



Innovative Technical Assistance & Transformative Education for Farmers and Ranchers in Arkansas



SMALL RUMINANTS FOR BEGINNERS & SMALL FARMERS

HANDBOOK

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Introduction

This handbook is a resource to complement the Small Ruminants for Beginners and Small Farmers webinar series.

About TransformAR

Innovative Technical Assistance & Transformative Education for Farmers and Ranchers in Arkansas

TransformAR is a statewide program to help farmers and ranchers, especially small-scale family producers, thrive through innovative technical assistance and transformative education. Specialists and extension agents will utilize a state-of-the-art mobile lab equipped to deliver on-farm, real-time analyses, generating indicators in key parameters that improve the accuracy of recommendations and the excellence of the University of Arkansas Cooperative Extension Service. The mobile lab will also be used extensively for hands-on demonstrations at educational events, such as workshops, field days, farm trials, county fairs, and expos. Additionally, TransformAR will implement a comprehensive outreach plan to increase the adoption of best farming practices, including webinars, workshops, seminars, and field days.

TransformAR goals are to:

- Improve the ability of farmers and ranchers to start and maintain successful agricultural and/or forestry-related operations
- Implement a comprehensive outreach program to promote best farming practices for sustainable agriculture
- Increase participation of farmers and ranchers in USDA programs

The objective of TransformAR is to promote best management practices for sustainable agriculture and strengthen local food systems. The mobile laboratory capabilities and education program will cover multiple areas of agriculture, such as crop production, animal husbandry, horticulture, agricultural engineering, agricultural economics, forestry, soil science, and fisheries science, as well as environmental and food sciences.

More information: www.uaex.uada.edu/TransformAR

Small Ruminants for Beginners and Small Farmers

Webinar	Topics	Pg
Part 1	Industry overview	3
	Planning	5
	Breeds	8
	Genetic improvement	11
Part 2	Pastures	13
	Nutrition	17
	Facilities	21
Part 3	Reproduction	24
	Health management	25
	Husbandry practices	30
	Predator deterrence	33
	Meat, milk, and fiber	34
	Marketing	39

1. Small ruminant industry overview

The small ruminant industry encompasses the commercial and subsistence raising of sheep and goats for meat, dairy, fiber, and vegetation management.

Market Trends

- **Rising Demand:** Consumption of alternative meats and dairy is growing in the United States, driven by diverse culinary interests and immigrant demographics.
- **Import Reliance:** The U.S. relies heavily on imports, bringing in roughly 50% of its goat meat and 75% of its lamb, mainly from Australia and New Zealand.
- **Sector Shifts:** Dairy goat herds expanded significantly over the past decade, while sheep production has diversified into hair and meat breeds alongside traditional wool.

Production Advantages

- **Low Resource Needs:** Small size allows high stocking density on small acreages or as companion grazers alongside cattle. Also, they have lower feeding demand than cattle, which is reflected in lower maintenance costs.
- **Vegetation Control:** Effective at managing brush, weeds, and invasive species.
- **Fast Return:** Rapid turnover and lower initial capital investments compared to cattle or large livestock. They are prolific, productive animals because they have short gestation periods, reach sexual maturity quickly, and frequently produce multiple offspring per birth.

Core Challenges

- **Infrastructure Deficits:** A shortage of localized processing and slaughter facilities creates distribution bottlenecks. Also, the costs are relatively high compared to cattle due to flat harvesting rates and lighter carcasses.
- **Veterinary Access:** Limited availability of specialized veterinary care. The costs of urgent services may also be high relative to the animal's value.
- **Health Management:** Vulnerability to internal parasites (like the *Haemonchus contortus* or barber pole worm), foot rot, and species-specific nutritional requirements (such as copper toxicity in sheep).

1.1 Sheep industry overview

The American sheep industry is a diverse and fragmented yet vital sector that manages roughly 5.2 million sheep across the United States.

- **Inventory:** ~5.2 million total head, including 3.3 million breeding ewes.
- **Top States:** Texas, California, and Colorado lead production.
- **Operation Types:** Small producers (<100 head) make up most farms; large Western ranches hold 80% of inventory.
- **Primary Outputs:** Meat (lamb and mutton) and shorn wool.
- **Market Share:** Accounts for under 1% of total U.S. livestock receipts.

- Consumption: Low domestic lamb consumption (~1.2 lbs per capita) compared to global peers.
- Vegetation management: Sheep have been increasingly used for vegetation management, for instance, solar grazing, where sheep graze in solar farms.

Key Challenges

- Predation: Vulnerable to coyotes, large cats, and domestic dogs.
- External Pressures: Market price volatility and synthetic fiber competition.
- Operational Constraints: Acute shortages of skilled labor and specialized shearers.

1.2 Goat industry overview

The U.S. Goat industry spans approximately 2.6 to 2.7 million animals nationwide, with demand significantly outpacing domestic production.

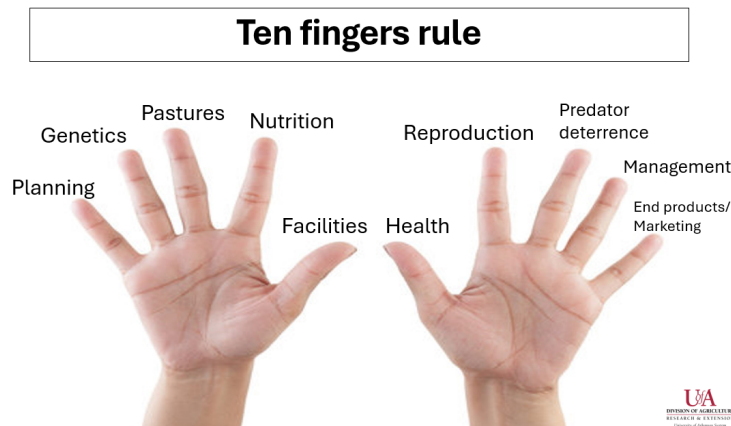
- Meat Goats: Comprise roughly 78% to 90% of the total U.S. goat inventory. Texas leads the nation, holding over 40% of the population and driving a large share of meat production.
- Dairy Goats: Number around 415,000 milk goats and kids, with primary production centered in Wisconsin, California, Iowa, and Texas.
- Fiber Goats: Angora and cashmere breeds represent a smaller niche, producing mohair and luxury wool, though numbers fell after historic program shifts.
- Ethnic & Religious Demand: A growing immigrant population and diverse cultural preferences sustain a strong, premium market for fresh domestic goat meat.
- Health Trends: Consumers look to goat meat as a lean, low-fat alternative to traditional red meats, and seek goat milk and cheese as allergy/intolerance-friendly dairy options.
- Targeted Grazing: Cities and agencies increasingly hire goat herds for sustainable brush control and wildfire prevention.
- Opportunity: Domestic supply meets only a fraction of overall consumption, keeping prices strong for local ranchers.

1.3 Small Ruminant Industry in Arkansas

Sheep and goat inventories are increasing in Arkansas. Comparing data from the Agricultural Census (USDA 2019 and 2024), sheep and goat inventories increased 44% and 11% (dairy goats 42%), respectively, which boosted sales by 117% and 57% (totaling more than 7 million in 2022). There were 3,618 farms raising small ruminants in 2022. Small ruminants play an important role in food security, as self-consumption of dairy and meat is very common. Besides, small ruminants generate extra income for family farmers and strengthen local food systems. As sheep and goat numbers increase, greater educational efforts are needed, especially since most producers are small farmers with little background in small ruminants.

2. Planning

Planning a successful, profitable sheep and goat operation requires defining clear, realistic goals and a comprehensive plan that accounts for all factors affecting animal production, health, and welfare, such as pastures and nutrition, facilities, breeds and breeding strategies, health care, predator deterrence, herd/flock and financial management, and marketing. Follow the 10 Fingers Rule.



Before getting started, elaborate on your farm management and business plans. Do your homework: consult reliable sources, talk to established producers, visit your county extension agent, and search for a veterinarian to establish a Veterinarian-Patient-Client Relationship (VCPR). Summarize what facilities you need to have in place, do an assessment of your pastures, check fencing requirements, consider your water sources, what their nutritional needs are, possible health problems, basic care, how to implement breeding programs, how you will handle the animals, predator deterrence strategies, and where you will market the products. It's important to review your resources and investments and estimate production and returns. You may want to develop a calendar for your flock/herd management with monthly activities to stay ahead of the game.

3. Basics of sheep and goats

Differences between sheep and goats

- Physical
 - Goats typically have narrow, upright horns. Sheep have curled horns, and female sheep often lack horns completely
 - Goats' tails point upwards, whereas sheep's tails hang down.
- Behavioral
 - Sheep are grazers, preferring grass close to the ground. Goats are browsers and prefer leaves, shrubs, and higher vegetation.

- Goats are curious, agile climbers, and more independent. Sheep are more flock oriented.
- Genetic
 - Sheep have 54 chromosomes and goats have 60, which is why hybrid offspring are extremely rare and usually unhealthy.
- Management
 - Goats require more secure containment because of their tendency to climb and test boundaries.
 - Sheep are easier to herd because of their preference to stay together.

Nomenclature

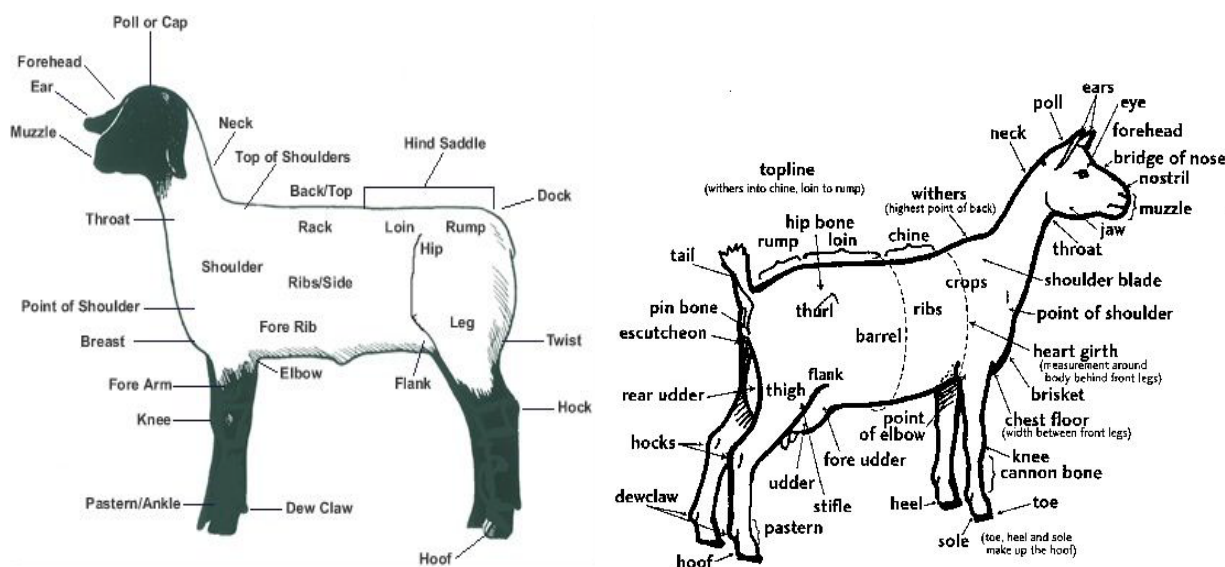
Category	Sheep	Goats
Species	<i>Ovis aries</i>	<i>Capra hircus</i>
Adult male	Ram	Buck or billy
Castrated male	Wether	Wether
Adult female	Ewe	Doe or nanny
Young animal	Lamb	Kid
Giving birth	Lambing	Kidding
Group	Flock	Herd
Meat	Lamb (young), mutton (older)	Chevon (general), cabrito (young)
Fiber	Wool	Mohair (Angora breed), Cashmere (cashmere breed)

