm portions. Prior to the examination, finger nails should be trimmed so as to avoid perforation of the sleeve. After use, the sleeve should be discarded and all towelling should either be discarded or thoroughly washed before re-use. Do not wash re-usable towelling in the washing machine in your house, unless suitable precautions have been taken to prevent disease transmission from the barn to the house. (The use of disposable products is the best way to maintain cleanliness and control disease transmission.)

Rule #2 Gentleness

All obstetrical interventions must be as gentle as possible. Excessive force rarely achieves satisfactory results and can lead to damage, or even death, of the ewe or doe. Kids and lambs are very fragile and surprisingly little force may result in separation of a limb joint.

Rule #3 Be Aware of Your Limitations

Most obstetrical procedures are most easily performed in standing animals. The pregnant uterus naturally falls away from the vagina into the abdomen and gravity will help to relieve some of the pressure imposed by the fetus or fetal parts on the pelvis and vagina. If the animal is unable to stand then perhaps the dystocia is very severe, very long standing, or complicated by a medical condition, in which case veterinary assistance should be sought. Most animals are born in the upright and anterior presentation with the head resting on the extended forelimbs (Figure 7, page 30). It is also very common for lambs or kids to be born in posterior presentation. If the hind limbs are flexed underneath the fetus in posterior presentation this is commonly referred to as a "breech" presentation and delivery will not be possible without correction.

Once your hand has been inserted into the vagina and identification of the fetal parts has been achieved, the usual first step is to push the fetus back into the uterus (repulsion). In some cases it may not be possible to push the fetus all the way back; however, in many cases just a couple of centimetres may be all that is needed. It is important to constantly reassess the situation. Make sure that all of the limbs in the vagina are attached to the same fetus and that the viability of the fetus is not being compromised. Any more than two limbs usually means that there is at least one more fetus present. The hock joint of a hindlimb feels very different from the knee joint of a forelimb so it is prudent to familiarize yourself beforehand by palpating the limbs of other newborns. Most successful interventions are completed in less than five minutes. If no progress is made in 10 minutes, then something else must be done. Avoid the “slightly better expert” sequence in which several individuals have a go at the situation, as this invariably compromises the viability of the dam and her offspring. Do not be afraid to seek veterinary assistance. It is most helpful to establish a relationship, before the lambing or kidding season, with a veterinary service that offers food animal emergency services. Veterinarians are typically generous with advice and are invaluable resources regarding flock/herd health. The educational value of a farm visit can far exceed the costs associated with examining and treating an individual animal.

Once the lamb or kid has been delivered, check that it is breathing. Many newborns may at first appear dead, especially after a protracted delivery. Clear the nostrils and mouth of placental tissue and mucus, then rub the chest and body vigorously using a clean towel. Swinging

the lamb about in a circle should be avoided as it makes it more difficult for the lamb to breathe because of excessive force on the diaphragm. Avoid mouth to nose resuscitation because of the risk of disease spread. Once normal breathing has been clearly established, the newborn should be placed in front of its mother so that she can continue to lick off her offspring and begin the bonding process. Always remember to check the uterus for additional offspring. **Again, remember to be clean and gentle.** Antibiotics are not indicated except in cases involving dead lambs, or if the health of the ewe/doe has been compromised. Consult your veterinarian regarding the choice and use of antibiotics. Disinfection of navels to prevent infection is commonly done and should be based on the advice of your veterinarian.

The coarse wool sheep breeds selected for meat production have the highest prevalence of dystocia and most cases problems are due to either fetal oversize or a small pelvis (feto-maternal disproportion). Excessive fat surrounding the vagina or a non-stretching vagina and vulva may also be involved. Maiden ewes do not have any higher prevalence of dystocia than older ewes. However, one-third of ewes experiencing dystocia, due to feto-maternal disproportion, did so again the following year. Therefore, it is prudent to cull affected ewes.

Most dystocias in does are due to relative fetal oversize. Other causes include more than one fetus entering the birth canal, head and limb deviations or various uterine abnormalities. Dystocias are more commonly seen in Nubians (multiple kids), Saanens (single births) and Pygmy goats (fetal head and limb deviations).

Ringwomb

***Ringwomb** can look and feel surprisingly similar to a twisted uterus (uterine torsion) and a veterinarian is often required to make the final diagnosis.*

This is a condition in which the cervix fails to open and enable passage of the fetus into the vagina. Ringwomb occurs relatively frequently in ewes, but is uncommon in does. In most cases, it is obvious that the birthing process has started as the ewe will have isolated herself from the rest of the flock and will be experiencing uterine contractions. Most affected ewes will not bear down, as if to push the fetus out, as this process will not occur unless the fetus engages the cervix. When examined, the cervix will only be open enough to enable the entrance of one or two fingers. Since the vagina is very relaxed, in preparation for delivery, it often very easy to feel fetal parts through the vagina, so a concerted effort to locate the cervix must be made. When faced with this problem, you may wait one hour after the onset of labour for further progress before making a decision to intervene.

