



Keeping Flocks Healthy **Sheep and Goats**





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The manual was updated in 2016 by Dr. Glenna McGregor, BC Ministry of Agriculture.

Legal disclaimer

This document provides a general description of management and health for keeping sheep and goats, especially for small producers and hobby flock owners. It should not be viewed as a substitute for legal or veterinary advice.

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British Columbia (provincial) legislation can be viewed at: <http://www.bclaws.ca/>

Canada (federal) legislation can be viewed at: <http://laws-lois.justice.gc.ca/eng/>

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Need more information?

For more information or to obtain a copy of this manual, call the BC Ministry of Agriculture, Animal Health Centre at 604-556-3003 or toll free in BC 1-800-661-9903.



INTRODUCTION

The focus of this binder and the associated workshops is “Biosecurity” or “keeping diseases off farms, controlling diseases that may be on farms, and preventing diseases from spreading”. We are trying not to duplicate any of the existing programs or information (the On-Farm Food Safety Program, predator program etc.). The most detailed sections are those on infectious diseases, where the principles of biosecurity play the most important role.

We have, however, included some basics on management to help demonstrate how biosecurity techniques are used in everyday practice. Biosecurity isn’t a set of “extra” or “separate” rules to follow, but is part of the farming routine. Biosecurity is important whenever animals are handled, are sick, need to be treated or isolated, or when people come onto the farm, etc.

The Canadian Food Inspection Agency (CFIA) has worked with a variety of industries, at the national level, to develop a national set of biosecurity standards specific to each commodity, including dairy, beef, avian, sheep, goat, mink, bees, potatoes, grains, etc. The Canadian Swine Health Board has developed a standard for the swine industry that is available to producers. These are voluntary, outcome-based tools for use in developing and updating on-farm biosecurity protocols. This is available for sheep at: <http://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/sheep-on-farm/> and for goats at: <http://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/goat-industry>. The information presented here will focus on the concepts that are important aspects of “good husbandry” on all farms, whether producers wish to participate in a formal program or not.





The funding for the creation of this manual was provided by Growing Forward, a federal-provincial-territorial initiative in 2012. The funding for updating the manual was provided by Growing Forward 2, a federal-provincial-territorial initiative in 2016. We sincerely hope that you will find information here that will be of use on your farm.

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BIOSECURITY

= **ALL** measures and policies taken to protect farm & animals from biological harm.

INCLUDES all actions to prevent disease entry, to contain disease spread once on farm, and to reduce the risk of animal infection & illness.

APPLIES to everything & everyone on sheep & goat farms, and working with flocks!

ENCOMPASSES good husbandry/routine care & handling of sheep & goats, as well as disease management.





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1.0 SHEEP AND GOAT FLOCK BIOSECURITY

1.0 SHEEP AND GOAT FLOCK BIOSECURITY

Biosecurity practices are put into place in order to protect the health of your animals.

The benefits of healthy sheep and goats may include:

- Improved productivity—better weight gains, more milk production
- Reduced animal or production losses—from death, abortion, culls, dumped milk
- Less labour associated with sick animals
- Reduced veterinary costs
- Improved animal welfare
- Protection of human health from food safety or zoonotic illness
- Potential for better prices and increased sales or better access to markets

Your flock is your investment. It is up to you to ensure that the following people follow the procedures you implement on your farm to help protect the health of your flock:

- Yourself (owner) and farm manager
- Employees
- Service providers
- Family
- Visitors

= *everyone who comes onto the farm.*



ACTIONS TO PROTECT FLOCK HEALTH INVOLVE:

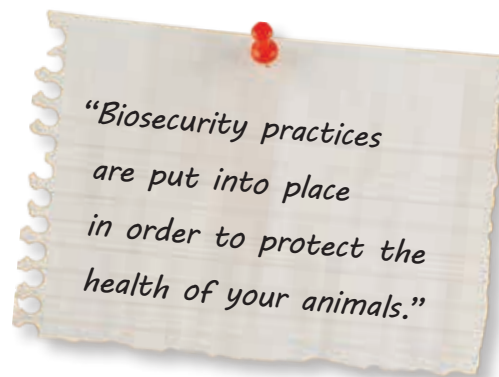
- Preventing disease entry (bio-exclusion).
- Reducing the risk of animal infection and disease (bio-management).
- Containing disease that is on farm (bio-containment).



DISEASE SOURCES

SOURCES OF INFECTIOUS DISEASE AGENTS INCLUDE:

1. Movement on and off the farm of:
 - New, or returning, sheep and goats.
 - Other domestic animals, including other livestock and working dogs.
 - Wildlife, including rodents, birds and insects.
 - Animal products.
 - People.
 - Vehicles.
 - Equipment.
 - Feed or water.
2. Resident animals on the farm:
 - Other sheep or goats on the farm that may be non-symptomatic carriers of disease e.g. caseous lymphadenitis.
 - Other domestic animals, e.g. cattle with Johne's disease, or cats with toxoplasmosis.
 - Wildlife, including rodents and birds, e.g. wild canids with tapeworm.
3. Farm environment, including organisms that occur:
 - naturally, e.g. *Clostridia perfringens*, or
 - due to contamination, e.g. *Coxiella burnetii* (Q fever).



1.0 SHEEP AND GOAT FLOCK BIOSECURITY

MAJOR ROUTES OF SPREAD

Infectious disease agents may enter or spread by two basic routes:

Direct

- From one animal directly to another animal.

Indirect

- From one animal to a person or fomite (an object, piece of equipment, or facility) and then to another animal.
- From one animal to the farm environment and then to another animal (contamination of environment).

CHOOSING FLOCK HEALTH AND BIOSECURITY GOALS

Managing a healthy flock means assessing the risks and costs of ‘breaches in health’ in terms of animal welfare, disease, and production losses (costs, genetics, time, anxiety).

Choices in management mean determining:

- What are the risks?
- What steps can be taken to reduce the risks?
- Where in the spectrum from “*Closed herd*” (lower risk) to “*Open herd*” (higher risk) will the flock’s management goals be set?

STEPS TOWARDS BIOSECURITY

Biosecurity-decision-making involves assessing all aspects of:

Monitoring Flock Health and Food Safety . . . *See* Section 2

Management of the Flock and Farm *See* Section 3

Flock Health *See* Section 4

An overview of biosecurity management techniques is included in this Section.



2.0 INFECTIOUS DISEASE AGENTS OF SHEEP AND GOATS

The following are the infectious diseases that must be taken into account when considering steps to biosecurity:

ANIMAL-ORIGIN DISEASES

Disease agents listed may spread from animal to animal, either directly or indirectly (via a fomite or person).

*For animal-origin diseases, the key source of disease entrance to farm
= New or Returning animals.*

EXAMPLES OF ANIMAL-SOURCE DISEASES BY MAIN AREA OF BODY AFFECTED:

FEET	Footrot (<i>Dichelobacter nodosus</i>)								
URINE	<i>Leptospira</i> spp.	Border Disease virus BDV							
EYES	Pink eye (<i>Mycoplasma conjunctivae</i> , <i>Chlamydia philae</i>)	Malignant Catarrhal Fever MCF							
RESPIRATORY TRACT	Respiratory viruses	Caseous lymphadenitis	Maedi Visna virus MV	Ovine pulmonary adenomatosis	Enzootic nasal carcinoma				
SALIVA	MV / Caprine Arthritis Encephalitis CAE	Johnes	Rabies	MCF	Foot and Mouth Disease	BDV			
REPRODUCTIVE TRACT	<i>Chlamydia abortus</i>	<i>Toxoplasma gondii</i>	<i>Coxiella burnetii</i>	<i>Listeria monocytogenes</i>	<i>Brucella ovis</i> and <i>B. melitensis</i>	Scrapie			
SKIN	Contagious ecthyma	Caseous lymphadenitis	Mange Chorioptic and Psoroptic	Lice sucking and biting	Sheep keds	Ringworm			
FECES	Parasites intestinal and lung	Parasites with wormer resistance	<i>Salmonella</i> spp.	<i>Listeria monocytogenes</i>	<i>Campylobacter fetus</i> and <i>C. jejuni</i>	<i>Coxiella burnetii</i>	Johnes Disease		
UDDER (MILK)	<i>Listeria monocytogenes</i>	Caseous lymphadenitis	<i>Brucella melitensis</i>	<i>Staphylococcus aureus</i>	<i>Toxoplasma gondii</i>	Coliform bacteria	Johnes Disease	MV / CAE	<i>Coxiella burnetii</i>

OBTAINING NEW GENETIC STOCK

Even the closed flock requires new genetic input from time to time. However, new animals may be a source of new diseases. Steps can be taken to reduce the risk.

2.0 INFECTIOUS DISEASE AGENTS OF SHEEP AND GOATS

Options and level of risk for obtaining new genetic stock:

Lowest Risk	Washed embryos
	Fresh semen from tested / approved sources
	Animal from known low-risk status flocks, single contact
	Borrowing or lending animals with low-risk flocks, multiple contacts with other flock(s).
	Animal from farm of unknown-health status
Highest Risk	Animal from sales barns or in contact with accumulations of animals (e.g. shows) of unknown health status

DISEASES FROM OTHER SOURCES:

Disease agents may be acquired directly from other animals, or through contamination of objects, clothing, facilities or the farm.

Other sources include:

- **People** (feed and equipment suppliers, veterinarians, salespersons, service-technicians, visitors) can carry many infectious disease agents from the last animal or animal-facility contact on their clothes or boots, body or equipment, including their vehicle.
- **Equipment** going from farm to farm may carry a host of agents that can survive on objects, e.g. shearing is a prime opportunity for the transmission of caseous lymphadenitis, foot trimming for footrot.
- **Other farm livestock, pets or wildlife**
See Section 4 Part C – Diseases between species.
- **Water sources** (such as wells, creeks, ponds, watering equipment or watering areas) may be contaminated through feces or other secretions, with disease agents, e.g. Johne's disease, parasites, *Salmonella*, toxoplasmosis, cryptosporidia, liver flukes, etc. See Section 4 Part B.
- **Feeds** (grains or cut forages) may be contaminated with caseous lymphadenitis, orf, *Toxoplasma gondii*, parasites, *Listeria monocytogenes*, mycotoxins, *Salmonella*, etc.



SHOWING

Many flock owners have sheep or goats in order to show at competitions or exhibitions. As showing and returning with the animals can be a risk for bringing disease back to the home flock, special planning and quarantine facilities are required to minimize the risk to overall flock health.

See Section 3 Part C and Section 4 Part B Specific disease protocols.

ENVIRONMENTAL-ORIGIN DISEASES

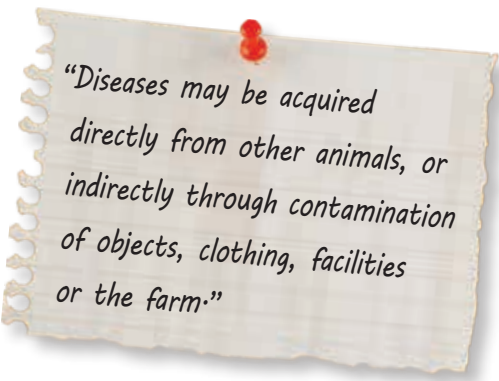
As noted above, the farm environment may become contaminated by disease agents that originated from infected animals, humans or equipment—once in the farm environment, these agents can subsequently infect other flock members. Other disease agents are commonly found in the environment.

Animal-origin disease agents, which can reside for long periods in the environment include:

- Johne's disease (*Mycobacterium avium* subsp. *paratuberculosis*),
- Parasites (e.g. gastro-intestinal nematodes),
- Caseous lymphadenitis (*Corynebacterium pseudotuberculosis*), etc.

Many disease agents normally reside or are widespread in the environment and may cause disease problems if the flock is stressed or exposed to large numbers of these organisms, such as:

- *Listeria monocytogenes*,
- *Leptospira* spp.,
- *Clostridia* spp.
- Coliforms (*E. coli*, *Klebsiella* spp., *Enterobacter* spp. etc.)
- Some *Streptococcus* spp. (*S. uberis*),
- *Campylobacter* spp.



"Diseases may be acquired directly from other animals, or indirectly through contamination of objects, clothing, facilities or the farm."

3.0 OVERVIEW OF BIOSECURITY MANAGEMENT TECHNIQUES

3.0 OVERVIEW OF BIOSECURITY MANAGEMENT TECHNIQUES

GENERAL FARM BIOSECURITY PROCEDURES

See also the “Biosecurity Checklist for Sheep and Goat Producers” in the Appendix. Practice good husbandry to increase the overall flock health and individual animal immunity; and to decrease stress factors on animals. For details, *See* Section 3 Management.

- *Controlling overall* activity on the farm.
- *Isolation* of sick or in-coming animals in isolation / quarantine area.
- *Vaccination* (primarily for environmental Clostridia, depending on risk factors may also vaccinate for caseous lymphadenitis and/or infectious abortion)
- *Monitoring* health status and body condition of flock; organization and sanitation of farm.
- *Screening* (testing) of flock for specific diseases, and treatment or culling of affected animals.
- *Diagnostic testing* of dead or sick animals, and medical treatment as necessary.
- *Cleaning and disinfection* of housing, equipment and clothing as appropriate.
- *Restricting and monitoring access* to farm of people, vehicles, equipment, wildlife and predators.

SPECIFIC BIOSECURITY TECHNIQUES

The general procedures of biosecurity include:

ANIMAL HEALTH

Steps can be taken to reduce the risk of animal infection and disease:

- Identify each animal individually with a permanent tag.
- Monitor animal condition – observe all animals in the flock, including males, daily.
- Gather and handle animals gently and with safe facilities to prevent injury or the transmission of disease. Practice running the animals through the handling facilities before-hand to reduce stress during actual procedures.
- For flock handling procedures use animal treatment tools that are cleaned and disinfected prior to use (and between animals when necessary), in order to minimize disease transfer or the build up of disease organisms.
- Plan and implement appropriate treatments and screening methods for the flock, such as vaccinations, foot baths or fecal tests, for necessary disease agents.



3.0 OVERVIEW OF BIOSECURITY MANAGEMENT TECHNIQUES

- For medical treatments, use appropriate drugs and amounts, as recommended by a veterinarian. Treat each animal each time with new single-use needles and syringes.
- Keep complete medical records, observe appropriate drug withdrawal times, cleanly and safely store medications and safely dispose of medical wastes such as used-needles.
- Control and medicate other domestic animals so as to minimize disease transfer, such as tapeworms in dogs.
- Isolate sick animals and try to determine the cause of illness.

NEW OR RETURNING LIVESTOCK

New or returning animals are the greatest risk for the introduction of disease to your flock. The recommended practices are:



- Obtain new animals from flocks with known health status.
 - Bring in virgin rams/bucks, if possible, for breeding or consider AI (artificial insemination).
 - Frequency of arrivals and the number of sources should be as low as possible.
 - Isolate new arrivals or returning animals in a quarantine area for at least four weeks, *See* Section 3 Part C.
 - Practice biosecurity health precautions at shows, *See* Section 3 Part C.
- Health check and screening for new animals should include a complete physical examination, foot trimming and foot bath, disease testing (*See* Section 4 Part D) before entry onto your farm, and then repeat while still in quarantine. Vaccination and/or treatment as required.
 - If possible, avoid bringing new stock onto farm during breeding or gestation periods.


QUARANTINE/ISOLATION AREA

A suitable quarantine plan includes:

- Structure or pen as far from main animal holding and movement areas as feasible, with no other animal contact, *See* Section 3 Part C for complete details.

3.0 OVERVIEW OF BIOSECURITY MANAGEMENT TECHNIQUES

- Quarantined/isolated animals must not share feeders, waterers, milking equipment, pasture, or fence-line contact with the rest of the flock.
- Visit the main herd first before the isolated/quarantined animals.
- Use separate coveralls and boots for the isolated/quarantined animals.
- Have a plan for disinfection of the facilities between animals.

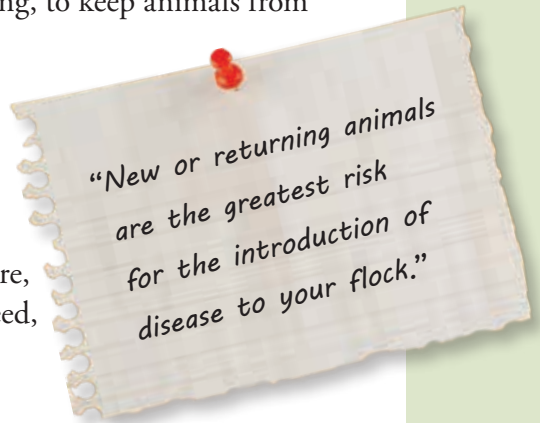


"Biosecurity measures including limiting access to the farm."

FARM MANAGEMENT

Plan the farm layout to control the flow of people, animals and activities, so that the most sensitive stock and farm areas are the least exposed to possible disease agents:

- Limit access to the farm to necessary service providers/visitors.
- Plan appropriate handling, treatment, quarantine/isolation, and dead-stock areas of the farm.
- Keep thorough records of farm operations, animal identification and animal treatments and vaccinations.
- Have safe, effective fencing, especially perimeter fencing, to keep animals from straying and to help to deter predators.
- Monitor and have a plan for predator protection.
- Exclude wildlife as much as possible.
- Practice effective pasture management to decrease the parasite burden and improve pasture nutrition.
- Manage animal wastes to contain and compost manure, and to limit or prevent fresh fecal contamination of feed, water, pastures and pens.
- For mortalities and abortions use separate boots/clothing/gloves when handling and either:
 - send to veterinarian/laboratory for diagnosis, or
 - dispose of in a way that is in accordance with local and provincial regulations (render, compost, bury [certain areas of BC only])
- Use safe, sanitary transportation for livestock and feed.



"New or returning animals are the greatest risk for the introduction of disease to your flock."

RESTRICTING ACCESS AND SETTING ACCESS STANDARDS

Techniques to protect the farm from disease agents can be introduced with signage and education referring to the protection of the animals. Specifically:

3.0 OVERVIEW OF BIOSECURITY MANAGEMENT TECHNIQUES

- A barrier or gate from public road to the animal area.
- Signage at the road gate and also at the barn or animal or feed storage facilities indicating that access is restricted to those taking flock-health-safety precautions with the owner's permission.
- Require all visitors to leave their vehicles in a designated parking area.
- Restrict anyone with soiled clothing. Require all unclean clothing, including hats to be left outside (i.e. in vehicle).
- Provide or require clean (freshly-laundered or disposable) protective clothing (coveralls, disposal gloves, boots).
- Provide washing facilities (water, soap, disinfectant spray) for entering and leaving farm.
- Require any equipment coming onto farm to be clean, then supervise the application of a broad spectrum disinfectant (soak or spray), or supervise the cleaning and disinfection.
- Provide farm's own shearing and foot trimming equipment if possible.

RECORD KEEPING

Makes notes of everything that occurs on your farm:

- Animal identification.
- Body condition score results.
- Disease testing and results.
- Each animal treatment or vaccination.




3.0 OVERVIEW OF BIOSECURITY MANAGEMENT TECHNIQUES

- Breeding (which ram / buck with which ewes) and births / abortions.
- Animal introductions and movements.
- Logbook for everyone / everything that comes on to your farm (including visitor log).

FEED AND WATER

Spreading of diseases through feed or water can be reduced or prevented by reducing contamination and improving quality:

- Clean and disinfect water / feed supply equipment and feed storage areas regularly.
- Only buy feed from places with FeedAssure (R) certification.
- Have sealed feed storage (bird and rat proof, and to deter domestic scavengers [dogs, cats]).
- Arrange feed storage areas to be away from animal areas.
- Use feeders so that feed is off the ground and feces cannot contaminate feed.
- Keep in mind that manure from upstream farms / fields / pens comes down to you.
 - Limit access to streams, ponds, etc.
 - Treat / filter well water.



“Record keeping is a key component of farm management and biosecurity.”

OTHER ANIMALS

Other animals on the farm, including livestock, protection animals and pets, can be a source of disease for sheep and goats:

- Monitor the health of other animals on the farm as closely as for your sheep or goats.
- Pets – keep away from the farm.
- Protection animals:
 - include in your biosecurity plan
 - de-worm dogs on a regular basis with an effective treatment
 - bathe dogs prior to return to farm if in contact with other sheep / goats (Ex. Herding competition, borrowed by friend for their sheep)

BIOSECURITY IS ALL ABOUT MANAGING RISKS

“An Ounce of Prevention is Worth a Pound of Cure”

4.0 APPENDIX

BIOSECURITY CHECKLIST FOR SHEEP AND GOAT PRODUCERS

For each item, place a check mark in the shaded box to record your current farm protocols.

The box to the right will indicate whether this is an area in which you might want to make changes:

FLOCK HEALTH AND MANAGEMENT*

<i>Animal identification:</i>		
each animal has a name, and does not need a tag		undesirable
every animal is individually identified with a permanent tag		good
<i>Sick and/or lame animals are:</i>		
kept with the flock		undesirable
isolated from the rest of the flock		good
<i>Vaccines:</i>		
are never used		questionable
vaccination protocols are routine and unwritten		could be improved
a vaccination plan is written down and followed		excellent
<i>Treatment records:</i>		
are not needed because I know what treatments I've given to which animal		undesirable
are kept for each time a medication / treatment is administered to each animal		excellent
<i>Animal management:</i>		
animals are managed / handled in whatever order is most convenient		undesirable
animals are managed / handled / milked in a specific order: young stock first, then healthy adults, sick animals last		good

*Note: depending on the goals of the farm there will be differences in the level of biosecurity a farm chooses to aim for. This checklist is not an ideal a farm should strive for, but rather serves to highlight high risk areas for the introduction or propagation of disease on a farm. For example, for farms with an agrotourism component to their operation keeping visitors out will be incompatible with the goals of the operation. However, it does represent a risk of disease introduction and movement that will need to be managed.

4.0 APPENDIX

<i>New animals or animals returning from shows:</i>		
join the rest of the flock / herd right away		undesirable
are placed in isolation for at least 4 weeks		good
are placed in isolation for at least 4 weeks and are vaccinated, dewormed, tested for unwanted disease (as needed)		excellent
<i>Breeding rams / bucks:</i>		
we borrow whatever ram / buck we can		undesirable
only virgin rams / bucks are used or rams / bucks from flocks with high health status		good
are not used – artificial insemination is used		excellent
<i>Mortalities / abortions:</i>		
Mortalities / abortions: are fed to the dogs		undesirable
disposed of in a way that is in accordance with local and provincial regulations (bury, compost, render)		good
are submitted to a veterinary laboratory for diagnosis		excellent

FARM ENTRANCE

<i>Driveway is:</i>		
not gated		undesirable
gated, but not locked		could be improved
gated and always kept locked		good
<i>Perimeter fence exists all the way around the farm:</i>		
no		undesirable
yes		good
yes, and prevents contact with wildlife and other animals		excellent
<i>Signage:</i>		
no signs at the farm entrance		undesirable
biosecurity or information signs are posted at farm entrance		good
biosecurity or information signs are posted at each farm access point		best

<i>Vehicle disinfection station on the farm:</i>		
none present or available		undesirable
a freshly stocked vehicle disinfectant station is at the farm gate (or is readily available)		good
<i>There is a designated and clearly identified visitor parking area:</i>		
no		undesirable
yes		good
<i>There is a dedicated driveway to the farm area and separate from the residence:</i>		
no		undesirable
yes		good
<i>Driveways and parking are:</i>		
dirt / grass		undesirable
gravel		could be improved
paved / concrete (no potholes)		good
<i>An occupied dwelling exists on the site:</i>		
no		undesirable
yes		good
<i>Farm buildings are secured with locks:</i>		
no		undesirable
yes		good

RECORDS

There is no record of what comes onto and off your farm		undesirable
There is a log book to record the date and time of: each visitor or delivery to the farm, and every animal movement on / off the farm		excellent

4.0 APPENDIX

PEOPLE

<i>The animal production areas of the farm:</i>		
are open to tourists and visitors		undesirable
are under a “no visitor” policy for non-essential visitors		good
<i>Visitors:</i>		
can come anytime		undesirable
are required to phone ahead and are greeted at the locked gate		good
cannot have been on another farm within the previous 48 hours		excellent
<i>Visitors wear:</i>		
the clothing they have brought with them		undesirable
wear farm-provided clothing and footwear		good
<i>Employees:</i>		
who own or work with other livestock must follow a written biosecurity protocol		good
<i>New employees:</i>		
already know about biosecurity		undesirable
must sign contractual agreement that outlines biosecurity expectations		good
<i>Biosecurity training:</i>		
is not necessary		undesirable
is provided to all new employees		good
is provided to all employees annually and is required		excellent
<i>Animal workers:</i>		
can come and go for their breaks		undesirable
have a designated clean and comfortable area to take breaks and avoid returning to vehicles		excellent

EQUIPMENT AND TOOLS

All equipment and tools are:

brought onto the farm without cleaning and disinfection		undesirable
cleaned and disinfected before being brought on to the farm		good
cleaned and disinfected before being brought on to, and before leaving the farm		excellent
farm maintains its own sets of tools and equipment as much as possible		excellent

MANURE MANAGEMENT

Manure is:

piled near the barn for convenience		undesirable
composted under cover away from animal production areas		good

BARNs

Barns/farm buildings are:

old and full of holes		undesirable
built and maintained to limit access for birds / vermin		good

Barns/farm buildings are cleaned:

never		undesirable
cleaned (and disinfected) 1-2 times per year or more		good

***Building entryways have clearly defined, visible, and maintained
“clean” and “dirty” areas:***

no		undesirable
yes		good

Entryways are swept daily and cleaned regularly:

no		undesirable
yes		good

4.0 APPENDIX

Hand wash stations:		
are not present		undesirable
are conveniently located at entry / exit		good
Boot wash stations:		
are not present		undesirable
are conveniently located at entry / exit		good
Disposable boots or farm-provided footwear are:		
not available, visitors walk on to farm with their own footwear		undesirable
provided to all visitors		excellent

FEED

Feed is purchased from:		
any place that is convenient		undesirable
only from feed mills with a FeedAssure certification		good
Feed storage is located:		
right by the sheep / goats where it's handy		undesirable
away from the animal pens so that the delivery truck doesn't enter the farm 'restricted' area		good
The feed storage bins:		
are open so it is easy to access		undesirable
are sealed when not in immediate use (i.e. bird and rat proof)		good
Feeders:		
are inconvenient and not used		undesirable
are used to keep feed off the ground (feces cannot contaminate)		good
are used and cleaned regularly		excellent

WATER***Animal water source is:***

surface water		undesirable
own well, shared well, municipal		good

Well water is tested:

sometimes, if I think about it		undesirable
yearly		good
twice yearly		excellent

Water lines and waterers are flushed and sanitized:

rarely		undesirable
regularly		good

Water filters are:

not needed		undesirable
changed routinely		good



1.0 MONITORING SMALL RUMINANT FLOCK HEALTH

1.0 MONITORING SMALL RUMINANT FLOCK HEALTH

Sheep and goats flocks need to be monitored on a regular, routine basis.

There are two methods by which to accomplish this:

1. Regular systematic flock observations and record keeping on your own, and/or
2. Participation in one of the formal structured flock health or food safety plans.

OBSERVING THE FLOCK

All animals need to be checked at least once a day!

GENERAL FITNESS/BODY CONDITION SCORE

To ensure optimal health and nutritional status of the animals, they must be maintained at an adequate level of nutrition. This will optimize animal comfort, improve production, and ensure farm operator and consumer safety.

Evaluate all animals for general fitness or body condition on a regular basis.

Body condition scoring can only be done by feeling each animal.

- Use **Body Condition Scoring Chart** (See attached chart).
- Evaluate at least three times per year.

Body Condition Score Goals:

FEMALE	Late Gestation	⇒ Score 2.5 - 3.5
	Weaning/Drying off	⇒ Score 2+
	Breeding	⇒ Score 3
MALE	Pre-Breeding	⇒ Score 3 - 3.5
	Summer	⇒ Score 2+



CHANGES FROM NORMAL

Animals that are unhealthy need to be examined more closely. Need to know the **range of normal** characteristics and behaviours.

RECTAL TEMPERATURE	Normal adult = 39.1°C (102.3°F) Range from 38.4°C-39.7°C (101°F-103°F)
RESPIRATORY RATE	Normal = 16-34 breaths/minute
HEART RATE	Normal = 70-80 beats/minute
RUMINATIONS	Normal = 1-2/minute

The normal, healthy animal is:

- alert and responsive
- shows interest in unusual noises and sights
- will drink water and graze as normal, and will spend time chewing its cud and resting
- will pass urine and droppings during the day without straining

Check for signs the animal(s) is NOT well:

General appearance / behaviour:

Not eating, e.g. if just standing at feeder.

Not chewing cud (ruminating).

Separated from group.

Slow to get up or move.

Depressed:

- Head hanging,
- Ears droopy,
- Eyes dull,
- Hunched stance,
- Sudden lack of maternal interest.



Abnormality at specific sites:

- Empty-looking, shrunken, or too full, bloated.
- Manure or blood stains down hindquarters.
- Noisy breathing, coughing, snotty nose, grunting respiration.
- Odd gaits, lame, circling, staggering, odd head movements.
- Abnormal milk, urine, discharges.

Also watch for lowered production, such as poor growth, which may indicate sub-clinical health problems.

1.0 MONITORING SMALL RUMINANT FLOCK HEALTH

EVALUATING PROBLEMS

Animal(s) not normal

1. Gather all background facts

Farm History:

- Has animal left the farm or changed pastures/pens?
- What are details of housing, feed, water or pasture?
- What other animals could have come in contact with the sick one?
- What is animal's status in flock?
- Any recent changes, introductions, activities?

Animal itself:

- Age?
- Sex?
- Origin?
- Vaccination, treatment, production status?

2. Describe animal's **changes from normal** – all parts of body and behaviour (*See above*).3. **Separate** the animal from flock if needed to examine/treat.4. **Mark the animal** for further observation, as necessary, if returning to flock.
Use non-toxic marker on hair/fleece to easily identify animal in flock

KEEPING RECORDS

MANAGEMENT RECORDS

All farm activities, and any treatments given to individual animals, should be written down as they occur. Record any farm or animal management activity, with respective details, in a notebook or in a binder. Activities can be recorded as they happen, using a daily calendar style log; or, entered under specific activities, such as feed deliveries, body condition scoring, worming, etc. Example templates that may make record-keeping simpler are provided in the appendix.

DAILY OBSERVATIONS AND ACTIVITIES

A record should be kept of all farm activities:

- Observe flock and if animal(s) is “abnormal” in any way
 - write a note in daily record
- Any vaccinations / medications / treatments given to animals
- Breeding (i.e. which buck / ram to which does / ewes)
- Parturition
- Body condition scoring
- Animal movements
- Feed delivery
- Manure management
- Service provider visits (e.g. shearing) etc.



1.0 MONITORING SMALL RUMINANT FLOCK HEALTH

WHY KEEP RECORDS?

Records provide evidence of producer's "due diligence" with regard to food safety in issues of safety and liability, e.g. demonstrates adherence to drug withdrawal times and veterinary prescriptions.

Accurate and verifiable records: Are necessary for many voluntary farm health programs, such as the sheep on-farm food safety program: <http://www.cansheep.ca/cms/en/Programs/FoodSafeFarmPractices/ProgramRecordKeepingForms/ProgramRecordKeepingForms.aspx>

Indicate **how the farm is doing** by evaluating production data in terms of potential goals (percentages provided), or simply to compare your farm from year-to-year:

Pregnancy Rates:	Ewe lambs / doelings	> 75%
	Ewes / does.	> 95%
	Visible abortion	< 2%
Birthing Rates:	Ewe lambs / doelings	> 70%
	Ewes / does.	> 90%
	Still births	< 2%
Reproductive Performance:	# offspring born / female exposed to male	80%
	# offspring born / female giving birth. .	> 1.6%
	# offspring weaned / bred female	> 95%
Mortalities:	Adult Mortality Rate.	2%
	Offspring Mortality Rate.	< 10%

* Please note these are general benchmarks. Flock productivity will vary greatly between different production systems and different breeds.

Record Keeping Examples

Computerized record keeping systems are available.

- EweByte sheep flock recording system:
http://www.ewebyte.com/EweByte_User_Guide.pdf.



1.0 MONITORING SMALL RUMINANT FLOCK HEALTH

FARM ACTIVITY EXAMPLES

See section 7 for additional full page examples that can be copied and used on farm

FLOCK BODY CONDITION SCORE RECORD				
FEMALE				
ID	YEAR	FEMALE SCORE AT LATE GESTATION	FEMALE SCORE AT WEANING / DRYING OFF	FEMALE SCORE AT BREEDING

FLOCK BODY CONDITION SCORE RECORD				
MALE				
ID	YEAR	MALE SCORE AT PRE-BREEDING	MALE SCORE AT POST-BREEDING	MALE SCORE AT PASTURE

2.0 FLOCK HEALTH PROGRAMS IN CANADA

INDIVIDUAL ANIMAL EXAMPLES

INDIVIDUAL ANIMAL INTERNAL PARASITE RECORD					
ANIMAL ID:					
DATE	FECAL PARASITE EXAM RESULT	DATE	DEWORMING PREPARATION AND AMOUNT	DATE	2 WEEK RECHECK FECAL PARASITE EXAM RESULT

INDIVIDUAL ANIMAL REPRODUCTIVE RECORD					
ANIMAL ID:					
BREEDING DATE(S)	MALE BRED TO	PREGNANCY TEST DATE	PREGNANCY TEST RESULT	PARTURITION DATE	# AND SEX OF OFFSPRING

INDIVIDUAL ANIMAL HEALTH ISSUE RECORD				
ANIMAL ID:				
HEALTH ISSUE	DATE	DESCRIPTION	TREATMENT	RESULT

2.0 FLOCK HEALTH PROGRAMS IN CANADA

There are several **Flock Health Programs** available for producers:

CODES OF PRACTICE

The National Farm Animal Care Council (NFACC) has developed codes of practice for sheep and goats. These are available at:

- Sheep: https://www.nfacc.ca/pdfs/codes/sheep_code_of_practice.pdf
- Goats: https://www.nfacc.ca/pdfs/codes/goat_code_of_practice.pdf

These are nationally-developed voluntary guidelines created by a review committee of representatives from farm groups, animal welfare groups, veterinarians, animal scientists, federal and provincial governments, related agricultural sectors and interested individuals. They serve as our national understanding of animal care requirements and recommended practices.

