Guide for Backyard Sheep Owners of New Brunswick

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Contributions made by Future GNB Veterinary Students

Disclaimer, this manual is a guide only and any in-depth questions and information should be addressed to a veterinarian.

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Starting out

Terminology

Term	Definition
Breech	Skin of inner thigh, around anus and vulva, and underside of tail
Crutching	Shearing wool around breech before lambing or to prevent flystrike. Also known as “dagging”.
Dag	Manure build-up in wool of breech and hind legs
Docking	Removal of the tail below the fourth tail joint to reduce dag, reducing risk of flystrike and concern of meat contamination at processing
Ewe	A female sheep
Extensive management	Sheep kept grazing on pasture for as much of the year as forage availability permits
Hair sheep	Hair-producing sheep that does not require shearing
Intensive management	Sheep kept in soil-floored or hard-floored pens, paddocks, feedlots, or barns, getting forage mostly from hay or silage rather than grazing
Lamb	A sheep under 12 months of age
Mulesing	Not performed or accepted in Canada, a procedure where skin of the breech and back of legs is removed to form a scar and prevent flystrike
Mutton	The meat from a sheep that is older than 12 months
Merino	A group of domestic sheep breeds, characterized by very fine soft wool
Polled	Lacking horns
Ram	Non-castrated male sheep used for breeding
Shearing	Removal of wool of the entire body, done at least yearly (except hair sheep)
Weaning	Separation of lamb and dam at 10-14 weeks old (or as early as 30 days in early weaning). Involves a process over 2 or more weeks before weaning of introducing more solid food, minimizing additional stress, and preparing to dry off ewes
Wether	A castrated male sheep
Wool	The fiber that most sheep (not hair sheep) grow

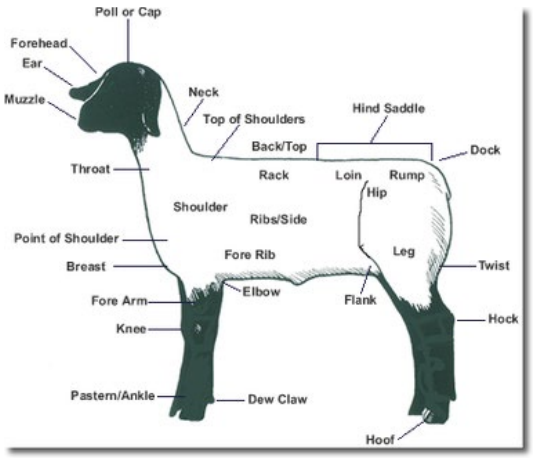


Image: Anatomical structures and terminology of an ewe. Image by Elkhart County 4-H Lamb Club.

Things to consider when starting out

- Number
    - Start small
    - Sheep are herd animals. They often require a companion to remain content. Companions suitable for sheep are:
        - Sheep
        - Horses
        - Donkeys
        - Alpacas
- Lambs
    - Being raised by dam (mother) is best
    - Colostrum is crucial for proper passive transfer of maternal antibodies. If the neonate did not receive colostrum from dam, feed colostrum replacer or consult your veterinarian. They should receive colostrum within the first 24 hours of life. Ideally, within the first 4-6 hours.
- Source is important
    - Reputable seller
    - Visit their facilities and see their animals
    - Consider having a pre-purchase veterinary exam
- Questions to ask seller
    - Why is this animal being sold?
    - Do they offer any guarantees of health, freedom from certain diseases, or pregnancy?
    - Would they refund or buy back the animal if they test positive for disease?
    - Their flock health protocols (nutrition, deworming, vaccination) and this animal's health and vaccination history
    - Breeding history

- Has the sheep been bred in previous years? How often?
- Is it pregnant or open?
- Conception rate?
- Lambing ease?
- Performance

- Yields
    - What is the breed?
    - What commodity is it used for?

Common and local breeds

Many breeds are used for multiple purposes, particularly production of either meat, fibre or dairy. Using a breed developed near your region and known for parasite resistance and hardiness to local climate can help maintain health and productivity.

Commodity	Breed	Characteristics
Meat breeds		
	Suffolk	Large, rapid rate of gain, respond well to confinement, Down-type wool
	Dorset	Medium size, horned and polled varieties, can breed out of season to produce two lambing's per year, good mothers, respond well to confinement, Down-type wool
	Rideau Arcott	Developed in Ontario. Medium, highly prolific, decent rate of gain
	Canadian Arcott	Developed in Ontario. Large, less prolific but greater ease of lambing, more suited to extensive management
	North Country Cheviots	Medium, black-nosed, hardy, do well in extensive management, fine medium-grade wool
	Polypay	Medium, polled, prolific, can breed out of season, respond well to confinement or extensive management
	Romanov	Silver to black wool, extremely prolific, produce most lambs per pregnancy of any breed, can breed out of season, produce very productive crossbreds
	Hampshire	Large, black-faced, stocky, docile temperament, rapid rate of gain, good carcass quality, medium-coarse Down-type wool
	Clun Forest Sheep	Sheep: small, hardy, easy keepers, good mothers, Down-type wool
Fiber breeds		
	Merino breeds	Known for fine, soft, long, high-quality wool. Includes rambouillets

	Border Leicester	Large, polled, docile, long white coarse wool. Good for multiple purpose, with good mothering ability, milk quality, and performance on pasture with relatively low protein
	Jacob	Multihorned, piebald, hardy, usually dual-purpose
	Shetland	Small, from short-tailed group of landrace breeds, hardy, many colours
Dairy breeds		
	East Friesian	

Supplies and equipment

It is important to be prepared before an emergency. Prior to purchasing your flock, some important daily supplies and equipment should be purchased and installed. These include housing, fencing, a well-balanced and researched feed, minerals, and watering system. Some less-obvious supplies you'll also want on hand include:

- Rope and/or sheep halter for handling or restraint in emergencies
- Clippers, blades, comb guards
- Hoof trimmers
- Animal-safe paint or marking chalk
- Ear tags or ear notching equipment
- Disinfectant
- Medical kit
    - Clean disposable gloves
    - Sterile syringes of various volumes
    - Sterile needles
    - Thermometer
    - Bandaging supplies
    - Iodine or chlorhexidine
- Lambing supplies, if keeping pregnant ewes
    - Obstetrical lubricant (label marking it as safe for intrauterine application)
    - Scissors
    - Umbilical tape
    - Wide-mouth jar and iodine for navel dip
    - Frozen colostrum
    - Good-quality sheep milk replacer
    - Lamb nipple and bottle

Emergency management

Emergencies happen when least expecting them. It is important to have an idea of what to do if an emergency occurs. Below are examples things to consider depending on the type of emergency that may occur.

- Disease outbreak plan
    - Where can affected animals be quarantined away from others?

- Severe weather plan
    - How/where to secure sheep on property, when to shelter vs evacuate, what may be damaged and how you will respond?

- **Evacuation plan**
    - Transport, where to go, who can help load them

- A **"shelter-in-place" plan** – can you stay on farm with enough feed/water/supplies for 21 days?

- Plans for small-scale emergencies such as escaped animals, broken equipment, loss of water supply, medical emergencies (human and animal)
    - Keep a list of emergency contacts
    - Establish relationship with a veterinarian ahead of time to ensure they will be more likely to be able to respond immediately and to establish protocols for on-farm medical emergencies

Legal requirements

Animal identification and traceability

Following the Canadian Sheep Identification Program (CSIP) is mandatory under the Canadian Food Inspection Agency (CFIA), *Health of Animals Regulations.* Information can be found on the Canadian Sheep Federation and CFIA websites. All sheep must have an approved CSIP ear tag before being sold or transported off the premises where it was born, even temporarily for e.g., a veterinary clinic visit or an exhibition.

- Information on buying and placing tags can be found on the Canadian Sheep Federation website.
- Imported sheep must be reported to CFIA, and if not already bearing an ear tag considered equivalent to a Canadian approved tag, must have one applied within 7 days upon arrival
- A non-CSIP-approved ear tag, ear notching, or tattoo can also be used for on-farm identification. Branding is not acceptable in Canada.
- Records for all sheep entering a flock for breeding purposes as well as all sheep over the age of 18 months old leaving the flock must be kept for 5 years (except for those going to a federal or provincial abattoir).

Livestock Premises Identification (LPID) is an important aspect of traceability, enabling a more rapid respond to emerging outbreaks and emergencies (e.g., floods). Registering your premises will help protect Canadian livestock and industry in the event of an outbreak and it is free.

- LPID numbers are issued provincially.
- To register a livestock premises go to your regional SNB office, New Brunswick Department of Agriculture, Aquaculture, and Fisheries office or visit https://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Services/Agriculture/ApplicationNBAnimalPremisesIdentification.pdf.

Provinces, such as British Columbia, Saskatchewan, Manitoba, and Alberta, may have additional regulations regarding animal transport documentation.

Municipal by-laws

Municipalities may have additional by-laws on where and how sheep can be kept. Research your local laws and zoning.

Code of Practice for the Care and Handling of Sheep

The Code of Practice for the Care and Handling of Sheep, published by the Canadian Sheep Federation and the National Farm Animal Care Council, is an exceptional resource on animal handling and management. It contains the minimum and recommended standards of practice for all aspects of animal husbandry.

Environmental management

If environmental impacts are not well managed, it can contribute to destruction of natural habitat, pollution, spread of animal and zoonotic disease, and antimicrobial resistance. Understand your local laws and regulations about issues with:

- Grazing
- Manure management
- Proper medication, handling, storage, and administration
- Body disposal

Contact a veterinarian or livestock development officer with the New Brunswick Department of Agriculture, Aquaculture and Fisheries for information.