Biology

Physiological Parameter	Sheep	Goat
Temperature, rectal	101.5-103.5, F	101.5-103.5, F
Heart Rate	70-80 Beats per minute	70-80 Beats per minute
Respiration	15-30 per minute	12-25 per minute
Rumen Movement	1-2 per minute	1-2 per minute
Estrous	14-20 Days	18-21 Days
Estrus	24-48 Hours	48-72 Hours
Gestation	144-151 Days	145-155 Days

Basic Anatomy

Knowing how to identify the different parts of a sheep's or goat's body is important for learning more about these animals, communicating with other producers and veterinarians, and general animal management. The figure below shows the basic anatomy of sheep and goats, respectively. You will notice that most parts of the body have the same name. Sometimes the tail of a sheep is called the dock if it has been shortened to prevent flystrike. The figure below also shows where measurements are commonly taken on goats, which are sometimes used in the genetic assessment of an animal.

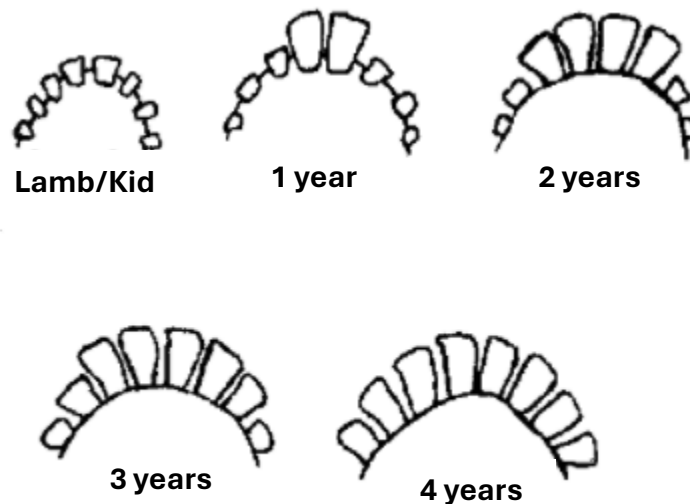


Basic anatomy of a sheep (left) and a nanny goat (right).

Identifying the age of sheep and goats

Being able to identify the age of animals is important for farm management, as animals of different ages can be worth different amounts on sale. For example, lambs are worth more than mature sheep per lb of body weight. The age of sheep and goats is often determined by examining their teeth. Figure below shows what the lower teeth of sheep and goats look like at different ages.

Lambs and kids will have small, sharp teeth that are gradually replaced by larger, permanent incisors. When a sheep or goat reaches 1 year of age, it becomes a yearling, and the two front teeth are lost and replaced with large permanent teeth. Around 2 years of age, the teeth next to the middle pair are replaced by permanent teeth, and at 3 years of age, the teeth next to them are replaced. After 4 years, sheep and goats should have four pairs of permanent incisors. The age of an animal older than 5 years must be estimated from the condition of the teeth, which can vary with diet. The teeth in older animals will spread, loosen, and eventually fall out, at which point the animal should be culled.



Teeth of sheep and goats at different ages.

4. Breeds

4.1 Sheep breeds

Sheep breeds are primarily classified by their production purpose (meat, wool, or dual-purpose), fiber type, and coat characteristics (wool versus hair).

Major Classification Categories

- **Fine-Wool Breeds:** Known for high-quality, dense fleeces with small fiber diameters (under 20 microns); highly adaptable to harsh climates.
 - *Examples:* Rambouillet, Merino.
- **Medium-Wool / Meat Breeds:** Bred primarily for superior carcass composition, rapid growth, and muscle shape rather than fine fleece.
 - *Examples:* Suffolk, Hampshire, Dorset, Southdown.

- Long-Wool Breeds: Large-framed sheep producing heavy, coarse fleeces with longer staple lengths; often adapted to high-rainfall areas.
 - *Examples:* Lincoln, Cotswold, Romney.
- Dual-Purpose Breeds: Balanced for both profitable wool and good meat production, often exhibiting high prolificacy (twinning/triplets).
 - *Examples:* Columbia, Corriedale, Polypay, Targhee.
- Hair Breeds: Adapted to hot, humid climates; they grow a mixed hair/wool coat that they shed naturally, eliminating the need for shearing.
 - *Examples:* Dorper, Katahdin, St. Croix, Barbados Black Belly.
- Dairy Breeds: Selected for milk production.
 - *Examples:* East Friesian, Lacaune.

4.2 Goat breeds

Goat breeds are primarily classified into four categories based on their primary agricultural purpose: dairy, meat, fiber, and dual-purpose/companion.

Dairy Goat Breeds

Dairy goats are raised for high milk production, used for fluid consumption, cheese, yogurt, and soap.

- Saanen: Large, all-white or cream-colored goats from Switzerland known as heavy, reliable milk producers.
- Nubian: Readily identified by long pendulous ears and a Roman nose; produces milk with a high butterfat content.
- Alpine: Athletic, versatile Swiss goats with varied color patterns that yield large volumes of milk.
- LaMancha: Characterized by very small ("gopher" or "elf") ears and consistent milk high in butterfat and protein.

Meat Goat Breeds

Meat breeds are selected for rapid growth, solid muscling, and environmental hardiness.

- Boer: Originating in South Africa, this is the leading commercial meat breed, recognized by a white body and a distinct brown head.
- Kiko: Developed in New Zealand from feral goats for high survivability, fast weight gain, and resistance to internal parasites.
- Spanish: A rugged American brush goat known for exceptional hardiness and foraging ability in rough terrain.

Fiber Goat Breeds

Fiber goats are grown for specialty textiles, fleece, and soft undercoats.

- Angora: Originating in Asia Minor, they produce silky white ringlets of mohair used in high-end fabrics.
- Cashmere: Not a single breed, but rather any goat capable of growing an insulating, downy undercoat harvested for cashmere “wool”.

Dual-Purpose & Companion Breeds

These breeds serve multiple functions, such as providing both milk and meat, or acting as manageable small-farm pets.

- Nigerian Dwarf: A miniature West African dairy breed that yields exceptionally high-butterfat milk.
- Tennessee Fainting (Myotonic): Known for a genetic condition causing stiffening when startled; kept as docile pets or light meat animals.
- Pygmy: Small, hardy African goats commonly kept as pets or small-scale meat producers.

4.3 Identification methods and record keeping

The primary identification methods for sheep and goats include official visual ear tags, electronic radio-frequency identification (RFID/EID) tags, and legible tattoos.

- Visual Ear Tags: Plastic or metal tags applied to the ear flap. They display serial numbers, individual IDs, or Flock ID numbers. They are inexpensive and easy to read from a distance.
- Electronic ID (EID/RFID): Microchips enclosed in ear tags. They transmit a unique number via radio waves when scanned with a digital reader.
- Tattoos: Permanent ink marks usually placed inside the ear or on the tail web. They are commonly used for registered purebred animals.
- Alternative/Temporary Marks: Crayons, paint brands, or neck chains. These are useful for short-term sorting or management but are not permanent or officially recognized for interstate travel.

Scrapie Program: In the United States, official identification (such as an approved ear tag or a legible tattoo with required documentation) is required to trace scrapie disease back to the flock of origin (www.aphis.usda.gov/animal-disease/sheep-goat/scrapie-tag).

You can order official free or low-cost identification tags through the USDA APHIS Scrapie Program by calling 1-866-USDA-TAG (1-866-873-2824).

Producers and others who handle sheep or goats in commerce who need additional tags or want a different type or color of tag may purchase official plastic, metal, or radio-frequency identification (RFID) tags directly from approved tag manufacturers. A flock or premises ID is required to order tags from these sources. A national premises ID is also required to purchase official 840 RFID tags or implantable devices.

Interstate Movement: Sexually intact sheep and goats generally require official individual or group identification before moving across state lines or entering public exhibitions.

Record keeping

Effective record keeping for sheep and goats requires tracking individual identification, lambing or kidding performance, health treatments, and regulatory compliance data.

- Notebooks or Barn Cards: Best for small operations (under 50–100 animals) using a dedicated page or card per ewe/doe for quick, hands-on pen-and-paper entries.
- Digital Spreadsheets: Programs like Excel or Google Sheets allow you to sort data, track individual lifespans, and calculate averages.
- Livestock Management Apps: Software and mobile tools automate health alerts, sync records across devices.

4.4 Genetic improvement

Genetic improvement in sheep and goats relies on structured selection, accurate record-keeping, and modern breeding technologies to enhance productivity, health, and hardiness.

Let's understand the concepts of two terms applied to genetic improvement:

- Genotype: The genetic makeup of an animal at a specific location (locus) or across the entire genome.
- Phenotype: The observable trait (e.g., weaning weight, fecal egg count, fiber diameter). Phenotype is affected by genetics and environment.

Key Traits and Heritability

You should identify and measure key traits aligned with your goals and define a genetic improvement strategy to achieve them. The trait's heritability will affect the genetic gain per generation. Heritability is the proportion of phenotypic differences among animals that are due to genetics and transmissible to the offspring. It ranges from 0 to 1 (or 0 to 100%). High heritability means selection based on phenotype works well, and genetic progress is faster. Conversely, low heritability means that selecting an animal based solely on its own record is risky because the environment strongly influences that trait, but it still needs to be included in a genetic improvement program.