Requirements: these reflect fundamental obligations relating to the care of animals and represent a consensus position that these measures, at minimum, are to be implemented by all persons responsible for farm animal care. Those who fail to implement requirements may be compelled by industry associations to undertake corrective measures, or risk a loss of market options. Requirements also may be enforceable under federal and provincial regulation.

Recommended Practices: These are recommendations towards which producers should be working. They are generally expected to enhance animal welfare outcomes, but failure to implement them does not imply that acceptable standards of animal care are not met.



VOLUNTARY SCRAPIE FLOCK SURVEILLANCE AND CERTIFICATION PROGRAMS (VSFCP)

Note: For Scrapie disease information See Section III Treating Diseases – Scrapie.

NATIONAL PROGRAM

The VSFCP is a national scrapie risk management program and is available to sheep or goat producers to assess whether their flocks/herds are currently infected and to minimize the risk of contracting scrapie in the future. Over time, producers will have their flock/herd recognized as being at a much lower risk for scrapie. The long

2.0 FLOCK HEALTH PROGRAMS IN CANADA

term goal is to eradicate scrapie in Canada. **Scrapie Canada** maintains a website site dedicated to providing scrapie information to sheep and goat producers (<http://www.scrapiecanada.ca/home.html>).

Scrapie is a **reportable disease**. The Canadian Food Inspection Agency (CFIA) (www.inspection.gc.ca or phone 1-800-442-2342) covers the cost of testing.

If a **Positive** case is identified, all animals exposed to the birthing environment are deemed to be at risk and slaughtered with compensation (for sheep: max. \$825 for non-registered and \$1200 for registered animals; for goats: max. \$600 for non-registered and \$1000 for registered animals). Additionally, disposal costs are compensated.

Under the national program, producers receive certificates (<http://www.scrapiecanada.ca/certification.html>): for 3 “pathways”, and must meet the following requirements:

All Pathways:

- For **testing**: Submit brain samples from all adult (≥ 12 months of age) sheep / goats that **die** on farm.
- Report any mature animals with unexplained weight loss, problems standing or walking, changes in behaviour.
- If there are no deaths, the producer must submit at least 1 cull animal > 24 months of age.
- Producers work with CFIA accredited veterinarian and make **annual vet-supervised inventory** of flocks
- **Animal movement records**: Maintain records of all animals entering or leaving farm.
- **Good biosecurity practices**: Animal ID, records, prompt isolation of sick animals, separation of birthing females, birthing cleanliness, disinfection of equipment.
- **Farm closed** to addition of females except from flocks at same or higher certification level. Males and semen source not restricted except for conditions at Pathway 2 and 3.

Pathway 1: Risk assessment by the number of years in the program without detection of scrapie

- 6 yr for certification.

Pathways 2 and 3: Combines genotyping etc with disease surveillance over time

- faster certification.

There are three sheep flocks and three goat flocks from BC currently enrolled in the VSFCP. All are in Pathway 1, and one flock is certified.



SHEEP FLOCK HEALTH PROGRAMS

SPCA CERTIFIED – FARM ANIMAL WELFARE CERTIFICATION



The SPCA Certified program is an independent, third party farm animal welfare certification and food labelling program. Since launching in 2002, numerous farms have been certified in British Columbia, Alberta and Ontario. For more information see: www.spcacertified.ca

Participation is voluntary. Current farm animal certifications include: beef cattle (includes veal production), dairy cattle, sheep, pigs, turkeys, broiler (meat) chickens and egg-laying chickens. There is currently no certification available for goat production.

SPCA Certified program standards were created collaboratively by farmers, veterinarians and animal welfare scientists. They are practical, achievable and are scientifically proven to improve animal welfare. The SPCA Certified Standard for the Raising and Handling of Sheep meets or exceeds Canada's Code of Practice for the Care and Handling of Sheep. The key components of the sheep Standard are:

- Space and an environment to move freely and exhibit species-specific behaviours
- Access to resting space
- Access to feed and water and provision of feed that does not contain mammalian or avian derived protein, except for milk products
- Surgical procedures are regulated by age and through pain control
- Development, implementation and maintenance of a Flock Health Plan for sheep health management

Once certified, farms may use the SPCA Certified red barn logo on their certified products and receive help in marketing to retailers, restaurants and SPCA supporters looking to buy SPCA Certified products. The SPCA Certified red barn logo is CFIA reviewed and is the only Canadian farm animal welfare certification logo approved for use on food products and marketing materials in Canada.

To become certified, farms must undergo an annual on-farm assessment performed by a trained, contracted, third party Validator. The assessment report is then reviewed by a separate independent, third party review panel who ensure compliance with program Standards. Farmers pay an annual fee for assessments; however, farms that are unconditionally certified two years in a row are eligible to have their annual fee waived.

2.0 FLOCK HEALTH PROGRAMS IN CANADA

For more information on the SPCA Certified program:

Administrator, SPCA Certified
 Phone: 604.681.7271 Ext. 1308
 Toll-free: 1.800.665.1868 Ext. 1308
 Email: spcacertified@spca.bc.ca

ONTARIO SHEEP HEALTH PROGRAM (OSMP) SUMMARY

The Ontario Sheep Health Program (OSMP) (http://www.uoguelph.ca/~pmenzies/OSHP_Home.htm) uses **disease control** and **flock evaluation** to increase the productivity of flocks, and promotes a strong working relationship between **producers and veterinarians**.

The program developed by the Ontario Veterinary College, and is administered by Ontario Sheep Marketing Agency (OSMA).

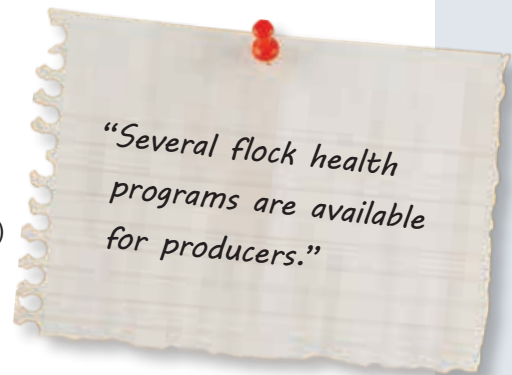
The program sets both **health** and **productivity** goals for assessment. Biosecurity status is part of the assessment. The program can be modified for all types of operations.

Producer certification shows that the:

- Producer uses procedures ensuring on-farm disease control and quality assurance practices.
- Producer puts time and effort into optimizing flock productivity and health.

Instructions for the Ontario Sheep Health Program:

1. Contact flock veterinarian.
2. Calculate flock productivity and set goals.
3. Review flock health management assessment form and the biosecurity assessment form.
4. Producers are encouraged to enroll in the Canadian Sheep and Lamb Food Safe Farm Practices program (on farm food safety).
5. Flock visit with veterinarian.
 - a. Review flock health management and develop priorities for areas to improve.
 - b. Review biosecurity and develop priorities for areas to improve.
 - c. Review goals for flock productivity and actual performance (if applicable) and select areas for improvement (i.e. to enable you to reach your goals).



6. Based on this review, develop strategies to meet your flock's goals for improved health and productivity.
7. Send in required reports to OSMA.
8. Set up an appointment to review flock health management for 12 months from initial review.

FLOCK GENETIC IMPROVEMENT PROGRAMS FROM AUSTRALIA

Similar programs exist in Australia for sheep producers and for goat producers which provide practical information for producers on the genetic potential of their animals. The animals are ranked according to various production characteristics (growth, carcass, wool, reproduction and disease resistance).

Breeders can track the level of improvement in the genetic make-up of their flock over time and can:

- reduce the risk associated with ram / buck selection,
- improve the rate of genetic gain of their flocks,
- more reliably meet market specifications, and
- improve overall productivity.



For further information see:

LAMBPLAN: <http://www.sheepgenetics.org.au/lambplan/>

KIDPLAN: <http://www.sheepgenetics.org.au/Breeding-services/KIDPLAN-Home>

3.0 FOOD SAFETY

3.0 FOOD SAFETY

Food safety is an important consideration for any animals or animal products that will be consumed, either by the producer him / herself or sold off the farm. On-farm food safety hazards include:

- Physical *e.g.* injection needles
- Biological *e.g.* infectious zoonotic diseases *e.g.* E. coli, Salmonella.
- Chemical *e.g.* antibiotic or other drug residues

Individual animal identification and record keeping are key element of food safety.

“National on-farm food safety programs provide verifiable methods of monitoring.”

ON-FARM FOOD SAFETY PROGRAMS (OFFSP) SUMMARY

National programs were established to address consumer concerns about food safety; they provide verifiable methods of monitoring in order to secure consumer confidence. On-Farm Food Safety Programs (OFFSP) use the internationally recognized food safety approach of “Hazard Analysis Critical Control Points (HACCP)”.

The Canada On-farm Food Safety working group has established a framework for on-farm food safety programs: <http://www.onfarmfoodsafety.ca/index.html>. The Canadian Food Inspection Agency (CFIA) provides a process of review, assessment, recognition and ongoing monitoring of on-farm food safety systems developed and implemented by Canada’s national producer organizations (List of OFFSP’s: <http://www.inspection.gc.ca/english/fssa/polstrat/reco/recoe.shtml>).

On-Farm Food Safety Programs outline management options to minimize food safety hazards, and provide tools to troubleshoot techniques and anticipate problems, reduce risks, and take corrective action. Food safety programs complement livestock identification programs as identification is a key element.

General On-Farm Food Safety Program components include:

- Animal and premises identification
- Animal health and safety
- Management and health records
- Sanitation and waste management
- Quality assurance for good production practices

“On-farm food safety hazards include physical, biological and chemical.”

- Specific documentation of medications and farm chemicals
- Feed and water quality and safety

The overall goal of food safety programs is for producers to be able to demonstrate to consumers:

- they have a commitment to on-farm food safety program,
- they are meeting the program's requirements.

SHEEP OFFSP

The Canadian Sheep Federation (CSF) Food Safe Farm Practices Program was developed in partnership (government, industry, producers). The program addresses and anticipates potential food safety challenges facing the sheep industry. It promotes Good Management Practices (GMP's) to minimize food safety risks and ensure safe, high quality products. This is a national program, available to all sheep producers. Participation is voluntary.

There is a manual, called the Canadian Sheep and Lamb Food Safe Farm Practices. As well, producer training courses are available (Food Safe Farm Practices Program Information and On-Line Training).

The program aims to:

- Assist with production goals.
- Document producer's "**due diligence**" with regard to food safety, providing a safe product for human consumption (demonstrate adherence to drug withdrawal times and veterinary prescriptions should safety issue and liability questions arise).

RECORD-KEEPING IS KEY

CSF templates are provided but not required (<http://www.cansheep.ca/cms/en/Programs/FoodSafeFarmPractices/ProgramRecordKeepingForms/ProgramRecordKeepingForms.aspx>). Farm records must track information that applies to farm operations, and must meet program requirements. These records must be easily accessible and legible. The records are audited along with the farm for certification under the program.



3.0 FOOD SAFETY

FSFP PROGRAM CERTIFICATION

Audits of records and the farm for certification are done by trained, certified auditors on a 4-year cycle (http://www.cansheep.ca/User/Docs/PDF/OFFS_FAQ-EN.pdf).

GOAT OFFSP

The Goat On Farm Food Safety (GOFFS) program (<http://www.cangoats.com/index.php?pageid=467>) was developed by The Canadian National Goat Federation and reviewed and accepted by the Canadian Food Inspection Agency (CFIA) as a credible, national on-farm food safety program for the goat industry. It is based on a HACCP (Hazard Analysis Critical Control Points) approach that examines all areas of production and outlines good production practices (GPPs) to minimize food safety risks and produce a high-quality product. It provides goat producers with the opportunity to access markets that might otherwise be closed without the assurances offered by such a program, and demonstrates to consumers that producers have exercised due diligence during production.

This is a voluntary national program available to all goat producers. A free manual is available (email info@cangoats.com to get a copy) as well as some online information, resources and training videos.



PART A: FLOCK MANAGEMENT PLAN

MANAGEMENT OF FLOCK AND FARM

Flock and farm management require regular systematic farm **observations** and **record keeping**.

Daily farm routine involves observing all aspects of the farm:

- Workers, Buildings and other Facilities including gates, Equipment, Feed, Water, Animal handling.
- Recording daily farm management activities as they occur.

Planning Goals: Minimize impacts of anticipated problems.
Maximize farm productivity and efficiency.

PART A: FLOCK MANAGEMENT PLAN

Create a **Management “Calendar”** or **“Plan”** **each year** for your farm!

The Calendar or Plan will include all management activities for the year. *See* list of essential activities below. Most management actions will be at the flock/herd level, such as general health activities (pasture management, vaccinations, foot trimming, etc), but yearly planning will also include individual animal activities (for breeding, examining, treating and recording, etc).

Goal: Overall health and welfare of flock.

Benefits of a plan:

- Enables early planning for preventative actions.
- Allows time for decision-making and prioritizing of management activities.

Facilitates record keeping and evaluation –
“How’s the Farm Doing?”

- Documents producer biosecurity measures – infectious disease security and due diligence.
- Brings attention to incorporating farm activities within the natural environment.



Management and planning varies with type and scale of productions:

- **Home farm:** pets and variety of products – wool, wool products, milk, cheese, soap, hides etc.
- **Commercial ewe / doe** for lamb / kid production.
- **Dairy** for milk or cheese production.
- **Crossbred ewe production** for ewes for commercial lamb market.
- **Purebred breeders** for foundation breeding stock sales. May or may not be involved in a Record of Performance (ROP) testing program.
- **Feedlot** for lamb / kid production.
- **Specialty flocks** for hair / wool production.

ESSENTIAL FLOCK MANAGEMENT ACTIVITIES

Breeding and Birthing	See Part B
Body Condition Scoring	See Section 2 Monitoring Flock Health
Carcass Disposal	See Part D Sanitation
Disease Treatment	See Section 4 Flock Health Part B
Euthanasia	See Part C
Feeding and Watering	See Part C Nutrition and “Nutrition Guide for BC Sheep Producers”
Foot Trimming	See Part C
Facilities (Housing)	See Part D
Identification	See Part C
Parasite Management	See Part C Nutrition and Section 4 Flock Health Part B
Record Keeping	See Section 2 Monitoring Flock Health
Shearing (Sheep)	See Part C
Slaughter	See Part C
Transportation	See Part C
Vaccination Program	See Section 4 Flock Health Part D
Waste Management	See Part D

“Flock and farm
management require
regular systematic
farm observations and
record keeping.”

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (Breeding and Birthing)

Note: Every flock is different! Management Plan or Calendar is tailored to the flock.

Reproductive Management Time Periods are Overlapping:

Breeding Season (varies, but generally the fall)

Pregnancy (approximately 5 months)

Parturition (varies, but generally in spring)

Lactation (varies, *e.g.* dairy could be up to 10 months)

Dry Period (at least 2 months)

Timing of Reproductive Cycle – possible Dairy Example:

STAGE/MONTHS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Estrous Cycles / Breeding season												
<i>e.g. Breeding</i>												
Pregnancy												
Parturition												
Lactation												
Dry Period												

Timing of Reproductive Cycle – possible Meat-production Example:

STAGE/MONTHS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Estrous Cycles / Breeding season												
<i>e.g. Breeding</i>												
Pregnancy												
Parturition and Weaning												
Lactation												
Dry Period												

BREEDING / REPRODUCTIVE CYCLE

PUBERTY

Puberty in sheep and goats is:

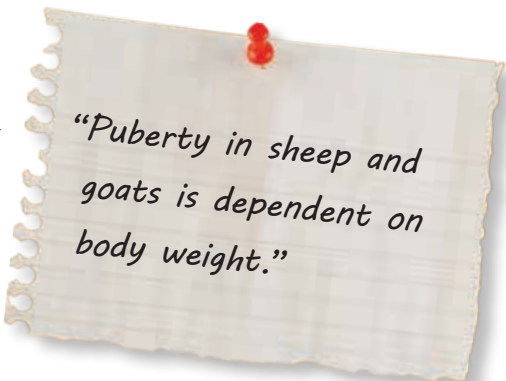
- Influenced by genetics, environment, breed, level of nutrition and season of birth.
- Dependent on body weight.

Sheep

- **Female:** Puberty is usually reached at about 6 to 9 months of age (50-70% of body weight for breed, e.g. Finns 3-4 months).
- **Male:** The testes increase in size at approximately 8 to 10 weeks of age (body weight 16 to 20 kg). Viable sperm usually produced between 4 to 6 months of age (40 to 60% body weight).

Goats

- **Female:** Most breeds reach puberty at 5 to 8 months of age (Angora may not until over one year of age). Females can be bred after reaching 60 to 75% of mature body weight for breed.
- **Male:** Can reach puberty at 3½ months. Ensure young males are weaned prior to breeding season.



"Puberty in sheep and goats is dependent on body weight."

BREEDING SEASON

Sheep and goats are **seasonally polyestrous**, which means they:

- Breed with decreasing day length, with peak in October-November.
 - Naturally breed in the fall, to have offspring in spring, when pasture would be available.
- May have shorter cycles (7 days) early in breeding season, but may not ovulate.

Certain breeds of sheep and goats have more variable breeding seasons than others:

Sheep

- Short season breeds (Sept-Jan): Suffolk, Columbia, Cheviot, Leister, Finnish Landrace, Corriedale.
- Long season breeds (July-Mar.): Merino, Rambouillet, Dorset, Romanov, Rideau Arcott.

Goats

- Short season breeds (Sept-Feb.): Toggenburg, Saanen, Alpine, LaMancha.
- Long season breeds (July-April): Pygmy, Nubian, Boer.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

BREEDING MANAGEMENT

Introducing the ram or buck to females in early breeding season initiates the estrous cycle.

Options for controlling breeding season:

- **Limiting season length**, *e.g.* 6 to 8 weeks or ~ 2 cycles, will shorten the duration of birthing and enhance the uniformity of the offspring.
- **Staggering breeding groups** is used to cope with large numbers for a variety of markets.
- **Breeding out of season** varies the timing of offspring or for more than one crop of offspring or for a continuous milk supply. In sheep, it is feasible to try 3 crops / 2 years or 5 crops / 3 years.

Use:

- Long-season breeds.
- Manipulate light exposure (must be housed indoors).
- Hormone stimulation (by veterinarian), is used in other countries to induce estrous out of season, or to synchronize estrous in season; however, no drug is approved in Canada, due to human health risks from residues and animal welfare issues.

Note: For out of season breeding the Male ratio: 1 Male <10 Female.

ESTROUS CYCLE

Estrous cycle in ewes and does refers to all of the following:

- development of egg
- readying of the uterus for possible pregnancy
- period of receptiveness to ram / buck
- ovulation of egg from ovary

The estrous cycle varies in length with breed, age, individual, environmental stress, nutrition, severe weather, stage of breeding season (shorter at either end of season).

Sheep

- Average Length = 16 to 17 days (14 -19 days)

Goats

- Average Length = 19 to 21 days (pygmy 18-24 days)

ESTRUS

Estrus = receptive phase of estrous cycle (“standing heat”).

“The estrous cycle varies in length.”

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Estrus length varies with breed, age (younger have shorter estrus), stage of breeding season (shorter at beginning and end), and presence of a male.

Sheep

- Standing estrus (receptive to ram) = 10 to 12 hrs.
- Signs: Minimal; may be restless, seek ram, vulva slightly swollen, switch tail.
- Ram presence useful for detection.

Goats

- Standing estrus (receptive to buck) = 12 to 24 hrs (10-40 hrs).
- Signs: Decline in milk production before estrus, decreased appetite, seek buck, tail wag = “flagging”, bleating, urinating, ± vulvar swelling, ± mucus discharge (changes from clear to creamy white as estrus progresses).
- Some does show estrus during pregnancy.

“Estrus (standing heat) is the receptive phase of the estrous cycle.”

BREEDING

Female: Optimal breeding near the end of standing estrus. Ram or buck introduction to females that are just entering the breeding season usually stimulates ovulation within 2 to 5 days. The result is to synchronize cycles. Could use a vasectomized teaser male for this purpose.

Sheep

- **Female:** Mate with ram 9 to 12 hrs after onset of standing heat. Eggs are viable for 10 to 25 hours after ovulation.
- **Male:** 1 mature ram for 30 to 50 ewes (1 ram lamb for 15-25 ewes). Best to have more than one ram / flock.
- **WATCH** flock at breeding for ewe receptivity and successful mounting. Small flocks can record ewe breeding dates.
- **Marking harness** on rams is used to mark mounted females. Change colour every 17 days.

Goats

- **Female:** Mate with buck at onset of standing heat, then at 12 hour intervals.
- Buck’s “odour” is important for estrus detection. If females and males are separately housed, it can be used to test female receptivity: Wipe a cloth over the buck’s scent glands, store in a jar, warm before use and expose to female to test her reaction.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- **Male:** 1 mature buck for 50 does. Keep only one buck per group as more than one buck leads to fighting and injury.

OVULATION

Ovulation occurs at the end of estrus.

Goal for sheep > 200% **lambing percentage** or an average of at least 2 lambs/female.

Ovulation rate depends on:

- Age (the number of eggs ovulated increases with age to max at 3-6 yrs in sheep).
- Breed = Most produce an average of 1.5 eggs/estrus (Finnish Landrace: 3-5 eggs/estrus). Cross breeding can increase lambing percentage.
- Season: Mature ewes, the ovulation rate is highest in mid breeding season. Ewe lambs' ovulation rate is highest early in the breeding season.
- Ovulation in sheep can be increased with better nutrition 2-3 weeks before breeding = "**flushing**". Monitor Body condition (See Body Condition Scoring), do not over feed.

Note: GOATS: Flushing is not proven to increase ovulation rate in does.

See Appendix for *Breeding – Lambing Chart*



MALE FERTILITY

Sperm development takes approximately 50 days. Thus, males should be in good condition at least 50 days prior to the breeding season.

Testes size:

- Testes size will increase with shorter day length.
- Mature **ram** (>110 kg) scrotal circumference for optimum breeding is >36 cm.
- **Ram lamb** scrotal circumference for breeding should be >30 cm, better if >33 cm.
- Mature breeder **buck** (non-miniatures) scrotal circumference for breeding is >25 cm.

Male Breeding ability is dependent upon:

- **Physical condition:** Good body health, scrotal size, sight, smell and limb soundness.
- **Semen quality:** Determined by semen evaluation (elector-ejaculation for rams; artificial vagina possible for bucks).

Note: Electro-ejaculation is a procedure that must only be performed by a veterinarian.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- **Mating ability or male libido:** Interest in checking females, mating, and successfully achieving fertilization.

Note: Male dominance affects breeding. Thus, use an odd-number of similar-age rams with a ewe group, in sufficient space to avoid fighting. With goats, use a single buck.

“Males should be in good condition at least 50 days prior to the breeding season.”

Male Fertility problems:

Brucella ovis: Affects rams, and is a venereal bacterial disease. Causes decreased fertility, abortion, weak lambs. No treatment. Cull. Not common in Canada.

Note: this is a federally reportable disease and can cause disease in people. If suspected contact your veterinarian or the Animal Health Center as soon as possible.”

Sheath rot (posthitis) = inflammation of prepuce: Affects both rams and bucks (more often in wethers). Results in painful, red raw tissue. Caused by excessive protein in diet and subsequent high ammonia levels in the urine *e.g.* high legume feeding. Treatment involves reducing the inflammation. Prevent by feeding more grass hays (remove excess protein from diet).

GESTATION (PREGNANCY) AND ABORTION

GESTATION LENGTH:

The length of gestation in sheep and goats is about 5 months. Sheep and goats have a coteledonary placenta, meaning the membranes around the embryo have button-like attachments. During pregnancy, the cervix contains mucus plug, protecting the fetus.

The actual length of gestation depends on:

- Breed
- Age (longer with older animals)
- Gender of fetus (longer with male offspring)
- Season (longer in spring)
- Number of foetuses (decreases with more than one baby)

Sheep

- Average length = 147 days (144 – 151 days)

Goats

- Average length = 150 days (147 – 155 days)

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

GESTATION MANAGEMENT CONSIDERATIONS:

Nutrition: During last 6 weeks of gestation, gradually increase feed to ewes and does – aim for a body condition score of 3 to 3.5.

Milking: Does and milking sheep should be dried off at least 2 months prior to kidding/lambing (udder rest period).

Vaccines: At least 4 weeks *prior to parturition* give dams:

- Clostridial vaccine booster (*Clostridium perfringens* type C & D, *Cl. chauvoei*, *Cl. septicum*, *Cl. novyi* and *Cl. tetani*)
- ± Vitamin E / selenium injection.

Birth facilities: Should be prepared and available at least 2 weeks prior to the first expected date.

Shear the ewes or “crutch” the udder area, **clip** does to remove hair from the udder area.

Encourage gentle **exercise** – *e.g.* put feed or water away from the rest area.

Discourage fighting.

PREGNANCY DIAGNOSIS

During the breeding season, a return to estrus usually indicates that the female is not pregnant, but occasionally a pregnant doe will “cycle”.

Pregnancy Diagnosis Methods:

	EWE	DOE	NOTES
ABDOMINAL PALPATION (BALLOTTMENT)	Placed in sitting position. Fetuses palpated after 120 days.	Standing. Fetuses palpated after ~120 days. Note: May confuse with hydrometra (Pseudopregnancy)	Takes skill / practice. Not in fat animals. May cause abortion .
BLOOD TEST-PROGESTERONE	Assess at 20-25 days after breeding.	Assess at 20-24 days after breeding.	Assessing non-pregnancy Accuracy 70-80%
BLOOD / MILKTEST – ESTRONE SULFATE	From 70 days onward	After 50 days onward.	Urine, serum, or milk. Very accurate. May be expensive.
PREGNANCY-SPECIFIC PROTEIN B (PSPB)	26 -106 days	21 days onward	New. 17% false positives. Not widely available
ULTRASOUND – REALTIME B-MODE	Intra-rectal scan (linear array transducer): From 0-100 days. Best 35-55 days. Flank scan (sector scanner): From 45-50 days onwards. Most accurate fetal counts 45-90 days (right side of abdomen, just ahead of udder).		Accurate, as can See fetus on BandW screen (previously used doppler technology). Best method currently available. Equipment expensive.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

ABORTION

Impairment of the dam's health, nutritional level or blood flow to uterus / placenta / fetus can lead to abortion (loss of pregnancy) or weak lambs / kids:

- Early embryonic death (between 1-50 days of pregnancy)
 - may only *see* as return to estrus (esp. late in breeding season)
- Abortion (after 50 days of pregnancy)
 - may find fetus and placenta
- Still births (at expected due date)
- Weak or mal-formed offspring.

When is Abortion a problem?

In a normal healthy flock, the abortion rate is <2%.

If the abortion rate is between 3-7%: Possible *endemic disease* present.

Abortion is a **PROBLEM** if the abortion rate is >5%, or abortions occur in a short time frame or in a single area (pen, group, farm).

Causes, Treatment and Control of Abortion:

See Section 4 Flock Health Part B – Contagious abortion.

Note: **Non-infectious causes** of abortion, especially environmental and dietary factors *e.g.* Iodine and other vitamin / mineral deficiencies, plant toxins, heat, transportation or nutritional stress.

PARTURITION (BIRTH) AND POST-PARTUM CONSIDERATIONS AND CARE

BARN/FACILITY FOR LAMBING/KIDDING

A clean lambing / kidding pen (or area) is needed for each female for 1-3 days.

The birthing facilities should be well bedded, and should be ready at least two weeks prior to the first expected “due” date. The pen should be at least 1.5 m² with:

- Corner divided off for a lamb / kid **creep area** (clean, dry, well-lit)
- Feed and water available to dam
- If on pasture, should have shelter / protection from weather
- Clean pails (washing, sheep drinking)
- Clean warm water
- Heat lamp (or other heat source)

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

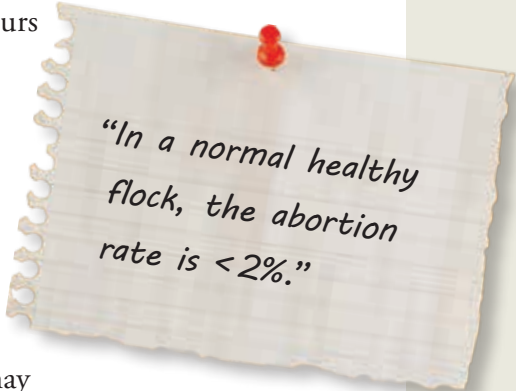
SIGNS OF APPROACHING PARTURITION AND END OF PREGNANCY

Sheep

- Teats full and firm up to 10 days before parturition.
- Vulvar lips swell and slacken <10 days before.
- Body temperature drops 0.5°C in last 48 hours, usually falling below 39.2°C.
- Ewe may separate from flock and stop eating a few hours before.
- Ewe restless, up and down, switch tail, bleat, ± strain (also may raise head, purse lips).

Goats

- Several days before – may not look as wide, as fetus re-positions for birth.
- Enlarged udder – several days before (young doe) – few hours before (mature doe). (Occasionally udder may engorge weeks before and require milking – save colostrum.)
- Relaxed pelvic ligaments, elongated vulva 1-4 days before. Hollow flanks.
- Body temperature drops ~1.0°C in the 12-24 hrs before. Ears may feel cool.
- Restless, uncomfortable, separates from herd, up and down few hours before.



"In a normal healthy flock, the abortion rate is <2%."

BIRTH STAGES

Parturition may be divided into three stages:

1. Preparation:
 - Dilation of cervix, lasts 3-4 hrs, dam restless, up and down, tail swishing, ± straining, thick creamy white mucous passed (often missed).
2. Delivery of lambs/kids:
 - Obvious uterine contractions with straining.
 - Water bags may be seen, often breaks in uterus.
 - Front hooves/nose seen if normal forward presentation; hind limbs if normal posterior.
 - After shoulders through cervix, usually birth is rapid.

Usually:

- <30 minutes from water bag rupture and straining to expulsion of a single offspring.
- Multiple offspring born <2 hrs.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Ewe lambs and multiple births take more time than older ewes or single births.
3. Delivery of placentas:
- Usually occurs within 30-60 minutes after the last lamb / kid is born.

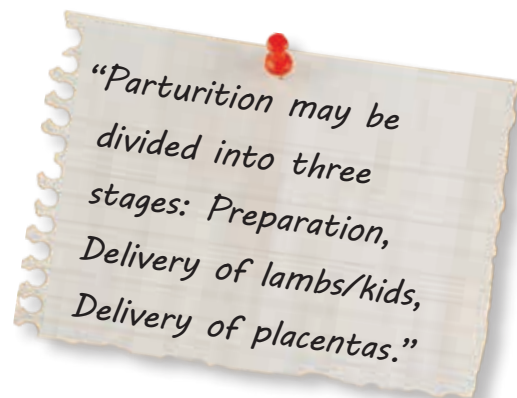
EQUIPMENT KIT FOR LAMBING / KIDDING

The following are items that should be readily available at the time of parturition:

- Soap – betadine scrub (Avoid chlorhexidine or strong iodine based)
- Navel dip or spray (tamed-iodine-based)
- Gloves (hand and long obstetrical)
- Obstetrical lubricant – K-Y Jelly
- Chains (for lambs or kids), or clean soft ropes, or sterile 2” rolled gauze, head snare
- Clean cloths, towels
- Colostrum (50-100 ml units) – Stored in freezer, warmed in water bath.
- Clean containers for collecting and then feeding colostrum (milk), and collecting for freezing
- Non-toxic marking chalk stick

From the **Medical Kit**:

- Sterile syringes 3 ml, 5 ml, 10 ml
- Sterile injection needles 20G x 1” and 1½”, and 18G x 1” and 1½”
- Antibiotics (injectable and intrauterine bolus)
- Dextrose
- Calcium borogluconate
- Vitamin E ± Selenium (given in neck area of lamb, if not given or fed to ewes prior to lambing).
- Stomach tube and dose syringe – newborn size.
- Rectal thermometer
- Dopram and epinephrine for emergencies.



PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

ABNORMAL BIRTHS (DYSTOCIA) AND ASSISTING DELIVERY

WHEN to assist or check:

- If nothing happens 24 hours after relaxed pelvic ligaments / full udder / restlessness in doe.
- Straining > 30-40 minutes (mature female) to one hour (ewe lamb) with nothing happening.
- Water bag visible and no progress for 30 minutes.
- Large offspring (limbs seen), no progress after several minutes, appears wedged.
- Delivery position not = 2 front limbs with nose following or 2 hind legs + no progress, *e.g.* could be head alone, single limb, tail.

Note: Dystocia occurs in 3-5% of goat births.

HOW to check:

Cleanliness!! Clean and dry vulvar area + hands and arms (betadine scrub). Wear clean barn-only clothes. Use clean gloves. Work on clean bedding material ~tarp under you and hind area.

Lubrication!! Apply lubricant liberally. Add lots of lubricant and gently stretch vulva.

Check cervix: **Not open:** Assume not into full labour, wait.

Partially open: Recheck 2 hrs. If no change:
Call veterinarian.



CORRECTING PROBLEMS

Goal:

To get one offspring, in a normal position, in the dam's immediate pelvic area, if possible.