In some cases, the cervix may be dilated just enough to enable a hand to enter the uterus. Proceed with caution. In these circumstances, the cervix may just be slow to dilate and the hand and arm may be used to attempt to gently open the cervix. (Be very careful. The cervix of small ruminants is easily ruptured. Just because you can get your hand through the cervix, this does not mean that you will be able to deliver a fetus through it.) If no progress is made within 10 minutes, then these cases may be considered to be ringwomb and a caesarean section is indicated.

Infrequent monitoring of the lambing flock is the most common reason ewes with ringwomb are missed, resulting in the loss of lambs, or both the ewe and the lambs. In does, varying degrees of failure of cervical dilation may occur and are often linked to low calcium levels, hormonal imbalances, season and breed. Often the doe appears to be experiencing some weak uterine contractions, and without timely intervention the uterus will fatigue.

The cause of ringwomb is not completely understood. Cervical softening and dilation are associated with changes in hormone concentrations in late gestation and just prior to lambing. Excessive levels of plant estrogens in the diet and mineral deficiencies had once been implicated as potential causes, but have since been ruled out. More recently, a genetic predilection has been reported, with an increased incidence in inbred lines.

4. Care of Newborn Lambs and Kids

Preparation for the Newborn

In confinement style production units, mothers and newborns should be housed together in mothering pens for 24 hours to encourage bonding and prevent stealing of lambs and kids. Suitable pen dimensions are 1.2 by 1.5 metres (four feet by five feet). Feed and water should also be available for the mother. The pens must be clean and dry, with sufficient bedding to protect the newborns from becoming wet and chilled.

In pasture style units, mothering pens are not used, but providing protection from the elements is still necessary; rain for extended periods of time or a sudden spring snow storm can cause devastating lamb/kid losses.

What to Expect from the Newborn

Newborns should be standing within 20 minutes of birth. Shortly after standing they will make their way to the udder to nurse. Misshapen teats, low udders or excessive wool or feces can impair the nursing process. Newborns can be checked frequently to assess their feeding status by observing them for abdominal fill. (Refer to the health module.)

If newborns are too weak to nurse or if the mother refuses to allow them to suckle, they will need to be fed colostrum within two hours of birth.

***Birth weight** is often underestimated.*

To accurately administer colostrum over a 24 hour period, you will need to weigh the newborns.

Feeding and Storing Extra Colostrum

Lamb/kid nurse nipples are available at farm supply stores. Very weak newborns will need to be fed by stomach tube. (For guidance on using a stomach tube, refer to the health module.) The initial feeding should be at a rate of 50 mL per kg (23 mL or 1 oz. per lb.) of body weight and lambs and kids should receive a total of 200 to 250 mL per kg (3 to 4 oz. per lb.) over a 24 hour period.

Colostrum can be obtained by milking the mother or from healthy flock/herd mates and is not the same as milk. Colostrum is a very thick excretion only available in the first milking after giving birth. Thereafter, the quantity of antibodies in the milk decreases substantially.

Colostrum should be frozen in 50 mL (2 oz.) quantities and can be safely stored for up to six months in a chest freezer. Thawing and warming to body temperature should be done slowly, using warm water only, as microwaving and excessive heat will destroy the antibodies. Colostrum from goats may be used for sheep and vice versa. Cow colostrum may also be used; however, in all cases colostrum from another species represents a poor second choice. Furthermore, the feeding of cow colostrum may cause a fatal anemia in some lambs.

When using cross-species colostrum, refer to relevant portions in the nutrition module and problems with lactation in the health module. Adequate colostrum consumption is multi-factorial, and all aspects are critical for neonate survival.

Taildocking and Castration

Taildocking and castration should preferably be performed within the first 24 hours of life after adequate colostrum has been consumed. If these procedures are not done in the first day, it is critical that they be done within the next seven days to minimize complications and still be as humane as possible. After this, the risk of complications increases dramatically. (Refer to Taildocking and Castration in the health module.)

Fostering Lambs and Kids

Indications for fostering newborns include:

- rejection of offspring,
- weak newborns,
- too many newborns,
- illness or death of the mother,
- disease prevention.

After adequate consumption of colostrum, lambs and kids can be raised on milk replacer and weaned onto solid feed within three to four weeks of age, or they can be cross-fostered onto another mother to be raised to weaning.

There are a variety of techniques for cross-fostering. Fooling the mother into believing that the animal is her own offspring by scent manipulation is very commonly done. If her own lamb or kid has been lost, then the fresh carcass can be skinned and the hide tied onto a foster animal. Alternatively, birth fluids from the foster mother could be used to wash the foster animal, or the placenta tied onto the foster animal for a period of time. It is helpful, in sheep, to tie the forelimbs of the foster lamb so that it appears to be awkward like a newborn.

Another method is to place the ewe in a small pen with stanchion or head gate along one side. Ideally, the lambs should not be able to access the ewe's head. The ewe and lamb(s) should be left together for two full days, then the ewe released. If she accepts the lamb(s), put them in a mothering pen for a few days to continue the bonding process. If she rejects the lamb(s), further attempts are likely to be unrewarding. The stanchion also works well for poor mothers who have rejected their own lambs.

Similarly, does may be tied so they may see the kid(s), but are unable to harm them. Every few hours the kid(s) are allowed to nurse while the producer restrains the doe. After a few sessions the doe will not need to be restrained and eventually may be housed in a small pen until she has bonded with the kid(s).