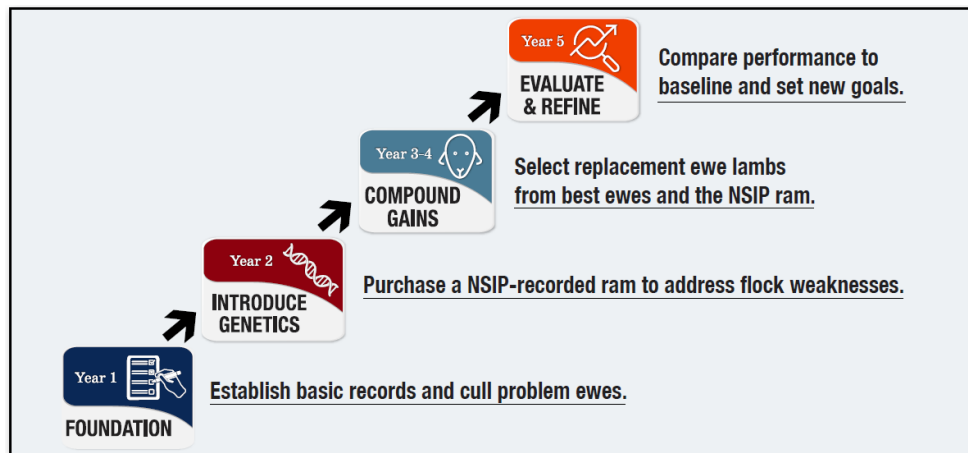
- High Heritability (0.30–0.50): Traits like growth rate, fleece weight, and staple length respond quickly to visual or performance selection.
- Moderate Heritability (0.15–0.30): Milk production and weaning weight show steady improvement through targeted selection.
- Low Heritability (0.05–0.15): Reproductive traits (litter size, fertility) and disease resistance respond slowly to direct within-breed selection and benefit more from crossbreeding or specialized genomic indexes.

Genetic improvement methods

- Estimated Breeding Values (EBVs): Tools like the National Sheep Improvement Program (www.nsip.org) provide numeric predictions of an animal's genetic merit, allowing accurate selection for traits you cannot see visually, such as parasite resistance.
- DHIR (Dairy Herd Improvement Registry): A nationally recognized program that monitors year-round milk volume, milk components (fat/protein), and somatic cell counts.
- Linear Appraisal: Visual trait assessments (www.adga.org) of body conformation and mammary systems that complement production records.
- Pedigree Analysis: Tools like the American Dairy Goat Association Performance Programs (www.adga.org) combine production data, type scoring, and DNA verification to issue accurate Sire Summaries and estimated breeding values.
- Genomic testing: genetic merit predictions that combine traditional pedigree and physical performance data with direct DNA (genomic) marker analysis to generate Genomic-Enhanced EBVs (GEBVs), which accelerate the identification of elite animals and improve accuracy.
- Culling and Selection: Regularly removing unproductive animals, poor mothers, or chronic health cases protects the flock average and optimizes herd performance.
- Reproductive Technologies: Artificial insemination (AI) and embryo transfer accelerate genetic gain by multiplying the influence of superior sires and dams.
- Crossbreeding: Crossing divergent breeds combines traits and boosts hybrid vigor (heterosis), rapidly boosting reproductive performance or hardiness in commercial flocks.

A 5-year genetic plan for your farm

The most advanced tools are only effective with a clear, patient, and executable plan. Genetic improvement is a marathon, not a sprint. The following five-year roadmap is designed to help producers build momentum, see tangible results, and create lasting change without feeling overwhelmed, as shown in the figure below.



Source: Quadros and Ahmad (2026, [FSA9630](#))

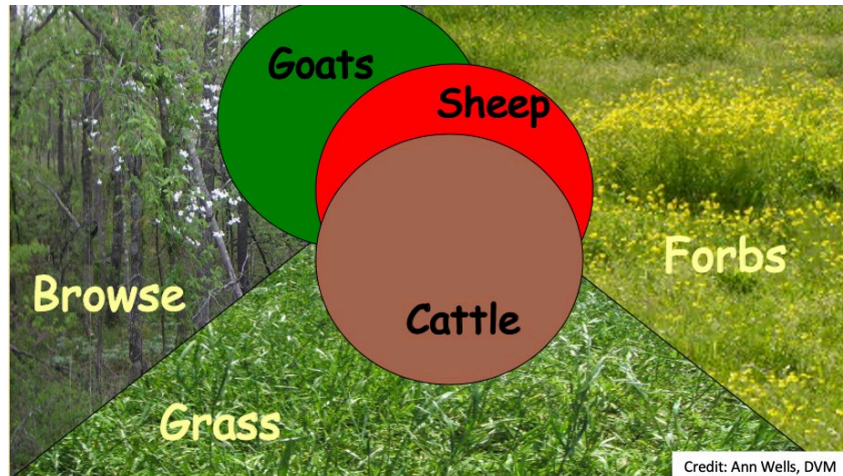
Traditionally, we have selected replacement animals based on phenotype (observable characteristics), pedigree, and progeny records. Nowadays, genomic selection holds the promise to offer faster, more accurate ways to improve traits that matter most, such as growth, maternal ability, parasite resistance, milk yield, and carcass quality. Genomic selection uses thousands of DNA markers spread across the entire genome to predict an animal's genetic potential. Instead of relying solely on an animal's own performance and parent average, we look directly at the DNA blueprint.

5. Pastures for small ruminants

Ruminants such as sheep, goats, and cattle can convert the nutrients they obtain from forages into useful products, such as meat, milk, and fiber. Forages are typically a more cost-effective way to provide essential nutrients than grain-based diets.

Rangelands are natural ecosystems dominated by native grasses, forbs, or shrubs that are suitable for grazing by wildlife and livestock, including grasslands, savannas, deserts, and tundra. Improved pastures are grazing land in which forage production is enhanced through management practices such as introducing higher-yield, higher-quality forage species, improving soil fertility, and implementing grazing management strategies to maximize productivity. In the U.S., there are two major distinctive forage-based production systems: range flocks and farm flocks. Rangeland flocks, predominantly in the Western U.S., are large commercial operations that use low-intensity grazing across vast, open land, while farm flocks, predominantly in the Eastern U.S., are smaller and more intensively managed on enclosed pastures.

Sheep and goats differ from cattle and from each other in how they graze, as shown in the figure below. In a pasture system, they may complement each other.



The best pastures for small ruminants like sheep and goats combine forage plants with high palatability, good nutritional value, and resilience to grazing, often utilizing a mix of cool-season and warm-season species.

Cool-Season Grasses (Spring and Fall Growth)

- **Tall Fescue:** Very tough and shade-tolerant but choose novel endophyte or endophyte-free varieties to avoid health issues and ensure better palatability.
- **Orchardgrass:** Highly palatable and nutritious with fast recovery after grazing; best used in a mix (up to 30%) with legumes.
- **Ryegrass (Perennial or Italian):** Establishes quickly and offers high sugar content, though it can be vulnerable to winter kill.

Warm-Season Grasses (Summer Growth)

- **Bermudagrass:** A heat-tolerant staple for southern pastures that provides solid summer forage.
- **Bahiagrass:** Resilient in poor soil and hot weather, though slightly lower in overall quality than bermudagrass.
- **Native Warm-Season Grasses:** Species like big bluestem and Indiangrass bridge the summer slump when cool-season grasses go dormant.

Forage legumes

Forage legumes provide high levels of protein, minerals, and digestible energy, making them a good feed source for small ruminants such as sheep and goats. Certain legumes, such as sericea lespedeza, contain condensed tannins that help reduce gastrointestinal parasite (worm) egg counts in small ruminants. They also significantly improve soil health by naturally fixing atmospheric nitrogen through a symbiotic relationship with root bacteria.

- White Clover: Excellent for permanent pastures and close grazing due to its lateral, stoloniferous growth habit that recovers well from grazing.
- Red Clover: A short-lived perennial that thrives in moister, slightly acidic soils, though it should be managed carefully as high intakes can impact ewe fertility.
- Birdsfoot Trefoil: Contains condensed tannins that naturally prevent frothy bloat, making it very safe for grazing sheep and goats on permanent pastures.
- Alfalfa: Delivers exceptionally high yields and protein levels in well-drained soils, though it requires rotational management to persist.
- Sericea lespedeza: warm-season perennial legume used as a natural dewormer to reduce gastrointestinal parasite, and coccidia loads in small ruminants because it contains condensed tannins ([Quadros, 2024](#), ACSRPC, Timely topics).

Important note: Lush, pure stands of spring legumes can cause potentially fatal frothy bloat. Maintain mixed grass-legume pastures (aiming for 40%–60% legume content), provide grass hay, or use rotational grazing. Establishment and persistence of some legumes may be a concern. Therefore, soil fertility, seed quality, inoculants, establishment method, and weed management should be considered.

5.1 Pasture management

The main goal of pasture management is to maximize persistence, productivity and quality in the most efficient, cheapest way possible. Good grazing management requires a basic understanding of two things: first, the growth habits of the pasture species we are trying to grow, and second, crop physiology.

Grazing management is necessary to control pasture conditions. If pastures are grazed too early, too short, or for too long, there is less leaf area available to intercept sunlight for photosynthesis; therefore, forage yield will be decreased, and the reserve won't be replenished, which may cause mortality. If pastures are grazed too late or maintained too high, they will reach physiological maturity; consequently, stems will grow, dead material will accumulate, and forage nutritive value will decrease dramatically. Farms that can divide pastures into smaller areas can exercise greater control over them and use them more efficiently. Grazing management strategies typically fall into two categories: rotational stocking or continuous stocking.

Under rotational stocking, pastures are grazed in sequence for short periods (from hours to days) to maximize pasture utilization, forage quality, and regrowth. This system provides the most control over pasture management in response to factors such as weather, herd size changes, and parasite infestations.

Under continuous stocking, animals remain in the same pasture area for long periods. Continuous stocking has reduced labor and lower investment in fencing and water distribution. However, it offers less control over responses to changing weather

conditions, animal numbers, and parasite infestations, and can also reduce pasture persistence, even in well-managed scenarios, because preferred species and patches can be overgrazed while less-preferred species and areas of pasture can be ignored.

In a very simplistic and practical approach, implementing a rotational grazing system requires fencing to create six to eight paddocks of similar size per group (at minimum) and rotating a flock or herd from paddock to paddock every 7 days or less, depending on the type of forage plant, forage growth and availability. Because it can take as little as 3 to 4 days for a parasite egg to develop into an infective L3, it is recommended that animals be moved to a new paddock within 1 to 3 days before reinfection occurs. If not moving regularly between pastures/paddocks, animals will spend extended periods in the shade or near water sources, where parasites thrive. Depending on the pasture configuration, moving animals every 1 to 3 days will discourage this behavior and decrease subsequent parasite loads.