Housing

Housing location and type

Housing is an important aspect of sheep husbandry and is determined based on multiple variables. These variables include:

- Location. Ensure the location is legal by considering zoning, municipal bylaws, and environmental regulations
- Type of management system. Whether it will be an extensive or intensive management system and if it will be an indoor, outdoor, or hybrid system. This choice is dependant upon:
    - Climate
    - Purpose of sheep
    - Predation pressure in your area
    - Area and nutritional quality of available pasture
    - Practicality of constructing indoor housing with sufficient space and ventilation
    - Reproductive class and age of sheep
    - Breed hardiness for your climate

Outdoor management

- Extensive management: The use of large quantities of land for sheep operation. Requires well maintained land and pastures with rotational grazing.
- Intensive management: The use of a lot of resources and labour on small quantities of land to maximize productivity.
- Look for potential hazards that could injure or trap sheep.
- Need areas of shelter from adverse weather conditions such as a shed, dense tree cover, or a windbreak 3 meters in height.

Fencing

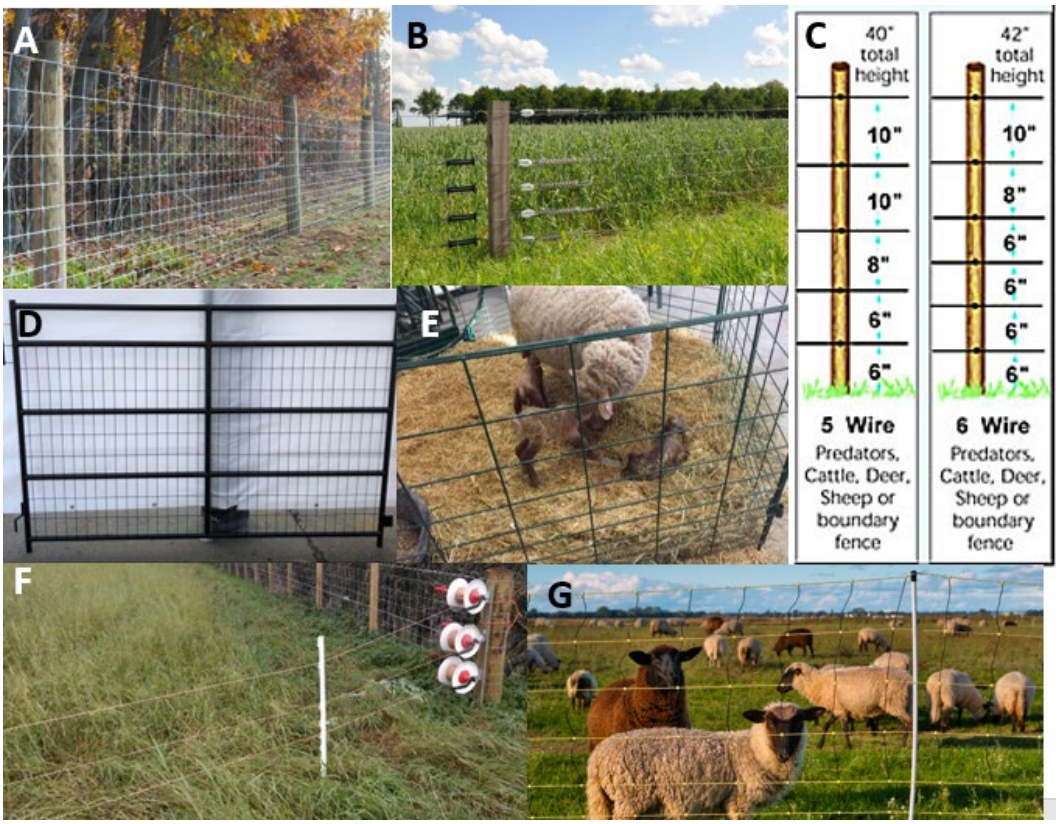
Adequate fencing is crucial for animal health and safety. It is important to build strong and reliable fences to keep animals from harm and prevent predators from accessing livestock. Fencing methods and materials. It is advised to have multiple strands of material at varying heights. Barbed wire is not recommended as it could become a hazard and cause injuries such as lacerations. Examples of fencing methods include:

- Perimeter fence
    - >95 cm in height, ideally >137 cm to prevent coyotes from jumping over
    - Wires are typically 12.5 gauge
    - Types of material:
        - High-tensile electric wire, 5-7 horizontal strands

        - Woven wire or welded wire
        - Wooden or vinyl rail fence (will need woven wire lining whole fence or strands of electric wire or polytape between rails)

- Inside fences around pastures, paddocks, feedlots, and low-density sorting/handling areas
    - 80-105 cm height
    - Openings no larger than 15 cm x 15 cm
    - Wires are typically 17-19 gauge
    - Types of material:
        - Most types of wire that are suitable
        - Temporary fencing needs to be replaced more frequently
        - Stock panels can also be rearranged to make temporary

- Fences in high-density handling pens and chutes need to be stronger
    - Types of material:
        - Stock panels
        - Woven or welded wire ± wooden rails



A. Welded wire fencing **B.** High-tensile wire fencing **C.** Recommendations for high-tensile wire spacing from Zareba Systems **D.** Sheep stock panels with wire mesh **E.** Lambing pen from portable wire stock panels **F.** Temporary electric fence using polywire on reels, **G.** Temporary electric fence using netting

Space allowance

- A sheltered area such as indoor pen or shelter within pasture or outdoor pen, should be large enough for all sheep to lie down, change position, or turn around in shelter without touching
    - Long fleece or horns therefore increase space requirements
- It is important to have more space with hot conditions or in areas with less ventilation
- Slotted floors decrease space requirements by increasing ventilation and heat escape
    - Proper measurements of distance between slotted floors and size of slots can be found in the Code of Practice for the Care and Handling of Sheep

Table 1. Minimum space requirements in **m^2/head** for different types of housing (adapted from Code of Practice for the Care and Handling of Sheep, 2013)

Class of sheep	Open-front shed	Hard-floored feedlot	Soil feedlot (with paved strip)	Slot-floored housing
Pregnant ewe	1.4	1.4	6.5	0.65
Non-pregnant ewe	0.93			
Ram	1.0			
Ewe and young lamb	1.5			
Feeder lamb	0.6	0.6	2.8	0.4

Protection from elements

- It is recommended that there are dry laying areas for the livestock during any adverse weather.
- An open-front shed is common and often sufficient
    - It should be at least 2.7 m (9 ft) high for proper ventilation
    - The shelter roof should be sloped to avoid accumulation of snow and prevent dumping snow/rain at the entrance
- It is also important to note, that during extreme winter conditions, additional bedding and feed may be required to meet the increase energy demands for maintaining body heat.

Indoor Housing

- Ventilation
    - Ventilation is crucial for good air quality and preventing respiratory diseases in all livestock
    - If ammonia can be smelled, ventilation is inadequate and measures to correct this must be performed.
    - Natural ventilation: shed ceiling heights of >2.7 m, open front shelter, windows.

    - Mechanical ventilation: fans or other ventilation system may be necessary.

- Drainage
    - Open-front shed: soil floors require the best drainage (build shed on high ground) due to mud; concrete floors should slope so that water runs off.
    - Barn/indoor housing will require more thought to drainage system design i.e., slotted floors, daily/weekly cleaning of pens, etc.
- Footing
    - Smooth floors can quickly become slick and become a slipping hazard.
    - Sheep and handlers are at a significant risk of injury from falls
        - Falls can cause anything from bruising that reduces carcass yield to serious injuries resulting in euthanasia
    - Deeper grooves in concrete will reduce risk of falls
        - Use 3.5 cm diameter expanded metal to stamp a pattern of grooves into concrete when it's laid
        - A grooving machine can score grooves into existing concrete

- Meeting safety and building codes
    - In many jurisdictions in New Brunswick, you must acquire a building permit before constructing any barn, silo, storage shed, etc.
    - First, look into building codes and regulations from the provincial Department of Agriculture as well as the appropriate municipal regulations
    - Determine appropriate pen size and aisle size
    - Determine electric and water supply – safety, outlets accessible wherever they may be needed for heat lamps, fans, etc.
    - Design quarantine/sick pens/stalls well-separated from the flock and each other

Handling and restraint area

It is important to have appropriate, efficient, and functional handling and restraint areas in any management system to reduce stress and therefore reduce risk of injury and disease. They also allow for inspection of overall health, treatments, and shearing/hoof trimming. Examples of handling systems can be found in the Handling section of this document (page 27-30), Saskatchewan Sheep Development Board (sksheep.com), Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) under livestock, and the National Farmed Animal Care Council Code of Practice for sheep.

Some handling equipment that may be practical is listed below:

- A confined handling area such as a stall or small pen
- A lead and sheep halter, with a sturdy bar or hitching ring

- Steel or aluminum blocking or trimming stand
- Headgate ± stanchions ± elevated platform

Quarantine pen

New arrivals should be quarantined for 2-3 weeks upon arrival to the farm. This is important for farm biosecurity as it allows the farmer to see if there is any disease in the new arrivals and prevents transmission to the current flock, but it also allows the new animals to adjust to the new environment.

Quarantine pens need to be made of materials that are suitable for sheep and are easy to clean, ideally non-porous material such as wood. They need to minimize risk of injury and allow sheep penned alone to see other sheep.

Lambing pen

A lambing pen or claiming pen is used to keep dam and lamb together for the first 2-3 days after lambing to decrease stress from other ewes and increase the chance they form a strong bond.

- At least 75cm or 30" high
- At least 1.20m x 1.50m (4ft by 5ft), 1.50m x 1.50m (5ft by 5ft) for larger ewes
- 4 stock panels with mesh are very convenient for setting up temporary lambing pens
- If lambing in winter, have an insulated lambing area, ideally with outlets for heat lamps, if needed

Cleaning and disinfecting

Establish a routine for when to clean, sanitize (lower the number of bacteria, viruses etc.), and disinfect (kill almost all viruses and bacteria, parasites) equipment and facilities.

Regular cleaning and biosecurity protocols go a long way to preventing an environment that breeds pathogens and to minimizing spread when sheep do fall ill. Manure and bedding need to be cleaned out most regularly.