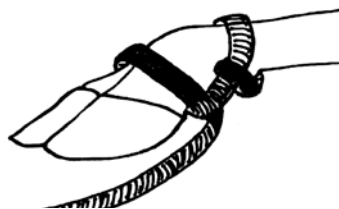
Method:

- **Lubricate thoroughly!**
- Always protect the wall of the uterus from any pointy hooves, bones, birthing tools and excessive pressure. The uterus can rupture!
- Manoeuvre any other offspring gently out of the way with caution!!!
- Readjust head or limbs of selected offspring (one most in pelvis) with caution.
- Chains, cords or head snares may help for repositioning.



PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- For repositioning limbs, place cords or chains around each fetlock above and below fetlock joint.



- **Head snares** are available of plastic-covered wire (as shown below), soft plastic or rope. Moderately stiff plastic-covered wire snares can be gently pushed ahead of fingers to reach inaccessible ears or jaws, to gently pull head into reach. Head snares can be gently placed around behind the ears and through the mouth.



Note: Be prepared to call a veterinarian if no resolution or progress after 15 minutes.

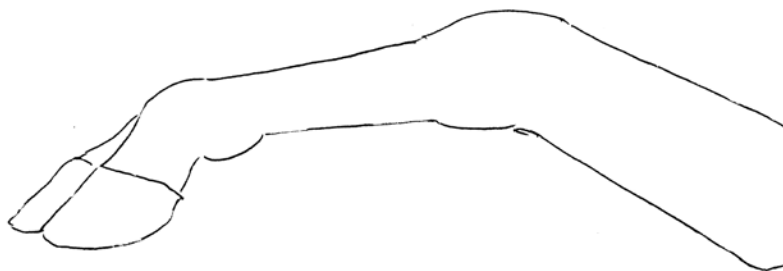
What is the Problem? Is it a Normal Presentation?

Which Limbs? **How to distinguish front and hind limbs:** Feeling up from toe, carefully check which way the joints on each limb **bend**:

FRONT Leg:

- **1st Joint** (fetlock) bends **back** (away from front surface of hoof);
- **2nd Joint** (knee) also bends **back**.

→ *first 2 Joints bend back and then back*



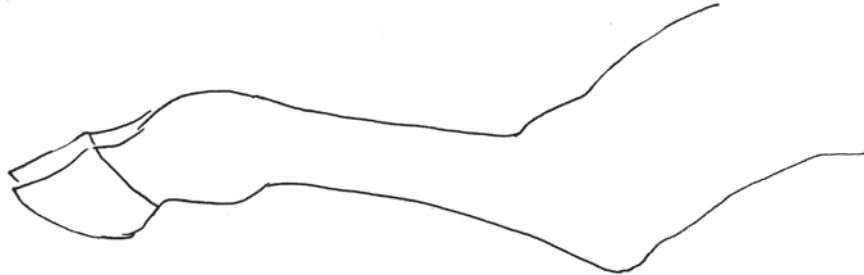
FORELEG

HIND Leg:

- **1st Joint** (fetlock) bends **back**;
- **2nd Joint** (hock) bends **forward** (towards front surface of hoof).

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

→ first 2 Joints bend **back** and then **forward**

**HINDLEG**

Position of limbs / head? If limbs and / or heads are not at abnormal birthing angles, such as too far ahead or back, try to return gently to normal position for birth (forward or backward).

Where is the Head(s)? If head is turned back or under: A smooth but rigid head snare (*see previous page*) may be gently pushed ahead of fingers to snare ear or jaw, which can be gently pulled into reach of the hand. Then, head is gently manoeuvred into normal birth position.

One lamb, two, more? Follow along limbs to identify front or back legs and then feel which limbs or head is attached to which body. Intertwined legs are common.

Be gentle, patient, thorough and systematically rapid.

Helping to pull

- **Zoonosis Caution:** Pregnant women are advised **NOT** to assist at sheep or goat parturition!
- Wear sterile or clean obstetrical gloves.
- Add lots of lubricant and gently stretch vulva.
- Gentle firm traction as dam strains.
- Adjust one front leg slightly ahead of other to reduce shoulder blockage at female's pelvis.
- May turn hips gently on a diagonal to reduce hip blockage at female's pelvis.
- Gently pull limbs outwards and slightly upwards until offspring's chest is seen and hips into pelvis, then angle down.
- When assisting always **check** for another lamb or kid!
- Seek Veterinary aid (in form of caesarean section or fetotomy) for: abnormally shaped fetus, very complicated inter-twinning, extremely large offspring, if unfamiliar with lambing/kidding techniques, or if no progress within 15 minutes.

"It is essential to be able to distinguish between front and hind limbs when assisting at births."

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

PREGNANCY AND PARTURITION HEALTH PROBLEMS

PROBLEM	WHO / WHEN	SIGNS	POTENTIAL CAUSE	TREATMENT
PROLAPSED VAGINA	Mature ewes and does . In late pregnancy .	Red ball (size of tennis or softball) protrudes below anus. Vagina is “inside-out”.	Breeds (Ewes – usually coarse wool breeds. Does – Saanen). Feeds (Increased if high fibre and dry diet, or with plant estrogens). Overweight or out of condition. Standing on hind legs at feeders.	Correct within 24 hrs due to urinary complications. Veterinarian replace and suture closed, remove suture at birthing . OR Insert “prolapse paddle” and tie in. Cull affected animals and do not retain offspring.
HYPO-CALCEMIA (MILK FEVER)	Occasional in dairy goats , rare in ewes. Usually at kidding or shortly after , but may occur before.	Similar to ketosis, onset faster: <ul style="list-style-type: none"> • off-feed, • unsteady, recumbent, • coma, death within 6-36 hrs. 	Failure to absorb and / or mobilize sufficient calcium for body demands (gestation and lactation)	Veterinary: <ul style="list-style-type: none"> • Slow intravenous injection 50-150ml calcium gluconate 23%. • May follow-up with subcutaneous or oral calcium gel drench.
PREGNANCY TOXEMIA / KETOSIS	Ewes and does in late gestation , or early lactation does.	Early: not eating, isolated, dull, depressed. Ketones in urine – detected with ketone test strips or tablets. Later: weakness, muscle tremors, uncoordinated, foam / teeth chomping, recumbent.	Insufficient energy to meet needs of growing fetuses. Prevent with proper ration during gestation.	Early (off feed in late pregnancy or 1st month of lactation): can drench with propylene glycol (150ml). If severe, veterinary intravenous injection of 50-150 ml of 50% dextrose solution.
RINGWOMB	More often in ewes , rare in does. At parturition .	Cervix fails to open Cervix only 1-2 fingers wide. Birth signs begin, but serious straining not occur as fetus not through cervix or in vagina	Not understood: failure of process of dilation in response to hormonal stimulation. Possible genetic predisposition.	Wait 1 hr to see if progresses. Note: cervix can be ruptured ≤ one hand’s breadth. If cervix remains ≤ hand’s breadth consider caesarean birth.
FALSE PREGNANCY	Does	No estrous cycle, may appear pregnant for 2-5 months. Followed by “cloud-burst” of cloudy watery fluid.	Unknown. Occurs more often in does bred late in season or if hormones for out-of-season breeding are used.	Diagnose with ultrasound. Terminate with Prostaglandin F _{2α} .
RETAINED PLACENTA / METRITIS	Uncommon in ewe . Occasional in doe . Post partum .	Dull, depressed, temperature >40.5°C, off-feed, smelly, watery, red vaginal discharge.	Infection in uterus / placental tissues	Veterinary treatment. Do not pull on tissue as may damage uterus.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

POST-PARTUM DAM CARE

If assisted with birth, watch dam for infection. She may require systemic injectable antibiotics and or intra-uterine bolus. Provide the dam with warm water to drink for re-hydration.

Udder care:

Ensure udder is healthy and producing normal colostrum (first milk). From healthy females, take small amount of good quality colostrum (best as early as possible, at least first day) into sterile container, freeze (sterile ice cube trays work well) and store for future.

Older animals usually have more antibody development, therefore better colostrum. The colostrums can be heat-treated, prior to freezing, to prevent virus transfer, *See method page 52.*

If planning to milk the dam, wait until bonded with newborn(s), then milk the female in milking stand, while giving her a small amount of food.

Afterbirth / Placenta:

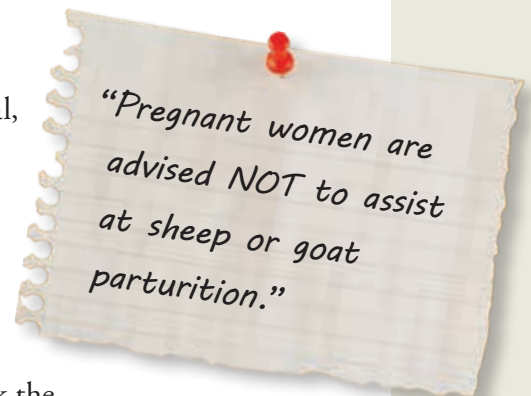
- The afterbirth is usually passed within ½-5 hrs of birth. **Do not** pull on the afterbirth or attempt to remove it manually.
- Not recommended for dam to eat the placenta. Dispose of the placenta in the same manner as you would a carcass.
- Uterine secretions vary from none to 200 ml of bloody discharge, which should cease by 5 days.
- Uterine involution – the uterus should return to normal, usually within 1 month after birth.

NEONATAL OR NEWBORN CARE

IMMEDIATE CARE

Immediately after the lamb / kid is born:

- Clear the nostrils of mucous and membranes and check the breathing. If there is a need to stimulate breathing:
 - Rub the chest and body gently, but vigorously, with a towel
 - Gently poke a piece of straw into a nostril
- Check for abnormalities (navel, eyes, anus, mouth, sucking ability, normal stretching when get up)
- May disinfect the navel (dip or spray)
- Present the newborn to the dam



PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Check the dam's milk (teat plugs removed?) **Note:** save some colostrum if possible, See previous page.

- Ensure newborn is dried, sheltered (warmed) and fed by mother
- Check 3-4x in the first day

Goal:

Newborns should be standing within 20 minutes of birth and nursing within 2 hours.

How to tell that the newborn has nursed: Pick up by the front legs. Full belly (tear-drop shape) will be wider than the rib cage.

Help newborns to nurse if weak from prolonged birth.

Colostrum (first milk):

Ensure the lamb or kid receives colostrum:

Soon = within 2 hrs of birth, less value after 12 hrs and can't absorb after 36 hrs.

Enough = 50 ml/kg 3x in first day. Normal lamb or kid gets close to 1 litre of colostrum in first 24 hours. If lamb/kid will not nurse, try bottle feeding colostrum. If they will not drink a bottle, tube feed colostrum. See using a stomach tube on page 54.

Good quality. Best if from older animals on the same farm.

"Older animals have more antibody development, therefore, better colostrum."

- Can interchange lamb and kid colostrum if necessary.
- Cow colostrum is a lesser substitute, may cause haemolytic anemia problems in some newborns and may introduce other diseases (e.g. Johne's).
- Commercial colostrum supplements may not raise serum antibody levels sufficiently in newborns.
- Careful heat-treating of colostrum prior to freezing is used to prevent virus transfer e.g. Caprine Arthritis and Encephalitis, but antibodies are preserved, See below for method.
- Colostrum quality can be estimated on farm using a colostrometer.

HEAT-TREATING COLOSTRUM

- Heat colostrum to (56-57°C) 133-135°F for 60 minutes in water bath / double boiler & stir.
- Heat-treated colostrum may be frozen for up to one year in small useable quantities, e.g. ice cube tray cubes, or 50-500 ml containers.
- Thaw in warm water bath, do not heat with stove or microwave.
- Do not pasteurize (inactivates antibodies).

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Not nursing, too weak to suckle: May be hypothermic. *See below.*

Note: Lamb and kid mortality should be <5%.

NEWBORN HYPOTHERMIA

Hypothermia = excessive heat-loss, chilling. Newborns are vulnerable. Hypothermia leads to weakness and death.

Chilling rate increases with smaller size, thinner coat, not being licked dry quickly, wet for prolonged period (esp. outside in rain and mud), drafts or low environmental temperatures.

For heat, newborns initially use brown fat reserves with which they are born. Colostrum helps initiate this process, after which nursing newborns obtain energy from the dams' milk.

Weak neonates may not get adequate colostrum. Weakness may be caused by long delivery, immature or debilitated newborns, poor mothering, poor udder, or lack of or poor colostrum.

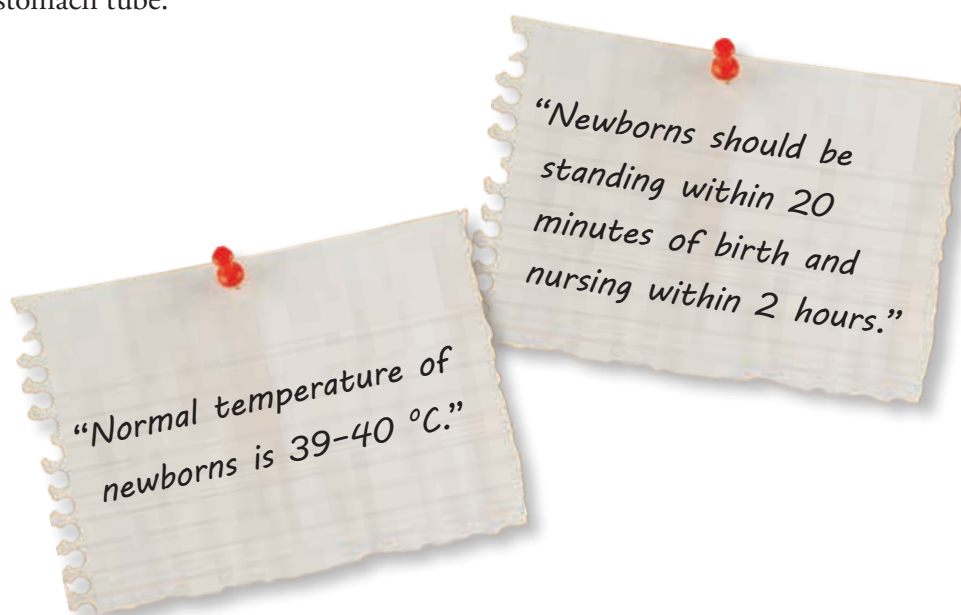
Signs:

Weak or recumbent newborn. **Rectal temperature < 39°C.**

Normal Rectal Temperature of newborn: 39°C – 40°C.

Treatment:

Warm up and provide source of energy. Best if new born can suckle. If weak but trying to suckle, then warm and dry and try back on dam. If not suckling, provide nutrient via stomach tube.



PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

HANDLING HYPOTHERMIA OF NEWBORNS

CONDITION	TEMPERATURE	BEHAVIOUR	TREATMENT OF NEWBORN
NORMAL	39 – 40°C (102.2 – 104°F)	Stands, suckles dam within 5 hrs	Normal newborn care (See above).
MILD HYPOTHERMIA	37 – 39°C (98.6 – <102.2°F)	Weak but can stand and can swallow	Move to shelter and dry. Dry. If emergency, not sucking: Feed colostrum, 50 ml / kg body weight by stomach tube or 50 ml @ 2 hr intervals. Small lamb <1.5 kg (3 lbs) may be fed equivalent amount of 20% dextrose solution.
SEVERE HYPOTHERMIA	<37°C (<98.6°F)	Recumbent, weak, semi-comatose	Provide immediate energy : IF can swallow , feed colostrum 50 ml / kg body weight via stomach tube (4-5× in 24 hr period). IF cannot swallow , give 10 ml / kg body weight of 20% dextrose solution injected into the body cavity *See intra-peritoneal injection below. Warm newborn in Warming box* . Check rectal temperature every 30 minutes until temperature reaches 37°C. Then remove from box and if can swallow give colostrum 50 ml / kg body weight, via stomach tube. If can stand and nurse return to dam. If cannot, stand place in Aftercare unit** .

* **Warming box**: Box heated by moving air to temperature of 37°C – 40°C.

** **Aftercare unit**: compartment with overhead heat lamp, monitored so as not to overheat newborns.

USING A STOMACH TUBE

A stomach tube is used for giving fluids or medication, and to relieve bloat.

Use only if really necessary with newborns: When using a stomach tube, colostral milk and antibodies may enter rumen and not be as well absorbed. The stomach tube may not trigger the newborn's esophageal groove reflex, which through suckling stimulation normally directs fluid to bypass the rumen and enter the omasum and abomasum for absorption.

Requirements: Flexible tube, <1.5 cm in diameter, soft plastic / rubber, rounded at stomach end, may or may not have holes on sides of rounded (stomach) end.

Method:

- Give: 50 ml / kg body weight / feeding, 3-5× / day of colostrum or milk.
- Lubricate **clean** tube with KY Jelly (always clean and disinfect equipment between uses).
- Restrain offspring on its right side. Measure the length of tube needed from mouth to last rib and MARK this point (tape / marker) on the tube.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Hold offspring upright in lap, open mouth, gently pass tube over tongue into back of throat and down.
- WATCH lower side of neck on its LEFT side.
 - can See and FEEL tube going down esophagus with no resistance.
- If in doubt, gently shake neck with fingers and listen. Tube in the larynx may rattle slightly.
- When down to your mark, blow down tube, can FEEL / HEAR bubbles in stomach (under ribs on left), no coughing.

Note: Fluid into the lungs can be fatal. If in doubt as to whether you are in the esophagus, remove the tube and try again.

- Attach 60cc syringe or funnel and allow small amount of fluid to flow in by gravity, do not force! WATCH, and continue gravity feeding rest of fluids.
- Then, remove syringe / funnel, **pinch** tube end to close, and remove tube slowly.
- Clean thoroughly.

INTRA-PERITONEAL INJECTION – INJECTING INTO THE ABDOMINAL CAVITY

Note: Used as a last resort to try to save a seriously hypothermic newborn.

- Newborn is suspended upright by front legs.
- Scrub site on abdomen with betadine or similar. There are 2 different recommendations:
 - 2.5 cm (1”) above the navel, insert 18G needle directed towards the tail
 - 2.5 cm (1”) below navel and 2.5 cm (1”) to one side of midline, insert 20G needle at 90° angle to body wall (straight in).
- Give a 20% dextrose / glucose solution at a dose of 10 ml / kg of body weight.

YOUNG LAMB OR KID MANAGEMENT

Choices for raising offspring:

Raise offspring with dams,

- After feeding colostrum for 2-3 days, raise on milk replacer and gradually introduce solid feed.

For **controlling disease** *e.g.* caprine arthritis encephalitis (CAE): Remove newborns from dam at birth (no contact *e.g.* licking, nursing allowed) and feed heat-treated colostrum and milk replacer. See pages 123-125.

Vaccinate offspring within 7-10 days for Clostridial bacteria, if dam not vaccinated, may also use antisera, *e.g.* Tetanus anti-toxin. See Section 4 Flock Health Parts B and D.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

FOSTERING LAMBS OR KIDS

Fostering of one lamb / kid onto a different mother is used for sharing multiples (foster strongest), replacing a dead offspring or dead dam, for rejected offspring, and for disease prevention.

Method:

Foster as soon after birth as possible. Fostering works best if the foster-offspring are not yet dried off from birthing. If fostering onto a dam with her own lamb / kid, remove her own while introducing the foster-offspring.

Rub foster-lamb / kid with fostering-dam's own placenta (if still available), or cover with skin of her dead offspring (if possible). May have to initially hobble foster-offspring so it acts 'newborn', if the lamb / kid is already moving about.

Foster dams may be tied (stanchion) so can *see* offspring but not smell or harm it. The foster-offspring are allowed to nurse every few hours.

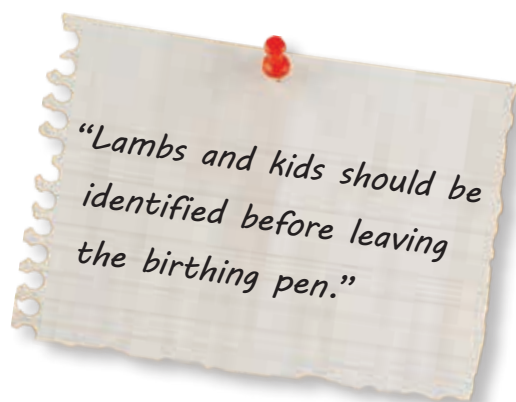
Note: Instead of fostering, if the lamb / kid received adequate colostrum, offspring may be raised on milk-replacer, creep fed and weaned onto solid-feed within 3-4 weeks.

IDENTIFICATION

Lambs and kids should be identified before leaving birthing pen. A temporary identification may be given in the birthing pen, and permanent identification applied later:

- Temporary – paint (non-toxic livestock paint / chalk stick)
- Ear tag
- Tattoo
- Leg band
- Ear notch

Always use clean, dry materials and very clean handling methods, *e.g.* clean hands, and a dropped tag or button should be re-washed and dried, etc.



CASTRATION, TAIL DOCKING AND DISBUDDING

Only perform these procedures if necessary, and only on healthy animals.

The lamb / kid should be between 24 hrs – 7 days of age, and must be protected against Clostridial infection (best if through colostrum from vaccinated dam).

Avoid bad weather, dirty conditions, and fly season.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Check repeatedly after, especially last thing on that day, for haemorrhage, weakness, discomfort.

Ensure competency of operator, and use only **clean** and disinfected equipment.

CASTRATION

Castrating is best after the lamb/kid has had colostrum and before 7 days of age.

Ensure there are no scrotal hernias and that both testes are present before castrating.

Advantages:

- prevent indiscriminate breeding, so allows male & female to run together

- less inter-male fighting & injury

- may enhance pelt removal & meat quality

Disadvantages:

- unnecessary where lambs marketed before puberty

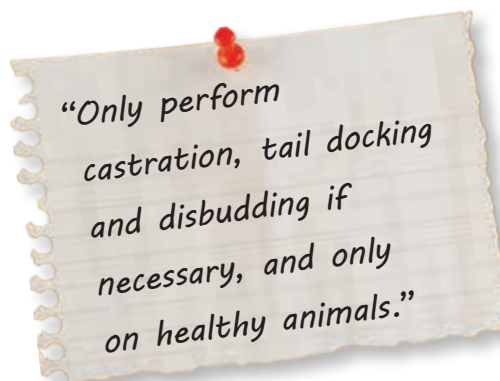
- non-castrated males show better growth rate, feed efficiency, carcass yield

- some markets want intact ram lambs

Methods: Rubber ring, Surgical, Emasculator (Burdizzo).

All methods of castration cause pain. Work with your veterinarian to develop protocols for pain relief.

Castration of rams beyond 10 weeks of age must be done by a veterinarian using anesthesia and perioperative analgesia (Codes of Practice for the Care and Handling of Sheep).



PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Castration Methods

	RUBBER RING	SURGICAL	EMASCULATOR
METHOD	Using elastrator, apply rubber ring around neck of scrotum just below rudimentary teats, capturing both testes in the scrotum below the ring. Ensure no scrotal hernia with intestines in scrotum & that ring is not placed over urethra (too high placement), or right over testes. Scrotum & testes slough in 3-6 weeks.	Check both testes in scrotum & no hernia present. Clean scrotum with disinfectant. Push testes up, cut off Lower 1/3 of scrotum with sharp scalpel or knife. Each testes separately is cut free of membrane, grasped & steadily pulled until cord breaks. Apply wound spray.	Crush spermatic cord on each side of scrotum with a burdizzo emasculator for lambs / kids. Ensure no scrotal hernia present. Apply below the rudimentary teats & above testes. Ensure spermatic cord is within the burdizzo jaws & hold burdizzo on each side for 10 seconds . Do not crush central part of scrotum. Apply to second side of scrotum slightly lower than the first. Ensure burdizzo is in very good condition, store with jaws open.
ADVANTAGES	Inexpensive. Quick. No blood loss / no open wound. Effective. Only in lambs <7 days old.	Inexpensive. Quick. Effective. Can be used on lambs up to 3 months of age, kids up to 5 months. *Surgical castration of lambs older than 4 weeks requires anaesthesia and analgesia.	No open wound. No blood loss. Can be used on lambs & kids up to 3 months of age. In lambs older than 6 weeks analgesia and anaesthesia is required.
DISADVANTAGES	Painful. May get infection around ring. May damage urethra. In very small lambs, testes may slip back through ring.	Painful. Risk of hemorrhage, infection, or prolapse. Required 2 people. Not during fly season.	Failure rate can be considerable & failures not easily detected. Requires 2 people. May damage urethra. Cost of burdizzo.

DOCKING LAMBS' TAILS

Dock tails only on healthy lambs that received adequate colostrums, and before 7 days of age. Remove at the joint just beyond the web of the underside of the tail

- Male below anus
- Female below vagina

- Advantages:**
- decreases accumulations of feces in tail area to reduce chance of blowfly problems
 - reduces chance of built-up feces contacting meat during butchering (food safety issue)
 - may provide easier management at mating and lambing

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Disadvantages:**
- tail is beneficial protection to the anus, vulva, and udder
 - not necessary if not in blowfly area

Methods:

- Rubber ring, Knife (Surgical), Burdizzo / Emasculator, Docking Iron (heat).

Methods – Tail Docking

	RUBBER RING	KNIFE	BURDIZZO/ EMASCULATOR	DOCKING IRON
METHOD	Using elastrator , apply rubber ring around tail , \pm on a joint, below the level of the anus in males and the vulva in females . Tissues will slough in 3-4 weeks.	Clean and disinfect tail. Using a scalpel or sharp knife cut tail at joint, below the level of the anus in males and the vulva in females. Apply wound spray.	Using burdizzo or cutting-emasculator , crush tail at a joint, below the level of the anus in males and the vulva in females . Hold in place 5-10 seconds. Cut tail below burdizzo jaws. Apply wound spray.	Using a heated-blade instrument cauterize & sever tail .
ADVANTAGES	Effective. Cheap. Quick.	Cheap. Effective.	Effective.	Least painful. Quick. Effective.
DISADVANTAGES	Painful. Possible infection around ring. Not in fly season. Only in lambs < 7 days old.	Risk of haemorrhage. Open wound – Not in fly season. Most painful. Requires 2 people. According to the codes of practice this method must be done by a licensed veterinarian with anaesthesia and analgesia.	Painful. Bone may damage burdizzo jaws. Requires 2 people. Open wound. Not in fly season. Cost of burdizzo or emasculator.	Risk of operator burns or fires. Requires 2 people. Wound healing required.

DISBUDDING KIDS

If choosing to remove horns, disbud a few days after birth – between 3-14 days of age. Horns may injure other stock or humans, but also have protective and grooming value for goat.

NOTE:

Horned breeds:

- Skin over horn bud is tight
- Hair swirl located over each horn bud

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Polled breeds:

- Skin over horn bud is loose (moves freely)
- Usually have swirl in centre of forehead

Method:

- Pain control should be used. Nerve blocks are problematic, so sedation with xylazine can be used (from veterinarian).
- Electric disbudding iron, or similar tool, must get hot enough to burn a complete circle when tested on a piece of wood.
- ± Clip hair over horn buds.
- Apply iron onto horn bud gently but firmly (do not press) with a rotating motion, for 5-10 seconds.
- Skin where applied should be copper-brown and horn caps should be easy to remove.
- Bottle fed kids should have warm water rather than milk immediately after disbudding, then a regular meal in 2 hrs.
- Check kids at 8 weeks – if any misshapen horns (scurs) have grown, these may be cut and the area burned. Pain control should be used.

LAMB OR KID HEALTH PROBLEMS

Lambs and kids may get variety of other health problems. For details on these potential conditions, unless otherwise noted, *See* references in Bibliography “Disease/ Health Issues” section:

- Atresia ani
- Border Disease
- Coccidiosis and other parasites *See* Section 4 Flock Health Part B
- Contracted tendons
- Entropion
- Injuries
- Navel or Joint ill
- Orf *See* Section 4 Flock Health Part B
- Premature births (weak, undersized)
- Scours
- Tetanus and other clostridial infections . . *See* Section 4 Flock Health Part B
- Umbilical hernia
- White muscle disease

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

LAMB OR KID EQUIPMENT KIT (*as needed*)

- Disinfectant
- Wound / fly spray
- Ear tags and tagger – clean and dry
- Tattoo kit
- Castrating equipment
- Tail-docking equipment
- Disbudding equipment

WEANING

Variable Timing for Different Systems:

Sheep

- Pasture systems – weaned at the end of summer, ewes being dried off for re-breeding.
- Intensive rearing – weaned at 6-12 weeks (at least 40 lbs), and raised on concentrates. Feed pelleted creep feed early to reduce stress of weaning from milk. Ensure lambs have high quality feed.
- Dairy – (usually bottle-raised lambs), wean from milk at 6-12 weeks (same as intensive rearing above).

Goats

- Dairy – (usually bottle-raised kids), wean from milk at 6-12 weeks.
- Meat – wean at 10-14 weeks.

*Method:**Sheep*

7 days before weaning, reduce the protein and energy ration to ewes:

- Gradually introduce lower value forage *e.g.* straw, corn stalks) to lactating ewes. This will reduce ewe dis-comfort, decrease the chance of mastitis, and encourages dry feed consumption by lambs.
- Continue for one week after weaning.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Goats

Meat and dairy goats:

- Similarly reduce ration (not water) 1-2 weeks prior to weaning.
- Meat goats: Can wean 1 kid / week from dam, which will gradually slow milk production.
- Dairy goats, varying practices:
 - Stop milking, may or may not dry treat, watch for any problems,
 - Gradually milk less often, may or may not dry treat, watch for any problems.



Ensure offspring (lambs and kids) are familiar with feed stations and waterers, and are eating the dry food and drinking water.

In order to reduce stress in weaning procedure:

- Choose good weather
- Quietly remove dams to area out of sight and sound of offspring
- Keep offspring in familiar surroundings and keep in established groups.
- Do not introduce single new kids to previously weaned group, introduce groups of 3 or more

Observe offspring well for signs of illness and to ensure water and feed consumption is adequate

MANAGEMENT SUMMARY BY ANIMAL GROUP

The following is a summary of management activities, *See* appropriate portions of manual for details.

PREGNANT DOES AND EWES

Pregnancy may overlap both lactation and dry periods, esp. dairy goats. For lactation *See* separate section page 65.

Dry period = at least 60 days prior to parturition = Mammary gland rest period.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

Major Problems:

- Pregnancy Toxemia
- Abortion
- Pseudopregnancy (Goats)

Goals:

1. Appropriate **BODY CONDITION** and **NUTRITION**:
 - Check body condition score Late gestation Aim: 2.5 to 3.5 Score. Critical not to over-condition. **AVOID obesity**.
 - Need good balanced appropriate nutrition for fetal growth period.
 - Supplemental feeding start @ beginning of last trimester (6 weeks before parturition) and gradually increase.
 - Watch vitamin / mineral deficiencies and toxicities. Provide free-choice mineral mixture, but need to watch and record individual intake. May need specific additives *e.g.* In Selenium (Se) deficient areas, either feed or inject Vitamin E and Se 30-45 days before parturition.
 - Provide sufficient feeder space: at least 1.5-2 ft / adult.
 - Provide exercise throughout gestation.
 - Provide ample clean, fresh water.
 - Check urine for pregnancy toxemia 2-3× mid-gestation on, or as necessary for ketones (urine sticks), esp. if previous problems. If positive for ketones, adjust feeding and watch carefully.
 - Check teeth / sides of mouth for jagged teeth or other problems
2. Protection from **ABORTION DISEASES OR FETAL INJURY AGENTS**:
 - Vaccinate for abortion diseases *if flock has abortion problem*.
 - Give only feed and medications as appropriate for pregnant animals.
 - No contact of new animals with pregnant does.
 - Avoid toxic plants or chemicals in environment.
 - Avoid stressful handling or transporting.
3. Enhance **ANTIBODIES** in colostrum:
 - Vaccinate for Clostridial diseases: *Cl. perfringens* *CandD* and *Cl. tetani* 30 days before parturition.
4. Decrease **PARASITE BURDEN**:
 - De-worm 30 days before parturition, as necessary

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Fecal test doe or ewe (Mid to late gestation, avoid winter, due to parasite ‘hibernation’).
 - De-worm with appropriate wormer, appropriate amount, if necessary.
 - Recheck fecal in 2 weeks to check wormer efficiency.
 - Prevent fecal contamination of feed.
 - Feed above the ground – use key-hole feeders (goats) and clean hay areas.
 - Check for external parasites mid-winter and treat if necessary.
5. Protect from **LAMENESS PROBLEMS**:
 - Check feet at least once (mid-gestation) and trim, treat as necessary.
 6. Protect from **INJURY** in facilities and on pasture.
 - Appropriate, safe fencing and handling facilities to keep does or ewes in, move, or confine (Fencing- woven wire, electric fence).
 - Provide safe dry shelter, especially from damp conditions.
 - Predator prevention (best management practices for predators, *e.g.* Fencing, guardian animals).
 7. Protect flock from **SPECIFIC INFECTIOUS WASTING DISEASES** or other specific known **DISEASES**:
 - Manage flock by testing and culling to reduce disease, or separate young at birth and maintain separate disease-free flock.
 - Possible testing for caprine arthritis and encephalitis (CAE in goats), Maedi Visna (ovine progressive pneumonia in sheep), caseous lymphadenitis, Q fever, Johne’s disease, scrapie (surveillance and control programs, *See* Section 4 Flock Health Parts B and D).
 - Develop health program for controlling other diseases in flock (*See* Section 4 Flock Health Parts B and D).
 8. Protect from **SUB-CLINICAL MASTITIS**, esp. if have mastitis problems in flock:
 - Check udders while dry.
 - Provide clean, dry housing facilities or pasture.
 - Use good udder hygiene and milking procedures, including teat dip or spray.
 - May wish to treat with “dry cow intra-mammary antibiotic infusion” when drying off.
 9. Prepare for actual **PARTURITION**:

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Prepare clean, dry, draft-free comfortable maternity pen or well-drained clean pasture with shelter.
 - If removing kids (lambs) at birth, prepare facilities for newborns. If removing for disease-reduction, prepare completely separate management area.
 - Clip udders free of dirt and debris, 2 weeks before parturition.
 - Prepare lambing/kidding kit: iodine, frozen colostrum, birthing aids (equipment, drugs).
 - Prepare to watch and if necessary assist newborns to get adequate colostrum within 2 hours.
10. May use **PREGNANCY DIAGNOSIS** (by 60 days):
- External Doppler ultrasound: Used during second half of pregnancy. Problem: false negatives and positives.
 - Intra-rectal Doppler ultrasound: Used from 35-40 days of pregnancy. Problem: false negatives and positives.
 - Real-time ultrasound: Trans-rectal, used from 18 to 60 days. External, used from 30 to 120 days. Very accurate.
 - Blood, milk, urine for estrone sulphate: Used after 50 days. Fairly accurate.