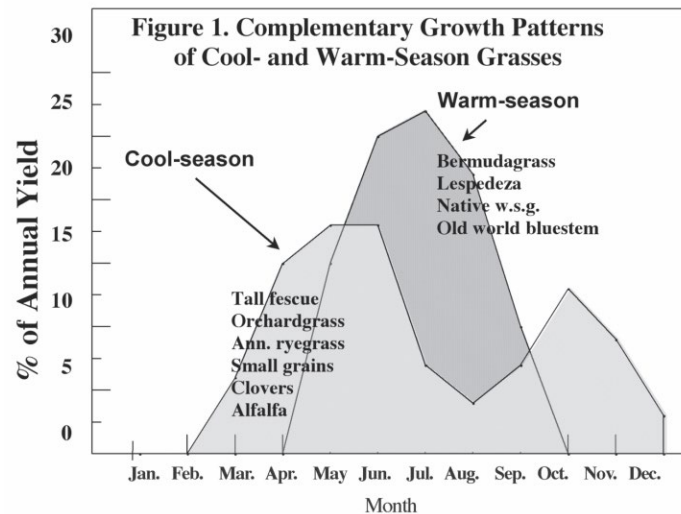
More intensive systems have more paddocks, allowing greater control over grazing duration and pasture recovery periods. Under ideal moisture and temperature conditions, most grasses are generally ready to re-graze within 14 to 28 days, depending on species and soil fertility. When pasture growth rates slow (due to drought or low temperatures), the grazing manager will inevitably be forced to reduce the time spent grazing each paddock, start grazing at lower pasture heights, and/or graze below the target post-grazing height, in addition to offering hay as extra forage.

Small ruminant producers can reduce the risk of parasite infections in their animals by properly managing forage plant grazing heights. Common cool-season perennial grasses such as tall fescue, orchardgrass, Kentucky bluegrass, and perennial ryegrass can be easily overgrazed if the producer leaves their animals in the pasture for too long. For tall-growing cool-season grasses, such as tall fescue and orchardgrass, it is recommended that animals begin grazing when they are 12 inches tall and end grazing when there is 4 to 8 inches of stubble height.

For short-growing grasses, such as Kentucky Bluegrass and perennial ryegrass, the recommendation is to start grazing at 6 to 10 inches and to graze no shorter than 3 to 4 inches of stubble to reduce ingestion of infective larvae. Warm-season perennial grasses such as eastern gamagrass, big bluestem and indiangrass can provide good quality forage during the summer months if they are grazed from a starting height of 16 to 22 inches down to an ending height of 6 to 12 inches. Grazing of warm-season annuals such as millet, sudangrass and sorghum-sudan hybrids should begin when the plants are 20 to 24 inches tall and end when they are 8 to 12 inches tall ([Glennon, 2024](#), ACSRPC, Best management practices).

A crucial factor to consider when managing pastures is the seasonal variation in growth among species. The goal is to reduce hay feeding and extend the grazing season to

improve farm profitability. Rotational grazing management and stockpiling pastures for fall and winter are key components of the grazing program. The system also involves adding forages that complement the existing forage base so that animals can be adequately supported from pasture for more days of the year.



Jennings (2022; [FSA2139](#))

6.0 Nutrition

Small ruminant nutrition focuses on feeding practices that provide animals with adequate nutrients to meet maintenance, growth, reproduction, and production requirements, while supporting rumen health and overall physiological function. Sheep and goats require the following essential classes of nutrients:

- water
- energy (carbohydrates, fats)
- protein
- minerals
- vitamins

Water is the most critical nutrient and is often the most overlooked. An inadequate water supply can significantly reduce feed intake, digestion, and performance. Sheep and goats generally require 1 to 3 gallons of clean, fresh water per day, with exact amounts depending heavily on weather, diet, and production stage. Water availability is particularly important in hot weather and during lactation, when requirements increase substantially. High-producing dairy goats may need 4 gallons or more of milk per day, depending on their milk yield.

Water quality is very important. Poor water quality (e.g., manure, debris, algae, bacterial contamination) may reduce water and forage consumption. Proper livestock water tank sanitation requires emptying, scrubbing, and disinfecting the troughs with a 10% bleach solution every week to every six months, depending on environmental conditions and animal use.

Energy is the nutrient most likely to limit performance in pasture-based small ruminant systems. It fuels vital functions, lactation, growth, and reproduction. Carbohydrates, particularly structural carbohydrates found in fibrous roughages, serve as the primary energy source for sheep and goats in forage-based diets. Rumen microorganisms ferment these carbohydrates into volatile fatty acids, which provide the majority of metabolizable energy used for maintenance, growth, and production. Additionally, fiber provides the physical structure that stimulates rumination (cud-chewing) and saliva secretion, which, in turn, buffers rumen acidity for healthy rumen function. Dietary fats are a concentrated energy source but must be included at appropriate levels, as excessive fat intake can negatively affect fiber digestion and rumen fermentation.

Protein plays a critical role in supporting rumen microbial populations (which in turn provide high-quality protein to ruminants), tissue synthesis, immune function, and productive processes such as growth and lactation. Optimal ruminant nutrition requires a precise balance of dietary protein

Minerals are essential elements for skeletal development, immune function, and reproductive success. They are divided into two categories: macrominerals (needed in larger quantities, measured as a percentage of the diet) and microminerals (trace elements, measured in parts per million, or ppm).

Macrominerals, including calcium (Ca) and phosphorus (P), are required in the greatest quantities. Calcium is essential for skeletal development, muscle contraction, and milk production, while phosphorus plays a critical role in energy metabolism, bone formation, and reproductive performance. Imbalances between calcium and phosphorus, rather than absolute deficiencies alone, can increase the risk of disorders such as milk fever or urinary calculi.

Trace minerals such as selenium, zinc, iodine, and copper are required in smaller amounts but are vital for immune function, enzyme activity, reproduction, and growth. Selenium deficiency is common in many regions and may result in white muscle disease, poor growth, or reduced reproductive performance. Vitamin supplementation, particularly vitamins A, D, and E, may also be required when animals rely heavily on stored forages, as vitamin content declines during storage.

Table 1. Roles of some minerals on physiological functions reproductive failures and toxicity in sheep and goats.

Mineral element	Physiological functions	Deficiency	Toxicity
Calcium and Phosphorus	Intracellular messenger for transmission of nerve impulses. Release ATP/ADP and nucleic acids	Lowered milk production, milk fever by hypocalcemia in lactating ewes and does, estrus suppression and poor conception rates	Hypercalcemia and soft tissue calcification, Urinary calculi formation and skeletal softening
Magnesium	Synthesis of nucleic acids and glutathione	Tetany	Urolithiasis, lethargy, disturbance in locomotion, diarrhea, and lower feed intake
Copper and Molybdenum	Enzyme component and catalyst involved in steroidogenesis and prostaglandin synthesis	Delayed and depressed estrus, abortion, death fetuses, infertility, congenital ataxia	Haemolytic crises, haemoglobinuria, haemoglobinaemia, and jaundice; Severe diarrhea, weight loss, anorexia, and reproductive failure
Selenium	Component of selenoproteins, antioxidant function	Lamb mortality, reduced sperm motility and uterine contraction, cystic ovaries, low fertility rate, retained fetal membranes	Poor growth, abnormal gait, vomiting, dispnea, titanic spasms, labored respiration, and death
Zinc	Component of numerous metalloenzymes, influences transcription and cell replication	Impaired spermatogenesis and development of secondary sex organs in males, reduced fertility	Reduced weight gain and feed efficiency, depressed feed intake, and eventually pica

Adapted from Minatel and Carfagnini (2000), Smith and Akinbamijo (2000), Underwood and Suttle (2003), McDowell (2003), NRC (2005), NRC (2007), Blache *et al.* (2008), Hefnawy and Tórtora-Pérez (2010).]

Producers can determine when mineral supplementation is needed by combining forage testing, animal performance indicators, and regional knowledge of deficiencies. Poor growth rates, reproductive inefficiency, weak newborns, or increased incidence of metabolic disorders may indicate mineral imbalances. Feed and forage analysis can identify mineral concentrations and help guide supplementation decisions, while Extension recommendations provide region-specific guidance.

Copper management requires particular attention in small ruminant systems. Sheep are highly sensitive to copper toxicity, whereas goats have higher copper requirements and are more tolerant of elevated copper levels. To determine whether animals have an appropriate copper status, producers should use species-specific mineral supplements and avoid feeding cattle mineral mixes to sheep. Monitoring copper intake from all sources, including concentrates and water, is essential. When copper deficiency or toxicity is suspected, liver mineral analysis conducted by a veterinarian provides the most accurate assessment of copper status. Clinical signs of copper imbalance may include poor coat quality, reduced growth, anemia, or, in cases of toxicity, jaundice and sudden death.

Using free-choice mineral supplements formulated specifically for sheep or goats, along with periodic evaluation of forage mineral content and animal performance, allows producers to meet mineral requirements while minimizing the risk of deficiencies or toxicities.

Ruminants such as sheep and goats primarily rely on their rumen microbes to synthesize B vitamins and Vitamin K. However, specific supplementation of Vitamins A, D, and E is critical to prevent deficiencies, which typically manifest as stunted growth, reproductive failures, and neurological or muscular disorders.

Nutrient requirements for sheep and goats vary depending on species, age, body weight, physiological state, and level of production. Animals at maintenance have relatively low nutrient requirements, while growing lambs and kids, late-gestation females, and lactating animals require substantially higher levels of energy and protein. Nutrient requirements are typically expressed on a dry matter basis (forage as fed minus the percentage of water). Dry matter intake (DMI) is typically estimated as a percentage of body weight (typically 2-4%) and serves as a basis for determining nutrient requirements, since total nutrient needs depend on both intake and diet composition.

Common feeds for sheep and goats include forage plants available on pastures, hay, silage, non-forage fiber sources, and concentrates. Forages typically provide most nutrients in small ruminant diets. Concentrate feeds are often used strategically to supplement diets during periods of increased nutrient demand, such as late gestation, lactation, or rapid growth.

Feed analysis is a foundational component of effective small ruminant nutrition programs. Producers can obtain feed composition values from:

- Laboratory feed analysis
- Extension publications
- NRC feed composition tables
- University forage testing databases

6.1 Strategic grain (concentrate) supplementation

- **Critical Production Stages:** Supplement during late gestation (to prevent negative energy balance, pregnancy toxemia, and low birth weights) and peak lactation.
- **Forage Quality Deficits:** Use grains when pasture or hay quality drops (e.g., dormant winter forages or severe drought) and cannot fulfill metabolic demands.
- **Immune Resilience:** Strategic protein and energy supplementation strengthens disease resistance and lowers gastrointestinal nematode (such as *Haemonchus contortus*) burdens.

To meet the high requirements of dairy animals, grain is normally part of their diet. A standard rule of thumb is to feed 1 pound of grain for every 2.5 to 3 pounds of milk produced daily. Look for grain mixes or pelleted feeds containing roughly 14% to 20% crude protein depending on your forage quality, with at least 65% total digestible nutrients (TDN).

Also, grain in the diet is used to accelerate the finishing phase in meat animals. We need to gradually adapt animals to new diets to prevent digestive upsets (e.g., bloating, acidosis). Having baking soda next to the mineral feeder is recommended.

7.0 Facilities

Effective facilities for small ruminants require proper housing, secure fencing, and functional working areas designed for their size and behavior.

Housing and Shelter

Sheep and goats need simple, dry, and well-ventilated shelters to protect them from wind, rain, extreme heat, and predators.