Examples of equipment that needs to be **cleaned:**

- Water troughs- drain and scrub
- Feeders- empty and clean
- Any equipment in contact with bodily fluids (e.g., ear notch punches after use, shears after shaving bloody or manure-stained wool)
- Clipper blades- clean after each use to remove any lanolin

Examples of equipment that needs to be **disinfected:**

- Equipment used in the quarantine pen. After contact with new sheep in quarantine
    - Ideally, keep a separate set of tools for use with quarantined sheep
- Stomach tubes

- Bottle teats and bottles after each use
- Lamb pens before lambing
- Before using equipment that contacts body fluids
- Hands and equipment before touching area vulnerable to infection (e.g., milking, bandaging a wound)

Steps of cleaning and disinfecting are the same when applied to livestock handling areas and equipment as any other surfaces animals/humans contact, and many resources on effective and safe cleaning, sanitizing, or disinfection are available.

1. Remove bedding, manure, large debris
2. Scrub with soap and water
3. Rinse
    - While planning housing, consider how you'll reach facilities with a hose and how they'll drain
    - High-pressured hot water will be more effective in removing biofilms left by bacteria and some endoparasites.
4. Dry (for tools, wipe dry; for floors, use squeegee and air dry)
5. Apply disinfectant
    - Disinfectants differ in
        - Efficacity for killing different pathogens
        - Efficacity on different surfaces
        - How to store and dilute to preserve effectiveness and use safely, and how long diluted solution stays effective
        - How readily they are deactivated by organic matter or minerals
        - Safety measures and protective equipment needed
        - Application: length of contact needed, whether disinfectant should be wiped off after contact period
    - Always follow label directions, or your disinfection may be completely ineffective

Pasture Management

Grazing Management

Continuous grazing involves using a large enough pasture to feed sheep grazing it without restrictions throughout the grazing season.

Rotational grazing systems involve subdividing pasture and moving sheep between pasture areas. This is more labor-intensive but with significant benefits:

- Rotational grazing limits selective grazing, under grazing, or overgrazing of areas
- More equal distribution of manure, preventing manure accumulation in shaded areas and soil nutrient depletion in the rest of the pasture
- Rotational grazing increases forage yield and quality
- The longer a pasture rests, the less infected it will be with parasite larvae

Grazing at the correct stage of growth

The grass must be long enough to have built its root reserves, yet short enough not to have gone to seed. When the sheep are moved out of the paddock, the grass should still have about **4 inches** of leaf to help the root reserves boost regrowth and to keep sheep away from the most parasite-infested growth near the ground. Grass is ready for re-grazing at **6-8 inches** of growth.

Seasonal grass growth

- Spring: grass growth is much faster and more vigorous. The sheep should be quickly rotated, just 'topping' the pasture at this time to prevent overgrowth
- Summer months: grass growth slows. Sheep are eating more of the grass. It takes longer for the grass to re-grow and hence, the rotation is slower.
- Late summer/early fall: grass begins to grow faster. Often paddocks can be saved for fall pasture.

Aim for even grazing

It is important to achieve even grazing, with no un-grazed clumps or overgrazed areas. If you have difficulty achieving this, consider:

- Reducing the size of the paddock and grazing interval
- Multispecies grazing.
    - Goats tend to be browsers, eating more of the leaves of large or woody plants and less of the grass
    - Cows and horses are grazers, like sheep

- Look for unpalatable species, especially toxic ones, in the ungrazed areas. Sheep, unless very hungry, will avoid even the palatable plants growing around a highly unpalatable one. Weeding out the unpalatable species will prevent this.
- If there are overgrazed spots, even with intensive rotation, the pasture is likely overstocked. This is especially the case if animals are hungry, thin, or often trying to escape the pasture

Do not over graze, particularly just prior to winter
Always leave 4 inches for cool-season grasses or 8-10 inches for warm-season grasses.

Recognize surpluses early and conserve
Signs a pasture is under-grazed:

- Overly long patches (>10 inches for cool-season grasses, >24 inches for warm-season grasses)
- Patches going to seed
- Dead plant material
- Patches of low-growing weeds due to overshading from overgrown pasture

To get the pasture evenly grazed to desired length, you may increase stocking density or reduce the area of pasture available at a time.

Pasture composition

Depending on your needs, you may reseed your pastures with your desired plant species to obtain desired nutritional contents and growth patterns.

Cool-season grasses

- Most growth occurs with temperatures under 24° C in spring, with a smaller growth peak in fall
- Usually make up the majority of pasture composition
- E.g., timothy, bromegrass, fescue, orchard grass, Bermuda grass
- Some species (e.g., tall fescue) are well-suited for stockpiling as late-fall/winter pasture

Warm season grasses

- Growth rate peaks during summer, fastest growth at 29° C
- In areas with very hot summers (e.g., Prairies), pastures dominated by warm-season grasses are a good option, but in areas with more mild summers, pastures should be mostly cool-season grasses.
- E.g., sudan grass, switchgrass, big bluestem, eastern gama grass, Indian grass

Legumes

- Legumes
    - High in calcium and protein, retain protein
    - Lower in indigestible fiber and higher in calories by weight than grasses
    - *Risk of frothy bloat* when sheep are turned out in spring
        - Avoid >50% legume pasture
        - Never turn hungry sheep onto lush pasture in spring
        - To reduce the risk of bloat, feed hay before turning sheep onto pasture
        - Turn sheep out onto small section of pasture so they cannot selectively graze large quantities of legumes

Toxic plants

- In general, sheep do not find toxic plants palatable and will usually avoid them unless they are hungry
    - The most important prevention is to rotate pasture before palatable plants are overgrazed
- Familiarize yourself with common toxic plants of your area. If possible, look for people with experience to teach you. Factsheets can be found from many government and university websites.

Integrated parasite management

Make use of multiple parasite control strategies because resistance to dewormers is high among sheep parasites. Pasture management is a great way to avoid resistance. Common worms of sheep complete part of their life cycle on the pasture. This means eggs are shed in feces, mature to an infective larval stage, and be eaten by sheep for the parasite load of your sheep to grow. Disrupting this cycle with pasture management helps decrease parasite load.

- Rotating at least every 3-5 days
- Very hot temperatures greatly shorten development and survival time.
- Very cold temperatures and freeze/thaw cycles have a variable ability to shorten survival time.
- Shady, wet areas on your pasture may harbor infective worms much longer than most of the pasture.
- Haying will speed the death of parasites left on the pasture from sun exposure, and those harvested in hay are killed by the hot, dry storage.
- Rotating grazing with horses or cows will also prevent overgrowth.
- Avoid deworming the whole flock before moving to clean pasture
    - As immediately after deworming, only the resistant worms survive within your sheep. Keep animals on pasture where there are still eggs from non-resistant worms (those laid before deworming) which will dilute the proportion of resistant worms in your sheep.

- Targeted selective treatment to only the high shedders before turnout to a
- lambing pasture greatly reduces contamination of pastures that the vulnerable lambs and lactating ewes are exposed to.

Feed and water

Feeding your sheep

To maintain your sheep in good health, fulfill their nutritional and physiological needs, and promote a positive state of well-being and vigour among your sheep, it is important to ensure they have sufficient access to enough quality feed (including salt and minerals).

- The amount and nutritional composition required will depend on factors including:
  - Life stage and reproductive class
    - Age (nutritional needs change rapidly as lambs grow)
    - Sex
    - Intact (ram) or castrated (wether)
    - Reproductive status
  - Purpose and level of production
  - Weight
  - Body condition
  - Health status
  - Environmental Stressors
- To ensure the availability of feed and water, it is recommended you inspect sheep kept in confinement at least once a day
- Sudden changes in diet composition can have a negative impact on the health and welfare of sheep, therefore introduce diet changes gradually.

Young lambs have very different physiology and nutritional requirements from adult sheep, digesting food more similarly to a non-ruminant animal until around 50 to 60 days old. Their nutrition is discussed in later subsections. Key points:

- Newborn lambs must receive colostrum within six hours of birth.
- If the lamb is separated from the dam, milk replacer used must be formulated for lambs. Artificially reared lambs must receive a volume and quality of milk replacer to promote health, growth and vigour.
- Prior to being weaned, lambs must be regularly consuming adequate amounts of clean water and solid feed daily

Nutrition

A sheep's diet must include sufficient water, energy, protein, minerals, and vitamins. This section gives a simplified overview of sheep nutrition for owners to understand how to recognize potential nutritional problems – in truth, nutrition is a complicated science and professionals should be consulted if you have doubts about your feeding program.

Energy

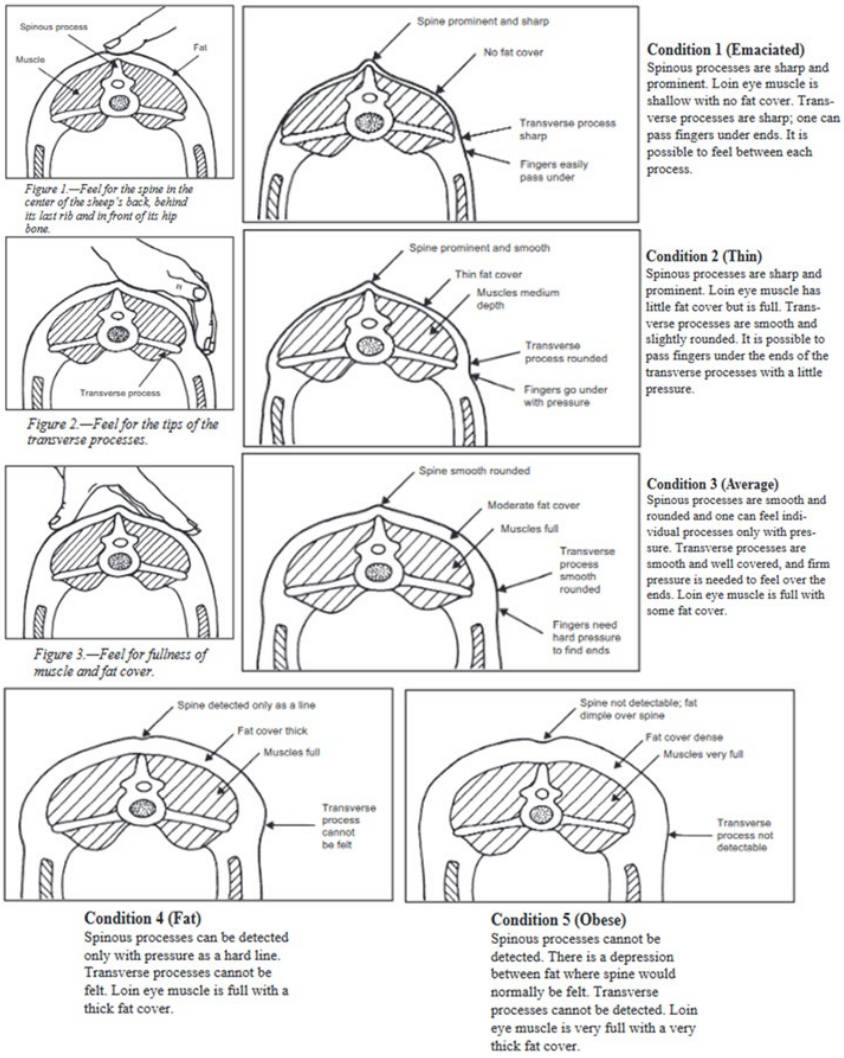
Energy provided by carbohydrates, protein, and fats is the most fundamental aspect of nutrition; it is often the limiting factor of their diet.