LACTATING DOES AND EWES

As well as many of those goals above, specific issues require attention during the lactating period.

Major Problems:

- Mastitis
- Hypocalcemia (Milk Fever) if very heavy producers.

Goals:

1. Appropriate **BODY CONDITION** and **NUTRITION**:
 - Check body condition score
 - Early lactation Aim: 3 to 3.5 Score.
 - Weaning or late lactation Aim: Minimum 2+ Score.
 - Appropriate nutrition for lactating females especially ample clean fresh water!
2. Ensure **MAMMARY GLAND HEALTH**:
 - Use stringent udder hygiene and good milking procedures. Check for sub-clinical mastitis at least weekly, using California Mastitis Test (CMT) or other method. Treat with appropriate antibiotics if necessary. (See page 195.)

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- If not milking, check udder weekly and observe nursing offspring.
- **Protect from LAMENESS PROBLEMS:**
 - Check feet and trim and treat as needed:
 - ~1 week post-partum.
 - Pre-breeding.
 - At drying off.
- 3. Reduce/evaluate **PARASITE BURDEN:**
 - Fecal test mid-late summer, if pastured will reflect pasture-parasite level and species. Worm if necessary and recheck fecal in 2 weeks to check wormer success.
 - Review pasture management:
 - Consider pasture plant choice (*See* Section 3 Management Part C). (Break up any fecal clumps in pasture and expose parasite (eggs, larvae) to sun and desiccation.)
 - Use clean pasture for dams and offspring, if possible (no sheep / goat for 1 year).
 - Check for external parasites mid-winter and treat if necessary.

KIDS OR LAMBS AND WEANLINGS

Major Problems:

- Hypoglycemia
- Navel / Joint ill
- Clostridial diseases
- Urolithiasis (urinary calculi)
- Trauma

Goals:

1. Ensure adequate **NUTRITION** and **BODY CONDITION:**
 - Check body condition score Pre-breeding: Doelings: 65 %, Ewelings 60% adult weight for breeding. Feed separately from adult females. Body condition score Aim: 3.
 - Newborn – Adequate colostrum within 2 hrs. Check offspring (weigh) and dam's udder, after parturition and daily for first few days.
 - Early creep feed available in area not accessible to dam.
 - Ample clean, fresh water.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Prevent fecal contamination of feed, feed above the ground *e.g.* with key hole feeders.
 - Provide free choice hay.
 - Kids: Prevent Urinary Calculi. Provide abundant continuously-available clean water (add up to 4% of NaCl to the ration to encourage water consumption), maintain sufficient Ca (1.5:1 to 5:1 of Ca:P ratio), provide mixed grass and legume hays free-choice if feed concentrate, may wish to acidify urine (1-2% ammonium chloride of concentrate ration, or 10 grams / head / day).
 - Prevent nutritional deficiencies. Ensure trace minerals (*e.g.* Se) available. *e.g.* thiamine deficiency, or inhibition, or sulphate contamination of feed / water leads to polioencephalomalacia (goats).
2. **PREPARE** to enter flock:
- Check for abnormalities in first week, including entropion, cleft palate, normal, intersex, normal navel (no swelling), suckling (indicated by belly width > ribcage).
 - **Castrate, Disbud and Dock tails** as needed 1-10 days old.
 - **Identify**, in birthing area with non-toxic crayon, or permanent (initially or later) with tattoo, eartag, neck chain, leg band.
 - **Wean**: Bottle-raised lambs and kids at 6-12 weeks, meat goats at 10-14 weeks, pasture animals at end of summer.
3. Prevent **PARASITE** build-up:
- Begin **coccidiosis** treatment at 2 weeks, if necessary (*See* Section 4 Flock Health Part B).
 - Watch for illness: anemia, weakness etc. especially at 3 weeks. Fecal test offspring at 1-2 months. Deworm as necessary. Recheck fecal in 2 weeks to ensure worming success.
 - Pasture offspring separately from dams. Pasture youngest animals on cleanest pasture.
4. Protect from specific known **DISEASES**:
- **Vaccinate for Clostridial diseases**: *Cl. prefringens* *CandD* + *Cl. tetani* as maternal antibodies wane: 6-8 wks, then Booster as indicated for vaccine used. (If dam not vaccinated – begin vaccination at 1 wk of age).
 - Develop health program for controlling other diseases in flock, *See* Section 4 Flock Health Part B.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

5. Prevent **UN-DESIRED BREEDING**:

- Separate dams and male offspring before 3-4 months

6. Protect from **INJURY**:

- Fencing and handling facilities to keep small ruminants in, moved, or confined without injury. (Fencing- woven wire, electric fence).
- Provide safe dry shelter, especially from damp conditions.
- Fencing or guardian animals to deter predators.
- Separate into groups based on stage of production *e.g.* watch overstocking.

BUCKS AND RAMS

Major Problems:

- Urolithiasis
- Injury
- Lameness

Goals:

1. Ensure adequate **NUTRITION** and **BODY CONDITION**:

- Non-breeding feed balanced maintenance diet. Prevent over-condition and obesity.
- Check body condition score Maintenance Aim: 2 to 2.5 Score.
- Prevent urinary calculi: Provide abundant continuously-available clean water (add NaCl up to 4% to encourage water consumption), maintain sufficient Ca (1.5:1 to 5:1 Ca:P), provide mixed grass and legume hay free-choice if feeding concentrate, may wish to acidify urine (1-2% ammonium chloride of concentrate ration, or 10 grams / head / day).
- Prevent pizzle rot (primarily rams or fibre-breed goats) (inflammation and ulceration of prepuce): Avoid high ammonia diet, provide abundant continuously-available clean water.

2. Prevent **PARASITE** build-up:

- Fecal test at least once a year. De-worm as necessary. Recheck fecal 2 weeks post-worming to check wormer success.
- Manage pasture as for rest of flock.

3. Provide adequate **EXERCISE** and protect from **INJURY**:

- Ensure separate well-fenced, safe enclosure to keep male in, predators and other contacts out.

PART B: MANAGEMENT ACTIVITIES – SEASONAL/REPRODUCTIVE (BREEDING AND BIRTHING)

- Provide safe dry shelter, especially from damp conditions.
4. Protect from specific known **DISEASES**:
- **Vaccinate for Clostridial diseases:** *Cl. prefringens C and D* + *Cl. tetani* at the same time as pregnant females.
 - Develop health program for controlling other diseases in flock (See Section 4 Flock Health Part B).
5. Prepare for Breeding:
- Gradually increase the nutritional level pre-breeding so that males develop good body condition prior to the required 50 days of sperm development for breeding.
 - Check body condition: Pre-breeding aim: 3 to 3.5 score.
 - Check general health, including teeth, eyes, skin (external parasites).
 - Ensure limb soundness. Check feet and trim, examine limbs.
 - Consider “breeding soundness exam” for fertility. **Minimum:** Check sheath and palpate testicles for abnormalities.
 - During breeding season, observe for libido and mounting success.



PART C: MANAGEMENT ACTIVITIES – ROUTINE

ANIMAL HANDLING

Catching and handling individual animals is required for body condition scoring, shearing, foot trimming, vaccinating, examining and treating health problems, tagging, worming, weighing, moving between holding areas, and transporting.

HANDLING:

- Minimize stress.
- Combine reasonable activities when handling animals, *e.g.* body condition score when vaccinating or foot trimming, etc.
- Ensure handling facilities are safe (no dangerous consumable products, no sharp projections or debris), clean and well drained (not harbouring footrot or other infectious disease agents), practical and secure.
- Practice with animals through handling systems.
- Consider animal behaviour:

General:

- Hierarchical structure exists in flocks such that certain animals establish dominance.
- Horned animals can injure un-horned.
- Horns and damage possible must be anticipated in planning, esp. with goats.
- Animals prefer routines.
- Sheep and goats stand on things, squeeze through things esp. the young and goats, often dislike wet and mud esp. goats, and are upset by harsh noises.
- Caution should be used around all male sheep and goats.

Sheep:

- Will move towards other sheep, away from humans and dogs.
- Will react as other sheep do. Will stop if others have stopped, run if others run, follow experienced leaders.
- Prefer flat to an incline and up, over down.
- Move more freely from dark to light, confined to open.
- Move more freely down unimpeded narrow corridors with seemingly un-impeded ends that are free of distractions (*e.g.* people / activities), than within open pens.

PART C: MANAGEMENT ACTIVITIES – ROUTINE

Goat:

- Highly curious, often move towards humans or other new activity.
- Climb readily, dig and squeeze through spaces and find escape routes easily.
- Usually dislike getting wet.

CATCHING:

- Use feed as an attractant.
- Catch under chin – bony jaw with other hand on tail / rump.
- Sheep can also be caught by:
 - Hind leg just above hock. Other hand moves to control head (for young stock.)
 - Front part of hind leg near body. Other hand moves to head.

**HANDLING FACILITIES:**

- Fixed facility or portable units: Pens with directional chutes, movable gates, scales, squeeze or tilt cradle systems.
- Portable gates used as visual barriers to manoeuvre animal into smaller areas or corners.

BODY CONDITION SCORING

See Section 2 Monitoring Flock Health.

EUTHANASIA

Euthanasia is an inevitable part of animal husbandry. Euthanasia is an act of inducing humane death in an animal with a minimum of pain, fear and distress.

Those involved must be adequately trained in evaluating animal pain, suffering, distress, as well as in methods, criteria, effectiveness and hazards of euthanasia.

Method:

- Must involve rapid loss of consciousness, cardiac or respiratory arrest and loss of brain function.
- Considerations: Human safety, animal welfare, reliability, economics, training required, aesthetics, human comfort, legal constraints, biosecurity, animal age, size, type, carcass disposal method.



Choices:

- Penetrating captive bolt gun
- Cartridge or pneumatic non-penetrating captive bolt gun
- Gunshot to skull – See appendix L of codes of practice for care and handling sheep for placement.
- Controlled system electrocution
- Manual blunt force trauma – only for <9 kg (<20 lb) lambs or <7 kg (<15 lb kids)
- Lethal injection (not if being consumed)

Unacceptable methods:


- Injection of any non-anaesthetic agent (incl. air), exsanguination without prior stunning, electrocution with 120V, starvation, dehydration, drowning, car exhaust, manual blunt force trauma other than above, gunshot to any site besides the correct placement on the skull (e.g. chest or abdomen).
- For application of methods and other considerations: See references – Bibliography.

FOOT TRIMMING

Also See Section 4 Flock Health Part B – Foot rot.

Check feet regularly:

- Regular foot-checking and gentle trimming as needed are essential for sound stock.
- Trim feet a minimum 2-3 x / year depending on feeding and housing conditions.



“Regular foot-checking and trimming as needed are essential for sound stock.”

Goal:

- Healthy normal foot with sole parallel to coronary band.

Equipment:

- Foot trimmers that are cleaned and disinfected *before use and between animals*.
- Avoid trimming in late gestation.
- Avoid gathering animals in low wet, mud or fecal-contaminated area for handling.
- May wish to stand feet in clean water bath prior to trimming to make hooves more pliable for trimming.
- Ensure vaccinated for *Clostridia* including tetanus, prior to trimming.

PART C: MANAGEMENT ACTIVITIES – ROUTINE

Method:

- Provide safe restraint: Sheep either tipped or in squeeze. Goat while standing, trained, held or with head tied securely.
- Examine foot for evidence of footrot or foot scald between toes or around coronary band. Clean foot if necessary. Separate animals if any evidence of footrot, for footbath treatment.
- Be gentle in trimming. Do not harm sensitive structures or cause injury and foot rot entry. Avoid drawing blood.
- Trim toes.
- Clean out dirt.
- Trim outside of wall, then inside wall slightly lower and finally heel if necessary.
- Repeat for each claw and check for claw-balance.
- Trim dewclaws: Remove very small portions at a time.

IDENTIFICATION

- In birthing pen may use temporary or permanent identification.
- For record keeping and if leaving farm, use permanent identification.
Note: for sheep as of 2011, *See* Canadian Sheep Identification Program below.

Temporary:

- *e.g.* use colour-mark with non-toxic livestock marking crayon stick or paint.

Permanent ID:

- *e.g.* ear tag, tattoo, leg band, neck chain or ear notch.
 - To decrease ear infection, abscesses and tag loss, always use clean, dry materials and very clean technique.
 - Dropped tag or button should be re-washed and dried.

SHEEP

Canadian Sheep Identification Program (CSIP)

Managed by Canadian Sheep Federation (CSF) http://www.cansheep.ca/cms/en/CSIPPrograms_new/CSIP/CSIP.aspx

Goals:

- Decrease the impact and control the spread of animal diseases.
- Improved assurance of safe food to consumers!
- Enable traceability in order to respond to disease outbreak.

CSIP Program

- The Canadian Sheep Identification Program (CSIP) is an industry-led trace-back system designed to help trace sources of animal health and food safety problems. It was introduced in 2004, and is applicable to all ovine animals in Canada.
 - **Mandatory** – Before leaving farm of origin (even temporarily), all sheep must be tagged with approved, individually numbered tags and series-numbers – assigned to each producer. All ovine animals that are imported must also be identified. The unique identification number of each sheep is maintained throughout its life, until the animal is slaughtered at an abattoir or exported.

DATABASE is maintained by Canadian Cattle Identification Agency except in Quebec where it is managed by Agri-Traçabilité Québec (ATQ).

PRODUCER – Records must be kept of:

- All sheep or lambs entering flock for breeding purposed
- All sheep 18 months or older leaving farm other than those sold to a federally / provincially-inspected abattoir.

Canadian Food Inspection Agency CFIA:

- Responsible for enforcement. Violations of any of the requirements may result in warning letters, fines or, in some cases, prosecution.
- CFIA will trace sheep involved in health or safety problem. Trace begins with flock of origin and follows to last location of animal. Testing used to confirm infection and toxin sources. <http://www.inspection.gc.ca/animals/terrestrial-animals/traceability/sheep-identification/>

TAGS:

- **Instructional Tagging videos:** <http://www.cansheep.ca/cms/en/tagvideos.aspx>
- Currently only approved tags are: CSIP approved RFID tags (Shearwell Data Ltd SET tag/ Allflex RFID Button Tag).
- **RFID = Radio frequency identification tags.** A tag reader can pick up radio waves from tags.

See CSIP website for full details: <http://www.cansheep.ca/cms/en/Programs/CSIPProgram/CSIPProgram.aspx>

Other Identification:

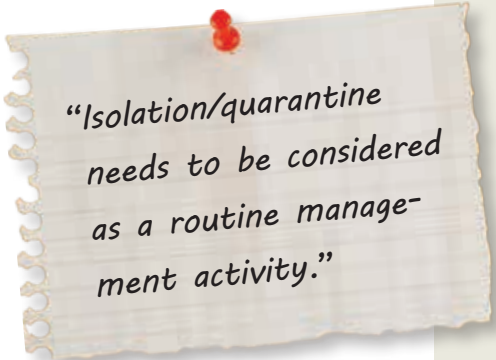
- Registered purebred sheep in Canada must be tattooed by 4 months of age with a unique ID.

PART C: MANAGEMENT ACTIVITIES – ROUTINE

- On farm identification tags:
 - metal (#3 Kurl-Lock) placed on top of ear in first 1/3 next to head (leave room for growth),
 - plastic dangle tag (*e.g.* UFA medium tags or engravable tags).

GOATS

- **Canadian National Goat Federation** initiated **voluntary** National Goat Identification Program. This will be moving towards a mandatory goat identification and traceability program; however, a specific date for mandatory animal ID is not yet known. See <http://www.cangoats.com>
- Before leaving farm all goats will have to be tagged with approved, individually numbered tags and series-numbers for each producer recorded.
 - Approved tags: Reyflex – Strip (RT-3370), Small Panel and RFID (electronic).
 - Once mandatory, approved tags will have an official number series and Canada symbol.
- Tagging:
 - Ear: Placed close to head, in middle section between and avoiding main ear veins, post side at the back.
 - Tail web: Placed mid-point of webbing, behind the thickened rib of web, close to body and sufficiently deep into web. Post portion of tag should enter from skin side, not hair side.
- Other Identification: Small ear tags, neck collars and leg bands are also currently used.
- Registered, recorded grade and percentage grade kids must be *tattooed*. Most goats are tattooed in ear, LaManchas are tattooed in tail web.



“Isolation/quarantine needs to be considered as a routine management activity.”

ISOLATION/QUARANTINE

Isolation/Quarantine needs to be considered as a routine management activity. Isolation/Quarantine periods for new or returning animals should be a minimum of 2 weeks.

Isolation/Quarantine facilities are used for:

- Any animals showing signs of illness, requiring monitoring or treatment,
- New animals, coming into the flock.
- Animals, returning from off the farm *e.g.* shows.

Isolation/Quarantine facility requirements:

- Facility with at least 2 m double-fenced off area from other animals (to prevent nose-to-nose contact), without drainage or traffic connections. Best situated away from traffic pattern areas and particularly from young, vulnerable stock.
- Facility or enclosure that provides comfortable, draught free shelter and that facilitates cleaning and disinfection, *e.g.* firm, smooth surfaces with contained drainage.
- Ability to observe and handle animal for treatment or testing (well-lit, with adequate tie-up or confinement facilities).
- Separate management routine, *e.g.* feed and clean after other stock, with specific isolation/quarantine equipment, in either special boots or with boot wash and disinfection site and separate coveralls.
- Area to dispose of (compost or burn) bedding materials, without contaminating other stock areas or the overall farm environment.

SHEARING

Sheep shearing: Fleece should be shorn at least once per year, with a minimum of 8 months between shearings. Shearing is major stress for sheep.

Note: Hair sheep do not require shearing as their coats have few “woolly” fibres or a mixture of hair and wool fibres that shed annually, usually in spring. Not used for wool production.

Value:

- Minimize external parasites.
- Harvest fleece.
- Clean ewes and ewes tend to stick to warmer sites (better for lambs) if done before giving birth.
- Cooler ewes, if done in summer.

Time of shearing depends on farm system:

- Prior to lambing (about one month). Ewes are clean for birth of lambs (ewes should be crutched if not shorn). **Caution:** handling pregnant ewes.
- After lambs are weaned.

CAUTION: Shearing is the most significant procedure for spreading caseous lymphadenitis (*Corynebacterium pseudotuberculosis*).

EQUIPMENT:

- Use own shears if possible.



PART C: MANAGEMENT ACTIVITIES – ROUTINE

- Thoroughly clean and disinfect shears prior to beginning (especially if not own shears) and between groups of animals, or individual infected animals.

Site: safe and clean, adequate ventilation, light, suitable catching facility / system.

SHEARING MANAGEMENT:

- Sheep should be vaccinated for Clostridial diseases, including tetanus.
- Ensure shearer uses biosecurity techniques:
 - Wearing freshly laundered clean clothing (including hat),
 - Thoroughly cleaned and disinfected boots,
 - Washed hands and other skin exposed to sheep.
 - Clean and disinfected equipment, in-contact areas of vehicle.
- Sheep must be dry.
- For sheep's digestive comfort, may hold off feed night before, with access to water.
- Separate into groups:
 - Shear youngest, most susceptible to potential disease, first.
 - Then, older animals.
 - Last, any animals infected with caseous lymphadenitis or other diseases.
- Inspect sheep after shearing and apply iodine or chlorhexidine to any wounds.

SHOWING AND HEALTH CONSIDERATIONS

Showing increases the likelihood of exposure to diseases and bringing disease organisms home to flock. Disease introduction can be expensive, time-consuming and heart-breaking. Also *See* Isolation/Quarantine, previously in this section.

MINIMIZE SHOWING RISK*Owner*

- Minimize stress on animals!
- Attend shows that require health checks prior to unloading animals.
- “Off the truck shows” are preferable in terms of disease exposure, to shows where animals are housed together.
- Minimize time animals spend at show or off the truck.
- Use own watering and feeding equipment (buckets, tubs etc.)
- Do not share, mix or expose feed and watering equipment with / to other flocks.
- Prevent nose-to-nose contact between own animals and those of other flocks, in pens and when moving or handling. Solid panels / tarps can be used over rail-type pens, or can set up own portable pen.



- Use own bedding and keep animals away from other flocks' bedding materials.
- Show animal's mouths for judges or provide judges with gloves for viewing mouths.
- Restrict access by visitors to petting animals as much as possible, Signage may be useful.
- With farm veterinarian, establish flock health program for show animals – returning isolation/quarantine times, premises, inspections etc.
- Ensure sheep have Canadian Sheep Federation's Canadian Sheep Identification Program tags. Ensure goats have appropriate identification, currently being brought in on voluntary basis by the Canadian National Goat Federation for a National Goat Identification Program.
- Do not take sick animals to shows.
- Clean and disinfect trailers prior to use, especially commercial trailers or if used previously to haul other livestock.
- Quarantine animals for at least 2 weeks. Only re-introduce to flock if healthy during that time.

Show manager

- Read health certificates.
- Check ear tags as animals arrive.
- Send home sick, coughing, abscessed or otherwise ill animals.
- In the future it may be possible to use disease testing to screen animals for shows, *e.g.* Ovine Progressive Pneumonia, or Caprine Arthritis and Encephalitis, as with Coggins tests for horses.

Judge

- Allow owners to show sheep or goat's mouth or use disposal gloves for viewing mouths.

SLAUGHTER

In B.C., livestock, for human consumption, must be slaughtered at a licensed facility. The exception is by the producer for their own consumption.

Graduated licensing of facilities in BC, based on number of animals and where sold:
<http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/food-safety/meat-inspection-licensing>

PART C: MANAGEMENT ACTIVITIES – ROUTINE

TRANSPORTATION

Transporting small ruminants = Stress!

Animal must be healthy enough to endure the stress of travel.

Sheep must have RFID tags to leave the farm of origin, goats still have voluntary RFID tags.

The Canadian Food Inspection Agency (CFIA), along with other federal and provincial authorities, enforces the transportation requirements **CFIA Phone:** 1-800-442-2342.

Website: www.inspection.gc.ca

Canada's Health of Animals Regulations Part XII Transportation of Animals requires that **every person responsible for transporting animals must ensure that the entire transportation process – including loading, transit and unloading – does not cause injury or undue suffering to the animals.**

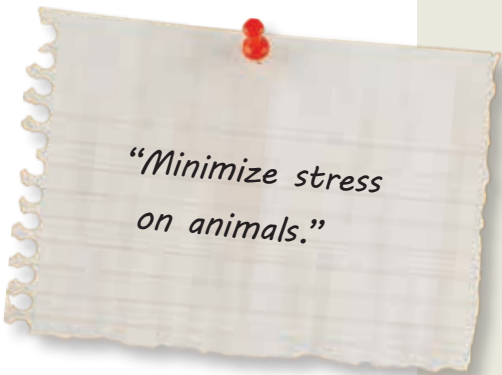
The federal regulations for transportation practices:

- Define when animal is considered unfit to travel.
- Outline the shipper's and transporter's responsibility to ensure livestock meet fitness requirements.
- Compromised animals may only be transported under special provisions for immediate slaughter or to a veterinarian for diagnosis or treatment.
- Persons transporting animals (sheep and goats) must be knowledgeable of their behaviour and welfare needs.
- If unsure of animal's fitness for transport, contact veterinarian or CFIA.

VEHICLES REQUIREMENTS:

All vehicles used to transport animals must be in good condition and in full compliance with provincial highway traffic regulations. They must also:

- Must protect animals from weather (sun, rain / snow, wind etc).
- Have adequate ventilation.
- Have adequate space and headroom for sheep and goats' normal position –
 - Animals: need to be able to can stand or lie down comfortably together.
 - Larger vehicle can be partitioned for stability (sub-pens no longer than 10ft / 3.1m)



*"Minimize stress
on animals."*

Vehicles interiors should be:

- Checked before loading.
- Cleaned and disinfected between loads.
- Free from damaging protrusions, defects.

Vehicles should be equipped with:

- Sides high and secure enough to prevent animals jumping, falling, being pushed out.
- Secure doors with livestock-proof closures and wide enough to avoid bruising injuries.
- Floors with secure footing (non-slip textured flooring suitable for animal).
- Bedding material to absorb moisture and free of irritants or harmful substances.

LOADING AND UNLOADING:

When loading and unloading sheep and goats:

- Use non-threatening loading procedures.
- Mix only suitable / compatible animals of about the same size / weight (*e.g.* Keep males and females separated, mature bucks / rams must be penned individually; keep horned goats separated from hornless).

The facilities and ramps for loading and unloading must be safe and suitable for sheep and goats. They should be free of damaging protrusions, provide good (non-slip) footing, and there should be uniform lighting (shadows and bright areas – may interfere with loading). Ramps should be no more than a 45° angle, and there should not be a step into / out of the vehicle >38 cm (15”).

Note: Grabbing fleece or tail of sheep esp. during loading / unloading is painful and causes carcass bruising at slaughter.

TRANSIT:

During transportation, drivers:

- Assume complete responsibility for care and welfare of animal during trip.
- Need to provide immediate and appropriate attention if necessary, including cessation of transport, to ensure well-being of animals.
- Check for animal discomfort, heating, chilling at least every 3 hrs.
- Start and stop as smoothly as possible, and avoid sudden or jarring manoeuvres.
- Adjust ventilation as needed. Hot or cold weather require extra attention and suitable precautions to maintain animal comfort (more ventilation, water, extra care in handling when hot. Protect from frostbite and over-crowding, but ensure ventilation when cold.)

PART C: MANAGEMENT ACTIVITIES – ROUTINE

Feed, water, and rest must be provided at regular intervals. For a trip lasting over 24 hours, feed and water must be provided within 5 hrs prior to departure. Animals may not be confined, without rest, in transport for >48 hours. Rest sites must have suitable safe facilities, with suitable quality and quantity of feed and ample, fresh, clean, un-frozen water

Note: Give special attention to lactating animals. Ensure offspring are allowed to nurse.

Note: Special conditions apply for young or old animals, or under adverse weather conditions.

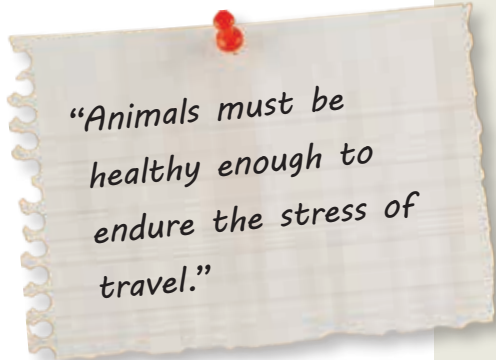
CAUTION:

Animals are experiencing problems with transport if they are:

- Scrabbling for footing.
- Making noise.
- Continuously moving.
- Panting, extending their necks, or mouth-breathing.
- Eating bedding.
- Found with fluid frozen on face.

VACCINATIONS

See Section 4 Flock Health Part D and Part B for individual diseases.



“Animals must be healthy enough to endure the stress of travel.”

PART D: NUTRITION

Nutrition is a major factor for flock health and production:

- Reproduction – Breeding success, fetal growth and health.
- Lactation – milk production and suckling offspring growth, health.
- Meat and Fibre production
- Young stock – growth and health.

- Maintenance – health.

Production Costs: Feed = **60-80%** TOTAL Production Costs.

Note: 37% of body weight = gastro-intestinal tract.

THE ELEMENTS OF FLOCK NUTRITION INCLUDE:

- Water
- Feed (cut forage, concentrates, grain)
- Pasture
- Minerals

ANYONE FEEDING SHEEP OR GOATS NEEDS TO KNOW:

- **Characteristics of feeds** and how to evaluate them.
- How food is utilized *e.g.* diverse and adapted rumen bacterial, protozoal populations.
- **Nutrients requirements** at various life-stages and production levels.
- How to sample water and feeds and interpret the analysis.

NUTRITIONAL GUIDES – A MUST TO READ AND USE!

Numerous excellent guides are available for sheep and goat nutrition. The following are Canadian sources that provide important and usable nutrition guidance (the items marked with a *are available on the internet):

1. * Nutrition Guide for BC Sheep Producers – BC Agriculture by B.D. Mason
2. * Alberta Lamb Producers/ Alberta Goat Breeders Association
3. * Canadian Sheep Federation
4. Meat Goats – Alberta Agriculture and Food by S. Emond
5. * Ontario Sheep Marketing Agency
6. Goat Production Manual by M. Smart

Also See other Bibliography resources

RATION BALANCING

SheepBytes is an online rationing balancing program available at www.sheepbytes.ca/

"Feed costs make up 60-80% of the total production costs."

PART D: NUTRITION

WATER

Provide abundant fresh, clean cool water available at all times!

Water quality guidelines:

- **Water analysis** recommended: Check for fecal coliforms, as well as possible toxic levels of minerals and metals.
- pH value must remain 6.5 – 8.5.
- Watch for algal blooms – may be toxic.
- Guard against any fecal contamination!

Quantity (amount of water required) per day:

Adult sheep	3.8 – 7.6 litres	(1 – 2 gallons)
Lactating Ewes	7.6 – 11.4 litres	(2 – 3 gallons)
Feeder lambs	3.8 – 7.6 litres	(1 – 2 gallons)
Very young lambs	0.4 – 1.1 litres	(0.1 – 0.3 gallons)

Example:

- Daily Water Requirements of Sheep:
 - Each kg of milk produced requires ~3.5 kg of water.
 - Hot ambient temperatures may increase water requirements by >70%.

FEED (CUT FORAGE, CONCENTRATE, GRAIN)

Feed **quality** recommendations:

- Use good quality feeds and provide “fresh” feed daily. Remove uneaten feed at least by next feeding or daily.
- It is essential to protect feed and water from fecal contamination – provide feed and water above the ground.

Quantity:

- Feed animals appropriate quantity for requirements (age, production, exercise).
 - Generally sheep and goats consume 2-4% of body weight / day in dry-matter.
- Monitor results by regular Body Condition Scoring!

Note: Nutrient requirements change with weather and ⇒ cold or heat stress, e.g. winter feeding will require higher nutrient cut-forage (hays) ± concentrate or grains.

Feed sampling (grains and forages) reveals quality of actual feeds on farm. Analysis from feed sampling allows for ration planning for a balance diet.

- **Goals:** To achieve a balanced and acceptable voluntary intake of total digestible nutrients, crude protein, calcium, phosphorus and other nutritional elements.
- **Benefits:** Cost savings, appropriate feed for production and overall health.

Feeding: Avoid making sudden changes in feeds. Introduce new feeds gradually.

- Choice of feed types needs to be appropriate for age and production.
- Handle and store feeds so they remain clean, dry, free of feces and run-off from high traffic-use or other areas and are protected from sun exposure.
- Accessibility: Provide adequate feeder space and appropriate housing arrangements, so all animals able to obtain correct amount and nutrient balance.

Specific aspects of feeding:

Creep feed: Important to provide feed for young stock soon after birth, in warm, draft-free well-lit area, not accessible to dam.

Flushing may be used with **sheep**, male and female. A gradual increase in ration prior to the breeding season will increase the ovulation rate and subsequent fertilization.

Grain feeding (avoid rumen acidosis and enterotoxemia, both of which can be fatal):


- Drops rumen pH. At a pH 5.5-6.0, sugar and starch digesting bacteria flourish and produce volatile fatty acids. At lower pH, lactic acid-producing bacteria proliferate, which can lead to systemic acidosis, deteriorating health and finally death.
- Introduce grain *very gradually* (2-4 week adaptation). Bacteria and protozoa adapted for current ration, need to re-adapt. No sudden changes!
- Feed whole grain, not chopped grain.
- Feed grain over several feedings during day, at <0.3 kg/head/feeding, so as not to overwhelm rumen organisms.
- Feed roughage first, before grain.
- Roughage (crude fibre) should constitute >20% diet's Total Digestible Nutrients.
- May supplement with buffers: baking soda (sodium bicarbonate) or calcium carbonate at 1.5-2% of concentrate, or magnesium oxide at 0.2-0.3% of concentrate/0.5-0.8% dry matter.

Haylage may offer a solution to cut forage (dry hay) in moist climates, as haylage requires less drying time (moisture of 50-60% [30-60%], compared to 16-18% for hay). Haylage is ensiled (anaerobically fermented) grass:



PART D: NUTRITION

- Grass or other forage used for haylage should be good quality with high sugar content.
- **CAUTION:** Growth of bacteria causing listeriosis (*Listeria monocytogenes*) can occur in spoiled or poorly ensiled haylage.
- Also potential growth of *Clostridia* bacteria.
- **Haylage Bales:**
 - Must be completely sealed.
 - Should be well-compacted with as little air as possible.
 - Must incubate for 3 weeks before use, to allow the pH to drop to between 3.8 – 5. The pH must remain <5.6.
 - Must be completely consumed soon after opened, as exposure to oxygen promotes mould growth and spoilage (within 3 day, possibly up to 10 days – time depends on temperature).
 - Should be sampled and analyzed for pH, moisture and quality.



“Protect feed and water from fecal contamination.”