Space Requirements (Indoor Pens)

- Open pens (maintenance to mid-gestation): 12 to 16 square feet per ewe or doe.
- With offspring/lambing/kidding: 15 to 20 square feet per mother.
- Rams and bucks: 20 to 30 square feet per adult male.
- Lambing/kidding jugs: 4 ft. x 4 ft. for small-to-medium mothers; 5 ft. x 5 ft. for larger breeds.

Outdoor and Location Needs

- Outdoor shelter space: 25 to 40 square feet per adult; 30 to 50 square feet for mothers with young.
- Location: Build on high, well-drained ground to prevent mud and water pooling. Face openings south or away from harsh prevailing winds.

Environment and Facilities

- Ventilation: Good airflow is critical to remove moisture and ammonia, preventing respiratory disease.
- Flooring & Bedding: Use clean, dry straw, hay, or wood shavings. Firm, absorbent floors (packed dirt, concrete, or elevated slatted floors) make cleaning easier.
- Water & Feed: Provide constant access to clean water (1 to 3 gallons per head daily) and enough feeder space so shy animals can eat without getting pushed.

7.1 Fencing and Containment

Woven wire and electrified high-tensile netting systems are the best choices for containing small ruminants.

Woven Wire Fencing

Use sturdy woven wire fencing as a reliable permanent boundary to keep animals in and predators out. Use non-climb with 4x4 inch openings or fixed-knot spacing with 3-inch vertical options. Maintain a minimum height of 48 inches to prevent animals from jumping or climbing over. Avoid standard 6-inch field fence spacing, which often causes horned

goats or young animals to get their heads trapped. Avoid barbed wire, which ruins sheep fleece and causes injuries.

Add electrified high-tensile wires or offset strands (at the top and bottom) to prevent goats from jumping over or rubbing against and damaging the fence. Electric wires can also be used for predator deterrence.

Electric Fencing and Netting

- **High-Tensile Electric:** Use 5 to 7 strands of 12.5-gauge wire powered by a low-impedance 4,000V charger. Stagger hot and grounded wires if relying purely on a psychological shock barrier.
- **Electric Netting:** Pre-wired plastic mesh with integrated spike posts. Offers physical and psychological barriers that deter predators such as dogs and coyotes. Ideal for intensive rotational grazing, though it takes longer to set up and roll up without tangling.
- **Multi-Strand Polywire / Smart Fence:** Lightweight spools of polywire with built-in step-in posts. Fast to deploy and wind back up (under 10 minutes) and handles uneven or hilly terrain better than netting.

Maintenance is important. Keep vegetation trimmed low along electric lines to prevent the system from grounding out and losing voltage. Check voltage periodically.

7.2 Working and Handling Facilities

Functional working and handling facilities for sheep and goats require a system of pens, a crowding area, a narrow single-file alleyway, and sorting options designed to minimize stress and prevent injuries.

Essential Facility Components

- **Holding and Gathering Pens:** Large initial pens to gather the flock, moving smoothly into a smaller forcing or crowding pen. Note that sheep flow well when a crowding tub is tightly packed, whereas goats may attempt to jump or climb if overly crowded.
- **Working Chute / Alleyway:** A narrow, single-file lane (typically 12 to 18 inches wide depending on the size of the animals) that prevents small ruminants from turning around. Solid-sided panels help limit outside visual distractions and reduce balking.
- **Anti-Backup Mechanisms:** Spring-loaded gates or one-way drop/guillotine gates inside the alleyway to keep animals moving forward during processing.
- **Sorting Gate:** A multi-way sort gate (2-way or 3-way) placed at the exit of the alley to efficiently separate animals by sex, age, health status, or treatment group.

Design tips

- **Non-Slip Footing:** Ensure flooring provides secure footing; slick concrete or muddy ground causes animals to lose confidence, balk, or injure themselves.
- **Species Adjustments for Horns:** Account for horns when handling goats by allowing wider clearances and avoiding narrow gaps where horns can get entangled in standard panels.
- **Specialized Restraint Equipment:** Integrate portable or fixed tilt-crates, spin-trim chutes, or raised stands to safely restrain animals for foot trimming, vaccinations, and drenching.
- **Portable vs. Permanent Layouts:** Modular or portable setups allow flexibility for multi-pasture operations or remote rotational grazing setups.

7.3 Housing dairy goats

If you are focusing on more intensive systems for raising dairy goats, you will need good facilities that keep goats dry, well-ventilated, protected from drafts and extreme weather, and easy to feed, milk, clean, and manage.

There are two main housing systems:

- **Open/loose housing:** Goats have shelter but can freely access pasture or an exercise area. A simple three-sided shed can work well, with the open side protected from prevailing winds. Each adult goat should have about 10–15 sq. ft. of bedded area plus approximately 25 sq. ft. for exercise. Kidding pens should provide at least 4 × 5 ft.
- **Confinement housing:** Existing barns can be remodeled, or purpose-built free-stall/tie-stall facilities can be used. An outdoor exercise area is beneficial, with at least 25 sq. ft. per goat recommended.

As was stated before, ventilation, good bedding, and cleanliness are particularly important.

7.4 Milking facilities

A clean milking environment is essential for producing high-quality milk. For high-quality milk, it's important:

- Healthy goats
- Clean udders and flanks
- Clean milking stalls
- Clean equipment
- A clean milker

Facilities can range from a simple individual milking stand to sophisticated rotary parlors with computerized milk metering. Milk should also be stored under appropriate cooling conditions. Producers planning to sell Grade A milk must meet applicable sanitation requirements for milking, storage, and processing facilities. More information in Section 12.

8.0 Reproductive management

Effective reproductive management in sheep and goats relies on controlling seasonality, optimizing nutrition, and maintaining herd health to maximize the number of healthy offspring weaned.

Sheep and goats are seasonally polyestrous, responding to decreasing daylight hours (fall) as melatonin from the pineal gland stimulates reproductive hormones. Breeds differ in the sensitivity to photoperiod. Estrus (heat) cycles in ewes average a 16- to 17-day cycle (13-19 days), while does average a 20- to 21-day cycle (18-24 days), with standing heat lasting 24-36 hours and 12-48 hours, respectively, with ovulation tending to occur toward the end of estrus.

Out-of-Season Breeding can be managed using artificial lighting protocols, the "buck/ram effect" (introducing males to stimulate cycling), or hormonal treatments like CIDRs and progestogens.

It is important to focus on nutrition and Body Condition Scoring (BCS). Target BCS: Aim for a Body Condition Score of 3.0 (on a 1-5 scale, figure below) at breeding, increasing to 3.5 by lambing or kidding.



Flushing can be achieved by supplementing with high-energy feed or by moving females to high-quality pasture 2 to 3 weeks before breeding, which increases ovulation rates and twinning.

Ensure proper trace mineral supplementation, particularly Selenium and Vitamin E, to prevent early embryonic loss.

Perform Breeding Soundness Exams (BSE) with physical and semen evaluations on rams and bucks 30 to 60 days pre-breeding.

Conventionally, a ratio of 1:25 to 1:30 for sheep and goats under standard pasture-mating conditions is considered ideal. But a higher number of dams per sire can be used depending on the situation.

The gestation length is 144 to 152 days (averaging 147 days) for sheep, and 145 to 155 days (averaging 150 days) for goats. Both species have a typical pregnancy duration of roughly 5 months.

Pregnancy detection provides an opportunity to adjust nutritional and lambing/kidding management to reduce feed and labor costs. For a smaller, more intensively managed breeding system, using marker paint or a harness on rams/bucks is recommended. You can track mating activity and use records to select for fertility. Blood testing is another method for pregnancy checking. Ultrasound imaging is the most reliable method for checking pregnancy.

9.0 Health management

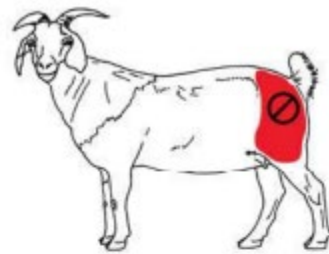
Effective health management for small ruminants (sheep and goats) relies on a structured program combining proper nutrition, core vaccinations, strict parasite control, and daily monitoring.

It's crucial to establish a biosecurity program that uses management measures to prevent disease from entering, spreading, or leaving a flock/herd:

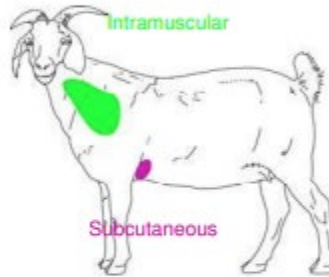
- **Closed or High-Health Flock:** Maintain a closed flock by growing your own replacement stock or using artificial insemination to limit outside exposure.
- **Quarantine New Additions:** Isolate all incoming or returning animals downwind or in a separate facility for 30 days before mixing them with the main herd. Screen them for key diseases (such as Caseous Lymphadenitis, Johne's disease, and Small Ruminant Lentiviruses) during this time.
- **Disease Testing & Screening:** Buy animals only from reputable breeders who can provide veterinary health checks and negative test results (CAE/OPP, CL and Johne's).
- **Control Visitors and Traffic:** Restrict farm and barn access to essential personnel. Keep a visitor and vehicle log and require clean clothes and disinfected footwear or boot covers.
- **Proper Cleaning and Disinfection:** Remove all organic matter like manure and bedding using soap and water *before* applying a disinfectant, since dirt renders many chemicals inactive.
- **Pest and Wildlife Exclusion:** Keep wild ruminants, pets, rodents, and birds away from feed and water troughs. Maintain a 5-foot non-vegetative buffer around buildings and store feed in rodent-proof containers.
- **Abortion Protocols:** Immediately isolate any ewe or doe that aborts, wear protective gloves and clothing, remove contaminated bedding, and submit samples to a veterinarian immediately.

9.1 Health Management Pillars

- **Nutrition & Water:** Provide continuous access to fresh water and high-quality forage. Maintain a balanced calcium-to-phosphorus ratio (roughly 2:1) to prevent urinary urolithiasis (stones), especially in male wethers and rams. Note: Avoid excess copper in sheep and camelids, as it can cause fatal copper toxicity; goats require different mineral profiles.
- **Vaccination:** Administer the core *Clostridium perfringens* Types C & D and Tetanus (CD&T) vaccine. Give an initial series to young animals, annual boosters to adults, and pre-parturition boosters to pregnant does or ewes about 30 days before birth to pass passive immunity through colostrum. 8-way vaccines provide protection against CD-T and additional clostridial diseases, such as blackleg and malignant edema.
 - The use of other vaccines depends on the flock/herd history and risk:
 - Soremouth (Ovine Ecthyma): For flocks with a history of contagious ecthyma.
 - Caseous Lymphadenitis (CL): To help prevent chronic abscesses.
 - Campylobacter and Chlamydia: For breeding ewes and does to prevent abortion storms.
 - Rabies: Considered in areas with high local rabies risk.
 - Footrot: For wet or muddy climates prone to lameness
- **Parasites:** Internal parasites (such as the barberpole worm, *Haemonchus contortus*) are a leading health threat. Use targeted checks like FAMACHA® eye-lid scoring for anemia and periodic Fecal Egg Counts (FECs) rather than blanket deworming. Implement rotational grazing to break parasite life cycles. More information in Section 9.2.
- **Biosecurity & Quarantining:** Isolate new or returning herd/flock members for at least 30 days before mixing them with your main population. Watch closely for signs of contagious footrot, caseous lymphadenitis (CL), or pinkeye.
- **Hoof Care & Physical Checks:** Inspect hooves and trim 1 to 2 times a year to prevent footrot. Monitor body condition scores (BCS) on a 1-to-5 scale to catch weight loss or obesity early.