Monitor body condition on an ongoing basis and adjust your feeding program accordingly. If body condition falls below the target for the stage of production (Table 3.1) it is important to make adjustments.

Table 3.1: Body Condition Score Targets for Breeding Flock on an Annual Production System

Stage of production	Body Condition Score
Breeding	3
Early – mid gestation	3
Lambing	3+
Ewe at weaning	2+
Rams – pre-breeding	3+

Table from *Code of Practice for the Care and Handling of Sheep*, 2013
https://www.nfacc.ca/sheep-code



Body condition scoring guide. Images by James Thompson and Howard Meyer, from *Body Condition Scoring of Sheep,* 1994 https://www.uidaho.edu/-/media/UIdaho-

- Concentrates, especially “sweet feeds” with lots of loose grains and/or molasses are more energy-dense than forages
- Good-quality pasture or hay should provide sufficient energy.
- Rams have 10-15% greater energy requirements than wethers/dry ewes of the same weight
- In the last 6 weeks of pregnancy, energy needs are generally 1.5 times greater for single-bearing ewes and 2 times greater for twin-bearing ewes
- Energy needs are greatest for ewes in lactation, especially when nursing multiple lambs
- When energy-rich concentrates are fed, it is important to introduce them slowly (over 2-3 weeks) and ideally feed them in multiple small meals per day

Protein

Good-quality forage and pasture generally provide adequate protein for mature, nongrowing, nonlactating sheep. Nursing lambs require high-quality and high-quantity protein from milk or milk replacer.

- A minimum of 7% dietary crude protein is needed for maintenance in most sheep; good-quality pasture will easily meet this requirement.
- Mature sheep can convert nonprotein nitrogen (such as urea, ammonium phosphate, and biuret) into protein in the rumen. This is cheaper than protein, but caution is needed when replacing protein and should be discussed with your primary veterinarian or a professional nutritionist.

Minerals

Sheep require the major minerals as any other species and is an important factor to consider when thinking about their nutrition.

Salt provides sodium and chlorine.

- Salt should be provided free choice
- Loose salt avoids damaging teeth (sheep often bite salt licks)

Other minerals may or may not be sufficient in the diet without supplementation. Nutrient analysis of pasture, hay, and feed is recommended.

If providing a complete feed formulated to meet the roughage, energy, mineral, and vitamin needs for sheep of the correct life stage, additional mineral generally should not be fed, except for free-choice salt. Always read feeding directions of the feed.

- Trace mineralized salt, mineral blocks, or loose mineral mixes are often used. This is often relatively cheap and usually sufficient. If there is concern that the animals are still deficient due to clinical signs or presentation, contact your veterinarian or professional.

Calcium and Phosphorus

Calcium and phosphorus have many biological functions, most notably making up the majority of bone. Deficiency in either, or an imbalanced ratio, can cause skeletal problems (low bone density, joint stiffness), increased risk of hypocalcaemia/milk fever, anorexia, and lethargy in adults, as well as poor growth and bone development (often with irreversible effects) in lambs.

Iodine

Iodine is an important component of a complete diet that if deficient will manifest as a goiter (enlargement of the thyroid) and/or as lack of wool. Feeding a diet containing approximately 0.2%-0.8% ppm is sufficient and can vary due to the level of production of the animal.

Cobalt

Cobalt is not commonly measured or known in feedstuff; however, it is found in legumes and other grasses. Feeding a trace mineral salt will provide the animals with sufficient requirements of cobalt which is approx. 0.1 ppm.

Copper

Copper is a sensitive mineral to manage as too much can cause health complications. This will be discussed further in the manual.

Selenium

In the Maritimes, the soil is deficient in selenium/vitamin E, therefore all sheep are born selenium deficient. It is recommended by veterinary professionals to administer a dose to prevent nutritional muscular dystrophy, also known as white muscle disease. The dietary requirement is ~0.3 ppm.

Zinc

The daily zinc requirement can vary and is most commonly higher for growing lambs as they require ~30 ppm of zinc in the diet on a dry-matter basis. A deficiency in zinc will result as parakeratosis (disorders of the skin) and can be due to excess dietary calcium (legumes).

Vitamins

Vitamins of concern for sheep are vitamins A, D, and E.

- Vitamin D is necessary in calcium and phosphorus metabolism, so deficiency results in bone defects (rickets) and needs are increased with low or imbalanced calcium or phosphorus intake
- Vitamin D supplementation is only necessary when
    - There is limited sun exposure
    - Vitamin D2 in feed is insufficient
- Sources of vitamin E include green feeds and the germ of seeds. Vitamin E is poorly stored in the body, so a daily intake is needed.

Sheep past weaning age can easily meet requirements for B vitamins, vitamin C, and vitamin K from ruminal synthesis and feed, with no supplementation needed for healthy sheep.

- Newborn lambs cannot synthesize these vitamins in the rumen and need them from milk
- Thiamine (vitamin B1) can become acutely deficient, causing polio-encephalomalacia
- Additional B vitamins are sometimes administered by a veterinarian to help recovery from some illnesses

Life stage nutrition

Feeding Ewes

The method of feeding ewes can vary depending on the desired outcome.

Ewes should make daily gains without getting overweight, as this can cause reproduction complications. The body condition score at lambing should be 2/5-3/5.

If multiple lambs are desired, flushing is started 6-8 weeks before breeding. Flushing is increasing the nutrient and energy provided to the ewes to induce multiple ovulations, most commonly in the form of grain. This is done slowly by gradually increasing the amount of grain prior to breeding, until lambing and during lactation.

The recommended daily average gain should be 0.5-0.75lb (225-350g)/ day.

Lactating Ewes

Managing lactating ewes can be done in various ways depending on weather and resources. If there are lush pastures with lots of good grass and legumes it is sufficient to provide the ewes with enough energy, proteins, etc. to produce milk. If pasture raising is not an option, good forages and rations are also sufficient. It is important to consult with your local nutritionist or veterinarian on proper ration use. It is also important to note that ewes with multiple lambs will have a higher energy demand than single lamb ewes.

Lambs

The method used to rear lambs is dependent on the path of production for the lambs (replacement, meat, etc.). If rearing lambs for the lamb meat market, there are some general guidelines according to age that can be followed:

- Creep feeding (giving access to grain) can be started at 2 weeks of age
- Pasture available: creep feed for another 1-2 months
- Pasture not available: finish in dry lot with forage and grain
- Always introduce and increase grain gradually
- Use coarse or rolled grain at the beginning and as they age can change to whole grains

Rearing Lambs on Milk Replacer

It is common to rear lambs on milk replacer if they are orphans, the ewe does not have sufficient milk, or if there are more than two lambs to a ewe. If the ewe does not have colostrum, you can use frozen or colostrum replacer.

When purchasing milk replacer ensure it is used for lambs and follow the instructions on the package as they vary between different brands.

- Split feedings into 4-6 feedings/day
- Number of feedings can be reduced over time

- By 9-10 days they can have access to water
- Lambs can be weaned at 4-5 weeks if they are eating sufficient feed and water

Feed quality

Feed of poor-quality puts health and productivity at risk in your flock. Feeds of poor quality also have a higher risk for toxic contaminants and pathogens.

- Remove stale or contaminated feed from troughs before more is added
- Dispose of silage that has deteriorated in storage or in the feed trough

Feed safety

Feed safety involved three general components: proper storage and forages stores, proper diet, and toxins. It is important to store forages properly and have enough forages to last the winter. This ensures high quality forages. Proper diet involves monitoring animal health and paying close attention to high energy diets. Prevention of exposure to toxins is also an important aspect of feed safety. Examples of toxins to sheep are:

- Lead batteries
- Fertilizer
- Treated seed
- Antifreeze
- Nitrates

Feeders

The recommendations for feeder space can vary according to the Code of Practice for the handling and care of sheep. Below you can find this recommendation:

- Ewes and rams free-choice feed: 6” per animal is required
- Ewes and rams hand fed: 16” per animal is required
- Feeder lambs free-choice feed: 4” per animal is required
- Feeder lambs hand fed: 12” per animal is required

If there is not enough space to accommodate all sheep to eat at the same time, it will lead to competitive interactions and increase waiting time to access feed.

Water

Water is a crucial component for good health as it is a contributing factor for controlling bodily functions such as temperature regulation. Consumption of water may vary greatly depending on the type and size of the sheep, physical state, health, level of activity, dry matter intake, quality of water, temperature of water and the environmental temperature.

Class	Approximate intake (gallons)	Approximate intake (L)
Lactating ewe	2.5 - 3.0	9.0 - 11.4

Dry ewe or ram	1.0 - 2.0	4.0 - 7.5
Feeder lamb (25-50 kg)	1.0 - 1.5	3.6 - 5.6
Lamb (3-9 kg)	0.1 - 0.3	0.4 - 1.2

- Needs increase with increasing temperature, decreasing humidity, drier feed and forage (green pastures have high water content), and high-protein and salt-containing diets
- During the winter, it is important that feed intake is not limited by a lack of water as there are increased energy needs during periods of cold temperatures
    - Snow is not an acceptable source of water
    - Keep water temperature above 3°C
- During summer, keep water temperature below 30°C

Water quality is important to sheep; it may affect feed consumption and animal health since poor water quality can result in reduced water and feed consumption.