As a rule, poor mothers should be culled at the first opportunity.

5. Postpartum Problems

Retained Placenta

Normally, the placenta separates from the lining of the uterus right after birth. Ruminant mothers will usually eat the placenta as an instinctive way of removing scent and protecting their offspring from predators. However, most would say that the shed placenta should be removed from the birthing area as its ingestion may lead to digestive upset or choking. Fortunately, retained placenta (failure to pass the afterbirth within 12 hours of birth), is an uncommon occurrence. Most ewes or does will not require specific treatment unless they appear to become dull, depressed and have an elevated body temperature in excess of 40.5°C (normal body temperature is 39.5 ± 0.5°C). These signs of illness are actually due to metritis (see the next topic) which develops secondarily to retained placenta. If signs of illness are noticed, you should consult your veterinarian to determine a suitable course of treatment. In does, only part of the placenta may be visible as does tend to eat what is accessible. In all cases, attempts to remove the placenta by pulling on the exposed tissue should be avoided as this may lead to permanent damage to the uterus and will most definitely predispose the dam to uterine infection (metritis).

Metritis

Metritis is a very severe infection of the uterus occurring within the first few days after delivery of the lambs or kids. Metritis often follows retained placenta and occurs much more commonly in does than ewes. Typical signs include fever in excess of 40.5°C (104.9°F), depression,

and reduced or absence of appetite. The presence of a very smelly, dark red, watery vaginal discharge is a classic sign of metritis. This disease is life threatening and veterinary attention should be sought immediately.

6. Causes of Infertility

Intersexes

Intersexes are animals that are neither completely male nor completely female and are a relatively common occurrence in goats, though relatively rare in sheep. Some affected animals are hermaphrodite, possessing both ovaries and testes, while others possess either testes or ovaries and are referred to as male or female pseudohermaphrodites, respectively. Male pseudohermaphrodites occur more commonly than all other types of intersexes, especially in dairy goats originating from western Europe, Saanen Toggenburg and Alpine, for example. In goats, there is an "intersex factor" linked to the polled gene. Most affected animals must possess two polled genes (homozygous polled) to be affected and since the polled gene is dominant in goats, and because the intersex condition is not always expressed in homozygous animals, not all polled animals will be affected. Affected animals may appear to be mostly male, mostly female, or a mixture of both; however, their testes do not produce sperm and they are not able to reproduce.

Chimeras are another less common type of intersex in goats and basically carry a mixture of male and female chromosomes in various proportions within their bodies. This condition has nothing to do with the polled gene and is essentially the same as the "freemartin" condition in cattle, except that relatively few doelings born co-twin or co-triplet to a buck are affected. In cattle, approximately 90 percent of females born co-twin to a male are Chimeras or freemartins and are unable to reproduce. Like affected cattle, freemartin goats are unable to reproduce but goat freemartins are quite rare.

Intersex animals may have testes, a short vagina, an enlarged clitoris and possess masculine behaviour and odour. Usually, the opening to the urethra is located at a point somewhere between that of a normal female and a normal male. Usually, when intersex kids reach puberty they start to act more like bucks often butting and displaying the urination behaviour typical of a buck. Because the testes are located within the abdomen their ability to produce sperm has been destroyed, but their testosterone (male hormone) producing capability remains largely unaffected.

Intersexes often act and smell like normal intact males so they make excellent "teaser" animals for estrus detection. If the prevalence of intersexes is high in the herd, then a horned buck should be used. The avoidance of mating polled animals to polled animals will substantially reduce the number of pseudohermaphrodite-type intersexes in a herd, but will have no effect on the incidence of true hermaphrodites or chimeras.

Pseudopregnancy

Pseudopregnancy tends to occur with greater frequency in does bred late in the breeding season or when hormones are used to induce estrus outside of the natural breeding season.

Pseudopregnancy or false pregnancy is a fairly common condition in goats. The exact cause is not known. What is known is that it tends to occur with greater frequency in does bred late in the breeding season or when hormones are used to induce estrus outside of the natural breeding season, and that it may occur in unmated does. In all cases at least one corpus luteum, the structure responsible for producing progesterone and maintaining pregnancy, is present on one or both ovaries. Does may remain in the pseudopregnant state for a variable length of time. Durations of two months, three months, or perhaps as long as five months, the length of a normal gestation period, have been observed. Other names for this condition include hydrometra and mucometra in reference to the variable fluid accumulation and associated abdominal enlargement that occurs in some does. The term "cloud burst" is often used to refer to the eventual evacuation of typically cloudy, watery fluid when the pseudopregnant state is finally resolved. In other cases, does may fail to cycle for a period of time then display a bloody vaginal discharge which could be easily confused with an abortion. Does may have only one episode or may have repetitive episodes of pseudopregnancy during the same breeding season.

Diagnosis is based on a history of anestrous and ultrasonographic evidence of uterine fluid accumulation. The incidence in some herds may exceed five percent.

Short Estrous Cycles

Short estrous cycles often occur naturally in does as they move into the breeding season. Introduction of a buck before the breeding season may also induce short estrous cycles.