MINERALS

Provide access to a salt and trace mineral mix. May also need to supplement with specific elements: *e.g.* Selenium.

Note: Sheep are sensitive to copper. Managing for correct copper for sheep is complex due to narrow margin between deficiency and toxicity.

- Mineral mix for sheep should contain between 0.01-0.05% copper.
- Molybdenum will reduce copper availability and high sulphur makes it worse.
 - Want: Mo:Cu ration of 5:1

PASTURE MANAGEMENT

Pasture management is highly significant in terms of both parasite control and nutrition.

Goals:

- Reduce the number of parasite eggs / larvae deposited on pastures.
- Improve the nutritional value of pastures, esp. for growth of new offspring.

Pasture quality changes throughout growth:

- Early growth >14% protein
- Stem / early flower 11-14% protein
- Stem / full flower 5-10% protein

- Mature <5% protein

Pasture management should include providing:

- **Water** – clean, fresh abundant continuous supply on pasture is essential.
- **Shelter.**
- **Salt / mineral mix** available at all times.

GRAZING MANAGEMENT FOR PARASITE CONTROL

Sheep are affected by a wide range of parasites.

Haemonchus contortus (a round worm, also known as the “barberpole worm”) is the most important.

Adult worms live in the abomasum (stomach) of the sheep/goat and release eggs in the feces. These eggs mature into infective larvae (L3).

Free-living infective larvae (L3) don't eat. They are trying to find a new host.

Infectivity = Time for egg to develop to infective L3:

- Ranges from 7 days to over-winter.
- Typically about 14 days in moderate summer temperatures.

L3 infective larvae:

- Take shelter from extreme heat (>35°C) and desiccation (use fecal masses for protection).
- Move <60 cm (2 ft) away from protective feces.
- Use moisture of dew or rain to move.
- Move only 5-8 cm (2-3 inches) up and down stems of vegetation.
- Can survive cold temperatures.

Timing:

It is best to graze when the dew is off grass to avoid extra moisture on pasture and thus higher larval movement. See above.

Stocking Rate:

Keep stocking rate to minimum. An increased number of animals leads to an increased number of parasite eggs, resulting in an increased number of infective larvae on the pasture, as well as an increased number of animals to infect. This is an ever worsening cycle of infection.

Feces:

Break up fecal thatch with harrow and expose L3 and eggs to sunlight (heat and drying):

- Will reduce the numbers of infective L3 larvae,

“Pasture management is highly significant in terms of both parasite control and nutrition.”

PART D: NUTRITION

- Remove protective fecal shelter for L3.
- Decrease lush growth due to fecal-fertilized spots, which attracts animals to these L3-contaminated spots (spread the fertilizer).
- Remove feces especially at sites in pastures where animals accumulate, *e.g.* feeding sites, trees and other shelter areas. These areas get excessive feces deposition and thus lead to increased exposure to L3.

Don't spread fresh feces on pasture or hay field (only use if well-composted).

Pasture Rotation:

Many pasture rotation systems exist. The general principles are:

- Graze fairly intensively but don't over-graze (leave stems taller than 3-4").
- Watch stocking rates. (increased stocking rate leads to increased parasite problem.)
 - Rest heavily contaminated pastures, and best not to use for grazing or hay for >1 year.

Animal and Pasture Selection:

Graze most susceptible animals on lowest risk pastures.

- Put young, weaned and more susceptible animals on clean pastures before adults.
- If possible do not graze young animals on same pasture with adult females. Adult females can go on more heavily contaminated pastures if their health is monitored.

Another option is to use alternative species pasturing (choose species, which in general do not share parasites):

- May graze sheep or goats alternatively with horses.
- Best not to graze sheep and goats on same pasture.

De-worm and Pasturing:

De-worm infected pregnant females before "peri-parturient egg rise" (2 weeks before to 2 months after giving birth), so as not to contaminate pastures. See Section 4 Flock Health. Make sure to choose a dewormer that is safe in pregnant/lactating animals and observe recommended withdrawal times.

Current research suggests: Do not move de-wormed animals straight onto totally clean pasture. Any parasites left shedding eggs after treatment are drug-resistant and will contaminate clean pasture with drug-resistant worms. Instead, keep animals on old pasture for 3-5 days before moving to clean pasture. Drug-resistance is increasingly common in sheep and goats. Consider retesting fecal samples 2 weeks after deworming to ensure it was effective.

PASTURE PLANT COMPOSITION

Plant nutritious locally-adapted forbes, in addition to (warm and cool season) grasses and legumes.

Use shrubby / browse plants to add height, to elevate grazing above climbing parasite larvae. Thus, reducing parasite exposure.

Include plants with high tannin content (or phenolic compounds) = “Bioactive forages”:

Temperate climate examples:

- Plantain (*Plantago major*, *P. lanceolata*): hardy prolific summer perennial on any soil.
- Chicory (*Chichorium intybus*): hardy leafy perennial, slow to establish, grows on many soil types, good with companion legume, several varieties available. Lower tannins but has other phenolic compounds.
- Bird’s foot trefoil (*Lotus corniculatus*): tough, perennial legume, 0.05-0.2 m high, sandy soil, temperate Eurasia and N. Africa, become invasive species in some sites.
- Red clover (*Trifolium pratense*): broadly adapted cool temperature perennial.
- French honeysuckle (*Hedysarum coronarium*): perennial, 1-1.5 m high, drought-resistant plant of North Africa, Spain, used for hay and honey production.

Note: many BC native plants have high tannins. Refer to the “British Columbia Rangeland Seeding Manual” for more information about forage species selection.

[https://www.for.gov.bc.ca/hra/publications/practices/Seeding-Manual/BC%20RL%20Seeding%20Manual_web_file_150dpi.09.04\[1\].pdf](https://www.for.gov.bc.ca/hra/publications/practices/Seeding-Manual/BC%20RL%20Seeding%20Manual_web_file_150dpi.09.04[1].pdf)

TOXINS AND POISONOUS PLANTS

Poisoning after ingestion of a toxin or poisonous plant depends on:

- Type of toxin / poison.
- Dose / amount consumed.
- Condition of plant *e.g.* some cyanogenic plants are toxic if wilted, but not if fresh or dried.
- Species of animal exposed: goats and sheep differ in sensitivities.
- Condition of individual animal: amount of food in digestive tract, size, sex, age, health.

Note: Toxins affect various systems of body, which result in various clinical signs and also various treatments. Knowing potential toxin is extremely helpful for possible treatment.

Poisonous plants or other toxins are usually only consumed if there is nothing else to eat or if poisonous plants are abundant. Animals may eat toxic substances due to:

- Starvation.
- Accidental ingestion, especially with fresh spring growth.
- To vary or supplement diet, *e.g.* ration lacking necessary elements.

PART D: NUTRITION

- Boredom or curiosity: *e.g.* something toxic newly dumped into (or uncovered) in pasture, or an algal bloom on pond.
- Escaping into a new area with toxic plants or toxic substances such as farm or garden chemicals *e.g.* warfarin, methaldehyde / slug bait.

Common chemical poisons include: glycosides, alkaloids, oxalates, oils, minerals, resins, lead, sulphates, nitrates.

Plants can be:

- Directly poisonous.
- Cause photosensitizing *e.g.* rape seed, St. John's wort.
- Cause mechanical damage *e.g.* with spines, such as poverty grass.

COMMON NATIVE OR INTRODUCED POTENTIALLY TOXIC PLANTS:

- | | |
|-----------------------------------|----------------------------------|
| • Bracken fern (large quantities) | • Oak (acorns and young shoots) |
| • Buttercup | • Poison hemlock |
| • Death camas | • Poppy |
| • Delphinium (Larkspur) | • Rhododendron / Azalea / Laurel |
| • Fox glove | • St. John's wort |
| • Horsetail – common | • Water hemlock |
| • Lily of the valley | • Yew |
| • Lupines | |

Poisonous plant list from the College of Veterinarians of B.C.

POISONOUS PLANTS			
Aloe Vera	Christmas Rose	Ivy, all varieties	Poison Ivy
Amaryllis	Cineraria Clematis	Jerusalem Cherry	Poison Oak
Apple (seeds, leaves)	Cordatum	Juniper (needles, berries)	Poison Sumac
Apricot (pit, leaves)	Corn Plant	Kalanchoe	Poppy
Asparagus Fern	Cornstalk Plant	Larkspur	Pothos
Autumn Crocus	Croton	Laurel Lily, most varieties	Potato Plant (leaves, sprouts)
Avocado (fruit, pit)	Cycads Cyclamen	Lily of the Valley	Primrose
Azalea	Daffodil	Marijuana	Rhododendron
Baby's Breath	Diffenbachia / Dumb cane	Mistletoe	Rhubarb (leaves)
Begonia	Dracaena / Dragon Tree	Morning Glory	Ribbon Plant
Bittersweet	Elephant Ear	Mushroom (some)	Sago Palm
Bird of Paradise	Fiddle-leaf Fig	Narcissus Nightshade	Skunk Cabbage
Buddhist Pine	Foxglove	Oleander	String of Pearls
Caladium	Geranium	Oregon Grape	Tomato (green fruit, stems, leaves)
Calla Lily	Holly (berries)	Peach (leaves, pits)	Tulips
Castor Bean	Hyacinth	Philodendron	Weeping Fig
Cerman	Hydrangea	Plum (pit, leaves)	Yew
Cherry (leaves, pits)	Iris	Poison Hemlock	

Note: This is not an exhaustive list of all poisonous plants. If a plant is not on this list, do not automatically consider it to be safe.

For additional toxic plant information:

Government of Canada Poisonous plant website <http://www.cbif.gc.ca/eng/species-bank/canadian-poisonous-plants-information-system>

NUTRITION-RELATED DISEASES

Nutritional disease conditions can be:

- Metabolic
- Toxicities (plants, spoiled or contaminated feed, medications, chemicals).
- Deficiencies or excesses

Examples of nutritional diseases are:

- Bloat (rumenal tympany or abomasal torsion)
- Grain overload (leading to lactic acidosis)
- Copper toxicity (enzootic ataxia)
- Copper deficiency (swayback)
- Goitre (iodine deficiency)

PART D: NUTRITION

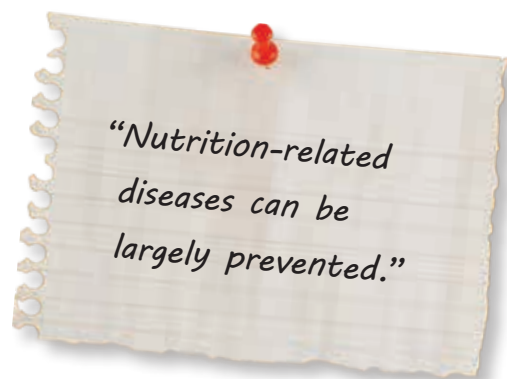
- Grass tetany (magnesium deficiency)
- Ketosis (pregnancy toxaemia)
- Milk fever (hypocalcemia)
- Pizzle rot (posthitis)
- Simple indigestion
- Thiamine deficiency (polioencephalomalacia)
- Urinary stones (urolithiasis)
- White Muscle Disease (nutritional myopathy) – Selenium or vitamin E deficiency
- Other vitamin and mineral deficiencies and toxicities

Nutrition-related diseases can largely be prevented by:

- understanding the basic nutritional requirements of sheep or goats
- ensuring that the nutritional requirements are met, and not exceeded, by feed and water analysis
- gradually making changes to the diet, when necessary

Ruminant digestion, in particular, requires diverse micro-flora, with a complex community of bacteria, protozoa, fungi, and viruses.

- Food for thought: 1 ml of rumen contents = more microbes than the world's human population!



PART E: HOUSING

SHELTER (FARM STRUCTURES AND FACILITIES)

Choice of facility depends on management system:

- Pasture run
- Partial confinement
- Total confinement

PROPERTY SELECTION AND LAYOUT

Site selection: Carefully select sites for buildings, pastures, and access, taking into consideration:

- Topography: Land slopes away from buildings (esp. from open-sides structures).
- Aspect: Open sides best to S or SE (depends on situation).

Property layout: Design layout while considering need for quarantine and “biosecurity flow”, enabling higher risk activities to occur away from the most susceptible animals.

Facility design: Consider natural behaviour and movement of sheep and goats when planning. *See* Animal Handling. Make sure facilities are appropriate for the animals’ size and height.

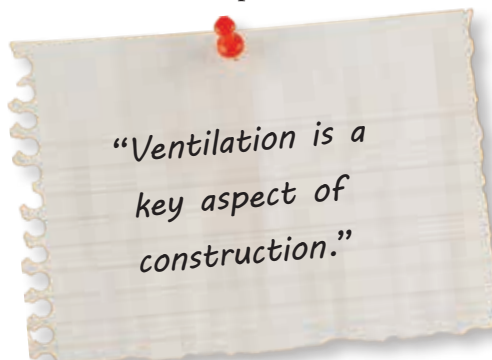
FACILITY PLANS

Many sources of information exist for facility construction and animal space requirements. *See* Bibliography – All-inclusive Management.

Canada Plan Service (CPS) <http://www.cps.gov.on.ca/english/frameindex.htm> provides detailed construction plans, also management and construction leaflets for sheep facilities.

CPS = Canada-wide network of agricultural engineers and livestock specialists from 10 technical committees, who gather ideas across Canada. They use up-to-date building technology and farmstead management practices and make plans available to all Canadian farmers.

Farm buildings have separate status within National Building Code. *See* National Farm Building Code of Canada. <http://www.nationalcodes.ca/eng/nfbc/index.shtml> The BC Building code requires buildings within municipal districts to conform to the National Code.



“Ventilation is a key aspect of construction.”

PART E: HOUSING

Space requirement examples:

Sheep

- Feeder length per adult head (from Canada Plan Service, *See* website above).
- Group-feeding = 0.4 m.
- Self-feeding = 0.15 m.

Goats

- Feeder space / goat = 0.42 – 0.6 m (1.4 – 2 ft).

Facilities for Pasture animals, example:

- South-facing pole-shed type shelter.
- Building for ‘birthing’ with individual pens. May be able to dismantle the pens and move as needed for pens, corrals, chutes.

SPECIFIC STRUCTURE AND FACILITY CONSIDERATIONS

Housing structures or shelters must consider adequate animal space; suitable feeder design and area; appropriate feed, bedding and manure handling space and equipment, facilities for observing, moving, separating and catching animals; access to pasture if not total confinement; adequate fencing and protection.

Ventilation is a key aspect of construction. *e.g.* If inside, open stall partitions allow for air movement.

GOALS for **air movement** in structures:

- Bring in fresh air and mix thoroughly with interior air.
- Remove or dilute air contaminants.
- Reduce heat and moisture to desired levels.

Do the above with minimum drafts, noise and disturbance.

Potential **air contaminants** removed:

- CO₂
- Ammonia
- Hydrogen sulphide
- Methane
- Carbon monoxide
- Dust – particulates including microorganisms
- General odours

Feeders with holes for heads, *e.g.* keyholes, could be made of substances to reduce bruising, splinters or other injuries and contamination. Bars could be covered by rollers or rubber.

Exercise is important, *e.g.* May locate feed bunks outside but covered (sheltered from elements), or separate feed and water locations.

An isolation/quarantine facility must be included but separate and away from other animals and animal movement and should be constructed with smooth, solid surfaces for ease of cleaning and disinfection.

Birthing building or pens should have smooth, solid surfaces for ease of cleaning and disinfection, and be located away from main traffic areas.

Water source available at all times, provided at high-ground locations.

Feed and water sources must be protected from fecal contamination!

Processing and treatment area for handling animals (vaccinating, foot trimming, shearing etc) with solid, dry, cleanable ground surface, with well-designed system of gates, pens, chute with perhaps a squeeze option, or space for using portable gates to move and control animals.

Property fencing: Suitable, adequate to maintain flock and keep predators out.

Manure disposal: Planned, Efficient, Safe (non-polluting), Contained, Away from animals, traffic and feed-storage areas.

Planned disposal site for **dead stock** (bury or compost).

SANITATION AND WASTE MANAGEMENT

Microorganisms are both helpful and harmful.

Normal flora:

Sheep and goat (and human) bodies normally consist of 10x more bacterial cells than animal cells, although bacteria are far smaller. Bacteria aid the body in digesting food, helping the immune system, and add to our gene complement.

Thus, taking care of normal healthy microorganism population is essential for small ruminant health.

Other factors:

- **Types** of microorganisms: Species of organism or its virulence can affect chance of infection.
- **Numbers** of microorganisms: Low numbers may be healthy, but huge numbers may be damaging.

PART E: HOUSING

- **Breaks** in animal's normal tissue defences *e.g.* intact skin, mucous membrane or immune suppression can give access to damaging numbers or species of organisms.

Goals of Sanitation:

- Remove excessively large numbers of microorganisms from the habitat of flock, particularly organisms in feces or other animal excrement.
- Remove potential irritants from flock habitat that might lead to breaks in animals' defences, *e.g.* dust, or moisture that might damage mucous membranes or scald skin surface.
- Prevent or clean up contamination of flock habitat due to disease-causing species of microorganisms.

CLEANING AND DISINFECTION**CLEANING**

Intended to remove build up of debris, including excrement, which harbours huge numbers of microorganisms, as well as remove about 90% of surface microorganisms. The debris may damage normal cells or disrupt normal cell function.

Most animals spend considerable time and effort keeping "clean", and, if free to roam naturally, would leave concentrations of problem organisms and debris behind.

Cleaning Objectives for domestic animal housing and handling facilities: Maintain clean, dry, dust-free environment in contact with animals, thus reducing exposure to large numbers of organisms and irritating / damaging environmental conditions.

Make cleaning easy and convenient. Good, handy tools and simple, planned methods help.

Clean regularly, thoroughly, safely!

In general:

- Alkaline-based detergents remove protein and fat debris.
- Acid-detergents remove mineral deposits.

DISINFECTION

Intended to kill or inactivate microorganisms.

Must clean first! Disinfectants cannot function through debris.

Many disinfectants are inactivated by organic material, *e.g.* soil, plants, milk, blood, manure etc.



Wetting, cleaning and drying destroys many microorganisms.

Porous surfaces may be difficult to clean.

- **Sunlight** is a potent physical “disinfectant”, others are heat, pressure. **In most cases, a good cleaning is sufficient and disinfection is not needed.**

Disinfectants are necessary to:

- **Prevent spread** of organisms between flocks or individual animals. Necessary to clean then disinfect all contact clothing and surfaces, or equipment.
- Overcome **pathogenic microorganisms** if they gain access to an animal or flock *e.g.* abortive organisms (*Campylobacter jejuni*), or foot rot (*Dichelobacter nodosus*).

Selection of a disinfectant depends on:

- Disease organism (disinfectant action against specific bacteria, viruses or fungi).
- Type of surface to be disinfected.
- Conditions where disinfectant used.

Types of disinfectants, See Appendix and Bibliography.

Use of disinfectants:

- Read complete label for directions and any warnings.
- Use appropriate protection for user, flock and other animals.
- Use recommended dilution rate and water temperature. **Note:** hard water may reduce disinfectant activity and distilled water may be needed for dilution.
- Do not mix disinfectants.
- Use recommended application method.
- Allow sufficient contact time for action of disinfectant, then rinse if animals will have contact.
- Observe “shelf-life” of disinfectant and store un-diluted disinfectant in safe secure site.
- Safely dispose of un-used diluted mixture (do not store), or aged disinfectant to prevent environmental contamination.
- Keep records of all disinfectant use.



MANURE MANAGEMENT

Prevent runoff from manure entering farm or natural water sources, animal handling or feed storage areas.

PART E: HOUSING

Storage and field application of manure must adhere to the BC *Agricultural Waste Control Regulation (Environmental Management Act)*.

- Store manure away from buildings, animal handling or traffic areas.
- Manure stored in fields over prolonged periods or in areas of high rainfall must be covered. Manure must not be stored in areas prone to flooding or high water tables.
- Permanent manure storage structures must be at least 30 m from a well or watercourse.
- Permanent manure storage structures must be sized and managed to account for precipitation without run-off (structurally and environmentally sound).

Compost manure, prior to spreading, and spread compost on crops rather than on pasture (if possible). A helpful series of fact sheets on composting has been produced by the BC Ministry of Agriculture and collected into the “B.C. Agricultural Composting Handbook”: <http://www.agf.gov.bc.ca/resmgmt/publist/300Series/382500-0.pdf>

CARCASS DISPOSAL IN B.C.

On-farm disposal of mortalities must follow the requirements set out in the *Agricultural Waste Control Regulation (Environmental Management Act)*. Part 8 – On-farm Disposal of Mortalities.

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_131_92

Note: Carcasses with potential specified risk materials (SRM) require special considerations.

Burial and incineration

Mortalities may be disposed of on-farm by burial or incineration if:

- the mortalities are disposed of on the farm where they died,
- the disposal does not cause pollution,
- where disposal is by burial, the pits are covered, located at least 30 m from any source of water used for domestic purposes and constructed to prevent the escape of any agricultural waste that causes pollution,
- where disposal is by incineration, the emissions from an incinerator do not exceed the levels specified.

Composting

Mortalities may be composted on-farm if:

- the mortalities are composted on the farm where they died,

- the composting site is located at least 15 m from a watercourse and 30m from any source of water used for domestic purposes, and
- the composting does not cause pollution.

For Carcass Composting Methods, see:

<http://www.al.gov.bc.ca/resmgmt/publist/300Series/384300-3.pdf>

PREDATOR PREVENTION

PREDATORS

Predators, both wild carnivores and domestic dogs, cause small ruminant stress, wounds and death.

Security methods are recommended to avoid wild animal predation when pasturing in wild predator areas: <http://www.cansheep.ca/User/Docs/VTBox/Predation%20Section%207.pdf>

HUSBANDRY PRACTICES:

- Choose pasture sites away from streams or other wildlife travel corridors.
- Check flock regularly, remove weak / sick animals that could attract predators.
- Remove any dead animals or tissue *e.g.* afterbirth completely from corral or pasture areas.
- Keep good records to account for animals and any losses to predators.
- Lamb / kid inside and then watch young stock at pasture while they learn to be cautious. Young stock are particularly vulnerable!
- Confine at night.
- Choose a breed that flocks (bunches up) well to help to deter predators.
- When docking and castrating, allow wounds to heal before put animals on pasture.
- **Predator scare devices / deterrents** are best used for short duration threats in high-risk situations. Predators learn to recognize the warning, then become accustomed and unafraid:
 - Bells on animals
 - Flaggging tape on fencing, night lighting, vehicles parked in problem areas.
 - Radios, water sprinklers, motion lighting, propane cannons.
- **Guardian animals** may act as deterrents, defenders or as early predator warning agents.
 - Mixed species pasturing, *e.g.* sheep with cattle or horses.
 - Specific guardian animals: dogs, llamas, donkeys.

PART E: HOUSING

- Dogs: more information can be obtained from the Livestock Guardian Dog Association <http://www.lgd.org/>

Note: Dogs must be wormed regularly for tapeworms.
Llamas share many parasites with sheep and goats.

FENCING:

Fences may be either permanent or portable, and may include electrified wires.
Avoid top boards on fences, which help predators to gain access by using as spring board.

KNOW THE NEIGHBOURS: BOTH HUMANS AND PREDATORS

Talk to others living in the area about predator issues, sightings etc.

Learn what is normal for area. What predators are present and how they behave, e.g. “Living with wildlife” from Washington state: <http://wdfw.wa.gov/living/species/>, or Ontario: http://www.mnr.gov.on.ca/en/Business/FW/2ColumnSubPage/STEL02_168419.html

Dealing with predators:

Understand predator habits in order to observe and interpret sign.

Verify identity of predator as domestic dog or species of wild predator.

Know trapping and hunting regulations.

For assistance with predator losses: Call Conservation Officer, 24 hour RAPP line 1-877-952-7277.

For more information, See reports produced by the BC Agricultural Development Research Corporation’s “Wild predator loss prevention pilot project”. The goal of the project was to reduce the economic impact of wild predation on livestock <https://www.bcac.bc.ca/sites/bcac.localhost/files/An%20Economic%20Assessment%20of%20Predation%20in%20BC.pdf>

For more information on dealing with predators see: <http://www.cansheep.ca/User/Docs/VTBox/Predation%20Section%207.pdf>

<http://www.cattlemen.bc.ca/docs/links%20to%20more%20research%20on%20predator%20bmp%20info.pdf>



APPENDIX

BREEDING – LAMBING CHART

Breeding Date is followed by Projected Lambing Date:

Based on an average 147 day gestation period

Bred January	Lamb May	Bred February	Lamb June	Bred March	Lamb July	Bred April	Lamb Aug.	Bred May	Lamb Sept.	Bred June	Lamb Oct.	Bred July	Lamb Nov.	Bred August	Lamb Dec.	Bred September	Lamb Jan.	Bred October	Lamb Feb.	Bred November	Lamb Mar.	Bred December	Lamb Apr.
1	27	1	27	1	25	1	25	1	24	1	25	1	24	1	25	1	25	1	24	1	27	1	26
2	28	2	28	2	26	2	26	2	25	2	26	2	25	2	26	2	26	2	25	2	28	2	27
3	29	3	29	3	27	3	27	3	26	3	27	3	26	3	27	3	27	3	26	3	29	3	28
4	30	4	30	4	28	4	28	4	27	4	28	4	27	4	28	4	28	4	27	4	30	4	29
5	31		July	5	29	5	29	5	28	5	29	5	28	5	29	5	29	5	28	5	31	5	30
	June	5	1		30	6	30	6	29	6	30	6	29	6	30	6	30		Mar.		Apr.		May
6	1	6	2	6	31	7	31	7	30	7	31	7	30	7	31	7	31	6	1	6	1	6	1
7	2	7	3	7	Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.	7	2	7	2	7	2
8	3	8	4	8	2	8	1	8	1	8	1	8	1	8	1	8	1	8	3	8	3	8	3
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APPENDIX

DISINFECTANTS

Disinfectants must only be used after *thorough* cleaning is completed.

Numerous types and brands of disinfectants are available.

Types of disinfectants vary in mechanism of action, attributes, basic precautions and value against various microorganisms. “Disinfection 101” from Iowa State University has a useful chart comparing these characteristics: <http://www.cfsph.iastate.edu/Disinfection/Assets/Disinfection101.pdf>

The following information has been adapted from “Disinfection 101”:

TYPES OF CHEMICAL DISINFECTANTS:

Acids: *e.g.* Acetic, Citric.

Note: Concentrated solutions can be caustic and vapour can be toxic.

Alcohols: *e.g.* Isopropyl, Ethyl.

Note: Flammable, damage rubber and plastic.

Aldehydes: *e.g.* Formaldehyde.

Note: Irritating, toxic to animals and carcinogenic.

Alkalis: *e.g.* Sodium hydroxide (lye), Ammonium hydroxide, Calcium oxide (quick lime).

Note: Highly corrosive.

Biguanides: *e.g.* chlorhexidine (Nolvasan®, Virosan®).

Note: toxic to fish, do not spill in environment.

Halogens: Chlorine and Iodine

Chlorine: *e.g.* Sodium hypochlorite (bleach).

Note: never mix with ammonia due to toxic chlorine gas release.
Corrosive to metals.

Iodine: Tamed iodine (an Iodophor).

Note: Concentrated are somewhat corrosive, staining.

Oxidizing agents: *e.g.* hydrogen peroxide, peracetic acid (hydrogen peroxide + acetic acid), Virkon-S®

Phenolic Compounds: (carbolic acid) *e.g.* Pine-sol®, One Stroke Environ®, Lysol®, Dettol®.

Note: Over 2% concentrations are highly toxic to all animals esp. cats.

Cresylic Acid: coal-tar / petroleum derivative combination of cresols and phenols. *e.g.* Creolin®.

Note: Can be corrosive, toxic (absorbed through skin and mucous membranes - systemic toxicity), toxic to fish and aquatic invertebrates, do not spill in environment.

Quaternary Ammonium Compounds: *e.g.* Roccal®, DiQuat®.

Note: toxic to fish, do not spill in environment.

POTENTIAL DISINFECTANTS FOR SPECIFIC INFECTIOUS DISEASES OF BIOSECURITY CONCERN:

Note: must be used as suitable concentrations under suitable conditions
(See disinfectant labelling or check with veterinarian):

Abortion agents:

- **Campylobacter** ⇨ bleach, ethyl alcohol, iodine.
- **Chlamydophila** ⇨ bleach 1%, ethyl alcohol 70%
- **Coxiella** ⇨ very resistant difficult: 70% ethanol, 5% “Enviro-Chem”®, all 30 minute contact time.
- **Toxoplasma oocysts** ⇨ very resistant difficult: scalding water, steam, bleach (sodium hypochlorite) contact time 30 minutes.
- **Bluetongue** ⇨ iodophores, phenol compounds
- **Caprine Arthritis Encephalitis (CAE)** ⇨ bleach (Sodium hypochlorite)
- **Caseous Lymphadenitis** ⇨ chlorhexidine, iodine, bleach
- **Clostridial diseases** ⇨ bleach
- **Foot rot** ⇨ 10% zinc sulphate, copper sulfate
- **Johnes** ⇨ Cresylic compounds (1:64), Sodium orthophenylphenate (1:200).
- **Maedi Visna** ⇨ most common disinfectants, bleach, phenolic and quaternary ammonium **Malignant Catarrhal Fever** ⇨ susceptible: bleach.
- **Orf Contagious ecthyma** ⇨ very resistant: bleach, alkalis, detergents, Virkon®, glutaraldehyde.

PART A: FLOCK HEALTH BACKGROUND

PART A: FLOCK HEALTH BACKGROUND

FLOCK HEALTH BENEFITS

Maintaining a healthy flock has three major benefits.

1. **Production and Welfare:** Healthy animals, whose comfort has been taken into account, produce more, with lower feed and management costs.
2. **Markets:** Reliable health also results in a more saleable product and increases the value and success of the market in general. In this regard, reportable diseases and food safety issues, recognized as serious problems by the government, can affect the viability of the industry as a whole.
3. **Zoonoses:** As many diseases of sheep and goats can affect humans, maintaining animal health is in the best interest of the producer (*See Zoonotic diseases below*).



NORMAL HEALTH DEFENCES

Health depends on maintaining the integrity of the animal's normal defences, primarily the skin and mucous membranes. Breaks in these normal tissue barriers can admit entry of disease organisms.

IMMUNITY

Animals develop immunity, first by passively receiving antibodies from their mothers, then by acquiring immunity to what they are exposed to (developing their own antibodies). Immunity is in the form of:

- **Antibodies** that are specific large proteins, produced by animal's immune system when exposed to toxins or disease agents *e.g.* bacteria, viruses, or they are received passively *e.g.* from colostrum. Antibodies bind to toxins or germs in various ways to nullify their effect.
- **Cell-mediated immunity** is the formation of trained 'killer cells', *e.g.* lymphocytes, that are stimulated to bind to infected agents or cells and trigger a protective response.

MAINTENANCE OF HEALTH

Factors that affect the normal maintenance of health include:

- Age
- Body condition/nutritional stress
- Stage of production/reproduction
- Previous health conditions
- Source – farm-raised vs. purchased
- Handling/housing - stress
- Environmental stress

"Maintaining animal health is in the best interest of the producer."

Many factors are affected by management actions. Thus, planning and attention to management details can maintain or improve health.

The introduction of new disease agents to the flock, also relates to these factors and influences health. This is limited by keeping as closed a herd as possible and using good sanitation procedures. See Section 3.

POTENTIAL DISEASE AGENTS

INFECTIOUS CAUSES OF DISEASE

- Bacteria – cells and/or toxins
- Viruses
- Mycoplasma
- Prions
- Fungi – cells and/or mycotoxins
- Parasites
 - Insects
 - Worms
 - Protozoa

As noted in Section 3 Management, most microorganisms are helpful, some are harmful.

NON-INFECTIOUS CAUSES OF DISEASE

- Allergic
- Congenital
- Degenerative
- Genetic
- Iatrogenic
- Neoplasia
- Nutritional (deficiencies/toxicities)
- Idiopathic (spontaneous)
- Toxins
- Trauma

PART A: FLOCK HEALTH BACKGROUND

FEDERALLY REPORTABLE AND NOTIFIABLE DISEASES

DISEASE CHARACTERISTICS

Disease agents that must be reported to the Canadian Food Inspection Agency (CFIA) tend to have the following characteristics:

- Highly contagious,
- Easily transmissible,
- Capable of causing high death losses and/or severe production losses,
- Could potentially injure Canadian export market.

The Office International des Epizooties (OIE) (World Organization for Animal Health) is the international intergovernmental organization responsible for:

- Defining reportable diseases for worldwide reporting
- Providing guidance for immediate response and control strategies (surveillance, early detection, control, compensation, biosecurity, vaccination)



THREE LEVELS OF CANADIAN (FEDERAL) DISEASE REPORTING

1. Reportable Diseases

- Foreign animal diseases, highly transmissible, and believed to be absent or not native to Canada.
- Important to **human health and/or animal health and/or the Canadian economy**.

Requirement: Animal owner, veterinarian, laboratory are **Required to report suspected diseased** animal to CFIA district veterinarian. *See* CFIA offices and operations in Appendix.

Action: Immediate control or eradication measures.

Example: If a disease, such as foot-and-mouth disease, is identified on a farm, the farm is quarantined and the animals determined to be “at risk”, must be slaughtered. Compensation is paid to owners as part of program.

Sheep and Goat REPORTABLE Diseases

- Anaplasmosis
- Anthrax
- Bluetongue (excluding types 2,10,11,13 and 17)
- Bovine tuberculosis (M. bovis)
- Brucellosis
- Foot-and-mouth disease (FMD)
- Peste des petits ruminants
- Rabies
- Rinderpest
- Scrapie
- Sheep and goat pox
- Vesicular stomatitis

Note: Brucella ovis, which causes epididymitis in rams is not a reportable disease and not zoonotic.