Don't inject in red area!



Intravenous

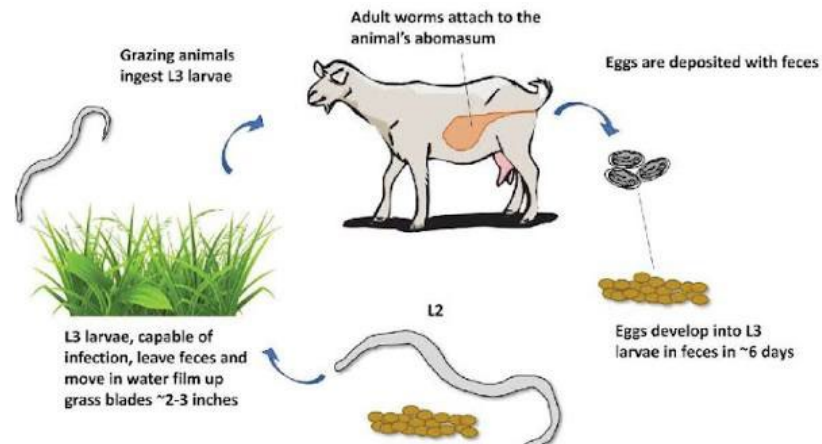
Figure 9.13. Injection sites for intramuscular and subcutaneous injections.

(Yami & Merkel, 2008; www.boerboksa.co.za/Publications/Articles/New/Sheep%20and%20Goat%20Production%20Handbook.pdf)

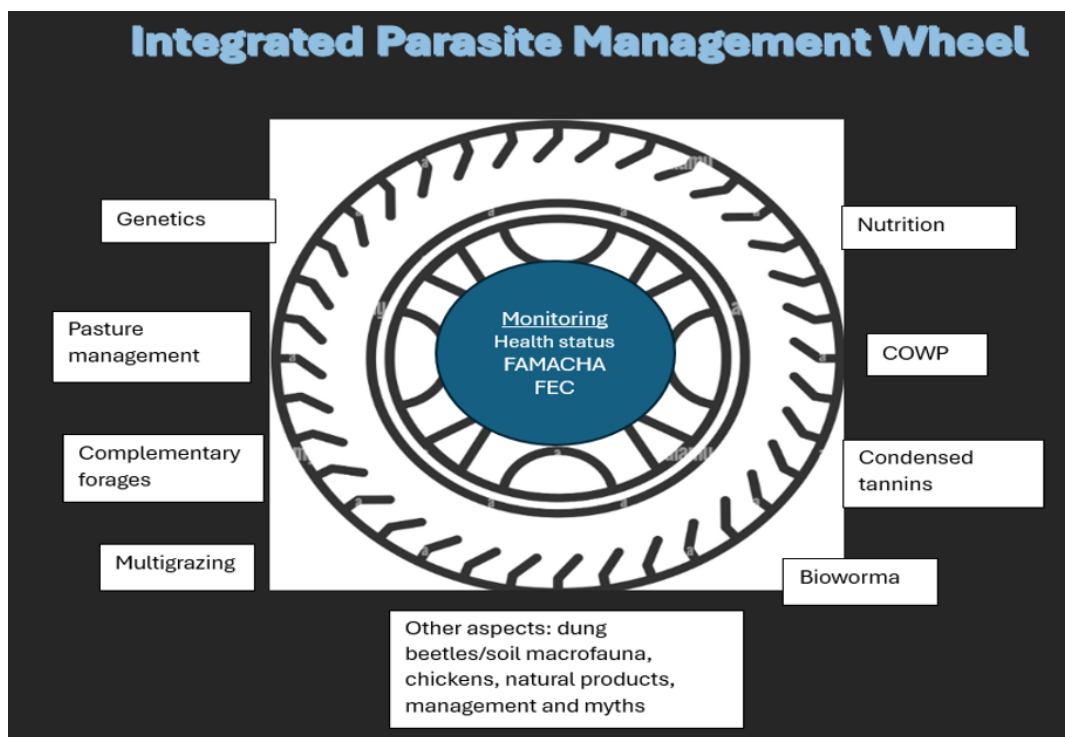
9.2 Parasite management

Worms (nematodes)

Effective parasite management in sheep and goats relies on an integrated pest management (IPM) approach rather than routine, calendar-based deworming, which accelerates drug resistance. Barber pole worm (*Haemonchus contortus*) is the main threat to small ruminants, notably in the southern US. It is a blood-feeding parasite and causes anemia, bottle jaw, weight loss, decreased intake, weakness, and sudden deaths.

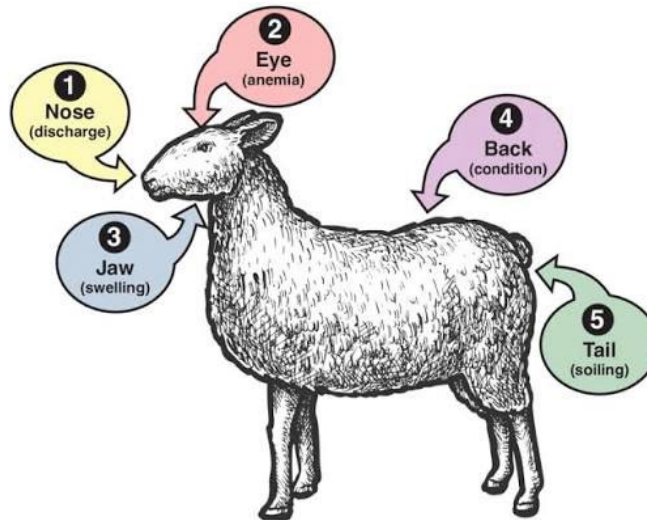


Toledo et al. (2025) https://www.researchgate.net/publication/392038774_Identification_and_Control_of_Internal_Parasites_in_Small_Ruminants_AN399_42025



Targeted Selective Treatment (TST)

- **FAMACHA® Scoring:** Use the FAMACHA® eyelid color chart to evaluate the color of the lower eyelid mucous membranes and assess for anemia caused by barber pole worms. Only treat animals that score in the anemic range (scores 4 or 5). There is free, online FAMACHA® Certification available (www.wormx.info/online-famacha-certification).
- **The Five Point Check** (www.wormx.info/changingdogma): Assess animals for anemia (FAMACHA®), bottle jaw, body condition score, coat condition, and dag score (fecal/brisket soiling).



Álvarez (2025) <https://extension.msstate.edu/publications/sustainable-parasite-control-for-sheep-and-goats>

- **Refugia:** Leave a portion of the flock or herd untreated (susceptible worms on pasture that have not been exposed to drugs) so they dilute the resistant worm population.
- **Accurate Dosing & Combinations:** Weigh animals individually on a scale (never guess or use weight tape) and consult your veterinarian to use multi-class combination dewormers given orally.

Pasture and Grazing Management

- **Short Grazing Periods:** Move small ruminants off a paddock within 3 to 4 days before the lifecycle of the worm larvae can complete and re-infect the animals.
- **Long Rest Intervals:** Rest pastures for **35** days or longer (or until grass height is adequate) to let infective larvae die off.
- **Forage Height:** Do not let animals graze lower than 4 inches from the ground, as most infective larvae live within the bottom 2 to 3 inches of the forage plant.
- **Multispecies / Co-Grazing:** Rotate or graze small ruminants alongside cattle or horses. Most nematode species are host-specific, and cattle act as a "vacuum" by ingesting and destroying small-ruminant larvae without getting infected.

Nutritional and Biological Controls

- **Condensed Tannin Forages:** Graze animals on tannin-rich legumes like sericea lespedeza, birdsfoot trefoil, or sainfoin, which naturally suppress worm egg hatching and adult burdens.
- **Bypass Protein & Minerals:** Provide adequate protein, energy, and trace minerals (such as copper oxide wire particles where recommended) to bolster natural host resilience and immunity (Quadros & Burke, 2024; DOI:[10.1093/af/vfae019](https://doi.org/10.1093/af/vfae019)).
- **Genetics:** Select and breed resistant small-ruminant lines (such as St. Croix or Gulf Coast sheep; Spanish and Kiko goats) that show natural genetic resistance to *Haemonchus*.

Coccidia

Coccidiosis is a common, economically significant parasitic disease in small ruminants caused by a protozoan of the genus *Eimeria*. Lambs and kids between 1 and 6 months of age (most commonly 30 to 60 days old) are the most vulnerable. The fecal-oral route is through contaminated feed, water, bedding, or pastures. Controlling coccidia in small ruminants relies on a combination of sanitation, stress reduction, preventive coccidiostats (medicated feed), and targeted treatments for clinical outbreaks. Keep areas dry, raise feed and water troughs, maintain clean bedding, reduce overcrowding, and minimize stress. Consult a veterinarian for proper diagnosis and extra-label drug approval.

10.0 Husbandry practices

10.1 Lambing/kidding management: What should I do to prevent losses?

Effective management of sheep lambing and goat kidding focuses on pre-birth preparation, delivery support, neonatal care, and postpartum nutrition (Quadros & Nichols, 2026; www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/lamb-kidding-season.aspx).

Pre-Birth Management (Last Trimester and 2–4 Weeks Out)

- **Nutrition:** Ewes and does add 70% of their fetal weight in the final 6 to 8 weeks of gestation. Provide high-digestibility forage (high-quality hay) and energy-dense feed (grain supplementation) to prevent pregnancy ketosis and hypocalcemia.
- **Vaccination:** Administer CDT as explained previously. Depending on the severity of selenium deficiency, a selenium/vitamin E booster may be recommended, although the best way to provide selenium is through a mineral mix.
- **Shearing and Crutching:** Shearing ewes 2 weeks to 2 months prior to lambing encourages them to seek protected shelter, makes it easier for newborns to find the udder, and reduces crowding.
- **Facilities & Supplies:** Set up dry, well-ventilated, draft-free kidding or lambing pens (jugs). Or use maternity pastures, which should be safe and close to home for inspection and assistance when needed, with shelter, natural windbreaks, water, minerals, and feeders.
- **Stock essential supplies:** 7% iodine tincture, disposable OB gloves and lubricant, towels, a rectal thermometer, a lamb/kid puller, and a stomach tube with a syringe.

Labor and Delivery

Stage 1 (Nesting and water breaking): Lasts 1 to 4 hours.