- Change water in troughs and scrub troughs regularly
- Get water tested for total solids, pH, chemical, and biological contamination if you suspect an issue (and, ideally, for regular monitoring)

Handling

Depending on the operation, sheep may be either handled frequently or barely. Either way it is important to have an efficient, safe, and effective handling system. Reasons for handling sheep can be found in the table below.

Table from Susan Schoenian (2021), http://www.sheep101.info/201/handling.html

Reasons for handling sheep

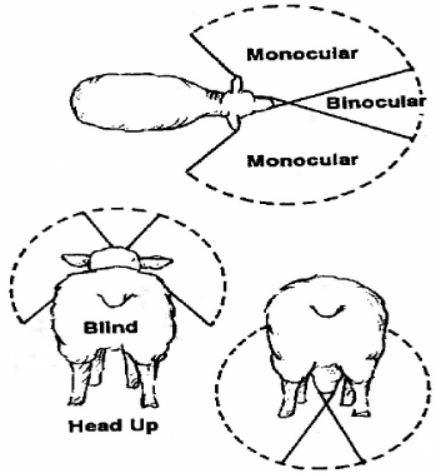
Body condition scoring Catching Crutching Deworming Dipping Ear tagging FAMACHA© scoring Foot soaking Hoof trimming	Loading Pregnancy testing Shearing Sorting Treating Ultrasound scanning Vaccinating Weighing

*FAMACHA scoring see page 30 of manual

Basic concepts of sheep behaviour

Understanding sheep behaviour is important to have the handling process go smoothly. Below is a list of some important concepts:

- Move most predictably and cooperate best with handling when not stressed or afraid
- Social animals, distressed by separation from and especially not being able to see flock
- Very strong instinct to follow other sheep
- Sheep *will* remember and learn from experiences, good or bad
- Sheep like the familiar and routine



Sheep field of vision, from Sasketchewan Sheep Development Board https://www.sksheep.com/documents/Ex_Understanding_Sheep_Behaviour.pdf

Have binocular vision (can see depth) over ~45° in front of them, monocular vision (cannot see depth) over ~125° to each side, and a blind spot of ~60° directly behind them

    - Larger blind spot for sheep with more fleece behind eyes
    - With their heads lowered, directly behind them comes into their field of view
- Do not like to move into darkness – place chutes, headgates, etc. in good lighting
- Stressed by rapid movements from potential threats (e.g., people, dogs), sudden loud noises, and certain smells (e.g., predators, burnt flesh from dehorning)
    - Move slowly and calmly, do not wave arms or objects around wildly

- Avoid dogs barking, yelling, banging, loud whistles

Flight zone

One of the most basic concepts in handling sheep and other livestock is the flight zone. A flight zone is an animal's personal space. It is where the animal feels comfortable and unthreatened. When a person is in the pressure zone just outside the animal's flight zone and in the field of view, the animal will watch the handler.

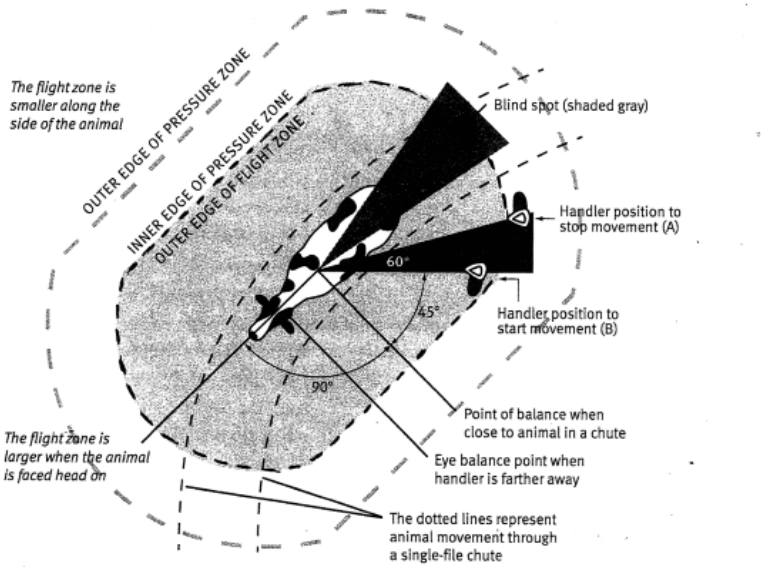
Entering the flight zone initiates movement away from the handler. When using the flight zone to drive sheep, keep these principles in mind:

- Work at the edge of the flight zone, moving in and out slowly to gently apply and release pressure
- Don't work against other principles of sheep behaviour (isolating animals, driving them quickly towards new or scary stimuli, etc.)
- The size of an animal's flight zone varies

Point of balance

To use the flight zone to drive sheep, the point of balance must be understood.

- Point of balance is at the animal's shoulder.
    - Livestock will move forward if the handler steps behind the point of balance.
    - Livestock will back up if the handler stands in front of the point of balance.



FLIGHT ZONE AND POINT OF BALANCE. To move a single animal forward, the handler must be behind the point of balance and stay out of the blind spot directly behind the animal. When the handler is close to the animal, the point of balance is at the shoulder. When the handler is farther away, the point of balance may move forward to just behind the eye. When the handler is on the outer edge of the pressure zone, the animal becomes aware of the handler's presence and turns around and looks. When the outer-most edge of the flight zone is penetrated, the animal moves away.

Moving sheep

Very often, you need to move sheep, to bring them in from a pasture or to move them to another pasture.

- Trained herding dogs can skillfully move sheep
- Train sheep to come via vocal command or feed bucket
- If the sheep aren't familiar with where you want to move them, you may need several people to act as herders
- Low-stress handling is always a priority
    - Always move sheep slowly, calmly, and quietly
    - Do not allow splinter groups to develop
    - If sheep start to get excited, allow them to calm down undisturbed before trying again

Catching sheep

When you need to catch individual sheep, if you do not have a chute or race to assist you, you can use gates and panels to make a small catch pen. You should make the pen small enough so that you do not have to chase the sheep – there should be standing room only for the group of sheep. Once the sheep are in the catch pen, maneuver them into a corner and use your arms or a portable gate to form a visual barrier

- Always approach sheep calmly and slowly
- Cup your hand under the jaw of the sheep you want. Grab the bony part of the jaw, not the throat
- Point the sheep's nose upward to stop its forward motion
- If you keep the sheep's head up, you will be able to maintain control of it
- Sheep have a lot more power when their head is down
- Once you have a hold of the sheep’s jaw, put your opposite hand on its rump to stabilise it

Sheep restraint, from Meat & Livestock Australia: A producer's guide to sheep husbandry practices

You should never catch a sheep by its wool.

Restraint

There are many different ways to restrain a sheep, depending upon what you need to do with it.

- Once you've caught the sheep as described above, you can press it against a wall or straddle it to limit its movement
- Sheep can be tipped onto their rear, as described below, to access their hooves and underside
- Restraint devices can be used to limit the strain on the handler or have both their hands free

A. DIY wooden headgate with feed trough, instructions at https://www.youtube.com/watch?v=h62nKUagh1w B. Example of a sheep chair, from Premier1 Supplies; C. Example of a trimming stand, from Hamby Dairy Supply; D. Example of a commercial chute, from Lakeland Farm and Ranch; E. Gambrel restrainers, from Premier1 Supplies

Reproduction management

Ram management

Rams have a slightly different mentality than ewes and it is important to understand these characteristics/facts to prevent any damage to the animal, the handler, and prevent unplanned breeding's.

- Ram lambs can start to breed at four months of age
- Keep rams of breeding age separate from ewes to prevent unplanned breeding's
- Rams can display aggressive behaviour towards other animals or the handler
- Introduce new rams to the flock slowly
    - Quarantine
    - Put in side-by-side pens
    - Place rams in same pen with obstacles in case of aggressive behaviour (e.g., barrels)

Ewe care (sheep)

Controlling estrus

It is common in a commercial setting for farmers to manipulate the reproductive cycle of the ewes. Examples for such reasons are the following:

- Marketing purposes
- Accelerated flocks
- Synchronization of the flock

Methods to manipulate the reproductive cycle of the ewe can be done with hormones, using the ram effect, or photoperiod adjustments.

Breeding

It is important to keep in mind that sheep are long day seasonal breeders, and therefore the photoperiod becomes a crucial aspect when breeding. The breeding season for sheep can vary, but in general it ranges between August and January.

Different breeding methods used are natural, artificial insemination, and embryo transfer.

Depending on the reproductive manipulation it is common for commercial systems to lamb once a year, whereas accelerated systems may lamb twice per year or three times in two years.

Gestation/Pregnancy

Pregnancies can be diagnosed via ultrasound at approximately 60 days of gestation/pregnancy. Keep the ewe on the same diet until six weeks prior to lambing. For the last six weeks, start feeding grain. Starting with small increments and increasing the amount gradually. It is important to have all ewes up to date on vaccines and being in a selenium deficient region, administration of selenium prior to lambing may also be recommended.

To increase cleanliness during lambing, it is recommended to shear the sheep around the vulva, and udder.

Lambing

It is important to think about the ewe's body condition when getting close to lambing. A ewe which is above a 3.5/5 can have increased risk of complications. It is recommended ewes have a body condition score of 3-3.5/5 at time of lambing.

Signs of lambing are the following:

- Ewe separating herself from the flock
- Pawing at the ground
- Discharge from the vulva
- Straining
- Presence of water bag

Ensure the ewe has a clean place to lamb either indoors or outdoors.

Complications

Complications can occur for various reasons during lambing, this is referred to as dystocias. Dystocias are influenced by:

- Breed
- Number of lambs
- Birthweight
- Age of ewe
- Nutrition during gestation and sex of lambs

Parturition for a normal lambing is ~30 min. If the ewe is straining with no visible progress over 30-40 min the ewe may need assistance. Assistance can be provided by the farmer or by calling a veterinarian.