2. Immediately Notifiable Diseases

- Disease not in Canada (also some rare diseases in Canada).
- Disease of significant importance.
- No eradication or control programs in place. But these would be undertaken by CFIA if necessary.
- Free status is necessary for export.

Sheep and Goat IMMEDIATELY NOTIFIABLE Diseases

- Bluetongue (types 2,10,11,13 and 17)
- Contagious caprine pleuropneumonia
- Louping ill
- Nairobi sheep disease



PART A: FLOCK HEALTH BACKGROUND

3. **Annually Notifiable diseases**

- Disease present in Canada, requiring annual report about presence in Canada to World Organization for Animal Health, OIE.
- All veterinary laboratories must provide this information annually to the CFIA.

Sheep and Goat ANNUALLY NOTIFIABLE Diseases

- Blackleg
- Botulism
- Bovine malignant catarrhal fever
- Caprine arthritis-encephalitis (CAE)
- Caseous lymphadenitis
- Coccidiosis
- Coxiellosis (Q fever)
- Echinococcosis or hydatidosis
- Enterotoxaemia
- Enzootic abortion
- Foot-rot
- Haemorrhagic septicemia
- Intestinal salmonella infections
- Listeriosis
- Maedi-visna
- Other clostridial infections
- Other pasteurelloses
- Ovine epididymitis (*Brucella ovis*)
- Ovine pulmonary adenomatosis
- Paratuberculosis (Johne's disease)
- *Salmonella abortus ovis*
- Sheep mange (scab)
- Toxoplasmosis
- Vibrionic dysentery
- Warble infestation

ZOONOTIC DISEASES

"A zoonotic disease is one in which the causative agent is transmissible from animals to humans."

A **zoonotic disease** is one in which the causative agent is transmissible from animals to humans. Zoonoses are particularly a problem for people who are immune-compromised (old, young, sick) *or* pregnant.

ZOONOTIC DISEASE AGENTS

Note: For Information about the following human diseases, See Public Health Canada <http://www.phac-aspc.gc.ca/id-mi/index-eng.php>

Agents causing SCOURS in Sheep and Goats and potential Human Diseases

ORGANISM	EFFECT ON HUMANS
<i>E. coli</i>	Watery diarrhea, stomach cramps, diarrhea may become bloody. In some cases, kidney disease known as hemolytic uremic syndrome (HUS) can develop and lead to death.
<i>Salmonella</i>	Stomach cramps, diarrhea, fever, nausea, vomiting, dehydration.
<i>Cryptosporidium parvum</i>	Watery diarrhea, nausea, headaches.
<i>Giardia sp.</i>	Diarrhea, fatigue, weight loss. Transmission of ruminant <i>Giardia</i> to humans is possible but not fully known.

Agents causing ABORTION in Sheep and Goats with potential Human Diseases

ORGANISM	EFFECT ON HUMANS
<i>Campylobacter jejuni</i>	Diarrhea, septicaemia, abortion, arthritis, Guillain-Barre syndrome
<i>Chlamydophila abortus</i>	Abortion
<i>Coxiella burnetii</i>	Q Fever: Mild-severe long-term illness/disability, acute pneumonia, undulant fever, hepatitis, extreme myalgia, endocarditis.
<i>Toxoplasma gondii</i>	Most mild fever, swollen lymph nodes, remain infected for life. If infected while pregnant: congenital neurological disease, blindness in human fetus. Encephalitis if immuno-compromised.
<i>Brucella melitensis</i>	Malta fever, weakness, intermittent fever.
<i>Leptospira spp.</i>	Flu-like illness, headache, myalgia, abdominal pain, diarrhea, jaundice, meningitis
<i>Listeria monocytogenes</i>	Meningitis, septicaemia, abortion, fetal infection
<i>Salmonella spp.</i>	Diarrhea, septicemia

PART A: FLOCK HEALTH BACKGROUND

Disease Agents contaminating MILK and potential Human Diseases

In addition to *Brucella*, *Campylobacter spp.*, *Coxiella burnetii* (Q fever), *Leptospira*, *Listeria*, *Salmonella*, *Toxoplasma*, *E. coli* presented above:

ORGANISM	EFFECT ON HUMANS
<i>Mycobacterium bovis</i>	Tuberculosis
<i>Mycobacterium avium paratuberculosis</i>	Possibly involved in Crohn's disease
<i>Staphylococcus aureus</i>	Food poisoning
<i>Corynebacterium pseudotuberculosis</i>	Lymphadenitis, malaise, fatigue, fever

SKIN DISEASES of Sheep and Goats and potential Human Diseases

In addition to *Corynebacterium pseudotuberculosis* presented above:

ORGANISM	EFFECT ON HUMANS
Contagious Ecthyma, ORF, Soremouth	Painful sores usually on hands, may last 2 months, + mild fever + swollen lymph nodes, unless immuno-suppressed.
Ringworm <i>Trichophyton spp.</i> or <i>Microsporum canis</i>	Inflamed, circular pustules/blisters on hair, skin and nails.

SPREAD OF ZONOSSES TO HUMANS

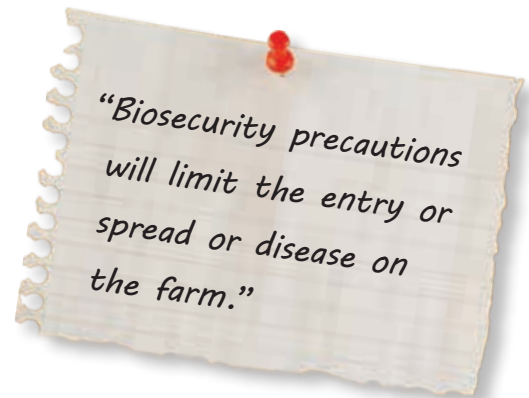
People acquire zoonotic diseases from sheep and goats by:

- Handling sick animals, their secretions, bedding materials.
- Contamination *e.g.* the home is contaminated by clothing or equipment from animal areas.
- Inhaling particles in a dusty contaminated animal environment, *e.g.* *Coxiella* is very contagious, as little as one organism can cause infection!
- Drinking raw (unpasteurized) milk.
- Toxoplasmosis is acquired by consuming *Toxoplasma* bradyzoites in undercooked sheep or goat meat, raw milk or un-ripened cheese, or consuming sporulated *Toxoplasma* oocysts from something contaminated with cat feces *e.g.* fresh vegetables, hands used in kitty litter maintenance.

"People can acquire zoonotic diseases from sheep and goats."

ZOOONOTIC DISEASE BIOSECURITY PRECAUTIONS

- Pregnant women should not work with birthing or aborting sheep and goats.
- Wear gloves for assisting at births.
- Isolate aborting animals where they aborted and obtain veterinary advice. If at all possible submit the aborted fetus and placenta to a veterinary diagnostic lab to determine the cause of the abortion.
- Isolate sick animals in isolation area and handle hygienically with separate equipment and coveralls.
- Plan for, and conduct, good sanitation practices for cleaning up after disease issues.
- Leave barn clothing, boots, and equipment in the barn and wash hands after barn work.
- Worm farm dogs regularly for tapeworms.
- Spay farm cats and if necessary, provide clean kitty litter opportunity for cats in barns (If cats leaving feces in feed areas).
- Do not consume raw (unpasteurized) milk.
- Use good flock management to reduce risk of entry or spread of zoonotic diseases on farm.
- Require all visitors to adhere to the farm biosecurity principles (both to protect your animals from introduction of disease, and to protect the visitors from acquiring disease from your animals).



Note: If you allow **non-essential visitors** to your farm to interact with your animals, your farm may be considered a “**petting zoo**” or “**open farm**”, and must adhere to strict biosecurity practices in order to protect the visitors from acquiring disease from your animals.

See: Information from the BC Centre for Disease Control:

<http://www.bccdc.ca/health-info/health-your-environment/animals/petting-zoos-and-farm-animals>

See: Specific guidelines on Prevention of Zoonotic Diseases from Petting Zoos and Open Farms March 2011 (BCCDC)

<http://www.bccdc.ca/NR/rdonlyres/7E1717A2-1295-41D8-BA5F-26C402198DDE/0/PettingZoos.pdf>

PART B: BACTERIA, VIRUSES, PRIONS

PART B: BACTERIA, VIRUSES, PRIONS

BACTERIA, VIRUSES, PRIONS

BENEFITS OF BIOSECURITY

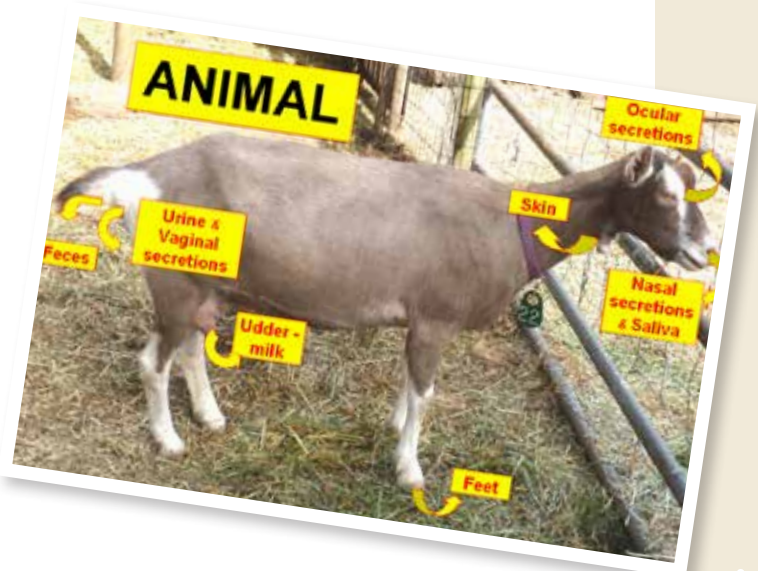
While there is no guarantee that enhancing biosecurity will completely prevent all diseases from entering your farm; in general, precautions taken to limit the entry or spread of disease on farm, will improve:

- Animal health and comfort,
- Producer health, time, finances, effort, and reduced anxiety,
- Overall farm and product safety.

Disease access to farms is most often through the introduction of new animals or the return of animals. However, disease may also be introduced to the farm via:

- Animals: sheep, goats, other livestock, pets, wild rodents, other wildlife, animal wastes or secretions.
- People: veterinarians, shearers, farm contacts (delivery, pick up, sales, technical, other) or visitors.
- Feed: unknown or unreliable source or dealer,
- Water: wells, water troughs, surface water on or entering property (streams, ponds, wetlands).
- Equipment: shared with other farms.

Example: Sheep and goats, even if appearing healthy, may be the source of disease in variety of ways:



Specific Diseases of Biosecurity, Zoonotic or Flock Significance reviewed here:

1. Abortion
 2. Bluetongue
 3. Caprine arthritis encephalitis
 4. Caseous lymphadenitis
 5. Clostridial diseases
 6. Foot rot
 7. Johne's
 8. Maedi Visna
 9. Malignant catarrhal fever
 10. Mastitis
 11. Orf (Contagious ecthyma)
 12. Scrapie
- Parasites – External and Internal will be covered in Part C.



PART B: BACTERIA, VIRUSES, PRIONS

ABORTION – CONTAGIOUS

Reportable¹: Brucella (*B. abortus*, *B. mellitensis* – not *B. ovis*)

Annually Notifiable²: Listeria, Coxiella, Salmonella, Toxoplasma

ZOONOSSES: Chlamydophila, Campylobacter, Brucella, Leptospira, Listeria, Coxiella, Salmonella, Toxoplasma.

SHEEP AND GOATS

BACKGROUND

Any impairment of dam's health, nutritional level or blood flow to uterus, placenta or fetus may result in the loss of a normal pregnancy:

- Early gestation (1-50 days) = early embryonic death.
- Mid to late gestation (50+ days) = abortion.
- At expected due date = stillbirths or weak/mal-formed offspring.

Abortion:

<2% = Normal in healthy flock.

3-7% = Possible endemic disease present.

>5%, or abortions in a short time frame or in single area (pen, group, farm) = Problem.

CAUSES OF ABORTION

Infectious:

Common INFECTIOUS causes of abortion in sheep and goats:

- *Campylobacter fetus and jejuni* (formerly *Vibrio*)(sheep),
- *Chlamydophila abortus* (formerly *Chlamydia psittaci*),
- *Coxiella burnetii* (Q Fever),
- *Toxoplasma gondii*.

Other infectious causes:

- Border Disease Virus (Pestivirus related to bovine viral diarrhea (BVD) of cattle),
- *Brucella ovis*,

"Disease access to farms is most often through the introduction of new animals."

1 Canadian Food Inspection Agency (CFIA) – **Reportable Diseases** – usually of significant importance to human or animal health or to the Canadian economy. Animal owners, veterinarians and laboratories required to immediately report to a CFIA district veterinarian. Control or eradication measures will be applied immediately.

2 Canadian Food Inspection Agency – **Annually Notifiable Diseases**: Diseases for which Canada must submit an annual report to World Organisation for Animal Health (OIE) indicating their presence within Canada. In general, diseases that are present in Canada.

- Caprine herpesvirus 1,
- *Leptospira* spp.,
- *Listeria monocytogenes*,
- *Mycoplasma* spp.,
- *Neospora caninum*,
- *Salmonella* spp.

Other (Non-Infectious) Causes of Abortion:

Nutritional: minerals (e.g. iodine deficiency), body condition scores, toxic plants, toxic drugs.

Environmental: extreme heat, cold, stressors within flock, predators, rough handling.

Hormonal: e.g. abnormal estrogen or progesterone levels.

Illness: health status.

Note: any disease with high fever may cause abortion.

TREATMENT

Isolate female(s) from all rest of flock, if possible isolate where abortion occurred and minimize spread of agent by using separate clothing and equipment (including feeding and cleaning).

Wear gloves!

Do not handle flock if pregnant or ill! (may also be human disease).

Wash exposed skin, clothing and footwear after contact with animal, secretions or tissue.

Diagnosis: Critical to set up treatment and control.

- Contact your veterinarian or animal health laboratory.
- **Submit whole fetus and placenta**, fresh, cool/chilled (not frozen), clean (not washed) as soon as possible to veterinarian or diagnostic laboratory.
- **Keep placenta and secretions away from other animals** (send for diagnosis, burn, bury deeply)
- Blood (serum) from dam(s) may also be requested.

Monitor dam, treat if necessary (antibiotics, or anti-protozoal for *Toxoplasma*, See Parasites). Check with veterinarian regarding dam's health and possible blood sample for lab.



PART B: BACTERIA, VIRUSES, PRIONS

Monitor rest of flock. Do not put new pregnant females right into that pen if possible. Check feed for contamination.

After female recovered: Clean facilities where abortion occurred and spray with disinfectant. Burn contaminated bedding.

PREVENTION/CONTROL

After diagnosis: Develop protocol with veterinarian.

- Possible vaccination: *Vibrio* (*Campylobacter jejuni and fetus*); Ovine Enzootic abortion (*Chlamydophila abortus*).
- Possible flock testing /screening.
- *Brucella ovis*: Best to only use virgin rams and not to share rams between flocks.
- Feed off the ground.
- Ensure clean feed and water. No fecal contamination *e.g.* other livestock, rodents, birds, or cats: Spay and keep mature barn cats and if find feces on bales or in grain area, then provide litter box in barn.
- Keep first time birthing females in a separate group.
- Avoid stress and crowding.
- Do not mix bedding from offspring with pregnant females.
- Use excellent birthing hygiene.



Summary of Common Infectious Agents Causing Abortion in Sheep and Goats

AGENT	DETAILS	TREATMENT AND CONTROL	ZOONOTIC DISEASE
VIBRIO ABORTION	<p><i>Campylobacter jejuni</i> Gram – 've microaerophilic</p> <p>SHEEP (v. rare in Goats)</p> <ul style="list-style-type: none"> Becoming predominant Vibrio abortion. In intestinal tract and gall bladder (sheep, goats, dogs, poultry, wild birds). <p>Signs:</p> <ul style="list-style-type: none"> Abortion storm 80-90%, then limited by flock immunity. Placentitis moderate, retained placenta, (edema, hyperemic cotyledons). Abortion 3d after fetal death. Ewe usually not sick, but may have diarrhea. Also stillbirth, weak, small. Incubation 8-60 days (usually 14-21 days). 	<ul style="list-style-type: none"> Culture sensitivity. Treat with antibiotics in outbreak (may reduce). Note: Some new clones are very resistant to tetracycline. Susceptible to tilmicosin, florfenicol, tulathromycin, enrofloxacin, tylosin. Vaccine Bacterin – start before breeding – 60-90 days apart then annually. 	Diarrhea, occasional septicemia, abortion, arthritis, Guillain-Barre syndrome
	<p><i>Campylobacter fetus</i></p> <p>SHEEP (v. rare Goats)</p> <ul style="list-style-type: none"> Becoming less common. Late outbreaks for a large % of flock. Cyclical: storms every 4-6 yrs as immunity wanes, but can have low level yearly. Same clinically as above. 	<ul style="list-style-type: none"> Culture and sensitivity. Less antibiotic resistance than above. Vaccine. 	as above
OVINE ENZOOTIC ABORTION	<p><i>Chlamydomphila abortus</i> Gram -'ve intracellular 2 states</p> <p>SHEEP and GOATS</p> <ul style="list-style-type: none"> Spread by aborted materials, vaginal discharge and environmental contamination. Also males may be infected and shed. <p>Signs:</p> <ul style="list-style-type: none"> Marked 25-60% abortion usually late term, may have fresh or necrotic fetus. Occasionally early with resorption or weak, stillborn. Severe placentitis (thickened, hemorrhagic and necrotic) and may get retained placenta. Female may have anorexia and fever. Enzootic levels 5-10% mostly in primiparous or new animals. If infected before breeding or in late gestation, organism remains dormant and may abort next pregnancy. After abort: flock immunity, but may wane and also may shed at estrus 	<ul style="list-style-type: none"> Eradication DIFFICULT. Can't identify infected or carrier animal. Serology (can confuse with <i>C. pecorum</i> causes arthritis, conjunctivitis in lambs). Incubation long 60-100 days Poor outbreak treatment. May be Tetracycline, Tylosin susceptible (Attention residues!) Vaccine – bacterin 60D before breeding, 2nd dose in 30D, then annual. Not prevent shedding. Embryo transfer for clean flock genetic transfer. 	Abortion, influenza-like syndrome

PART B: BACTERIA, VIRUSES, PRIONS

	AGENT	DETAILS	TREATMENT AND CONTROL	ZOONOTIC DISEASE
Q FEVER	<i>Coxiella burnetii</i> Rickettsia variable Gram -ve intracellular pleomorphic	SHEEP and GOATS <ul style="list-style-type: none"> Also affects cattle, swine, dogs, cats, wildlife rodents, birds, ticks. Stress ↑ chance of abortion. Shed in birth fluids, placenta, vaginal secretions, semen, feces and milk. Resists drying, spread in dust. Survives months-years in environment. Signs: <ul style="list-style-type: none"> Abortion more common in goats and more organisms shed by goats. Usually asymptomatic infection in both. Outbreaks in non-immune 5-35%. Usually late abortion, maybe stillborn, weak. Placentitis thickened, exudate, necrotic Also may get uterine inertia and rupture. Female may have anorexia and depression. Some herd immunity after abortion but goats can repeat. May have Endemic infection and no abortion. 	<ul style="list-style-type: none"> Antibiotics, tetracycline. Has little effect on shedding. ↓ stressors in management Biosecurity measures to reduce spread e.g. bury or incinerate placentas, compost manure > 5 months, spread on still days, disinfect birthing area, wear masks and protective clothing. Vaccine currently not available in NA. Pre-infected animals less abortion but will shed. Note: persistence of environmental contamination. 	mild, no signs 10% severe long term disability acute atypical pneumonia, undulant fever, etc. Need prompt diagnosis and treatment e.g. Doxycycline Elderly or immuno-suppressed may die Vaccine in Aus.
TOXOPLASMOSIS	<i>Toxoplasma gondii</i> Protozoa	SHEEP and GOATS <ul style="list-style-type: none"> Only source of infection = domestic and wild cats (Felidae). All warm-blooded animals can get oocysts (infective for up to 18 months) from feed, pasture contaminated by cat feces Fetus gets from dam ingesting oocysts. Fetus affected at any stage. Signs: <ul style="list-style-type: none"> Can get resorption, abortion, mummies, still born, weak. Abortion 5-100%. Some fetuses in litter may be unaffected. Placental cotyledons are white, with necrotic foci and calcification. Female usually not sick. Usually abort only once after infected and can be resistant to abortion if infected before pregnancy. 	<ul style="list-style-type: none"> Little treatment in birthing period. Reduce exposure to cats or cat feces: Spay barn cats* and can put litter box in barn to ↓ feed and feeder contamination. Possible to feed prophylactic medications throughout gestation. Vaccine in NZ and Eur. Immunity for 18M+ (not available in NA, as is infective for humans). * Kittens < 3months of age more likely to shed oocysts. 	Congenital neurologic disease and blindness in fetus. Encephalitis in AIDS patients.

BLUETONGUE (BT)

Disease to BE AWARE of if located in south Okanagan.

Reportable (other than serotypes which are Immediately notifiable)

Immediately Notifiable Serotypes 2, 10, 11, 13 and 17

(Most of Canada is currently Bluetongue-free³)

SHEEP (GOATS)

BACKGROUND

Bluetongue is an insect-borne viral disease of ruminants.

Cause: Bluetongue virus: Family Reoviridae, Genus Orbivirus. 24 serotypes worldwide.

- Serotypes 2,10,11,13,and 17 occur in USA and are monitored in Canada.
- New serotypes found in Europe are of concern and are reportable in Canada.
- Spread by specific midges *Culicoides sonorensis*.
- Only seen in late summer – fall, as virus must replicate in midge after bite infected animal, takes approximately 2 weeks.

Note: Since 2007, bluetongue testing is no longer required for US importation. BT-infected animals may enter Canada from USA. The Canadian Sheep Federation has information about BT insurance, which could apply to sheep within potential midge-contact areas within Canada.

SIGNS

Clinical disease more often in **sheep and deer**:

- Signs vary in severity and include fever; mucous membrane erosion and ulceration; reddening and congestion of mouth and nose, swollen lips, gums, tongue (**blue tongue**); dyspnea (difficulty breathing); lameness from muscle necrosis and coronary band inflammation (may slough hoof); loss of wool, death may occur in 1-7 days (mortality ranges from 0-30%).

Goats, cattle, elk: Usually no sign of disease, or mild, self-limiting disease.

Cattle may have prolonged viremia and be reservoir carriers.

TREATMENT

No treatment.

³ Over the past 30 years, there have been several incursions of bluetongue into the Okanagan Valley, believed to be the result of wind-borne introduction of infected midges from the U.S. In September 2015, bluetongue was confirmed in 3 cattle in southwestern Ontario.

PART B: BACTERIA, VIRUSES, PRIONS

PREVENTION/CONTROL

Within midge areas: Insect control and move animals into barns in evening to reduce exposure to midges.

Federal government monitors for bluetongue in Canada:

- Six sentinel cattle herds located in the southern Okanagan. Tested from June to mid-Oct.
- National surveillance: 15,000 random cattle blood samples at slaughter across Canada at three year intervals.

If you have animals with consistent clinical signs of Bluetongue please contact your veterinarian or the Animal Health Center (1-604-556-3003) as soon as possible.

If you notice die-offs of wild ungulates, particularly deer, please contact the BC Wildlife Health program (for online reporting see: <http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/wildlife-health/report-sick-injured-or-dead-animals> or phone 250-751-3234.)



CAPRINE ARTHRITIS ENCEPHALITIS (CAE)

Annually Notifiable Disease

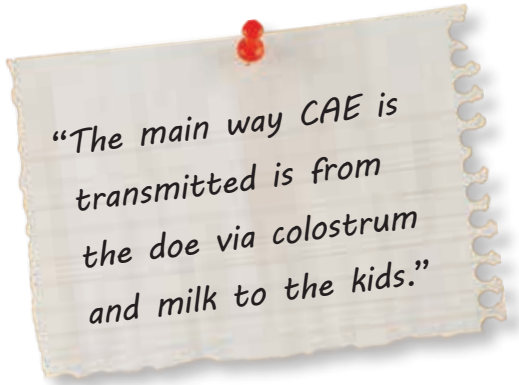
GOATS

BACKGROUND

Caprine Arthritis Encephalitis Virus = CAE

Cause: RNA virus in *Lentivirus* genus, Retrovirus (Retroviridae) family, enveloped, single-strand virus.

- Closely related to Maedi-Visna (MV) virus (ovine progressive pneumonia) in sheep.
- CAE and MV are sometimes “Small Ruminant Viruses”.
- Common in dairy goats, uncommon in meat or fibre goats.
- Experimental transmission possible between goats ↔ sheep, but apparently not under natural conditions.
- No transmission to humans.
- The virus infects white blood cells (WBC) that travel to target tissues (joints, lungs, udder), where virus becomes activated. Results in “lymphoproliferative” damage by lymphocytes and macrophages.
- Infection stimulates both antibody and cell mediated immunity and neither is protective. Maternal antibodies (in colostrum) also provide no protection. Damage occurs due to immune reaction to virus.
- Persists for lifetime, animal becomes a carrier, always fatal.



“The main way CAE is transmitted is from the doe via colostrum and milk to the kids.”

Incubation variable:

- Usually months to several years after infection before clinical signs, especially arthritis, except encephalitis form, which can occur in kids 2-6 months old.

Spread:

- Main transmission via colostrum and milk to kids.
- Also animal to animal transmission via body fluids, secretions, blood (needles, wounds).
- Found in semen, but transmission during breeding is unlikely.

PART B: BACTERIA, VIRUSES, PRIONS

SIGNS

Most (~70%) infected goats show no signs, but can shed virus and infect others.

5 forms:

1. **Neurologic:** usually young kids 2-6 months, and rarely older animals.
Progressive weakness and paralysis, often hind first, recumbent, initially no fever, bright, eating, often die of secondary conditions *e.g.* pneumonia.
2. **Polyarthritic:** most **common form**. Usually > 1 yr of age.
Swollen joints (may begin as stiff). Most common = anterior carpus (may be any limb joint or atlanto-occipital – nape of neck), fluid-filled swelling, not painful, progress to firm joints with painful debilitating lameness (may wax and wane).
3. **Hard bag mastitis:** udder hard, no heat, skin loose (no edema), no other illness signs, little to no milk, enlarged supra-mammary lymph nodes.
4. **Pneumonia:** exercise intolerance, difficulty breathing, wasting.
5. **Chronic weight loss:** usually (not always) occurs with other forms.

With all forms some suppression of the immune system occurs, which leads to other diseases.

TREATMENT

No treatment, except supportive: comfortable housing, easily accessible food and water, analgesics for arthritis (aspirin 100 mg/kg orally every 12 hours or phenylbutazone 10mg/kg orally once a day).

If advanced and in severe pain, humane euthanasia.

No vaccine.

PREVENTION/CONTROL

Two approaches to removing CAE from flock:

1. Reduce risk based on blood testing and culling
 - Blood testing requires management, commitment to culling.

Diagnostic Blood Serum Test:

- May test after 12 months of age; some recommend testing after 6 months.
- Enzyme Linked Immunosorbent Assay (ELISA) test – more sensitive and replaced Agar Gel immunodiffusion (AGID) test. ELISA testing available at: Animal Health Centre.
- May get false negatives, due to variable time period from infection to antibody development.

Note: Goats exposed to *sheep with Maedi Visna* (OPP) may give false positive CAE test.

Protocol

- Maintain a closed flock. New animals only from CAE-free flock and then quarantine and test.
 - Test all animals in flock twice in first year, then test annually. Test kids after 6 months of age, then test annually.
 - All positive animals must be culled for slaughter immediately, or isolated until slaughtered, or kept completely segregated for life.
 - Cull any CAE diseased animals.
 - In bottle rearing kids, take steps to reduce the risk of exposure to virus:
 - Use heat-treated colostrum and then milk replacer or milk known to be free of CAE (disease-free animals or pasteurized milk).
 - Manage with low stress and good sanitation.
 - Use all needles once and destroy needles safely.
2. Raise Separate CAE-free Herd
- Requires commitment to maintaining two flocks on farm – CAE-positive and CAE-negative flocks—and using strict biosecurity hygiene principles between segregated groups, allowing **no contact** between different flock animals:
 - Double fencing, at least 2 m apart, between the flocks.
 - Different products, feed, bedding.
 - Use different tools/equipment between flocks.
 - In dairies milk negative animals first and clean and thoroughly disinfect after milking flock, etc.
 - Remove kids immediately after birth (i.e. before can stand and suckle) and raise in a separate facility (negative flock area as above)
 - Ensure removed kids get virus-free source of antibodies, *e.g.* colostrum from CAE negative goats, heat-treated goat colostrum.
 - Raise kids on pasteurized goats milk (heat to 165°F or 73.9°C for 15 seconds) or on commercial milk replacer.
 - New animals:
 - Purchase new animals only from CAE-free herds.
 - Use virgin, CAE test negative bucks each year, or test bucks at least every 6 months.
 - Quarantine new animals for 2 months: Test serum samples from animals, twice, 30 days apart, using ELISA test, available at: Animal Health Centre.

PART B: BACTERIA, VIRUSES, PRIONS

CASEOUS LYMPHADENITIS (CL)

Zoonosis**SHEEP and GOATS****BACKGROUND**

Caseous lymphadenitis (CL) is a chronic contagious disease. CL is one of the diseases responsible for “thin ewe syndrome” due to internal abscesses, *e.g.* in lymph nodes of lung. Others include Maedi-Visna (ovine progressive pneumonia), Johne’s disease, scrapie, parasites, footrot, *etc.*

Cause: *Corynebacterium pseudotuberculosis*, a Gram positive or Gram variable, anaerobic bacteria.

- Gains entry through tiny breaks in skin or mucous membranes. Localizes in lymph nodes. May reside as intracellular organism in macrophages.
- Long incubation in animal, usually 2 to 6 months, sometimes years.
- **Extremely contagious!** Survives in environment at least 1 yr.
- **Zoonosis** Human illness: causes pain, swelling, fever, malaise, chronic lymphadenitis

Spread: By direct contact with pus, usually through draining abscess. Can be spread through coughing if bacteria is in lung lymph nodes. Pus from abscesses contaminates equipment and surfaces. Thus, other animals may contact organism.

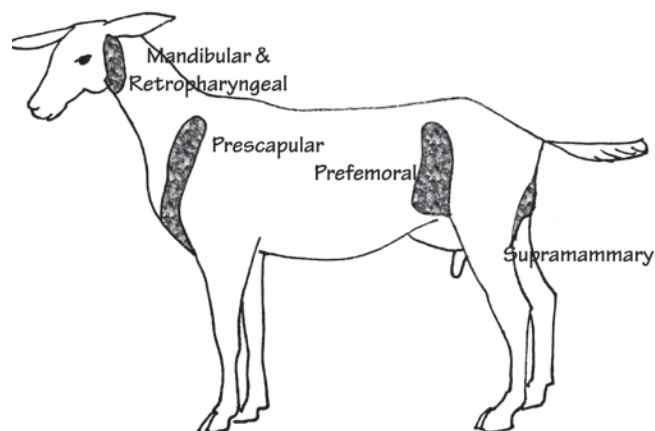
Shearing = Major mode of transfer.

SIGNS

The common lymph node areas affected are shown in the diagram:

Abscesses: soft to firm swelling in lymph node areas.

- External abscesses can be seen in areas shown.
- Internal abscesses are difficult to diagnose.



“CL is extremely contagious and can survive in the environment for at least one year.”

“Shearing is the main mode of transmission for CL.”

Additional clinical signs relate to site(s) of internal abscesses.

DIAGNOSIS

If abscess seen: Culture sample of pus.

Note: Not all *Corynebacterium* are CL, See lab results at end of section.

Serology: There are a few blood tests available that detect the antibody response to CL. None are sufficiently reliable to confidently detect infection in individual animals, although they may support the diagnosis in some cases. False negatives are common. False positives will occur in animals that have been vaccinated or those that have been exposed and either not developed the disease or where the infection has resolved. Serological tests are typically more useful for herd-level screening.

Note: If animal vaccinated, serum will test positive for CL.

TREATMENT

Difficult to treat. Due to contagious nature of pus, chronic disease potential for flock and potential human disease, often best to cull infected animals.

For very valuable animals:

- Separate, isolate affected animal(s) in strict quarantine.
- Wear gloves and using extreme hygiene, lance (open) abscess.
- Flush ripe abscess with Iodine, being careful to collect and safely dispose of pus!
- Or surgically remove encapsulated abscesses.
- Generally CL is not “curable”. Treatment aims to decrease transmission to the rest of the flock, but with all treatments recurrence rates are high.

Vaccination: See below.

PREVENTION/CONTROL

If no history or signs of disease in flock:

- Purchase animals from CL-free flocks.
- Can use blood testing to remove any test positive animals. Screening is good for detecting positive; but a negative result does not absolutely guarantee that animal is free of internal abscesses, so owners should continue to watch test-negative animals.
- Quarantine new animals for a minimum of four weeks and blood test.
- Reduce contamination of environment and exposure of animals:
- Remove potential sharp injury areas in housing.
- Regularly check potential sites on animals for abscesses.
- Use very clean technique with injections and only use needles once.

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- Clean and disinfect equipment between animals, *e.g.* ear taggers, tattooing needles, hoof trimmers, and esp. shears.

*If known infected animals in flock:***To Establish Flock with Low Risk of CL:**

- Cull infected animals for slaughter.
- Separate herd into 2 management units: Free flock and Infected flock.
- Remove offspring at birth. Must watch as birthing occurs and remove before suckling or licking.
- Feed colostrum from CL-free flock, or heat-treated colostrum (*See* Section 3 Neonatal Care).
- Vaccinate for Clostridial diseases.
- Raise on milk replacer.
- Rear replacements only with CL-free flock animals.
- Need to maintain extreme biosecurity standard for separation of equipment, humans etc. between 2 management units.