Stage 2 (Active delivery): Normally lasts under 45 minutes, with the front feet and the head appearing within 30 minutes of the water bag breaking.

Intervention: Step in if the mother strains hard with no progress for 20 minutes in stage 2, or if you spot an abnormal presentation (breech, head back, or only one leg). Gently reposition the baby or contact a veterinarian if the cervix is undilated or stuck.

Neonatal Care (First 24 Hours)

- **Breathing & Drying:** Clear mucus from the nose and mouth, dry the newborn with clean towels to prevent hypothermia, and let the dam lick and bond with them.
- **Navel Dip:** Dip the navel cord in 7% iodine tincture immediately to stop bacterial entry.
- **Colostrum Intake:** Ensure the lamb or kid consumes colostrum equal to 10% of its body weight within the first 12 hours (ideally within the first 4 to 8 hours and maximum within 24 hours) to gain passive immunity. If needed, use a stomach tube with warm colostrum (do not microwave) if the baby is too weak or cold.
- **Temperature Monitoring:** Check the newborn's temperature with a rectal thermometer; normal range is 101.5°F to 103.5°F. Warm severely chilled animals (under 99°F) in a hot box or warming area before feeding them.

Postpartum Management

- **Jug Bonding:** Keep the mother and newborn(s) in an individual 4-by-5-foot jug for 24 to 48 hours so they learn each other's scents and sounds before rejoining the main flock.
- **Lactation Nutrition:** Increase the energy and protein in the dam's diet immediately after birth to support heavy milk production.
- **Creep Feeding:** If you plan to use creep feeding, introduce a high-protein (around 20%) creep feed to lambs and kids at 10 to 14 days of age to encourage early rumen development.

10.2 Castration Practices

Castration prevents unwanted pregnancies, reduces ram/buck taint in meat, and manages aggressive or mixed-sex grouping. Best completed early within the first 1 to 6 weeks of life to minimize stress and health risks, though some delay until after 6–8 weeks in specific pet markets to reduce urinary calculi (urolithiasis) risks by allowing wider urethral diameter development.

Methods include:

- **Banding / Rubber Rings:** Bloodless method using an elastrator to constrict blood flow to the scrotum; testicles drop off weeks later. Requires verifying both testicles are below the band.
- **Burdizzo (Clamping):** Bloodless method that crushes the spermatic cords inside the scrotum without breaking the skin.

- **Surgical Castration:** Uses a clean knife or scalpel to open the lower scrotum and remove testicles; offers 100% immediate effectiveness but carries higher risks of hemorrhage, infection, and fly strike.

Essential whenever rubber rings or banding are used; lambs and kids must have active clostridial/tetanus coverage.

Best practices and modern regulations increasingly recommend local anesthetics (such as lidocaine blocks) or integrated pain-relief tools (such as combined ring/analgesic applicators).

10.3 Tail Docking

Tail docking prevents "fly strike" (myiasis) by reducing fecal and urine staining around the rear end. Must be left long enough to cover the vulva in females or the anus in males to prevent rectal prolapse. It's typically performed within the first week to 2 weeks of life. Methods include rubber rings/banding (elastator), electric docking irons, or emasculators/knives.

10.4 Disbudding

In goat kids, disbudding is best performed early, typically between 3 to 10 days of age (and generally before 14 days) before the horn buds fuse with the frontal bone. Dehorning animals older than 2 weeks or mature animals opens the frontal sinus, carries high risks of severe pain, hemorrhage, and infection, and should be performed by a licensed veterinarian.

Using a heated electric or gas iron for 7 to 15 seconds to form a copper/silver cauterization ring around the base is the gold-standard, most reliable technique.

10.5 Hoof trimming

Animals living in soft, damp, or muddy pastures experience less natural wear and require more frequent trimming. Animals on rocky or abrasive terrain wear down their hooves naturally and require less intervention. Goat hooves generally grow faster than sheep hooves. Nutrition is another component that affects hoof growth.

Inspect hooves every 4 to 6 weeks. Actual trimming may be needed 1 to 4 times a year.

Equipment

Hoof Trimmers / Shears: Sharp, specialized handheld trimmers.

Hoof Pick or Brush: To clear out trapped mud, manure, and small stones.

Hoof Knife: For scraping and leveling the sole if needed.

Hoof Rasp / File: To smooth out rough edges.

Blood Stop Powder: To quickly clot minor nicks or bleeding.

Disinfectant: To clean tools between animals to prevent disease spread.

Step-by-Step Trimming Process

Restrain the Animal:

- a. Sheep: Often tipped onto their rump into a sitting position ("sheep chair" or dock lean) or placed on a tilt table.
- b. Goats: Usually trimmed while standing on a milking stand, in a stanchion, or tied securely next to a wall or fence.

Clean the Hoof:

- c. Use a hoof pick or the point of your shears to remove all dirt, manure, and debris from the sole and between the two toes (claws). Inspect closely for foul odors or signs of rot.

Trim the Overgrown Hoof Wall:

- d. Grasp the pastern and bend the leg back.
- e. Snip off the folded-under outer hoof wall flaps until the wall is even with the white/hard sole.
- f. Work from the heel toward the toe. Remove thin slices rather than large chunks.

Level the Sole and Heel:

- g. Match the inner and outer claws so they are even, flat, and balanced. A properly trimmed hoof looks flat and boxy, similar to a newborn lamb's foot.
- h. Stop immediately the moment you see a pink tint or pinpoint red spots; this indicates you are dangerously close to the living blood and nerve supply (the quick).

Finish and Treat:

- i. File down any sharp edges with a rasp.
- j. Apply blood stop powder if accidental nicking occurs.

Managing Common Hoof Issues: 10 Ways to Prevent Foot Rot

(Quadros & Rogers, 2026; <https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/prevent-foot-rot.aspx>)

- Foot Rot (Contagious): Caused by bacterial interaction (*Dichelobacter nodosus* and *Fusobacterium necrophorum*). It produces severe foul odors, pus, heat, and lameness. Treatment requires aggressive trimming, topical antibiotics or 20% zinc sulfate foot baths, and isolating infected stock.
- Foot Scald (Non-Contagious): Inflammation of the soft skin between the toes caused by wet conditions and *F. necrophorum* (normally present in the manure), leading to redness and tenderness.
- Environment Management: Keep housing clean, dry, and well-bedded, and rotate pastures to break the bacterial lifecycle.

11.0 Predator deterrence

Protecting sheep and goats from predators requires a multi-layered approach combining secure fencing, guardian animals, and proper night management

Fencing and Physical Barriers

- **Hot wires/Electric Netting:** Adding hot wires to high-tensile fencing (top and bottom) is helpful. Portable or semi-permanent electric netting (such as 48-inch rolls) provides both a physical and psychological shock barrier against coyotes, dogs, and bobcats.
- **Woven Wire Fencing:** Install tall woven wire fencing (at least 4 feet high) with electrified bottom, middle, and top strands to deter digging or climbing predators. Clear vegetation underneath to prevent electrical shorts.
- **Night Corrals:** Lock sheep and goats into sturdy, enclosed, predator-proof barns or heavy-duty night pens after dark, especially during lambing and kidding seasons when newborns are vulnerable.

Livestock Guardian Animals

- **Livestock Guardian Dogs (LGDs):** Breeds like the Great Pyrenees, Maremma, and Anatolian Shepherds bond with the flock and actively patrol perimeters to deter or fight off coyotes and stray dogs.
- **Llamas and Donkeys:** Single geldings or guard-trained llamas and donkeys have a natural dislike for canines and can aggressively chase or kick away coyotes and stray dogs. (*Note: Donkeys should be removed during lambing or kidding periods*).

Management and Environmental Control

- **Target Common Predators:** Primary threats include coyotes, domestic dogs, bobcats, feral hogs, and birds of prey.
- **Sanitation:** Clear out afterbirth, garbage, and feed waste immediately after kidding or lambing to avoid attracting scavengers and predators to the pens.
- **Deterrent Lights:** Install motion-activated or flashing LED strobe lights around night pens to startle nocturnal predators.

12.0 Milk, meat and fiber

In this section, we will explore the harvesting of the main small-ruminant products and their quality.

12.1 Milk

Best practices for milking dairy animals focus on animal hygiene, proper hand or machine technique, and rapid milk cooling to ensure safety and quality.

Preparation and Hygiene

Secure the goat in a clean milking stand or stanchion with a small amount of feed to keep her calm and still. Wash the udder and teats with warm water and an approved udder wash or unscented soap to remove debris and stimulate milk let-down. Dry each teat thoroughly using a separate disposable paper towel or an individual cloth per animal to prevent the spread of mastitis-causing bacteria. Strip the first 2 to 3 squirts of milk from each teat into a strip cup or paper towel to check for clots, chunks, or discoloration, and to flush out high-bacteria milk.

Milking Technique

Avoid pulling or yanking down on the teats, which causes painful tissue damage and injury. Use a trapping and squeezing motion. Pinch or seal off the top of the teat near the udder using your thumb and index finger to trap the milk inside, then roll and press your remaining fingers downward in a sequence to push the milk out.

Milk the doe out completely until only drops remain; leaving milk behind can trigger udder health issues like mastitis. Dip teats immediately after milking in an approved sanitizing post-dip solution to seal the teat canal while it remains open.

Keeping milk quality

Filter the milk right away through a clean stainless-steel strainer lined with a disposable milk filter or cheesecloth. Cool the milk down to 50°F (10°C) or lower within 4 hours of milking to stop bacterial growth.

Mastitis

Mastitis is an inflammation of the mammary gland most commonly triggered by bacterial infections. The key causes and predisposing factors include bacteria (*Staphylococcus aureus*, *Streptococcus* species, *E. coli*, and *Mycoplasma*), virus/systemic factors (Caprine Arthritis Encephalitis Virus – CAE/Ovine Progressive Pneumonia - OPP. Orf virus can damage teat ends or increase susceptibility), environmental and management triggers (overcrowding, wet or dirty bedding, poor milking hygiene, worn milking machine parts, or sudden weather changes) and nutritional deficiencies (lack of Vitamin E and Selenium).

Clinical vs. Subclinical Mastitis

- Clinical Mastitis: Hot, swollen, painful, or hard/fibrotic udders; abnormal milk (flakes, blood, wateriness, or pus); severe cases can turn dark/gangrenous or cause systemic fever and loss of appetite.
- Subclinical Mastitis: No visible changes to the udder or milk, but accompanied by a decreased milk yield and elevated Somatic Cell Counts (SCC).

Note: Normal goat SCC can naturally exceed 1,000,000 cells/mL late in lactation, making trends more important than a single reading.

Diagnosis

- Strip cup: It is a simple, direct diagnostic tool used to detect clinical mastitis in dairy goats by examining the first streams (foremilk) of milk before milking.
- California Mastitis Test (CMT): A quick field test, though it can yield false positives due to goats' naturally higher baseline SCC.
- Somatic Cell Count (SCC): Tracking individual animal trends to catch spikes.
- Microbiological Culture: The gold standard via veterinary laboratories to identify the exact bacterial agent.