Lactation

Ruminants obtain all their antibodies from the transfer of maternal antibodies via colostrum. Lambs also do not have many body reserves. Therefor it is important that lambs obtain colostrum approx. 6-8 hrs after they were born. The Code of Practice for the Care and Handling of Sheep recommends the following:

- 50ml per kg of bodyweight within two hours of birth
- 200ml per kg of bodyweight within the first 24 hours

If there is inadequate intake or absorption of colostrum it is referred to as "failure of passive transfer". This can result in lambs that are poor growers and have an increased risk of becoming sick.

Disease prevention

Concepts - biosecurity

There are basic concepts that need to be understood regarding biosecurity. These farm-level biosecurity concepts come from the National Sheep On-Farm Biosecurity Standard, and they can be found below:

Farm-level biosecurity

- Introduction of infectious pathogens on to the farm
- Spread of pathogens within farm
- Export of pathogens off the farm

Focus of biosecurity

- Exclusion of pathogens introduction
- Management to reduce spread
- Containment within the farm

Animal Health Management Practices

There are simple animal health management practices that should be considered for best practice. Examples are listed below:

- Use a flock health program
- Source sheep from reliable source
- Biosecurity management
- Isolate and separate sick sheep
- Quarantine new entries
- Implement health standards
- Limit access to pests, predators, wildlife and visitors

Record Keeping

Maintaining good records is an important component to farming. Recording animal movements (on-off farm), breedings, vaccinations, treatments, veterinary breeding/reproductive exams, and deaths are all very important. There are resources present to assist with record keeping. Having an emergency plan in place is also a good idea and should be recorded and accessible to everyone on the farm.

People/Visitors

1. Conduct risk assessments for all people entering the farm (e.g., do they have their own sheep?)
2. Develop and enforce risk management practices for all people visiting the farm, using the risk assessment outcomes
3. Know what people are on the premises

4. Train farm workers and communicate with them about biosecurity; inform all visitors and service providers
5. Recognize zoonotic risks

Herd health

It is good practice to have an annual or bi-annual veterinary check up, known as a herd health or flock health visit. This allows the farmer to ask any questions, learn new techniques, learn new information on vaccination, have sick animals examined, and have pregnancy checks performed.

It is also important for the farmer/owner to be able to identify normal and abnormal behaviour for indication of the health status of the animals. Below you can find a chart of normal ranges for a general physical exam.

Normal ranges for physical examination findings in sheep

Finding	Normal Range
Respiration	20-30 breaths/minute
Heart rate	70-90 beats/minute
Rectal temperature	38.9-40.0°C (average 39.5°C)
Rumen contractions	1-2 contractions/minute

Rodent control

Rodent control is an important aspect of cleanliness of the farm. Rodents carry various pathogens that can contaminate feed sources and therefore affect the health of the sheep. It is important to consider how rodents can be controlled. This can be via a chemical method (rodenticide) however this must be located where the sheep cannot obtain access to it, natural deterrent (cats), or traps. Proper waste management will also decrease the chance to attracting rodents.

Animal health and well-being

Signs of poor health

- Rectal temperature less than 38.0° or over 40.0°
- Behaviours indicating pain
    - Change in activity level or behaviour
    - Guarding or avoiding using a body part e.g., not wanting udder touched or milked
    - Lameness
    - Restlessness, repetitively getting up and laying down
    - Abnormal posture e.g., hunched back
    - Abnormal behaviours e.g., stomping, grinding teeth, “yawning” repetitively
    - Rapid breathing while resting
    - Kicking, biting, rubbing, or shaking a painful body part
- Dull eyes and attitude
- Inner eyelid (mucous membranes) white or pale pink
- Spending more time laying down or seeming weak
- Reduced appetite
- Weight loss
- Less time spent chewing cud
- Bloated abdomen
- Diarrhea or clumped feces
- Coughing, wheezing, shallow or otherwise abnormal breathing
- Discharge from orifices (eyes, nose, vulva, etc.)
- Poor wool or hair quality or loss
- Body part that is reddened, swollen, or hot
- Hooves with overgrowth, underrun heels, foul smell, any pus or slimy/tar-like substance, or redness/swelling/heat/moisture/hair loss in coronary band or heel or between toes
- Inappropriate body condition

Health emergencies

It is important to be prepared for medical emergencies when they arise and to have a good relationship with your veterinarian to come and assist. Some emergencies may be more straightforward, whereas others will require professional help. Below are examples of some medical emergencies that may be encountered when raising and breeding sheep.

- Flystrike
- Rumen overload
- Hypocalcemia (milk fever)

- Ketosis (pregnancy toxemia)
- Polio-encephalomalacia
- Bloat
- Water belly (urinary calculi)
- Rectal prolapse
- Vaginal prolapse
- Uterine prolapse
- Stabilizing fractures.

Flock health protocols

The goal is to prevent health problems (and increase productivity through prevention of sub-acute health problems, which can go undetected) rather than treating problems once they've developed. Other goals of flock health protocols are to prevent animal suffering and avoid considerable economic losses.

- Identify the greatest health challenges to your flock and its performance
- Identify the causes or risk factors contributing to the health challenges
- Eliminate or mitigate risk factors

Protocols you should develop for your farm include

- Biosecurity
- Vaccination (which vaccines, timing)
- Deworming (how to select animals, timing, and product)
- Breeding management
- Lambing and lamb care (recognizing when assistance is needed, ensuring lambs get colostrum, when to castrate, whether/when to dock tails, etc.)
- Supplementation, if ewe does not have enough milk to feed lambs, triples are born etc.
- Preventing predation and injuries
- Recognizing and knowing how to respond to different health problem
- Emergency responses (flood, fire, storm, etc.)
- A vet-client-patient relationship (VCPR) also is important to have access to medications and protocols for their usage on your farm and for access to emergency visits

Veterinarians in New Brunswick are licensed under the New Brunswick Veterinary Medical Association (NBVMA). All practicing veterinarians must adhere to by-laws and a veterinary act in New Brunswick. A veterinarian can not diagnose or treat an animal without a valid VCPR. To learn more about the NBVMA and to locate a veterinarian see https://nbvma-amvnb.ca/

Shearing

Shearing is an important aspect of sheep health management and husbandry. Shearing the sheep has many benefits and should be done at least once a year. It is best to contact a

professional sheep shearer in your area to see how it is done and learn tips and tricks before attempting on your own. It is a skill that takes time to learn, requires various equipment, and is a stressful time for the sheep.

When shearing the sheep, it is important to consider the time of year, weather, and lambing season. There is risk of transferring disease from one sheep to another during shearing, so keep any diseased sheep for the end.

Dehorning/Horn Trimming

Dehorning is not common practice as majority of the breeds are polled. Familiarize yourself with the breed you have and understand their needs.

If there is an animal in your flock with horns, it is important to ensure the horns are not growing inwards towards the eyes or head or are preventing the animal from accessing water or forage. If this were the case, a horn trimming may be necessary and may require assistance from a veterinarian.

Medical supplies and equipment – basics

Below is a list of items that every sheep owner should keep:

- Syringes and needles
    - Have a sharps container for safe disposal
- Rectal Thermometer
- Stethoscope
- Vet wrap
- Bandage scissors
- Hoof trimmers
- Balling gun, sheep size
- Chlorhexidine soap for washing wounds
- Deworming medication
- Clean towels for lambing
- Nitrile/latex gloves
- Saline solution

Vaccination guidelines

Vaccination guidelines can vary depending on your region. It is best to contact your veterinarian about preferred vaccination protocols. Vaccinations contribute to preventative medicine.

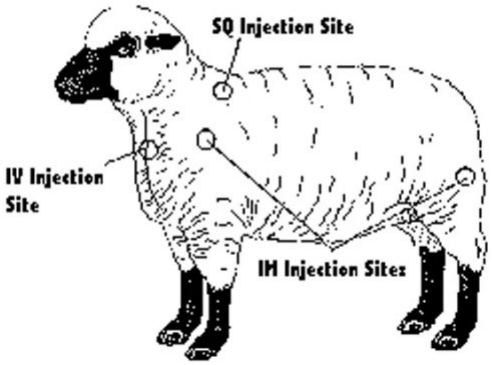
Some tips and tricks to vaccinations:

- Always read the label
- Follow instructions
- Use most accurate weight if required
- Have proper handling facilities

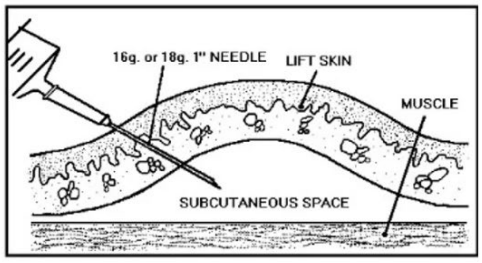
- Ensure injection site is clean to prevent formation of post-injection abscess
- Use new needle per animal to prevent disease transmission

Below are images on the appropriate injection sites and more detailed image of needle placement for subcutaneous and intramuscular injections.

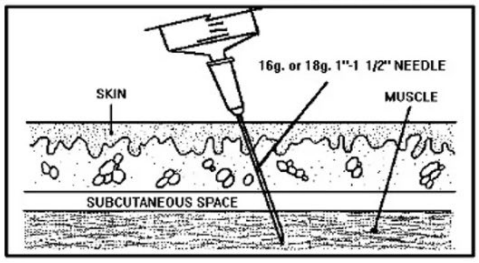
INTRAVENOUS INJECTIONS (IV)



SUBCUTANEOUS INJECTIONS (SQ)



INTRAMUSCULAR INJECTIONS (IM)



Images: https://ourlittleflock.com/administering-medications-1

Parasite control

Controlling parasites is an important aspect of sheep health and management. There are two types of parasites, internal (endoparasites) and external (ectoparasites). Parasites can impact the animal in many ways:

- Disease
- Emaciation
- Anemia
- Irritation
- Death

What makes parasites difficult to control is the increasing resistance to anthelmintics (dewormers) and for this reason sheep should only be treated when symptoms are present or if there is a high worm burden on fecal flotation. It is important to discuss with a veterinarian on types of dewormers to use.