To Keep Show Animals with Reduced Risk of CL:

Vaccinate: ONLY in an **infected flock**, or if flock has show animals that return.

See: Medications.

- If used with cull (possibly treatment of valuable animals), will reduce chance of infection.
- Will not cure or completely prevent new infection.

Note: Vaccinated animals will test positive, if serum tested.

Possible Vaccine schedule:

- Replacements at 6, 10, and 14 weeks of age.
- New animals = 2 doses, one month apart (isolate until 2nd dose).
- Repeat the vaccination annually; may use semi-annual booster in heavily infected flocks.

Note: Goats: Vaccine is not licensed for goats by the company due to unacceptable reactions, *e.g.* temporary lameness for up to 30 days, injection site swelling up to 35 cm (14 inches), fever, lethargy, decreased milk production.

Not recommended in pregnant animals.



ANIMAL HEALTH CENTRE TEST RESULTS FOR CL

Culture samples were taken from abscesses of sheep and goats. These samples were either submitted to the Animal Health Centre, or collected by pathologists from carcasses necropsied at the laboratory. Samples included swabs, exudates, aspirates and tissues.

The results illustrate that not all abscesses with *Corynebacterium* are CL.

***Corynebacterium* culture results:**

Year	SHEEP		GOAT	
	# Cultured*	# CL positive^	# Cultured	# CL positive
2007	1	1	3	2
2008	3	0	6	5
2009	3	1	4	4
2010	4	4	6	6

* # Cultured = # of samples that grew a *Corynebacterium* spp. organism.

^ CL positive = # of *Corynebacterium* spp. isolates that were *Corynebacterium pseudotuberculosis* (cause of CL)

Serum samples submitted to the Animal Health Centre and sent to the Diagnostic Laboratory of the University of California Davis for Synergistic Haemolysin Inhibition test for *Corynebacterium pseudotuberculosis*.

Year	SHEEP OR GOAT (SPECIES NOT INDICATED)		SHEEP		GOAT	
	# Tested	# positive	# Tested	# positive	# Tested	# positive
2006					1	1
2007	1	1			1	1
2009					1	1
2010			3	1	3	0
2011					4	0

PART B: BACTERIA, VIRUSES, PRIONS

CLOSTRIDIAL DISEASES

Sheep and Goats

Clostridium perfringens Enterotoxemia = Acute bloody enteritis and Overeating disease/pulpy kidney

BACKGROUND

Cause: *Clostridium perfringens* Bacteria: Gram positive rod. Produces heat-labile protein exotoxins. All types of *Cl. perfringens* have a toxin which breaks open mammalian cells.

Types of *Cl. perfringens*:

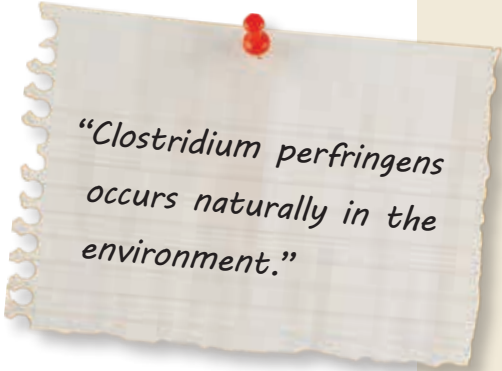
- *Cl. perfringens* **Type A:** α toxin. Causes Yellow lamb disease.
- *Cl. perfringens* **Types B and C:** $\alpha + \beta$ toxin (trypsin-labile, destroys cells). Causes Acute bloody enteritis (Lamb dysentery, Hemorrhagic enteritis).
- *Cl. perfringens* **Type D:** $\alpha + \epsilon$ toxin (trypsin-activated, destroys cells). Causes **Overeating disease, Pulpy kidney.**

Cl. perfringens occurs normally in low numbers in the gastro-intestinal tract of all sheep and goats.

Cl. perfringens also occurs naturally in the environment and survives as spores. Survival is best in fecal contaminated areas during cool and damp periods.

Bacterial growth may be due to reduced peristalsis (intestinal movement), poor rumen or abomasal function, or various stressors such as weather, handling, feed changes, or an overabundance of high-energy feeds—including increase in grain, protein supplement, milk, milk replacer, grass, or any feeds that are rich in starch and/or protein.

Toxins are released with bacterial growth.



"Clostridium perfringens occurs naturally in the environment."

ACUTE BLOODY ENTERITIS/LAMB DYSENTERY/HEMORRHAGIC ENTERITIS

Cause: *C. perfringens* **Types B and C** (usually Type C is found in North America and Type B in the United Kingdom).

Usually affects young animals <3 wks, often between 2-5 days old, occasionally older animals.

Usually due to fecal contamination.

SIGNS

Acute: May be found dead.

Less acute: See yellow liquid feces and blood, colic, off-feed, terminal convulsions and death. Older sheep may be found dead.

TREATMENT

Give penicillin, Clostridium antitoxin, fluids, anti-inflammatory (if found in time).

PREVENTION/CONTROL***Vaccination:***

- Pregnant dam: 2 wks prior to the start of lambing/kidding.
- Young: Ensure gets colostrum from vaccinated dam. Then vaccinate young animals after 6 weeks and booster according to label directions.
- Males – vaccinate annually.

Note: recommended vaccination protocols vary depending on the product used and on many farm management factors. Follow the label directions and consult a veterinarian who is familiar with your farm.

Reduce feed-related stressors:

- Take care with high nutrient-content foods, *e.g.* divide daily allotment, feed roughages first.
- Make diet changes gradually, ensure sufficient feeder space sites,
- Introduce pasture slowly, *e.g.* increase by 10 min/day.
- Manage high milk-producing dams so nursing offsprings' milk diet not too rich or variable.

Note: Goats The vaccine is not approved for use in this species and may have a short half-life and may need to have booster 3-4 times/year.

PART B: BACTERIA, VIRUSES, PRIONS

OVEREATING DISEASE/PULPY KIDNEY

Cause: *Cl. perfringens* Type D (worldwide).

- Toxin will increase the gut permeability, and causes widespread tissue damage.
- Animals most often affected are often >2 weeks of age, often largest, fastest growing. More ewe lambs, nursing lambs 2-12 weeks old, singles 3-8 weeks of age, feedlot lambs 4-6 months old, adults after stresses (\pm stress history).

SIGNS

SHEEP: Enterotoxemia and found dead; or fever with increased heart and respiratory rates, colic, nervous signs, terminal diarrhea.

GOATS: Severe enteritis, fewer neurologic and systemic signs.

TREATMENT

Penicillin, Clostridium antitoxin, fluids, anti-inflammatory (if found in time).

PREVENTION/CONTROL

Vaccination: As for Acute bloody enteritis.

Reduce feed-related stressors: As above for Acute bloody enteritis.

TETANUS (LOCKJAW) CLOSTRIDIUM TETANI

BACKGROUND

Cause: *C. tetani* **Bacteria:** gram positive rod

- Found normally in intestinal tract. Spores found in feces, and are viable in soil for years.
- Sheep and Goats more susceptible than cattle, worldwide.
- Bacteria enters through skin break, infection *e.g.* metritis.
- May lie dormant after infection for several weeks.
- Bacterial proliferation occurs where conditions are acid and anaerobic.
- 3 toxins produced: Most important is tetanospasmin, also tetanolysin and spasmogenic neurotoxin.

SIGNS

Stiffness, may have spasms, recumbent, bloat, aspiration, death.

TREATMENT:

Muscle relaxation, supportive care (slings, good footing), fluids/nutrition, dark, quiet, sedation.

High doses penicillin, Tetanus antitoxin and toxoid.



PREVENTION/CONTROL

Vaccination in first year, then annually, often included in multi-Clostridial vaccines. May give boosters after injuries.

OTHER CLOSTRIDIAL DISEASES

Clostridium botulinum = **Botulism**

Clostridium novyi = **Big head/Malignant edema/Black disease (+liver fluke)**

C. sordelli = **Malignant edema/Abomasitis and toxemia**

Clostridium septicum = **Malignant edema/Braxy**

Clostridium chauvei = **Blackleg/Malignant edema/ Post-parturient gangrene**

Clostridium haemolyticum = **Red water disease (Bacillary hemoglobinuria)**

Vaccination: Multi-valent Clostridial vaccine for small ruminants must have at least:

- *Clostridium perfringens* Type (B) C and D for Endotoxemia (lamb dysentery, pulpy kidney).
- *Clostridium septicum* for Malignant edema (from wounds), Braxy (grazing frosted fields).
- *Clostridium tetani* for Tetanus.



PART B: BACTERIA, VIRUSES, PRIONS

FOOTROT

Note: Vesicles around coronary band and in interdigital spaces; erosions on dental pad may indicate **Foot and Mouth Disease**.
REPORTABLE DISEASE.

SHEEP and GOATS

BACKGROUND

Cause: 2 Gram negative anaerobic bacteria: *Fusobacterium necrophorum* + *Dichelobacter nodosus*.

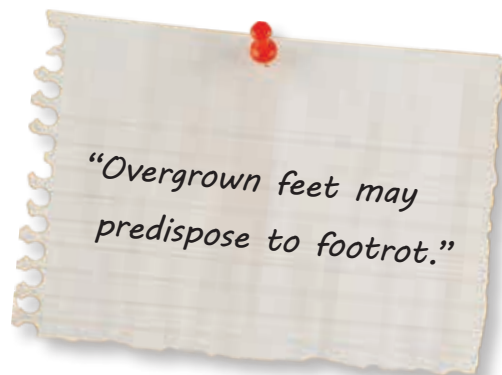
- **Benign Form** = “Foot scald” or “interdigital dermatitis” caused by *F. necrophorum*, which is found in the environment.
- **Virulent forms** are more aggressive, caused by up to ten varying strains of *D. nodosus*.
- *D. nodosus* can only survive off the foot for short periods in environment even under optimum moisture and temperature conditions (moist > 10°C).
- There is an increased risk of foot scald or footrot on pastures or handling areas that are wet or rough and damaging to feet.
- Overgrown feet may predispose to footrot.
- There may also be a genetic or conformation-related susceptibility to footrot.
- Sheep and Goats of all ages may be affected but increased risk with older animals.
- Sheep usually more severely affected than goats.

Spread: Footrot organisms are carried on animal’s hooves.



SIGNS

- Usually affects more than one foot.
- Progressive: Begins as interdigital inflammation and excoriation, with tissue damage of the skin/horn junction. Soft horn may be involved and separate from skin.
- Virulent footrot can cause severe lameness. Get under-running of the sole to the outer edge, and involves the hard horn as under-running becomes more extensive with deeper tissue damage of sole from heel to toe.
- Goats have different footrot problems from sheep, even if infected with same bacterial strain.
- Goats can also show no signs but carry strains that may give sheep severe footrot.



TREATMENT AND CONTROL

Footrot can be eradicated through active management.

Must include all flock while minimizing stress!

Requires:

- Checking feet regularly 3-4 x/year and careful trimming, as necessary, *See* Section 3 Foot trimming.
- Handling facilities that are clean, dry and safe for feet, or the process of handling may actually spread footrot through flock.
- **Note:** Foot trimming tools should be disinfected between animals!
- For illustrations of evaluating footrot when checking feet, *See* Bibliography. Seaman and Evers p.4-5.

Checking feet and managing footrot:

Known Infected flock, handle flock as two groups: Infected and Uninfected.

Uninfected animals:

- Footbath** at least 15 min. to 1 hour. Then move onto clean ground that has had no sheep for a minimum of 2-3 weeks.
- Re-check feet, and repeat footbath weekly for 3 weeks.
- Recheck feet in 2-3 months.

PART B: BACTERIA, VIRUSES, PRIONS

Infected animals:

- Preferably cull for slaughter. These animals are an on-going source of infection.
- If cull not possible:
- Gently trim feet
- Footbath at least 15 min. to 1 hour.
- Consider antibiotics if virulent footrot
- May choose to vaccinate. Vaccine not licensed in Canada, must be obtained as an emergency drug release by veterinarian with authorization from CFIA.
- Examine feet weekly and when clean, add to un-infected group.
- If infection persists cull for slaughter.

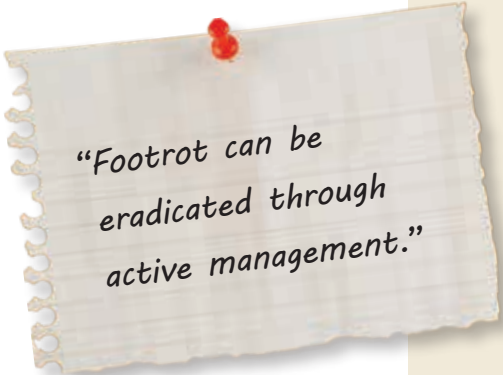
Any flock:

- Check and trim feet 3-4 times/year.
- **New or returning animals:**
- Feet of new animals should be checked prior to purchase.
- Footbath animals before transport and when reach or return to home farm.
- Quarantine (minimum 4 weeks), check feet and footbath at least once prior to entry or re-entry to flock.

****Foot bath construction and use:**

(adapted from Western Canada Flock Health Program [WCFHP], *See Bibliography*).

- sturdy, leak-proof, non-slip, portable foot bath, away from muddy area, used with drain board.
- 10% – 20% zinc sulphate solution. Can check % by checking specific gravity with battery tester, for 20% solution, Specific gravity = 1.225.
- Fan out powder, mix thoroughly with rake.
- Use solution that is at least 3" deep. Can measure volume to determine amount needed.
- Must stand for 15 min to 1 hour.
- Can add liquid laundry detergent (1 cup/30 gallons) to get solution to "stick" better to the feet.
- Animals should walk out into dry area.



"Footrot can be eradicated through active management."

Note: zinc sulphate is **poisonous**, animals must not drink the foot bath. Also disposal of solution requires attention, See, guidelines for **disposal** of zinc sulphate footbath solution in the WCFHP.

Note: Also, be aware, a highly virulent footrot, as yet only present in sheep in United Kingdom, is “Contagious ovine digital dermatitis (CODD)”. This disease may involve a spirochete as the causative agent. Initial problem is at coronary band, with rapid separation of horn downwards and loss of hair above coronary band. This organism responds to antibiotics: tylosin, lincomycin, or lincomycin/streptomycin footbaths.

PART B: BACTERIA, VIRUSES, PRIONS

JOHNE'S DISEASE (MAP)

SHEEP and GOATS

BACKGROUND

Disease affecting primarily the digestive tract. Bacteria infect the intestinal wall, causing thickening and reduced ability to absorb nutrients.

Still debated whether Johne's is a zoonosis and implicated in Crohn's disease.

Cause: Bacteria *Mycobacterium avium* subsp. *paratuberculosis* (MAP)- several strains.

- Small, acid fast, Gram positive rod, very resistant to degradation.
- Agent shares biological characteristics with other Mycobacteria, such as those responsible for tuberculosis and leprosy in humans.
- Infects all ruminants.
- There is a sheep strain, a cattle strain and an intermediate strain.
- Cattle are susceptible to all three strains, but are uncommonly infected with the sheep strain. Sheep usually are infected with the sheep strain, but can develop disease after infection with the intermediate strain. Goats usually have the cattle strain.

Spread: Usually spread through feces contaminating the environment and/or water sources. Sheep are infected by ingesting the organism. Animals less than 6 months of age are most susceptible.

- Also spread through colostrum and milk to offspring, and from the dam to the fetus in utero.
- Survives in environment for long periods. Lasts approximately one year in wet manure, soil, and water; and lasts up to four years in dried manure.
- Not completely destroyed by pasteurization.
- Killed by 100 hours of direct sunlight.
- Disinfectant: Cresylic acid compounds –dilute 1:64 and Sodium orthophenylphenol (One Stroke Environ T).

"Johne's disease is usually spread through feces contaminating the environment."

"Manure management is the most important control factor for Johne's disease."

SIGNS

Signs usually begin at 2-7 yrs of age. May be initiated by stress.

<5% infected animals in a flock may be showing clinical signs.

In testing both Quebec and Alberta had a high sero-prevalence in cull ewes.

Stages:

- | | | | |
|-------------|--------------|-------------------|-------------------------------------|
| 1. Exposed | Not infected | | |
| 2. Exposed | Infected | Not shedding | |
| 3. Infected | Shedding | Not sero-positive | |
| 4. Infected | Shedding | Sero-positive | No clinical signs |
| 5. Infected | Shedding | Sero-positive | Clinical signs (0.5-5% adults/year) |

If a young animal is exposed to high dose of organism, clinical signs of disease may appear at an earlier age (12-18 months).

If infected as older adult may shed before show clinical signs.

With the decreased ability to absorb nutrients, animal loses weight and chronic weight loss results.

- Variable is appetite.
- Animal becomes thin wasted, pale, anaemic, hypo-proteinemic (bottle jaw).
- 20% have diarrhea (may be terminal).

DIAGNOSIS

Necropsy: is best at diagnosing Johne's disease in an individual animal.

Fecal culture: Fecal test (Radiometric-BACTEC). Takes 2-3 months, may be as good as a flock screening test. Sheep strains tend to be difficult to grow. Bacteria may be shed intermittently, especially in early stages of disease, so may have false-negative tests.

Fecal PCR: Looks for the genetic material of the bacterium and has largely replaced fecal culture since it is much faster and similarly effective at detecting the organism. As with culture, false negatives are common, particularly at the early stages of disease.

Blood test (Serology): These are typically used as screening tests. They have limited value in the early stages of disease since false negatives are common. Use in animals greater than 18 months since the infection is typically not advanced enough in younger animals for detection by serological methods. Some brands of ELISA tests will cross-react with *Corynebacterium* resulting in false positives so double-check with the lab that the particular serological test performed is suitable for sheep and goats.

PART B: BACTERIA, VIRUSES, PRIONS

TREATMENT

No Treatment.

PREVENTION/CONTROL

Reduce contamination of the environment.

Manure management is the most important control factor.

- Reduce fecal contamination at birth. Clean birthing area, clean female vulva and udder area (crutch/clip).
- Reduce fecal contamination in nutrition and overall management.
 - Elevate and keep feeders (keyhole) and waterers clean.
 - Compost manure minimum 1 year and then plow into only cultivated fields.
 - Ensure animals cannot access manure storage areas.
 - Ensure building runoff does not contaminate any water or any traffic or housing area.
 - Rotate pastures. Regularly remove faeces from barns and pens and compost.
 - Graze young on pastures adult-free for at least 1 yr.
 - Check where hay comes from – make sure is not from recent fecal-contaminated fields.
 - Do not graze flock on cattle pastures (high prevalence of Johne's infection).
 - Use manure-handling equipment for manure alone. Clean and disinfect tools frequently.
 - Do not wear barn or animal-handling clothes or boots away from the barn.

Test and Cull: Each farmer will need to decide how aggressive they want to be in eliminating Johne's disease from their flock. Eliminating Johne's disease from an infected flock can be very costly and require the culling of large numbers of animals.

- Test and remove shedding and infected animals to slaughter, based on fecal testing and/or blood test.
 - Annually test animals >12 months and cull test positive animals for slaughter.
 - Mark and also sell for slaughter any offspring of test positive animals. Do not retain for breeding.
- Necropsy any other culled animals to check for Johne's.
- Operate a closed herd with high biosecurity standards for animals, people and equipment.



- Obtain semen, embryos from test negatives.
- Purchase new stock from herds at low risk and isolate and test animal serum and fecal culture.
- Establish low risk herd if have all negative flock tests and necropsy for 5 yrs.

Milk Management:

- Remove young at birth, no nursing. Feed heat-treated colostrum and pasteurized milk (but now *evidence that Johne's may survive heat treatment*) or milk replacers.

Note: Difficult to use this route to establish a separate Johne's-free herd, due to potential environmental and milk contamination.

Vaccine: Not licensed in Canada, but is available through your veterinarian with an Emergency Drug Release (with authorization from CFIA).

Note: Vaccine will **reduce** clinical disease and fecal shedding, but **will not** completely prevent infection.

Note: Vaccinated animals will blood test positive and may also react on tuberculin test.

PART B: BACTERIA, VIRUSES, PRIONS

MAEDI-VISNA (MV) OR OVINE PROGRESSIVE PNEUMONIA (OPP)

Annually Notifiable Disease

SHEEP

BACKGROUND

Maedi-Visna (MV) is one of the diseases responsible for “**Thin ewe syndrome**”, usually due to respiratory infection. Others include caseous lymphadenitis, John’s disease, scrapie, parasites, footrot, *etc.*

MV is one of the most important sheep diseases in North America.

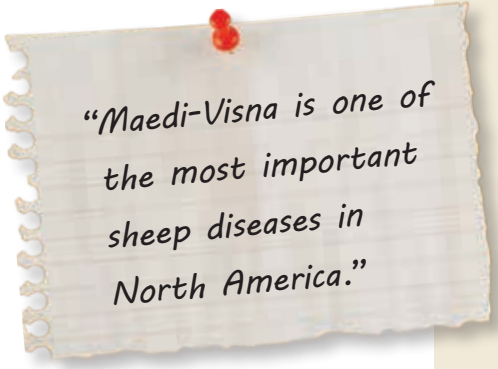
Cause: RNA virus in *Lentivirus* genus, Retrovirus (Retroviridae) family, enveloped, single-strand virus.

- Closely related to Caprine Arthritis Encephalitis (CAE) in GOATS.
- CAE and MV also called “Small Ruminant Viruses”.
- Experimental transmission possible between Goats↔Sheep, seems not under natural conditions.
- Worldwide except Australia and New Zealand. Disease of industrialized countries.
- From 2001 to 2002, 353 cull ewes from Alberta were examined and 27% were found to have lesions of MV.
- In 2001, in USA, voluntary tests of flocks (21,000 samples) showed 36% of flocks were infected. (24% of animals) [81% of open-range flocks were positive, compared to 36% of farm flocks and 34% of fence-range flocks].
- Like CAE, virus infects white blood cells (WBC) that travel to target tissues (joints, lungs, udder), where virus becomes activated. Results in “lymphoproliferative” damage by lymphocytes and macrophages.
- Infection stimulates both antibody and cell mediated immunity and neither is protective. Maternal antibodies (in colostrum) also provide no protection. Damage occurs due to immune reaction to virus.

Spread: by direct contact through respiratory secretions especially in housed sheep.

Also via colostrum and milk, by blood (injections with same needle, wounds), rarely in-utero, may be shed in semen.

- No transmission to humans.
- Virus does not survive long outside sheep.
- Persists for lifetime, animal becomes a carrier (have antibodies, but these are not protective), always fatal.



“Maedi-Visna is one of the most important sheep diseases in North America.”

Incubation: Long, often 2 to 4 years.

SIGNS

Most infected sheep show no clinical signs, but can shed virus and infect others.

Signs may begin after periods of stress.

Manifests most commonly as pneumonic form, but can get arthritis, mastitis and/or encephalitis.

- In pneumonic form, See progression from a general loss of body condition, to laboured breathing, exercise intolerance, chronic cough, mouth-breathing – a chronic degenerative condition.
- Hard bag mastitis shows as one or both sides of udder, swollen, firm, not hot, with little to no (but not abnormal) milk.
- Occasionally arthritic swelling of knee or hock joints, mineralization and lameness, or less frequently in North America, central nervous system disease with stumbling gait and progressive paralysis.
- Some suppression of immune system leads to infection with other diseases.

Sub-clinical: Appear healthy but not thrive, they show poor conception, reduced milk production thus poor lamb growth and they shed virus.

DIAGNOSIS

Confirm with blood (serology) test or at necropsy. Take blood sample after 6 months of age (some recommend at least 12 months of age).

TREATMENT

No treatment.

PREVENTION/CONTROL

No vaccine available.

Three basic methods to reduce (or eliminate) infection with MV:

Note: Blood testing requires management, commitment to culling.

1. Reduce Risk Based on Blood Testing and Culling

Diagnostic Blood (serology) Test: as above for diagnosis.

- May test after 6 months of age; some recommend testing after 12 months.

Note: Sheep exposed to goats with CAE can give false positive MV test.



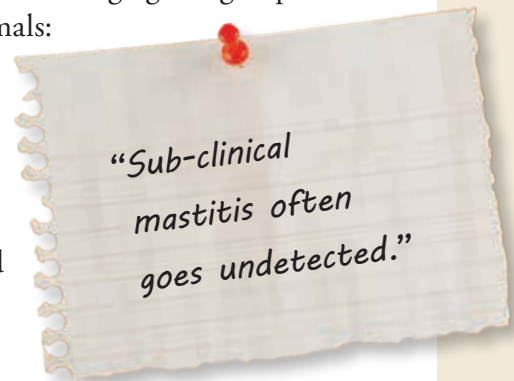
PART B: BACTERIA, VIRUSES, PRIONS

Protocol:

- Maintain a closed flock. New animals only from MV negative flocks and these should be quarantined and tested prior to entering flock.
- Test all animals in flock twice in first year. Test lambs after 6 months of age. Then test annually.
- All positive animals must be culled for slaughter immediately, or completely segregated, or isolated until slaughtered. Cull other “thin ewe syndrome” sheep.

2. Raise Separate MV-free Herd

- Requires commitment to maintaining MV positive and negative flocks and using strict biosecurity hygiene principles between segregated groups, allowing no contact between different flock animals:
 - Double fencing, at least 2 m between the two flocks.
 - Different products, feed, bedding.
 - Use different tools/equipment.
 - In dairies, milk the negative animals first, and clean and thoroughly disinfect after milking flock.
 - Remove lambs immediately after birth (i.e. before can stand and suckle) and raise in separate facility (negative flock area as above)
 - Ensure removed lambs get virus-free source of antibodies, *e.g.* heat-treated colostrums (can use heat-treated goat colostrums).
 - Raise lamb on pasteurized goats milk (heat to 73.9°C [165°F] for 15 seconds) or commercial milk replacer.
- **New animals:**
 - Purchase new animals only from MV-free herds.
 - Use virgin, MV negative rams each year, or test rams at least every 6 months.
 - Quarantine new animals for eight weeks: Test serum samples from animals, twice, 30 days apart, using Enzyme Linked Immunosorbant Assay ELISA test, available at: Animal Health Centre.



3. Cull, clean and repopulate

- Cull **entire** flock and **thoroughly** clean and disinfect facility and equipment.
- Repopulate with MV-free sheep that have had **at least** 2 negative tests over 2 years (virus has short life outside sheep).



MASTITIS

SHEEP AND GOATS

BACKGROUND

Mastitis = Inflammation of udder (mammary gland). Mastitis can occur any time: either when lactating or when dry.

Significance: May result in mortality, increased culling rate, reduced milk quality and amount, poor offspring growth.

Causes: Two broad causes of mastitis are **contagious** organisms or **environmental** contaminants.

Underlying Causes:

- Physical injury to udder (environment, management, numerous offspring).
- Stress (high production, usually with contamination from bedding, i.e. increased bacterial organisms);
- Systemic disease, *e.g.* CAE, MV.
- Allergy.
- Neoplasm (uncommon).

Causative Organisms:

- Clinical mastitis, most common cause is Bacteria: *Staphylococcus aureus* (most common cause of clinical mastitis in ewes. Spreads easily between ewes and on milker's hands and is difficult to treat) and *Mannheimia (Pasteurella) hemolytica* (typically comes from the throat of nursing lambs);
- Subclinical, most common cause also Bacteria: coagulase negative *Staphylococcus* sp.

Note: many Staphylococci are normal udder flora.

- Other bacterial causes: *Streptococcus agalactiae* and other sp., coliforms (*e.g.* *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*), *Arcanobacterium (Corynebacterium)* sp., *Serratia marcescens* (from infected-teat cups)
- Virus: Lentiviral infection of white blood cells *e.g.* *Maedi Visna* (Ovine Progressive Pneumonia) in sheep or rarely Caprine Encephalitis Arthritis. Causes hard bag mastitis, or an enlarged hard udder, little-no milk and both sides affected, with resultant decreased lamb weaning weight.
- Mycoplasma *e.g.* *Mycoplasma agalactiae* causes
- agalactia and arthritis, conjunctivitis, perhaps with pneumonia. Is very rare in North America.
- Opportunistic fungal, *e.g.* *Aspergillosis*.

PART B: BACTERIA, VIRUSES, PRIONS

SIGNS

Clinical mastitis, health problems or changes in milk can be seen:

- **Pre-acute clinical:** severe clinical, depression, fever. If gangrenous, udder could be cold, discoloured. If untreated may die. If survives, usually sloughs affected udder tissue.
- **Acute clinical:** Half may be swollen. May *See* lameness, hungry lamb, milk often abnormal.
- **Chronic clinical:** Feel changes in udder tissue. Udder may be swollen or shrunken.

Subclinical mastitis often goes undetected, but is detectable by increased somatic cell counts (SCC).

DIAGNOSIS

Collect milk sample from each udder “half” for culture and antibiotic sensitivity. Sample must be cultured at a veterinary clinic (some clinics have incubators) or a laboratory.

Check Somatic Cell Count (SCC):

Subjective SCC test = CMT (California Mastitis Test), *See* below.

Causes of variation in SCC:

- With increased number of lactations will see increased SCC.
- Morning milk samples have higher SCC than evening milking samples.
- Normal elevation in white cells possible in very early and late lactation = increased SCC.

Type of milk secretion and milk cell populations are different in Sheep and Goats:

SHEEP Resemble cows (merocrine secretion).

GOATS Milk secretion is apocrine and shed apical-cell particles, some of which have nuclear fragments, which results in an increased SCC. Also, the early and late lactation elevation in white cells is greater in goats than sheep.

Note: If the SCC is increased, as demonstrated by CMT, then contact veterinarian and/or laboratory to submit samples for culture to determine the actual cause(s) for effective treatment.

*“Good management
is the best way to
prevent mastitis.”*

TREATMENT

Clinical: Isolate affected animals and offspring.

Massage udder, milk out completely 2x/day - dispose of contaminated milk (do not feed to young stock).

Mastitis requires early veterinary systemic and supportive treatment, *e.g.* fluids (severe: IV dextrose, electrolytes), non-steroidal anti-inflammatory agents (flunixin meglumine) and antibiotics.

Antibiotics:

Note: Prior to giving antibiotics, **take milk samples** for bacterial culture and antibiotic sensitivity. Use broad spectrum and then adjust as necessary based on sensitivity.

- Use intra-mammary antibiotic infusions (cow products – use full tube) with sterile technique *e.g.* alcohol swab for teat orifice!

Note: Do not use injectable antibiotic formulations as intra-mammary infusions (up the teat), as they may be irritating to delicate tissue.

- May need injectable antibiotic: macrolides, trimethoprim, tetracyclines, fluoroquinolones disperse well through mammary gland.
- Always consult with your veterinarian for meat/milk withdrawal times for drugs not licensed for sheep or goats (veterinarian can access gFARAD for information: <http://www.cgfarad.usask.ca/home.html> or <http://www.farad.org/>). Use test kits for antibiotic residues (Best if these are evaluated for sheep and goats and meet regulatory requirements for the country. Cow kits are available: Delvo P, Charm SL, and Beta-lactam test kits.)

Note: Antibiotic-resistant strains of *Staphylococcus* are now found in dairy goats.

PREVENTION/CONTROL

Most important preventative for mastitis = Good management, esp. for milking technique/hygiene and bedding/waste management.

- Bedding clean and dry.
- Good drainage around yards, pens, pastures.
- Attention to stocking density, no overcrowding.
- Attention to milking technique: both machine and manual milking.
- Milking order, *e.g.* milk healthy females on lowest lactation number first.
- Equipment management:
 - Sanitation,
 - Replacing machine liners (rubber-yearly; silicone-every 2 years),
 - Service machine regularly at least annually and review effective reserve, vacuum pump capacity, pulsation characteristics.
- Attention to weaning regime: 3-5 days pre-weaning remove/reduce grain, feed low nutrient roughage, or delay weaning until milk production drops.

PART B: BACTERIA, VIRUSES, PRIONS

Cull: any animals that had acute or chronic mastitis, hard lumps, abscesses, asymmetry of udder.

Dry-treating:

Consider taking samples from females prior to dry-off/weaning for bacterial culture and antibiotic sensitivity to be aware of any flock problems and to select appropriate antibiotics for dry treatment.

May consider intra-mammary infusion treatment at weaning or injectable tilmicosin (meat sheep) if there is a high prevalence of clinical and sub-clinical cases. But best to review milking and sanitation management.

CMT (CALIFORNIA MASTITIS TEST)

Adapted from: <http://www.drugs.com/vet/cmt-california-mastitis-test.html>

Designed for CATTLE *Note:* Results not as clearly defined for sheep or goats:

CMT = Inexpensive cow-side test to assist producers to monitor udder health and use good mastitis management practices. CMT reagent reacts with leukocytes (somatic cells) elevated during mastitis.

Test could be used regularly (*e.g.* every 2 weeks) to screen individual udder halves within entire milking herd for subclinical mastitis, characterized by increases in somatic cell count (SCC). Elevations in SCC can indicate mastitis problem in individual or entire herd.

CMT Gel: Degree of gel formation is proportional to numbers of leukocytes (cells) in the mammary gland inflammation. Greater gel formation = higher CMT score (higher number of cells).

Gel results obtained from CMT correlate broadly to Somatic Cell Count (SCC).

- **Positive** CMT reactions = abnormally high SCC. Contact veterinarian when get positive CMT results, for assistance in designing a treatment strategy.
- **Distinct, strong positive gel** (CMT Scores 2 and 3) = ongoing inflammatory response. May be due to:
 - Mechanical injury: Need to identify cause (stray voltage or milking machine problem) and correct.
 - Mastitis-causing organisms: Take samples for culture and antibiotic sensitivity, then treat with appropriate antibiotics.
- **Trace or weak** (CMT Score 1) = suspicious mastitis diagnosis.