Prevention, & Treatment

Use pre- and post-milking antiseptic teat dips (iodine- or chlorhexidine-based) to seal and disinfect the teat canal. Operators should wash hands or wear latex gloves. Keep pens clean, dry, and well-ventilated; use fresh straw, sand, or wood shavings; and regularly service/replace milking machine liners and check vacuum pressure. Isolate infected does immediately; milk them last or by hand/separate machine to prevent herd-wide spread, and cull chronically infected animals.

Treatment includes frequent milking out of the affected udder half (sometimes aided by oxytocin), intramammary antibiotic infusions (adjusting bovine products or using veterinary-prescribed caprine dosages), and systemic antibiotics (such as penicillin) if the infection spreads body-wide, and anti-inflammatories and supportive care under veterinary supervision, keeping strict milk withdrawal times in mind.

Milk quality

Sheep milk generally packs higher concentrations of nutrients, total solids, protein, and fat compared to goat milk, whereas goat milk excels in digestibility, smaller fat globule size, and unique medium-chain fatty acids.

Sheep milk has higher total solids and roughly twice the fat content of goat milk, making it naturally creamier and more energy-dense. Sheep milk contains roughly 5.4% to 5.8% protein, nearly double the protein found in goat milk (around 3.1% to 4.6%). Sheep milk provides higher amounts of calcium, iron, magnesium, zinc, Vitamin B12, and folate. Sheep milk is rich, clean, and mildly sweet with far lower levels of the specific fatty acids that cause a "goaty" or gamey flavor.

Both milks are naturally homogenized with smaller fat globules than cow milk, but sheep milk features the smallest average globule size, followed closely by goat milk. This makes both easier on the human digestive tract.

Goat milk is widely noted for its superior alkalinity, buffering capacity, and specific short- to medium-chain fatty acids (such as caproic, caprylic, and capric acids) that are metabolized efficiently.

Because of its high protein and solid content, sheep milk yields significantly more cheese per pound/gallon of milk and creates firmer, richer curds (such as feta or pecorino), whereas goat milk produces a softer, lighter curd.

Goat milk is not a safe alternative for a true cow's milk allergy. About 90% of people allergic to cow's milk will also react to goat's milk due to similar protein structures (high

cross-reactivity). However, Goat milk is often easier to tolerate than cow milk if you have mild lactose intolerance or general digestive sensitivity.

12.2 Meat

Harvesting for self-consumption

Small-ruminant meat harvesting (sheep and goats) for personal self-consumption on a small farm requires strict adherence to legal limits, humane handling, and safe processing protocols.

- **Ownership Rule:** Under USDA and state personal exemption rules, you must slaughter an animal that you have raised yourself.
- **Consumption Limit:** The resulting meat is strictly restricted to self-consumption—meaning it can only be eaten by the owner, members of their household, and nonpaying guests or employees. It cannot be sold, bartered, or traded.
- **Labeling / Custom Exemption:** If processed at a custom-exempt facility, carcasses are stamped "not for resale".

For sale

Harvesting and processing small ruminants (sheep and goats) for commercial sale requires navigating strict food safety laws and selecting the right commercial avenue.

- **Selling Retail Cuts (USDA/State Inspected):** If you plan to sell individual packages of ground meat, chops, or roasts at farmers' markets, online, or to restaurants, the animal must be harvested at a USDA/State-inspected facility. The facility must have continuous inspection, a Hazard Analysis Critical Control Point (HACCP) plan, and approved labels.
- **Selling Live Animals (Custom-Exempt):** You can sell a live animal (whole, half, or quarter shares) directly to a consumer. Under this custom-exempt model, ownership transfers before harvesting. The animal is then sent to a state-licensed custom slaughterhouse, and the resulting meat is strictly labeled "Not for Sale" and may be consumed only by the buyer's household.

Key steps and yield expectations

- **Target Weight:** Sheep and lambs are typically harvested between 100 and 150 pounds, while goats (chevon or cabrito) vary by age and market preference, but normally light carcasses result in more acceptable meat.
- **Carcass weight is roughly 50-55% of live weight.**
 - ~60-70% bone-in.
 - ~50% boneless.

Carcass grading systems

- **Sheep/Lamb Grading (USDA):** Uses official yield grades (YG1 to YG5) based on back fat and cutability, alongside quality grades determined by maturity, conformation, and flank streaking.

- **Goat Grading:** There are no official USDA quality or yield grades for goat meat. Instead, the industry relies on general muscling selections—Selection 1 (heavily muscled), Selection 2 (moderately muscled), and Selection 3 (poorly muscled), or is sold strictly by live weight and frame size.

Meat quality

Sheep meat (mutton/lamb) and goat meat (chevon/cabrito) share many nutritional similarities, but they differ significantly in fat content, flavor profile, carcass composition, and grading standards.

Healthy sheep and goat meat ranges from light pink to deep red depending on age. Goat meat is leaner with minimal marbling, higher moisture (~74-75%), and slightly higher shear force values, making it leaner and sometimes firmer or less tender than lamb if not cooked low-and-slow.

Sheep/lamb has a more pronounced, traditional species-specific flavor and aroma backed by higher lipid content. Goat meat has a milder, sometimes sweeter, or more earthy lean flavor, though older goats can develop a stronger aroma. Meat from younger animals has less off-flavors and improved tenderness.

Cabrito refers to milk-fed kids (4–8 weeks old); *Chevon* refers to older kids/goats (6–9 months or older). Sheep are divided into lamb (younger, more tender, milder) and mutton (older sheep with a stronger flavor and firmer texture). Younger animals consistently yield more tender meat and lower cooking/drip losses.

Both meats are excellent sources of high-biological-value protein, iron, zinc, selenium, and B-complex vitamins. Goat meat is typically lower in total fat, saturated fat, and calories than traditional grain- or pasture-finished lamb. Goat meat (chevon or cabrito) and sheep meat (mutton or lamb) are leaner, lower in calories, and higher in certain minerals than beef, though they differ distinctively in fat content, flavor profile, and texture.

12.3 Fiber

Wool

Wool production in sheep involves growing, harvesting, and processing natural protein fibers (keratin) from the animal's fleece.

Most sheep produce between 2 and 30 lbs of fleece per year, with the U.S. average around 7.2 lbs per sheep annually.

Types of Wool:

- *Fine wool* (e.g., Merino): High value, soft, small fiber diameter (measured in microns) used for apparel.
- *Medium wool* (e.g., Columbia, Corriedale): Used for blankets, socks, and sweaters.
- *Long wool / Coarse wool*: Heavier, stronger fibers used for carpets and upholstery.

From Fleece to Fiber

1. Shearing: Done typically once a year for animal welfare (preventing heat stress and flystrike) since domestic sheep do not shed.
2. Skirting & Grading: Fleeces are cleaned of belly wool and tags, then graded by fiber diameter, crimp, color (white is preferred for dyeing), and strength.
3. Scouring: Raw wool is washed in hot water and detergent to remove grease, dirt, and lanolin.
4. Carding & Spinning: Machines align the fibers into slivers, which are then spun into worsted or woollen yarns for textiles.

Mohair

Mohair is a strong, lustrous, and durable luxury animal fiber produced exclusively by Angora goats (not to be confused with Angora rabbits).

Angora goats are single-coated animals that grow continuous hair at a rate of roughly 1 inch (2.5 to 3 cm) per month. Goats are typically **shorn twice a year** (in the spring and fall), unlike sheep, which are usually sheared only once. A single adult goat yields an average of 5 to 10 pounds of mohair per shearing, translating to roughly 8 to 16+ pounds of fiber per year depending on the animal's size, age, and sex.

Mohair has a smooth surface with very thin scales, giving it a distinct sheen and a superior ability to absorb bright, vibrant dyes. Unlike sheep's wool, mohair lacks microscopic barbs that cause felting or shrinking when washed. It is exceptionally elastic, wrinkle-resistant, and strong, yet drapes smoothly without stretching out of shape easily.

Mohair quality is largely determined by the age of the goat:

- Kid Mohair (Finest): Clipped from young goats. It has a very small fiber diameter (under 30 μm), making it the softest, most luxurious, and most expensive grade.
- Young Goat / Yearling Mohair: Intermediate softness and diameter.
- Adult Mohair (Coarser): Clipped from mature goats. It has a larger diameter (often 40 μm or greater) and higher strength, making it ideal for hard-wearing home furnishings, upholstery, and heavy drapery.

13.0 Marketing

Marketing small ruminant products (sheep and goats) involves balancing live-animal sales, direct-to-consumer meat, value-added dairy, and fiber streams.

13.1 Live Animals & Meat Marketing

- Live Auctions / Sale Barns: Traditional venue requiring minimal effort (drop off animals and collect a check), though prices fluctuate and commission/yardage fees reduce profits.
- On-Farm & Direct-to-Consumer Sales: Sell by the head, live weight, or hanging carcass weight.

- Specialty & Niche Markets: Target ethnic holidays, local restaurants, or vegetation control/grazing services.

We divide the lamb market into traditional and non-traditional markets:

- Traditional market prefers a larger, fatter lamb that weighs 120 to 160 lbs, which typically takes 8 to 14 months from birth to harvest. Therefore, the supply of most late winter- and spring-born lambs to the traditional market occurs from November through June. Most traditionally marketed lambs are fed in a feedlot prior to slaughter. In the spring, inventory of harvest-ready lambs often outpaces the rate of lamb harvest; therefore, lambs gain extra weight in the feedlot, resulting in larger carcasses. Large, overly fat lamb carcasses are common from April through July.
- Non-traditional lamb market generally prefers lighter and leaner lambs than the traditional market. The highest volume of lambs entering the nontraditional market is 50 to 90 lbs of live weight and generally 3 to 7 months old at harvest. Therefore, the supply of most winter- and spring-born lambs to the nontraditional market occurs during the months of April through October. There are premiums paid for nontraditional lambs during both peak demand periods, often associated with religious holidays, and when supply is low during the December to March period.

13.2 Dairy & Value-Added Products

- Milk & Cheese: Dairy enterprises are more labor-intensive than meat production but offer higher income potential. Options include selling raw milk (where state laws permit), supplying bulk milk to local processors/cheesemakers, or launching an on-farm bottling and cheesemaking business.
- Non-Food Goods: Process goat or sheep milk into lotions and soaps, which feature a long shelf life and do not require a commercial kitchen to produce.

13.3 Fiber & Byproducts

- Raw & Processed Wool/Mohair: You can sell wool in the U.S. through commercial wool warehouses, regional wool buyers, direct-to-consumer online platforms, or local fiber events depending on whether you have a few fleeces or thousands of pounds. If small-scale, you can sell raw fleeces directly to hand spinners, weavers, and crafters, or send fiber to regional mills to be turned into roving, yarn, or finished apparel.
- Hides & Manure: Market skins, hides, and composted manure as secondary revenue streams.

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