Cystic Ovarian Disease

Cystic ovarian disease is relatively unheard of in ewes, but is a common clinical diagnosis in does. Mature ovarian follicles measure approximately 10 mm with follicles greater than 12 mm being considered cystic. Generally, owners notice that affected animals appear to display heat at four to seven day intervals with several of these episodes occurring in succession. Very little is known about the cause of this condition, but there is speculation that heredity, plant estrogens from legume-rich diets, and calcium and phosphorus balance may be involved. The diagnosis should include a thorough history and an ultrasonographic examination of the ovaries. Treatment is very similar to that used for cattle and success is usually determined by a return to normal cycling.

Hormone Therapy to Manipulate Estrus or Terminate Pregnancy

The use of prostaglandin F2 alpha to manipulate the estrous cycle or terminate pregnancy in goats during the breeding season often results in a shortened subsequent estrous cycle following its use. Fertility may be reduced at estrus periods following cycles of abnormal length. The use of prostaglandin F2 alpha is not associated with estrous cycle abnormalities in ewes.

Endometritis

A low–grade inflammation of the uterine lining (endometritis), may also cause short estrous cycles. Endometritis may affect fertility and is often left untreated as it is not easily diagnosed.

Poor nutrition is a frequent cause of anestrus and poor fertility.

Nutrition

Poor nutrition is a frequent cause of anestrus and poor fertility. Animals must have adequate protein and energy in their diets and specific deficiencies of phosphorus, iodine, copper and manganese have been linked to impaired fertility including abortion and the birth of weak kids and lambs. Inadequate deworming programs may also result in nutrient-

robbing parasite loads. When the diet is inadequate the reproductive function is the first sacrifice.

Toxins

Various plants have been documented as causes of abortion in sheep and goats, but those that cause abortion are not commonly found in western Canada. Legume plants may produce enough estrogenic substances to negatively affect ovulation rates and cause early loss of pregnancies. Dewormers containing levamisole, cambendazole and albendazole have been associated with pregnancy loss and fetal defects; therefore, careful use, in consultation with your veterinarian, is advised.

7. Management of Breeding Rams and Bucks

Breeding Soundness Evaluation

In order for a ram or buck to be a successful breeder he must be physically sound, possess satisfactory semen quality and be able to mate with females. Only physical soundness and semen quality are evaluated during most breeding soundness evaluations, leaving mating or serving ability to be observed by the producer or evaluated by conducting a serving capacity test. (Refer to page 49 of this module.)

Most large animal veterinary clinics are capable of performing breeding soundness evaluations of rams or bucks.

Physical Condition

Lameness, impaired vision, and poor body condition are common examples of physical impairments to a ram's or buck's breeding ability and these animals should be replaced prior to the breeding season.

Scrotal Circumference

Scrotal circumference is probably one of the most often overlooked physical attributes associated with breeding potential. Scrotal circumference is a measure of the volume of testicular tissue, which is an indication of sperm producing ability. In other words, males with larger testicles have greater scrotal circumferences and are able to produce more sperm. Although most reproductive traits are not highly heritable, scrotal circumference is. Efforts should be made to select males with

larger scrotal circumferences as it is well correlated with age at puberty of female offspring and the ability to produce multiple offspring.

Larger scrotal circumference ... is well correlated with age at puberty of female offspring and the ability to produce multiple offspring.

Males with small scrotal circumferences may be capable of producing satisfactory semen, but they will lack the volume to cover a reasonable number of estrous females. The long term effects on reproductive performance will have economic implications for generations to come as the consequences of female ovarian capacity become evident.

Scrotal circumference varies with the time of year. Measurements should not be taken outside of the normal breeding season unless light treatment has been used, as these will not be representative of the true physiological measurement. Seed stock producers should aim to produce yearling rams with scrotal circumference measurements in excess of 33 cm (13 in.) Mature rams weighing over 110 kg (250 lb.) should measure greater than 36 cm (14.2 in.). Ram lambs measuring less than 30 cm (11.8 in.) should not be used for breeding. No specific guidelines exist for minimum scrotal circumference in goats; however, efforts should be made to select animals with larger scrotal circumferences. Most information seems to suggest that a reasonable minimum scrotal circumference for mature bucks, excluding miniature breeds, should be 25 cm (9.8 in.).

Following the measurement of scrotal circumference the veterinarian will palpate the testicles. The testes should be firm, not soft or hard, and should be freely moveable within the scrotum. There should also be no abnormal lumps at either the top or bottom of the testes or within the neck of the scrotum. The contents of the scrotum should be symmetrical; asymmetry is often an indication of defect or disease.

Figure 7: Excellent scrotal anatomy, ram

Semen Collection and Evaluation

In the majority of situations, the most efficient way to obtain a semen sample is by electroejaculation. Specialized ram or buck rectal probes are available and they can be easily attached to the same control unit used for bulls. There is growing opposition to the use of electroejaculation in livestock species, largely because of concerns that it is not humane; however, the procedure has been approved by the Canadian Veterinary Medical Association's Animal Welfare Committee. Only milliamperes of electrical current are used and a semen sample can be obtained with the application of less than six to eight volts. Skilled and experienced operators should be able to obtain a semen sample with minimal discomfort to the animal. Most veterinarians prefer to perform the electroejaculation procedure with the animal standing tied to a rail with a halter, but some may prefer to have the animal lying on its side. Bucks can be easily trained to serve an artificial vagina and this method of semen collection should be considered if semen is to be collected frequently for freezing and storage. Guidelines for semen evaluation are provided by the Society for Theriogenology, as are the reporting documents.