There are two seasons when treatment for gastrointestinal parasites (GI) is important, spring and fall. The protocols for each season are listed below:

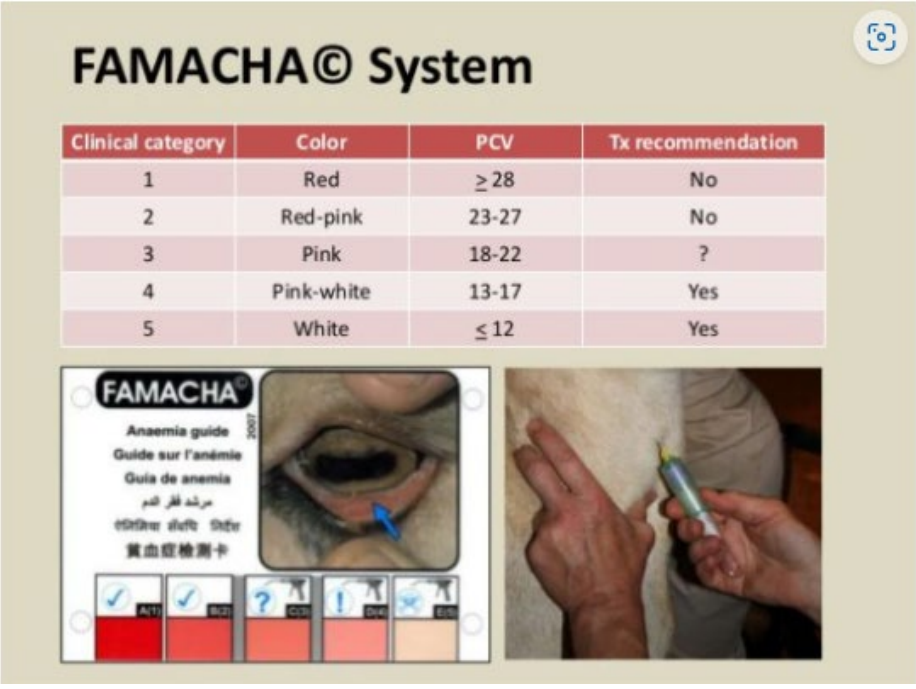
GI parasites spring control:

- Do not graze late gestation ewes – increased risk of parasite overload
- Weaned lambs should be moved to clean pastures
- Only animals presenting with symptoms of a high parasite burden should be treated to decreased parasitic resistance. Signs of high parasite burden:
    - High fecal egg count
    - Loose feces
    - FAMACHA scoring
    - Weight loss

GI parasites fall control:

- Rotate pastures as parasites can remain on pastures for 3 months
- Use effective dewormers
- After deworming targeted sheep – do not rotate for 3-5 days after
- Do not treat prior to breeding
- If pastures are heavily burdened – pasture with different species of animals, plough or re-seed with grass species

The most common internal GI parasite is *Haemonchus contortus (*Barber's pole worm) which causes Haemonchosis. This parasite drains blood from the mucosa of the abomasum and make the animal anemic leading to death. The best method for diagnosis is Haemonchosis is via the FAMACHA score.



Ectoparasites can also be a concern and are commonly seen on sheep skin or fleece and can have a big impact on growth and production. The best way to reduce the number of ectoparasites is to quarantine all new sheep, treat new sheep who present with ectoparasites, and keep environment clean.

Disease management

Animal health relies on proper and effective disease management. This can be affected by:

- Nutrition
- Ventilation
- Housing
- Management practices

Prevention is key and includes, organized on-farm record-keeping including, breeding's, lambing's, diagnosis, treatment, drugs administration, vaccination, and mortality.

Common diseases

Urinary calculi (stones)

Crystals are carried along in the urine flow and block the urethra. Severe blockages cause the bladder to distend and possibly rupture ("water belly"). If rupture occurs prognosis is poor. Common occurrence in:

- Wethers (very common)
- Rams fed high-grain rations
- Lambs being creep-fed
- Feeder/finisher lambs

Calculi development is related to the intake of magnesium, calcium, phosphorus and potassium.

Footrot

Footrot is caused by bacterial species which favor warm, moist conditions, and is common during a rainy spring/summer. The foot may start to swell due to inflammation, warm to the touch and red.

The best way to prevent footrot is to catch it early, discuss treatment with a veterinarian, isolate animals to prevent from spreading to other animals, and making a note in records.

Polio-encephalomalacia

Polio-encephalomalacia is a neurological condition caused by a thiamine deficiency. For prevention, it is important to make slow dietary transitions and to feed enough forage. Signs of polio include the below non-specific signs:

- Unusual gait
- Disorientation
- Weakness
- Anorexia
- Blindness

- Inability to stand
- Rigid posture with neck hyperextended (" stargazing")
- Seizures

Get in touch with your veterinarian to discuss treatment options and other preventative measures.

Epididymitis

Epididymitis is caused by *Brucella ovis* and *Actinobacillus seminis.* The texture of the testes becomes harder than normal as the disease progresses. Oftentimes, only one testicle is affected. To confirm diagnosis, a semen collection and examination can show that there is a reduced semen production. There is no treatment for this condition and no approved vaccine in Canada.

Pneumonia

Pneumonia is when there is inflammation of the lungs which is almost always multifactorial. The infecting agent of pneumonia can be bacterial, mycoplasma, or virus, and make it difficult to identify as a lot of these are normal lung flora. This disease process can be brought on by stress, environmental (poor barn ventilation, ammonia build up, high humidity, overcrowding, etc.), and/or decreased immune system.

Clinical signs can vary depending on severity, but are listed below:

- Panting
- Nasal discharge
- Coughing
- Heavy breathing
- Increased respiratory rate
- Lethargic
- High temperature

Talk to veterinarian about treatment and discuss any management or environmental factors that can prevent the onset of disease.

Johne's Disease

Johne's disease is caused by *Mycobacterium avium* subspecies *paratuberculosis* which is characterized by wasting and followed by death. It often is seen clinically in animals older than 3 years of age. The bacteria are spread via the fecal oral route from ewes to lambs. Clinical signs occur due to the thickening of the intestine where the bacteria manifests and leads to decreased and interference of nutrient absorption. As this disease is detrimental it is crucial to have early diagnosis and contact your veterinarian.

Chronic Copper Poisoning (CCP)

Sheep are at highest risk of chronic copper poisoning. Excess copper is stored within the liver and when released in large amounts due to an inciting stress event (weather, poor nutrition, etc.) the copper breaks down hemoglobin – oxygen carrier of red blood cells – it leads to poor body oxygenation and the animal becomes cyanotic and anemic. Even though the copper accumulation in the liver can take months to build up before it reaches toxic levels, it is important to give sheep low copper feed and forage.

If copper toxicity is presumed contact your veterinarian to obtain a blood sample to diagnose and discuss treatment/preventative options.

Flystrike

When flies lay eggs on an animal it is called flystrike. Risk of flystrike depends on the individual susceptible sheep and environmental conditions. There are common locations where flystrike occurs which are the hindquarters, around the anus, wounded areas, and areas of wet wool. Signs are scratching, biting, rubbing, lethargic animals. Once flystrike is suspected, treat immediately.

Reportable diseases in Canada for Sheep

As an animal owner it is important to be aware of some of the reportable diseases in Canada for sheep. If any of the diseases listed below are suspected, call your veterinarian immediately. Reportable diseases in Canada for sheep are the following:

- Anthrax
- Bluetongue
- Brucellosis
- Cysticercosis
- Foot-and-mouth disease
- Peste des petits ruminants
- Rabies
- Rift Valley Fever
- Scrapie
- Sheep and Goat pox
- Vesicular stomatitis

Euthanasia and deadstock

Euthanasia plan

It is important to have a plan in place when there is a decision to made regarding euthanasia. The method of euthanasia must be quick, result in rapid loss of consciousness and cause minimal pain or stress to the animal.

Methods of euthanasia can be found below in Table 7.1 from the Sheep Canadian Code of Practice.

Table 7.1: Identifies the acceptable methods of euthanasia for sheep

Method of Euthanasia	Suitable for:	Procedure and Equipment
Firearm	All animals	Minimum of .22 caliber firearm using "long-rifle" hollow-nosed ammunition and .22 magnum for horned animals; or shotgun with appropriate ammunition (See *Appendix L.: Euthanasia*)
Penetrating captive bolt* followed by a secondary method	All animals	Restrain if necessary Use appropriate cartridge, charge and bolt length for the animal (Manufacturer's manual) Accurate marksmanship is critical for ensuring loss of consciousness (See *Appendix L.: Euthanasia*) Confirm insensibility then follow with immediate bleeding out or pithing to ensure death
Non-penetrating captive bolt guns (Controlled blunt force trauma)	Lambs (under 15kg (33lbs. [70])	Confirm insensibility then follow with immediate bleeding out to ensure death
IV Barbiturate overdose	All animals	Must be administered under the direction of veterinarian Restraint if needed Carcass is toxic; safe disposal is required
Blunt force trauma followed by bleeding out	Neonatal lambs up to 5 days of age and under 9kg (20lb.) only	Sufficiently strong blow accurately placed on top or back of the head Palpate or visually confirm the skull is crushed Confirm insensibility then follow with immediate bleeding out to ensure death

** Penetrating captive bolt guns specifically designed for euthanasia are available and should be used according to manufacturer's instructions*

Things to consider when euthanizing an animal are listed below:

- Human safety
- Ability to easily restrain the sheep
- Appropriateness for the type of sheep (e.g., animal age, weight or horns)
- Degree of difficulty of the procedure
- Procedural costs
- Emotional effects on the operators or observers
- Disposal options

It is important to have someone on the farm who has the training, skills, ability and knowledge regarding euthanasia or contact someone who does (e.g., veterinarian).