Serving Capacity

Serving capacity refers to a male's sex drive and ability to successfully to serve a female. To ensure success, managers of breeding flocks or herds should make an effort to observe the activity of the males during the breeding season. Males with adequate serving capacity should be interested in checking out the ewes, and have the desire and ability to complete several services within a given period of time.

In large multi-sire sheep flocks, careful observation of ram activity may not always be possible, so placing a ram with a few ewes to test serving capacity may go a long way toward improving flock reproductive performance. Up to 10 percent of rams may have very little interest in mating with ewes and just exist to interfere with other rams attempting to mate.

Use of rams with adequate serving capacity allows for an increase in the ewe to ram ratio, a decrease in the length of the lambing season and more uniformity in the lamb crop. Moreover, it has been shown that ewes selected for producing heavier lambs at weaning also produce rams with greater serving capacity. Serving capacity is heritable in cattle and poultry; therefore, it seems likely that it is also heritable

in sheep and goats. Placing sires in an AI program because they have poor serving capacity is not a solution to this problem.

Pasture Hierarchy in Rams and Bucks

Social dominance plays an integral role in the mating ability of rams and bucks. For the most part, older rams and bucks dominate the younger males and the social ranking at the feed trough or hay bale roughly predicts what will occur in the pasture breeding situation. Close observation will enable determination of the dominance order by the number of head butts each animal delivers on his flock/herd mates. When housed in a confined space, dominant rams may mate 12 to 15 times per day while subordinate rams only mate two to three times per day.

Bucks can be more aggressive and may spend all of their time fighting rather than breeding so is a wise idea to select a single buck to breed a selected group of does. Rams should be of similar age groups and allowed sufficient space so as to avoid excessive fighting when multi-sire mating systems are employed. Use of odd numbers of rams is more effective than even numbers. For example, three rams per 100 ewes will be more effective than two, because with only two, fighting activity might exceed breeding activity.

8. Reproductive Problems in Rams and Bucks

Rams

Brucella ovis

Brucella ovis, a venereally spread bacteria, is the primary cause of reduced reproductive performance in flocks in many parts of the world. Fortunately, this disease is not common in Canada, but it is present. Signs within a flock include non-pregnant ewes, a decreased number of lambs born per ewe, abortions, the birth of weak lambs and a longer lambing season. Rams usually become infected by breeding infected ewes, typically within multi-sire breeding systems. Infection may also be transmitted by rams mounting each other or contaminated urine coming in contact with mucous membranes within the nose and mouth.

Infected rams may be detected during a breeding soundness evaluation. Typical signs include a mass within the tail of the epididymis (part of the duct system linking the testis with the urethra) located at the bottom of the testis. In many cases there are no obvious lesions and infected rams may go undetected. There is no treatment for the disease except culling of affected rams. Infected animals may also be identified by serology. Other bacteria may cause similar lesions in rams, but tend to have a limited effect on flock reproductive performance. *Brucella ovis* is not a problem in goats.

Posthitis (Pizzle Rot, Sheath Rot)

Posthitis is inflammation involving the prepuce (pink-coloured tissue surrounding the penis). Affected tissue may look reddened and raw, and be covered by yellowish exudate. This condition is very painful, leading to a lack of interest in breeding. Occasionally, scarring associated with healing may be so extensive that the ram is unable to protrude his penis. Posthitis is caused by the feeding of excessive protein in the diet, leading to the excretion of high levels of ammonia in the urine. Ammonia is very alkaline and damaging to many tissues. Treatment of individual cases requires frequent application of antibiotic-containing salves. Feeding more grass hay verses high protein legume hay will prevent the problem from occurring.

Testicular Hypoplasia

Testicular hypoplasia means that the testes have not fully developed and remain much smaller in size than what is expected for a normal breeding age ram. Hypoplastic testes have reduced sperm production capacity, or may not be capable of producing sperm at all. Sperm morphology is often abnormal in affected males. Rams with only one testicle are not desirable for breeding purposes. Selection for rams with adequate testicular size will go a long way toward establishing a fertile flock.

Bucks

Gynecomastia

Gynecomastia is a condition in bucks whereby the normally rudimentary teats develop like those of a female and engorge with milk, while the testes continue to function normally. Such bucks are also susceptible to mastitis. Some very recent reports have noted that affected bucks may actually have an abnormal chromosome complement. Affected animals should be culled.

Posthitis

Posthitis also occurs in goats, with wethers being more susceptible than intact bucks. Treatment and prevention are the same as for rams. (Refer to *Rams, Posthitis* above.)

Sperm Granulomas

Any blockage in the tubular duct system within the testes can lead to a backup of sperm. Over time, sperm build-up becomes so severe that the fragile lining of the duct ruptures and sperm leak out into surrounding tissue. Sperm cells are recognized as foreign tissue; therefore, the animal's own immune system reacts to neutralize the threat. Eventually a mass of scar tissue surrounding the sperm, known as a sperm granuloma, forms. Sperm granulomas can become so numerous and large that they completely block the outflow of sperm from the testes and the animal becomes sterile.

Testicular Hypoplasia

As with rams, testicular hypoplasia means that the testes have not fully developed and remain much smaller in size than what is expected for a normal breeding age male. Hypoplastic testes have reduced sperm production capacity, or may not be capable of producing sperm at all. This condition is a common cause of sterility in bucks and many of these animals have been found to have an abnormal chromosome complement, usually possessing at least one extra 'X' (female) chromosome. (Normal males have an 'XY' chromosome complement.)

Sperm granuloma formation is most common in polled bucks. As bucks mature their testes usually develop and function normally, with most animals being able to successfully breed for at least one to two years. After that, a marked decrease in fertility may be noticed. As the condition worsens the testes undergo irreversible degeneration evidenced by small, shrunken, and overly firm testes. Scrotal circumferences in affected bucks reportedly decrease from greater than 30 cm (11.8 in.), common in mature bucks, to 20 to 25 cm (8 to 9.8 in.) or less. The occurrence of sperm granulomas and testicular generation has been linked to the polled gene. Most affected animals are homozygous polled (carry two copies of the polled gene); therefore, breeding of polled animals to polled animals will result in more frequent occurrence of this condition.

Appendix 1

Body Condition Score (BCS) in Sheep

from ***Body Condition Scoring in Farm Animals***

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Body condition scoring is an important management practice used by producers as a tool to help optimize production, evaluate health, and assess nutritional status. This practice helps evaluate their flock as to the amount of body reserves, particularly fat, an animal possesses. If body condition scoring is conducted at planned intervals throughout the production cycle, nutrition and management can be altered if needed.

The most critical times to body condition score animals during the production cycle include pre-breeding, mid-gestation, parturition, and weaning. The practice of body condition scoring is used mainly to increase economic returns through increased reproductive performance and realize more efficient feed costs.

Body condition scoring is done by palpation of the animal; this helps to avoid confusion brought on by colored animals (think of the black dress) and when long hair or wool is present. Evaluations look at the amount of muscle and fat cover in eight important anatomical points when assigning a body condition score. Once the score is determined, it can be compared to a desired condition score at a particular period of the production cycle for a species. At this time, a producer determines the appropriate nutritional changes or management needed.

Body condition scoring is a subjective practice. Sheep and goats are scored from 1 to 5, the lower the number, the thinner the animal. They are often assigned half numbers, for example, 2.5 or 3.5. Knowing how to body condition score is useful for individual animals, as well as for the herd or flock in general. Herd owners, veterinarians and nutritionists can make the proper adjustments to their feeding or health programs to reach the optimal body condition score for their animals.

To examine the animal, the person scoring must concentrate on the amount of muscle present, skeletal features, and fat cover in eight important anatomical points.

The animal should be standing in a relaxed position. It should not be tense, crushed by other animals or held in a crush. If the animal is tense it is not possible to feel the short ribs and get an accurate condition score.

Locate the last rib (the 13th). Using the balls of the fingers and thumb, try to feel the backbone with the thumb and the end of the short ribs with the finger tips immediately behind the last rib.

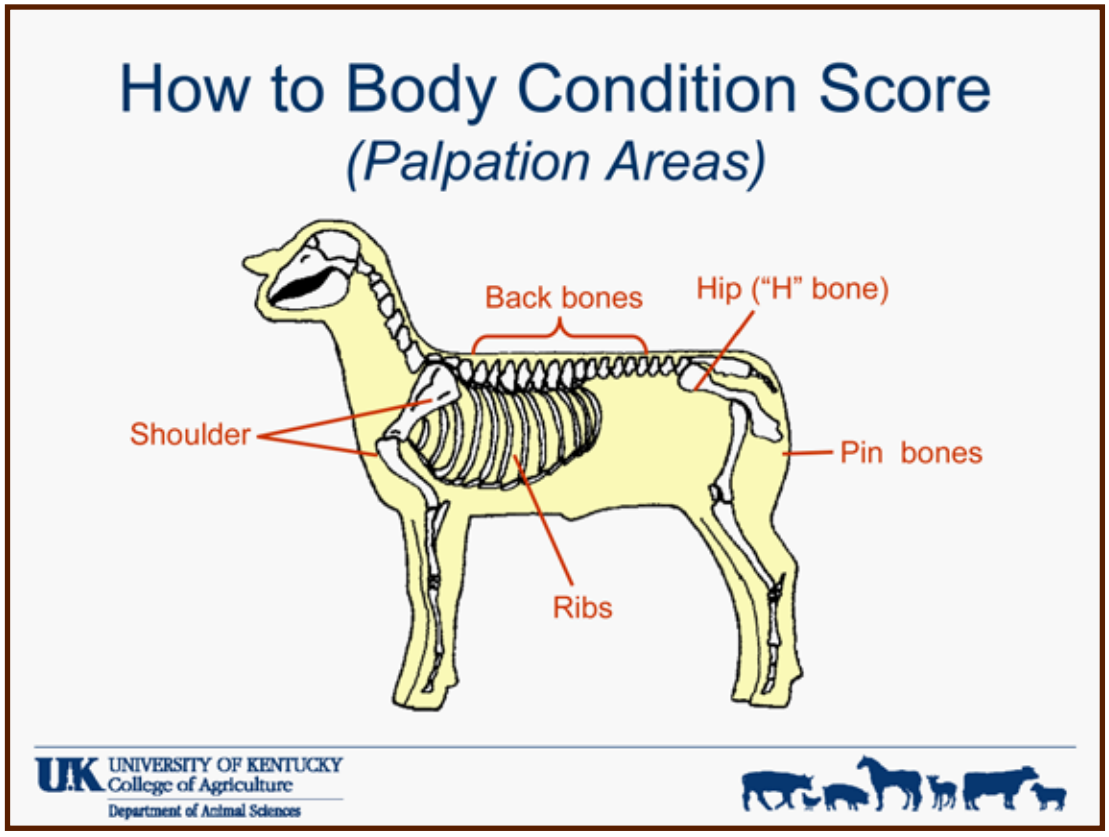
Feel the muscle and fat cover around the ends of the short ribs and over the backbone. Feel the fullness of the eye muscle.