There are two steps to euthanasia, unconsciousness followed by death. Indicators for unconsciousness are lack of corneal reflex, lack of jaw tone, lack of rhythmic breathing, lack of coordinated movement. Death is confirmed via lack of heartbeat, breathing and dilated pupils.

Deadstock disposal plan

It is important to think about a deadstock disposal plan for your farm. Deadstock can serve as a biosecurity risk/environmental hazard and should be disposed of and managed as soon as possible. Follow any guidelines or by-laws implemented on disposal for your regional, municipal, and provincial governments. Here are some different options for disposal listed below:

- Incinerating (at an approved incinerator)
- Sanitary landfills (at an approved landfill)
- On-site/farm burial
- Composting

See the provincial guidelines associated with carcass disposal at:
https://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Agriculture/Livestock-Betail/CarcassDisposalGuidelines.pdf

Transport

Fit to transport

In a production setting sheep are often moved either from farm to farm or from farm to slaughter plant. It is important to evaluate the health and fitness of your animal prior to transport to evaluate if they can be transported. There are three categories to consider when evaluating the animal for transport: fit (good health and no underlying disease or illness), unfit (signs of infirmity, illness, injury or indicates it cannot be moved without suffering) and compromised (reduced ability to withstand transport). It is important to contact regulatory authorities for further clarification and refer to the Canadian, Sheep Code of Practice.

Tools and supplies needed

A livestock transport trailer is the preferred method for moving livestock. The size and design of the trailer should be compatible with the size and number of livestock being transported. A truck should also match the size and design of the load and be in good working condition. When transporting animals in trailers, adequate ventilation and protection from the weather conditions (e.g., hot or cold temperatures) must be provided. The front of all transport vehicles must provide protection from the wind. Animals must also be tagged before leaving the farm.

Proper loading

When transporting animals, loading is the most stressful aspect. For this reason, reducing stress is an important aspect. Some tips on properly loading animals can be seen below.

- Ensure there is good lighting
- Move sheep in appropriate groups
- Allow sheep to dictate pace
- Be calm and quiet
- Do not overcrowd animals
- Separate sheep into different classes: females with lambs, mature males, pregnant females, etc.

Resources

General

- The Code of Practice for the Care and Handling of Sheep https://www.nfacc.ca/codes-of-practice/sheep
- https://agpal.ca/#/home searches federal, provincial, and agriculture organization databases for articles, guides, services/programs/funding, and training/courses relevant to all agriculture-related topics
- Canadian Sheep Federation https://www.cansheep.ca/index.html offers information on national sheep biosecurity programs, newsletters, and market reports
    - The Canadian Verified Sheep Program is a quality assurance program offering free training, including an extensive manual available online https://www.cansheep.ca/cvsp.html
- Canadian Sheep Breeders Association https://sheepbreeders.ca/ has resources on sheep breeds and genetics available, and has a list of over 1000 registered breeders available
- Canadian Co-Operative Wool Growers Ltd https://www.wool.ca/ offers resources including lists of sheep breeders by breed, in-person shearing courses, and resources on all stages of wool production
- Sheep 201 http://www.sheep101.info/201/ is an online handbook developed by extension specialist Susan Schoenian intended for beginner sheep owners
- Maryland Small Ruminant Page https://www.sheepandgoat.com/ has many brief and very easy-to-understand articles, PowerPoints, and info sheets useful both for beginner sheep owners and more experienced small producers, as well as links to many other resources including apps
- ATTRA has many videos, publications, and podcasts on sustainable agriculture of all topics, including many on sheep https://attra.ncat.org/topics/sheep-goats/

Getting started

- *Starting a Sheep Enterprise* https://extension.okstate.edu/fact-sheets/starting-a-sheep-enterprise.html is a quick read of some of the most important and often-overlooked things to consider before getting sheep. Although details (e.g., relating to exact growing seasons) differ between Canada and Oklahoma, the broad concepts hold true.
- https://www.slideshare.net/schoenian/conformation-101-64679217 illustrates conformation defects to look for when buying Katahdin sheep – although sections on

muscling, substance of bone, and frame-size are breed-specific, the rest are applicable to any breed

Housing

- Sheep building plans, free https://www.ag.ndsu.edu/extension-aben/buildingplans/sheep
- Sheep building and equipment plans, free https://www.lsuagcenter.com/portals/our_offices/departments/biological-ag-engineering/extension/building_plans/sheep
- Sheep building and equipment plans, paid https://extension.colostate.edu/publications-2/blueprints-and-housingequipment-plans/blueprints-sheep-equipment-and-housing-plans/
- Plans for a barn and for a lambing shed (as well as feeders and mineral boxes), free https://csbe-scgab.ca/publications/canada-plan-service-archive
- *Wire Fences for Livestock Management* https://publications.gc.ca/collections/collection_2015/aac-aafc/A53-1848-1990-eng.pdf

Nutrition

- Tables of nutrient requirements for ewes and lambs from NRC's *Nutrient Requirements of Sheep,* sixth edition (1985) https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/6685/files/2015/09/NRC-Sheep-1985-1m52js8.pdf
- New Mexico State University *Sheep Nutrition* https://pubs.nmsu.edu/_circulars/CR685/index.html includes tables of NRC recommendations for ewes and rams and guides producers through figuring out how to practically apply these recommendations to feeding their sheep, reading feed labels, and forage analyses
- Pennstate Extension *Feeding the Flock* https://extension.psu.edu/feeding-the-flock
- Oregon State Extension *Getting Started with Sheep and Goats: Nutrition and Feeding* https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec1652.pdf
- *Truth About Grain* https://www.sheepandgoat.com/truthgrain
- Virginia Cooperative Extension *Minerals and Vitamins for Sheep* https://www.sites.ext.vt.edu/newsletter-archive/livestock/aps-06_10/aps-373.html is a useful summary but is intended for US-based producers and their recommendations are based on pasture-fed ewes – do not over-extrapolate
- Larry Berger's *Salt and Trace Minerals for Livestock, Poultry, and Other Animals* https://seaagri.com/wp-

content/uploads/2012/05/salt_and_trace_elements_in_animal_nutrition.pdf provides a much more in-depth look at salt and mineral supplementation

Handling

- *Understanding Sheep Behaviour* fact sheet https://www.sksheep.com/documents/Ex_Understanding_Sheep_Behaviour.pdf

Reproduction management

- *Sheep Health and Management* https://extension.okstate.edu/fact-sheets/sheep-health-and-management.html summarizes reproductive management for rams and ewes
- *Management during Late Pregnancy* summary sheet https://www.sheepandgoat.com/_files/ugd/aded98_1b62d5f1aff3479fba588d535f4e9f0b.pdf
- *Sheep Production: Birth to Weaning* https://pubs.nmsu.edu/_circulars/CR703/index.html
- *Pregnancy Toxemia* summary sheet https://www.sheepandgoat.com/_files/ugd/aded98_877bd564ca854581bf3df692250e391b.pdf

Biosecurity

- *Biosecurity for Small Scale Livestock Production* http://nsnewfarmer.ca/wp-content/uploads/sites/5/2018/02/Biosecurity-for-Small-Scale-Livestock-Production.pdf

Sheep health

- Wool sheep record keeping software https://extension.okstate.edu/fact-sheets/wool-sheep-record-keeping-software.html and hair sheep record keeping software available as free Excel spreadsheets
- A planning calendar for sheep herd health and management https://extension.okstate.edu/fact-sheets/a-planning-calendar-for-sheep-herd-health-and-management.html may be useful as a starting point for developing your own
- *Sheep Production Guide* https://catalog.extension.oregonstate.edu/em8916 is a free, 20-page summary guide to sheep reproductive management and herd health including management calendar
- *Sheep and Goat Health Management Schedule* https://pubs.nmsu.edu/_b/B127/index.html gives a brief, easy-to-follow overview of vaccines and herd health timing. This guide is developed in New Mexico so some recommendations may vary from your region – consult your veterinarian

Parasite control

- The American Consortium for Small Ruminant Parasite Control https://wormx.info is the primary resource for information on parasite control. Their factsheets are highly encouraged reading, and the site includes a compilation of many other resources
    - *Management of Coccidia* https://www.wormx.info/_files/ugd/6ef604_e84ead623d4c4082acaf2a68ddbbbe52.pdf
- Online FAMACHA Training Program https://web.uri.edu/sheepngoat/famacha/ including four videos on worms, dewormers, integrated parasite management, and FAMACHA scoring
- The Five Point Check https://www.sheepandgoat.com/_files/ugd/aded98_e328968a6e844a7d934772e83fb88d2f.pdf
- *Periparturient Egg Rise* summary sheet https://www.sheepandgoat.com/_files/ugd/aded98_657df6201431474abc236bba11df6bfd.pdf
- Cornell University *Deer Worm Factsheet* https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/e/7832/files/2017/11/P.-tenuis-Producer-Factsheet-2gkq1rv.pdf
- Paula Menzies et al. *Handbook for The Control of Gastrointestinal Parasites in Sheep* https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/agriculture/oacc/en/livestock/Handbook_Control_of_Parasites_of_Sheep_Dec2010.pdf
- Alberta Sheep & Wool and Ileana Wenger *Parasite Manual for Sheep Producers* https://ablamb.ca/images/documents/factsheets/Guide-To-Parasites-In-Sheep.pdf

Predation

- *Coyote Predation of Livestock* https://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/agdex43/$FILE/684-19.pdf

Disease

- A brief overview of many conditions of sheep is available at http://www.sheep101.info/201/diseasesa-z.html
- *Bloat in Small Ruminants* summary sheet http://www.uapb.edu/sites/www/Uploads/SAFHS/FSA9625.pdf
- *Footrot in Sheep and Goats* summary sheet https://www.extension.purdue.edu/extmedia/As/As-596-footrot.pdf
- *Urinary Calculi* summary sheet https://www.sheepandgoat.com/_files/ugd/aded98_b25edd2ab6264c479d25ea3a4f258db6.pdf

Transport, slaughter, euthanasia, and deadstock

- *Disposing of Dead Goats* https://www.sheepandgoat.com/dispostinggoats provides an accessible summary of the practical pros and cons of disposal methods. Although intended for goats, the principles are the same for sheep