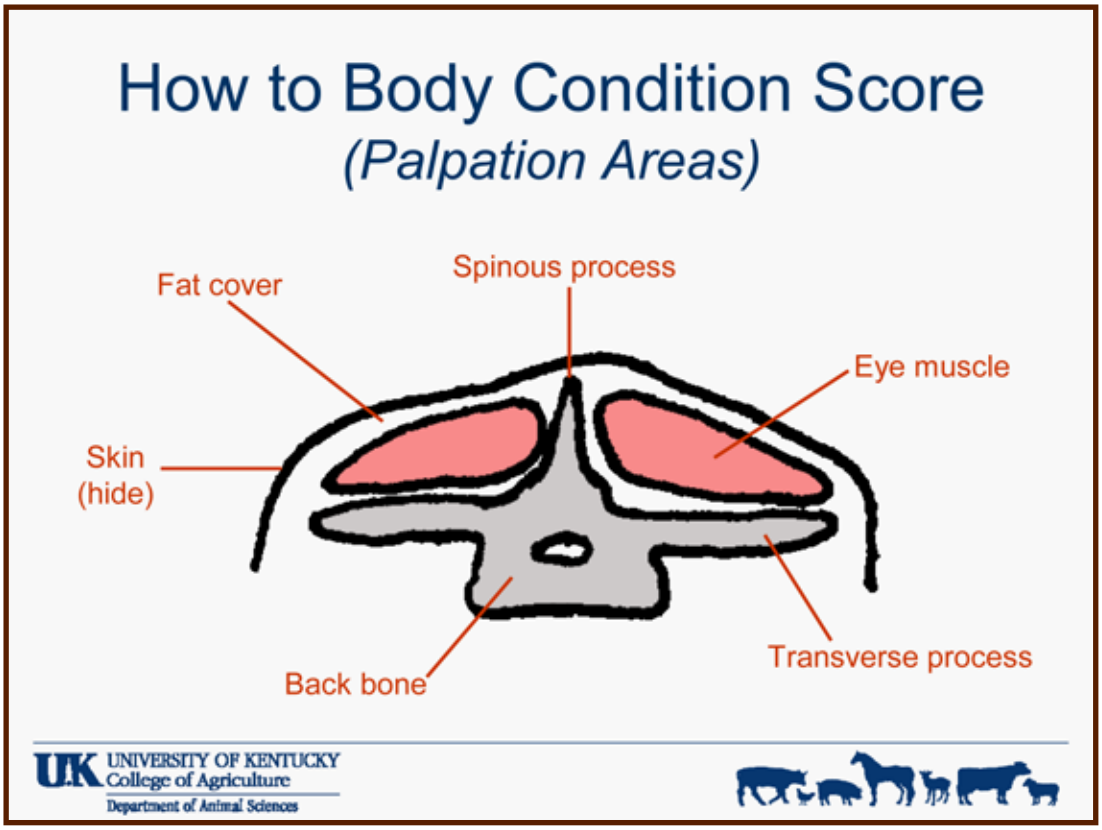
The degree of roundness of the ends of the bones, the amount of tissue between the bones and the fullness of the eye muscle determines the condition or finish of the animal the condition score.

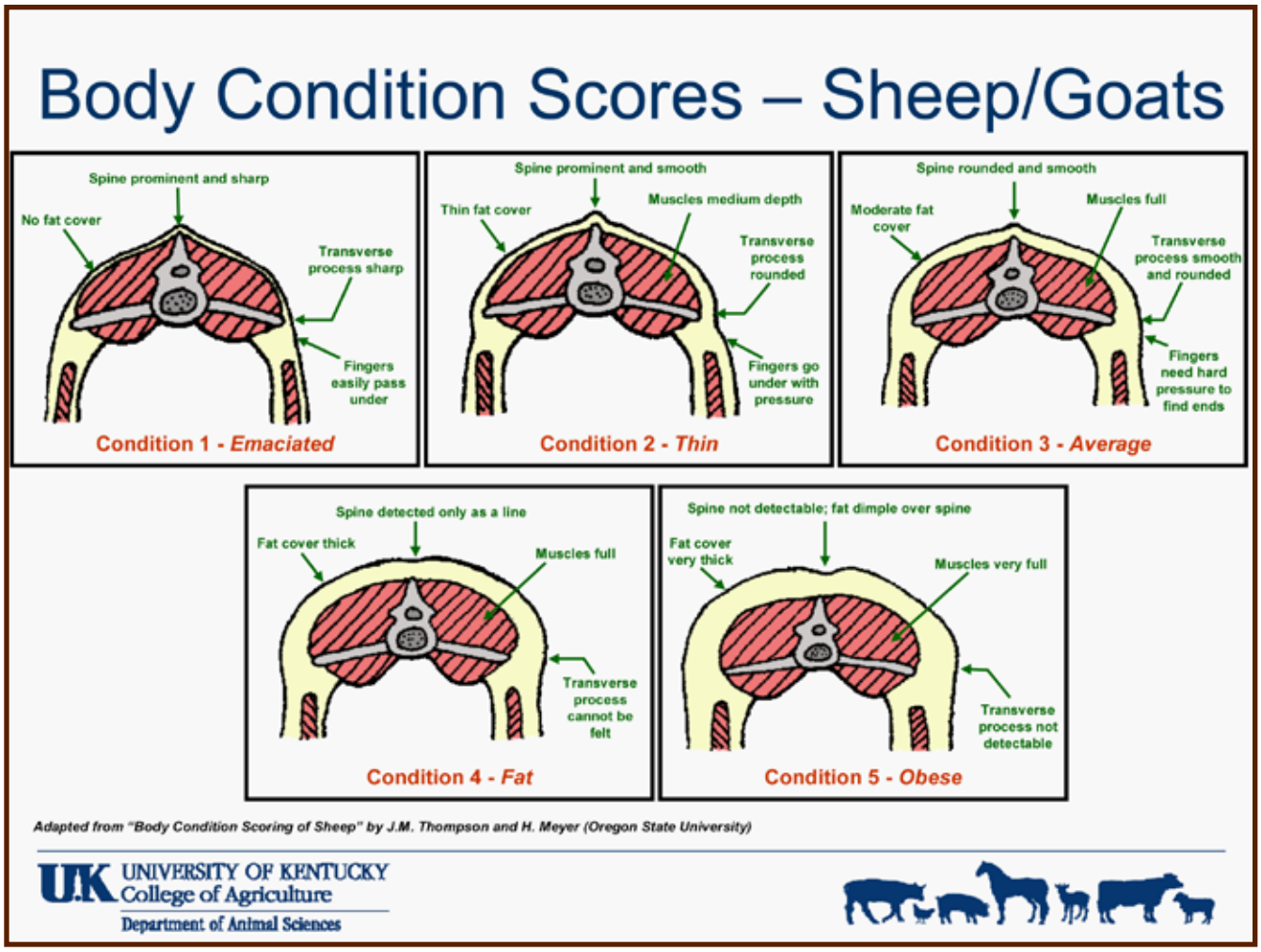
In addition, three factors must be considered when body condition scoring an animal.

- Gut fill, including stage of pregnancy.
- Amount of hair or wool.
- Amount of muscle.

Gut fill (feed and water intake) and stage of pregnancy can influence body condition score of an animal. Full and/or late gestation animals appear fatter and may mistakenly be scored higher, whereas animals that have very little gut fill may appear thinner and mistakenly be scored lower than their true body condition. Heavily muscled animals typically appear more round, and this can be confused with smoothness due to fat deposition. Similarly, light-muscled animals can be mistakenly viewed as thin. To evaluate expression of muscle, the area through the center of the round (or hindquarter) is least affected by fat. Animals with a lot of bulge and flair tend to be more heavily muscled. In contrast, animals that are angular and tend to be lighter muscled.


How to Body Condition Score
(Palpation Areas)
Back bones
Hip ("H" bone)
Shoulder
Pin bones
Ribs
UK UNIVERSITY OF KENTUCKY
College of Agriculture
Department of Animal Sciences


How to Body Condition Score
(Palpation Areas)
Fat cover
Spinous process
Eye muscle
Skin
(hide)
Back bone
Transverse process
UK UNIVERSITY OF KENTUCKY
College of Agriculture
Department of Animal Sciences



Condition Scoring Table			
Score	**Spinous process**	**Rib cage**	**Loin eye**
BCS 1 Very thin	Easy to see and feel, sharp	Easy to feel and can feel under	No fat covering
BCS 2 Thin	Easy to feel, but smooth	Smooth, slightly rounded, need to use slight pressure to feel	Smooth, even fat cover
BCS 3 Good Condition	Smooth and rounded	Smooth, even feel	Smooth, even fat cover
BCS 4 Fat	Can feel with firm pressure, no points can be felt	Individual ribs can not be felt, but can still feel indent between ribs	Thick fat
BCS 5 Obese	Smooth, no individual vertebra can be felt	Individual ribs can not be felt. No separation of ribs felt	Thick fat covering, may be lumpy and "jiggly"

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24. Figure 1. CIDR-G (Controlled Intra-vaginal Drug Release) – progesterone releasing vaginal implant for sheep and goats, and applicator.