May suggest mammary gland recovering from previous infection, or early mastitis.

Either case: Another CMT test should be performed, to determine if mastitis present and treatment needed.

For detailed CMT Procedure, *See Appendix.*



MALIGNANT CATARRHAL FEVER (MCF)

Ovine herpesvirus 2 and Caprine herpesvirus 2

Disease to BE AWARE of, if near bison or deer farms.

SHEEP AND GOATS

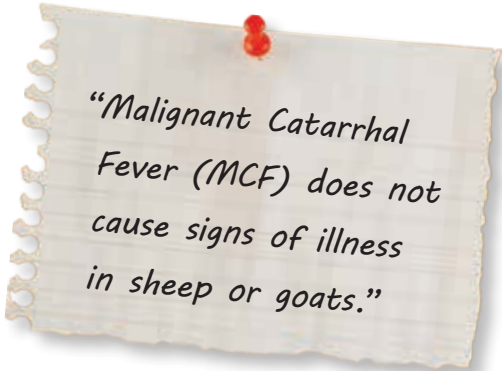
BACKGROUND

Malignant Catarrhal Fever = MCF

Cause: Virus Family: Herpesviridae, subfamily: Gammaherpesvirinae, genus *Rhadinovirus* MCF subgroup MCF virus has 10+ members:

- **Ovine herpesvirus 2 (OHV-2)** Sheep = major cause of MCF worldwide
- **Caprine herpesvirus 2 (CpHV-2)** Goats = can cause MCF in cervids (deer)
- Most sheep and goats are infected, resistant and carriers.
- MCF can be a fatal disease syndrome in many other cloven-hoofed mammals *e.g.* deer, moose, bison, cattle (most North American cattle (*Bos taurus*, *B. indicus*) are fairly resistant.
- Not all animals of susceptible species come down with clinical disease. Disease triggers are unknown.
- **Incubation** can be up to 9 months.

Spread: by direct contact between carrier and susceptible animal. Not spread between clinically infected animals and does not last long in environment.



"Malignant Catarrhal Fever (MCF) does not cause signs of illness in sheep or goats."

SIGNS

No signs in sheep or goats.

Variable signs in susceptible species: lethargy, fever, discharge (eyes, nose, mouth), cloudy eyes, diarrhea, mouth sores. Death can occur in hours to a few weeks.

No treatment.

No vaccine. Techniques for developing vaccine difficult due to virus changing at different stages within body. No attempt at OHV-2 vaccine. Virus has not been successfully grown in lab.

PREVENTION/CONTROL

Do not pasture or house sheep or goats with, or near, susceptible ruminants or where drainage, equipment, personnel etc comes from sheep or goat areas.

Do not transport sheep or goats in same vehicles as susceptible ruminants.

Blood test: Polymerase chain reaction (PCR) assay or enzyme-linked immunosorbent assay (ELISA). Test is helpful, but not 100% to determine carrier state in sheep or goats.

PART B: BACTERIA, VIRUSES, PRIONS

ORF (CONTAGIOUS ECTHYMA/SOREMOUTH)

Zoonosis**SHEEP and GOATS****BACKGROUND**

All ages are susceptible to pustular dermatitis known as contagious ecthyma, orf, or soremouth. Disease may be more severe in goats.

Common worldwide.

Cause: Virus = Group I (dsDNA) Family – Poxviridae Genus – Parapoxvirus Species – Orf virus

- Virus replicates in and damages skin cells.

Spread: Virus is shed from skin and contaminates environment (equipment, feed, fencing etc.).

- Persists for months to years in environment.
- Infection from contact through breaks in skin.

SIGNS

Vesicles or pustules on:

- teats of lactating ewes,
- mouths of young lambs (esp. artificially reared),
- genitalia of rams, where it may to proliferative lesions on head and legs
- or face, ears, coronary band, vulva,

Vesicles become scabby sores, may be painful. Persist 3-6 weeks.

May get secondary bacterial infection.

If on mouth or teats can lead to respective weight loss.

Note: Skin lesions may resemble other diseases *e.g.* cutaneous anthrax.

DIAGNOSIS

Diagnosis of orf is usually based on clinical signs.

Zoonosis Human illness: Similar skin lesions as sheep or goats, may persist for up to 6 weeks, also may have swollen, painful lymph nodes.

TREATMENT

No specific Treatment.

Supportive treatment. **Note:** wear gloves – zoonosis.



Lesions will heal, with normal body immune system.

Antibiotic if necessary to treat secondary bacterial infection.

PREVENTION/CONTROL

Disease is difficult to eliminate once present!

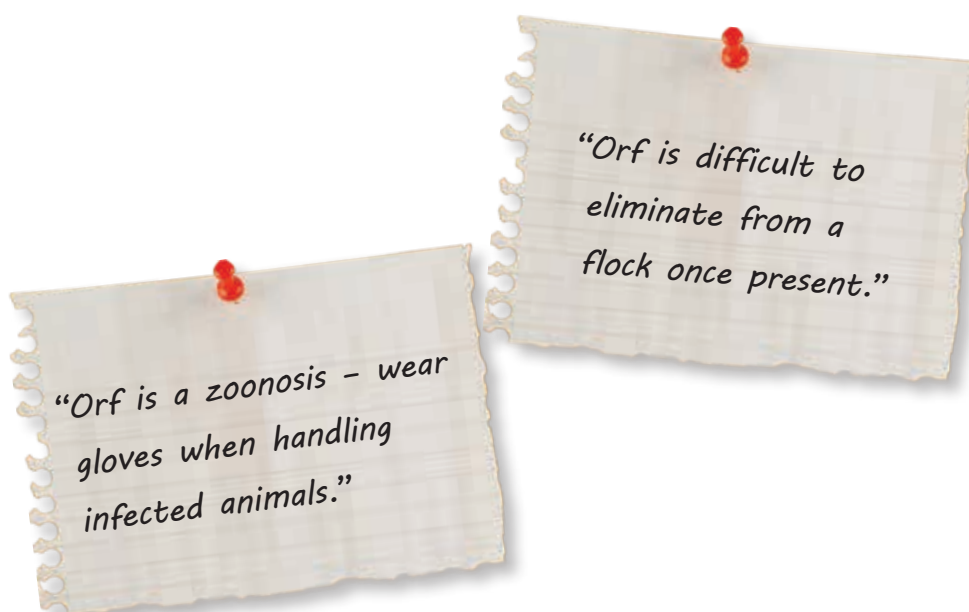
Maintain a closed and virus-free herd. Do not purchase animals with lesions.

Quarantine new animals.

Disinfect:

- Feeding bottles and teats frequently for hand rearing.
- Birthing facilities, if outbreak occurs.
- Vaccine is not licensed in Canada. Can be obtained by veterinarian. Should only be used where virus is present and a problem. Vaccine is given to ewes 8 weeks before lambing. Must vaccinate lambs soon after birth, as there is no transfer of protective antibodies via colostrum.

Note: Live virus (careful handling!) and vaccine scabs may persist.



PART B: BACTERIA, VIRUSES, PRIONS

SCRAPIE

Reportable – All suspected cases must be reported to the CFIA for immediate investigation.

SHEEP and (GOATS)

BACKGROUND

Scrapie is a fatal central nervous system disease. Scrapie is one of the Transmissible Spongiform Encephalopathies (TSE's) and is related to Bovine Spongiform Encephalopathy or "Mad Cow Disease".

Cause: Thought to be an abnormal infectious protein or "Proteinaceous Infectious Particle", also known as a prion.

- Most commonly found in black-faced sheep and crosses. Very in rarely goats.
- No immune or inflammatory response when infected, but no immune suppression.
- Not known to transmit to humans.

Spread: From dam to offspring in utero and via contact with birth materials.

- Incubation usually 2-5 years before clinical signs appear.
- **Males** can get Scrapie but do not appear to transmit the disease.

SIGNS

- May have itching,
- Weight loss,
- Various neurological signs,
- Death in occurs in 1 to 6 months.

NO TREATMENT OR VACCINE

DIAGNOSIS

Live animal: Biopsy lymphoid tissue inside of third eyelid, or rectal tissue biopsy.

Dead animal: Sample of brain stem (obex).

- British Columbia: No cases reported.
- Genotype testing of purebred sheep took place between 2005 – 2009 as part of the National Survey of Scrapie Genetics in Canadian Purebred Sheep. Certain species or genotypes are more resistant to scrapie than others. In BC, 2,728 sheep on 110 farms were tested. <http://www.scrapiecanada.ca/genotyping-NatSurvey.html>
- Scrapie has been found in Alberta, Saskatchewan, Manitoba, Ontario and Quebec.



NATIONAL SCRAPIE CONTROL PROGRAM

- Scrapie Canada <http://www.scrapiecanada.ca/home.html> is a site dedicated to providing scrapie information to sheep and goat producers.
- For details of Scrapie control programs, *See* Section 2. Flock Health Programs. VSFCP.

Note: Scrapie programs are not current practical for very small flocks due to the requirement to necropsy-sample at least one animal older than 2 years annually.

Note: There is also a USA Voluntary Scrapie Flock Certification Program http://www.aphis.usda.gov/animal_health/animal_diseases/scrapie/status_def.shtml



PART C: PARASITES

PART C: PARASITES

PARASITES

Annually Notifiable Disease Sheep mange/scab **Psoroptic mange mite**

Zoonoses *Echinococcus granulosus* **Hydatid cyst**, *Fasciola hepatica*,
Cryptosporidium caninum

SHEEP and GOATS

BACKGROUND

Parasites of Sheep and Goats:

Internal:

- Nematodes
- Cestodes
- Trematodes
- Protozoa

External:

- Flies
- Lice
- Mites
- Ticks

Heavy parasite infection can lead to decreased productivity, and may predispose animal to other diseases.

Many excellent sheep and goat parasite references have been written, *See Bibliography*.

Different parts of BC have different parasite issues, thus will need to design slightly different management control programs depending on location, *e.g.*:

- Northern prairie with dry summers and cold winters: roundworms not survive well on pasture.
- Vancouver Island and some Rocky Mountain areas: liver fluke maybe present.

GOATS:

- Browsers and tend to have less of a parasite problem.
- But do not develop immunity to parasites as well as sheep.
- Also, drug resistance develops more rapidly in goats.



INTERNAL PARASITES

NEMATODES (ROUNDWORMS)

List of Nematodes (Roundworms)

SCIENTIFIC NAME	COMMON NAME	LOCATION
<i>Bunostomum trigoncephalum</i>	Hookworm (GI)	SI*
<i>Chabertia ovina</i>	Large-mouthed bowel worm (GI)	LI*
<i>Cooperia curitae</i>	(GI)	SI
<i>Dictyocaulus filarial</i>	Lungworm	Lung
<i>Haemonchus contortus</i>	Barber pole, Blood worm (GI)	Abomassum
<i>Muellerius capillaris</i>	Nodular lungworm	Lung
<i>Nematodirus battus</i> , <i>N. filicollis</i> , <i>N. spathiger</i>	Thread-necked worm (GI)	SI
<i>Oesophagostomum columbianum</i>	Nodular worm (GI)	LI
<i>Protostrongylus refescens</i>	Lungworm	Lung
<i>Strongyloides papillosus</i>	Threadworm (GI)	SI
<i>Teladorsagia (Ostertagia) circumcincta</i>	Brown stomach worm (GI)	Abomassum
<i>Trichostrongylus axei</i>	Stomach hairworm (GI)	Abomassum
<i>T. colubriformis</i> <i>T. vitrinus</i>	Black scour, Bankrupt (GI)	SI
<i>Trichuris ovis</i>	Whipworm (GI)	LI

* SI = small intestine, LI = large intestine GI = gastro-intestinal

Most important parasites are coloured in red and described below.



PART C: PARASITES

GASTRO-INTESTINAL (GI) NEMATODES

GI nematodes refers to those roundworms that live somewhere in the gastro-intestinal (GI) tract of a sheep or goat. The GI tract can be any/all of the stomach and the intestines.

Understanding GI parasite **life-cycle** is critical to management.

Also See Section 3: Nutrition. Pasture Management.

The basic life cycle = egg passed in feces ⇒ develop into infective stage (usually to larvae – L3) ⇒ ingested by susceptible host ⇒ develop into adult worms ⇒ reproduce and release eggs which are passed in the feces

Times of greatest numbers of GI nematode eggs in the feces:

1. Pregnant females – undergo a **peri-parturient egg rise** (PPER), near parturition = occurs from 2 weeks *before* to 6-8 wks *after* giving birth.
2. Lambs and kids – after being on pasture for 2-4 months.

Thus fecal sampling, at these times, can indicate flock GI parasites.

Dormancy: Worm larvae can go dormant in unfavourable environmental conditions (winter or dry), called “hypobiosis” = arrested larval development, after being eaten by host.

- Post-dormancy syndrome *e.g. Teladorsagia*:
 - Larvae go dormant in abomasal wall of host over winter.
 - In spring get massive re-emergence of worms.
 - Animals become diseased due to large numbers of worms, before parasite eggs are shed (fecal egg count is still negative), called Type II Ostertagiasis.

Infectivity: Period of time on pasture for parasite eggs to become infective larvae = (L3):

- Varies from 7 days to over-winter.
- Under moderate summer conditions is generally about two weeks.

Summer pasture parasite loading: Parasite numbers increase due to an increased number of eggs deposited by grazing dams and offspring. Eggs develop into infective L3.

If these L3 over-winter, then next spring, they infect:

- **Young animals** going to pasture for first time, when they are most susceptible to infection, due to their un-developed immunity to parasites. Young animals:
 - Become heavily infected with developing L3 and may develop illness!
 - Shed eggs heavily as adult worms develop, thus increasing pasture parasite load.
 - Develop immunity over 4-6 months and retain low parasite numbers.

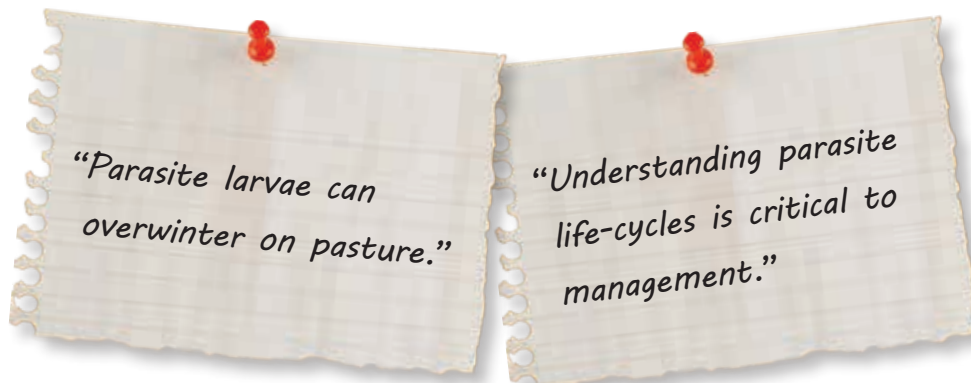
- Retain immunity if stimulated by continual low-level exposure.

Pre-Patent Period (PPP) in host = time from L3 ingestion to adult worm egg-laying:

- Time for GI parasite species vary, but many are approximately 21 days.
- As noted above, host may develop disease in this period but have negative fecal test, *e.g.* young or new animals on heavily infected pasture or Type II disease after larvae emerge from over-wintering dormancy.

Most important clinical GI nematodes:

- *Haemonchus contortus* “Barber pole worm”
 - Length of adult = 1.5-3 cm.
 - Blood feeder, causes anemia, bottle jaw.
 - Thrives in hot moist conditions. *e.g.* problem by late July in hot summer.
- *Teladorsagia circumcincta* (formerly called *Ostertagia*)
 - Adult worm is tiny, need microscope to see in gut.
 - Nutrient feeder, damages lining, causes diarrhea, bottle jaw (edema under the jawline), wasting. Condition called ostertagiasis.
 - Thrives in cool moist conditions.
- *Trichostrongylus columbriformis* and *T. vitrinus* “Bankrupt/Black scour worm”
 - Adult worms are small = 0.5-0.7 cm.
 - Nutrient feeder, but burrowing damages intestine and causes bleeding which results in (dark) diarrhea, bottle jaw.
 - Thrives in cool moist conditions.
- *Nematodirus spp.* “Thread-necked worm”
 - Adult worm length = 1-1.2 cm.
 - May have only species of minor concern in BC, *e.g.* *N. battus*.



PART C: PARASITES

LUNG NEMATODES:

- *Muellerius capillaries* “Nodular lungworm”
 - Length of adult = 1-3cm, in lung tissue.
 - Worms are difficult to see in lung tissue.
 - Require intermediate host: snails and slugs. *Larvae* found in fecal samples.
 - Not considered very serious for sheep but may be problem for goats, causing coughing, dyspnea, pneumonia.

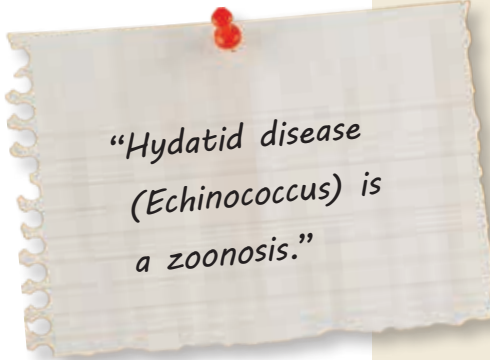
Note: For other individual nematode parasite descriptions and sites in host, See Bibliography *e.g.* Menzies – “Handbook for the control of internal parasite of sheep”.

CESTODES (TAPEWORMS)

Tapeworms require intermediate hosts.

Sheep and goats are either **definitive hosts** (have adult tapeworm, *e.g.* sheep tapeworm) or **intermediate hosts** (have larval stage, *e.g.* sheep measles) for tapeworms.

Normally, tapeworms are not a major cause of disease in sheep and goats. However, the intermediate stages can cause problems in carcasses, which may cause some or all of carcass to be condemned at slaughter, such as from “sheep measles” or cysts from dog tapeworms (*e.g.* *T. ovis*, *T. hydatidigena*) in carcasses.



“Hydatid disease
(*Echinococcus*) is
a zoonosis.”

List of Cestodes

SCIENTIFIC NAME	COMMON NAME AND TYPE OF HOST
<i>Moniezia expansa</i>	“Sheep tapeworm” Sheep or goat = definitive host
<i>Cysticercus tenuicollis</i>	“Dog tapeworm” (<i>Taenia hydatigena</i>) Sheep or goat = intermediate host.
<i>Cysticercus ovis</i>	“Sheep measles” of dog tapeworm (<i>Taenia ovis</i>) Sheep or goat = intermediate host.
<i>Coenurus cerebralis</i> *	“Dog tapeworm” (<i>Taenia multiceps</i>) Sheep or goat = intermediate host.
<i>Echinococcus granulosus</i>	Hydatid disease. Sheep or goat (and other species) = intermediate host.

* Likely no longer in N.A.

Red colour indicates a zoonosis.

"Tapeworms require intermediate hosts to complete their life cycle."

Dog Tapeworms

- Sheep or goats consuming feed or pasture contaminated with dog feces may be infected by eggs or larvae of several tapeworm species, which have dogs or wild canids, as the definitive host.
- Cysticercosis is term used when larvae of dog tapeworms, develop in sheep and goats. The cysts can be in abdominal organs, muscle, or brain, depending on worm species.
- The tapeworm cycle is completed when a dog (or wild canid) eats a raw/undercooked sheep carcass infected with the encysted larvae. The larvae develop into adult worms in the dog, and eggs are shed in its feces into the environment of the intermediate host.

Note: *Echinococcus granulosus* can be contracted by humans: **Zoonosis**.

Dog Tapeworm Species – Sheep and Goats Intermediate (Larval) Hosts

<i>Echinococcus granulosus</i>	
Definitive host	dog, wolf, coyote
Larval stage	<i>E. granulosus</i> – Hydatid cyst
Intermediate hosts	Sheep, goat, cattle, pig, humans, moose, caribou, etc.
Location	Liver, lung, kidneys, spleen, heart, brain, bone
Size of cysts	4-5 mm at 3 months. 20 mm at 6 months.
Appearance	<ul style="list-style-type: none"> • Viable cysts enclosed within fibrous capsule. • Embedded in substance of affected organ. • If fertile, contain many scolices ('hydatid sand'). • Degenerated cysts contain caseous material that 'shells out'.

<i>Taenia ovis (Cysticercus ovis)</i>	
Definitive host	dog, wild canids
Larval stage	<i>Cysticercus ovis</i> (sheep measles)
Intermediate hosts	Sheep, goat
Location	Heart, diaphragm, masseter muscles, oesophagus, all striated muscle
Size of cysts	3-6 mm at 7 weeks. Oval shape, up to 10 mm long.
Appearance	<ul style="list-style-type: none"> • Viable cysts contain fluid and a single protoscolex. • Dead cysts become calcified.

PART C: PARASITES

<i>Taenia hydatigena (Cysticercus tenuicollis)</i>	
Definitive host	dog, wild canids
Larval stage	<i>Cysticercus tenuicollis</i> bladder worms
Intermediate hosts	Sheep, goat, cattle, pig, wild ungulates
Location	Liver and abdominal cavity
Size of cysts	Average 50 mm. Range 1-60 mm.
Appearance	<ul style="list-style-type: none"> Cysts loosely attached to surface of viscera. Contain clear, jelly-like fluid and a single large scolex

Above Table adapted from: http://www.wool.com/Grow_WormBoss_Know-your-worms_Tapeworms-causing-cysts-in-sheep.htm

Sources: Love and Hutchinson (2003). Pathology and diagnosis of internal parasites in ruminants. Post Graduate Foundation in Veterinary Science, University of Sydney. Adapted from Coles (1986); http://www.unbc.ca/nlui/wildlife_diseases/taenia_multiceps.htm, http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.09.05_CYSTICERCOSIS.pdf.

Note: There are additional dog tapeworms that have other intermediate hosts (not sheep or goats).

TREMATODES (FLUKES)

Flukes or Trematodes

SCIENTIFIC NAME	COMMON NAME	INTERMEDIATE HOST
<i>Fasciola hepatica</i>	Liver fluke	Intermediate host=amphibious snail (<i>Lymnaea</i> sp).
<i>Fascioloides magna</i>	Large American liver fluke	Intermediate host=fresh water snail.
<i>Dicrocoelium dendriticum</i>	Small lanceolate fluke	Intermediate host=1° land snail, 2° ant.

* Likely no longer in N.A.

Red colour indicates a zoonosis.

These liver flukes require one or more intermediate hosts, at least one snail species. Fluke eggs are passed in feces, and fecal sampling may identify infection.

F. hepatica can be major problem, causing anemia, bottle-jaw and death in sheep and goats, in areas where parasite is found. Humans can be infected.

Fascioloides magna: Found on Vancouver Island and Rocky Mountains, near wetlands if there are suitable intermediate hosts (aquatic snails).

- Sheep and goats are aberrant, or not normal hosts. Normal hosts are deer and moose.
- Sheep or goats are infected from eating encysted fluke-stage on aquatic vegetation.
- Infection can be fatal even with low numbers, due to liver damage caused by migrating flukes.

D. dendriticum not considered very pathogenic in sheep and goats.

TREATMENT AND CONTROL OF NEMATODES, CESTODES AND TREMATODES

Evaluate clinical condition, before deciding to treat:

- **Body Condition Score** See Section 3 Monitoring Flock.
- **Dag score** See Below.
- **Anemia score** See Below.
- **Weight gain** in young animals.
- **Fecal Sample** See Below.

DAG score.

Dark patches wool below tail called “daggy” in Australia/New Zealand. Wet feces looks like ‘dags’ or points.

Amount of fecal contamination on the hind quarters is used as an indicator of degree of diarrhea.

SCORING

- 0 clean
- 0.5 trace under tail
- 1 distinct dark mark under tail
- 2 dark marks under tail & on each side above belly.
- 3 dark marks down legs half-way to hocks.
- 4 dark marks down legs below hocks.



Note: are other causes of diarrhea than parasitism.

Anemia score.

FAMACHA® = system for anemia scoring, used where *Haemonchus* is a major problem. Used to check flock every 2-3 weeks, then treat specific animals as needed. Can only obtain anemia scoring charts through a veterinarian or by attending a workshop <http://www.scsrpc.org/SCSRPC/FAMACHA/famacha.htm>

Fecal sample.

Screening with fecal tests (if possible), indicates what intestinal parasites are present; however, must be aware of cases when disease may develop prior to fecal egg count, e.g. Type II ostertagiasis. Usually treatment is advised if there is a high fecal egg count or clinical signs and a corresponding fecal egg presence.

Remember Drug-resistance can develop. Important to conserve the effectiveness of de-wormers.

PART C: PARASITES

TREATMENT

Best to de-worm:

- Only those animals that need it.
- Against only what parasites are necessary.

Best TIMES to de-worm:

- Treat dams one month prior to parturition.
- Offspring in mid-summer.
- Also, if necessary, prior to housing for winter.

Treatment Methods:

Best to drench (not inject):

- Increases exposure of parasite to drug (especially for GI parasites).
- Decreases exposure time in body, which decreases chance of building drug resistance and avoids longer drug residues.
- Ensure accurate dose (weigh at least several animals to be able to accurately estimate weights).
- Use dosage indicated on product.
- Give full dose at back of throat.
- To enhance effectiveness, may fast 12 hr in advance (not females in late lactation!).

Check if de-worming successful:

- Re-check fecal 2 weeks post-worming.
- If still large numbers of worm eggs = not successful.
- May be due to wrong drug, inadequate technique or resistant parasite.
- If rotate classes of drugs used for treatment, do so slowly.

Note: No treatment for intermediate stage tapeworms (cysticercosis) in sheep.

De-worm dogs.

Note: NEW Drug-resistance-based treatment concept from Ontario research:

Do not move de-wormed animals straight onto totally clean pasture.

Any parasites in host left after treatment and shedding eggs tend to be drug-resistant and will contaminate clean pasture.

Hold on old pasture for 3-5 days, then animals will have low numbers of both sensitive and resistant parasites to shed on clean areas.

Products:

Choose de-wormer appropriate for:

- Parasite species and stage of infection.
- Time of year and management.
- Production stage *e.g.* pregnant females.
- Safety.
- Near market time for meat or milk, pay attention to withdrawal times.
- May need veterinary approval or prescription for drug use.

Categories of De-worming Products:

Benzimidazoles ("White drenches")			
Fenbendazole <i>(USA drench approved for goat)</i>	<ul style="list-style-type: none"> • all nematodes and adult tapeworms, also eggs of both. 		Safeguard, Panacur
Albendazole	<ul style="list-style-type: none"> • all nematodes, tapeworms, liver flukes 		Valbazen
Imidazothiazoles and Tetrahydropyrimidines ("Yellow drenches")			
Levamisole – <i>no longer made in Canada or USA.</i>	<ul style="list-style-type: none"> • ovicidal and best for adult worms (reduced against larval stages), good for lungworm! 		Levisol,
Pyrantel	<ul style="list-style-type: none"> • toxic dose close to therapeutic dose. 		Tramisol
Morantel tartrate <i>(USA feed formulation approved for goat)</i>	<ul style="list-style-type: none"> • not effective for immatures. 		Rumatel
Macrolides or Macrocytic Lactones			
Avermectins	<ul style="list-style-type: none"> • most nematodes, some external parasites (sucking lice, nose bots, adult keds, mange) 	Ivermectin*	Ivomec, Merial, Noromectin
	<ul style="list-style-type: none"> • Withdrawal – meat: Drench sheep 15 days 	Doromectin	
	<ul style="list-style-type: none"> • Not tapeworms or flukes. 	Eprinomectin	Eprinex (pour on)
Milbemycins	<ul style="list-style-type: none"> • Drug stored in fat tissue, released slowly – long withdrawal times for meat and milk 	Moxidectin <i>Withdrawal –meat: Drench sheep 21days</i>	Dectomax, Cydectin
Amino-Acetonitrile Derivatives			
Monepantel	<ul style="list-style-type: none"> • new drug in UK, Australia • nematodes and immature forms, particularly <i>Haemonchus</i>. Also currently-resistant worms. 		Zolvix

***Approved for use in sheep and goats in Canada.**

Others require veterinary prescription (extra-label usage).

PART C: PARASITES

PREVENTION/CONTROL

GOAL: Reduce pasture contamination with parasites.

See Section 3 Part D Pasture Management

Fecal testing:

- Use fecal screening to determine which gastro-intestinal parasites are in flock. Do NOT test in winter due to dormant parasites and thus false negatives.
- Best time to fecal test: Dams: near parturition. Offspring: at 2-4 months old, when on pasture.

Quarantine New animals: New animals may bring new species or **drug-resistant worms**. Fecal test and treat as needed while in quarantine. Then re-check fecal 14 days after treating.

Where young stock are kept separated from dams, do not graze on same pastures. Dams can go on more heavily contaminated pastures if health is monitored.

Feed Additive (being developed): Nematophagus fungi (*Duddingtonia flagrans*). Fungus grows in sheep and goat feces. Fungal hyphae trap and infect newly hatched larvae. Occurs naturally, but to get necessary activity in sheep, must feed daily for 60 days before birthing time to reduce the peri-parturient egg rise. Currently too expensive, but bolus for slow release being developed.

DOG (CANID) TAPEWORM CONTROL

Any dog allowed near sheep, or near water or areas that drain towards sheep, needs to be de-wormed monthly and checked for tapeworms.

Note: Newly infected dogs have 6-9 week period before they begin shedding eggs (negative fecal egg counts), while larvae grow to adult tapeworms.

Wormers for DOGS: Many routine dewormers for dogs, particularly those purchased over-the-counter, are not effective for tapeworms. Ensure the product you use is labeled for tapeworms.

- Praziquantel (Droncit® tablets or injectable)
- Praziquantel+Pyrantel pamoate+Febantel (Drontal® Plus tablets)
- Nitroscanate (Lopatul® tablets)
- Epsiprantel (Cestex® tablets)

Raw sheep meat must NOT be fed to dogs (or scavenged by wild canids). Meat for dogs must be cooked thoroughly (internal temperature using meat thermometer of 72°C) or frozen to -18°C for a minimum of 10 days.

"Evaluate the clinical condition of your animals before deciding to treat for parasites."

PROTOZOA

List of Internal Parasites – Protozoa

SCIENTIFIC NAME	NAME OF DISEASE
<i>Eimeria</i> spp.	10+ species – Coccidiosis
<i>Cryptosporidium parvum</i>	Cryptosporidiosis
<i>Neospora caninum</i>	Neosporosis
<i>Sarcocystis</i> spp.	Sarcocystosis
<i>Toxoplasma gondii</i>	Toxoplasmosis

Red colour indicates a zoonosis.

Eimeria spp. (Coccidiosis)

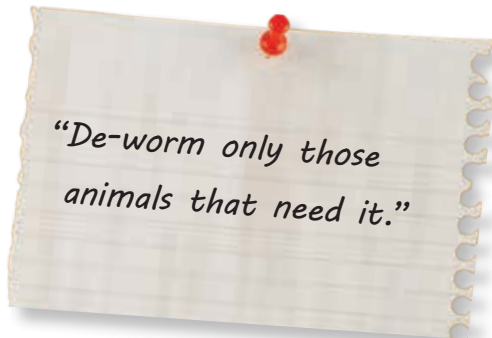
Eimeria genus of protozoa causes what is known as coccidiosis. There are numerous species of *Eimeria*, but not all species cause disease. *Eimeria* are now considered to be host specific and are not believed to be transmitted between sheep and goats or other animals. The names of some of the *Eimeria* spp. are still being resolved.

Eimeria are found in most sites.

Eimeria are normally present in low number in healthy sheep and goats. Sheep and goats develop a relative immunity to the species in their environment. Immunity usually develops by 5 months of age. A continual low-level of exposure is required for persistent immunity.

Life Cycle:

- Oocysts passed in feces of sheep or goat.
- In environment become “infective sporocysts” which contain sporozoites.
- These are ingested by another sheep or goat and sporozoites invade host intestinal cells and become schizonts.
- Each schizont forms many merozoites, which break out of host cell and invade new host cells and make new schizonts. The number of these cycles depends on *Eimeria* species.
- Final stage is production of new oocysts to shed into environment to infect new host sheep or goats.
- Oocysts are quite resistant to disinfectants and may over-winter.
- Disease usually occurs in animals less than 5 months of age and is usually related to contaminated environment and stress.



“De-worm only those animals that need it.”

PART C: PARASITES

Signs:

- Subclinical: poor growth, weight loss, poorly formed fecal pellets
- Clinical degree varies:
 - Per-acute: severe blood loss in intestine, sudden death
 - Weak, abdominal pain, pasty to watery to bloody (fresh or dark blood) feces, straining, tail and hind end stained, dehydration.
 - Diarrhea, weight loss.

Detection:

- History, clinical signs, necropsy. Fecal floatation is of little value as oocysts are “normal” and their absence does not mean there are no *Eimeria* as oocyst production varies.

Cryptosporidium parvum (Zoonosis)

- Small coccidian protozoa that infects small intestine.
- Infects sheep, goats, cattle, horses, deer, poultry, humans (gastro-intestinal disease).
- Life cycle similar to *Eimeria* above, but short, can be completed in 1 week and oocysts produced by the host may re-infect the same animal. The oocysts are very resistant.
- Signs: Young animals, often <2 weeks of age, acute white, yellow watery diarrhea, lasting days to 2 weeks, mild to severe. Causes intestinal damage, mal-digestion.
- Treatment: supportive fluid therapy and good management.

Neospora caninum: Similar life cycle to *Sarcocystis* below. More likely abortion or nervous disease.

Sarcocystis spp.: Many species of cyst-forming protozoa.

- *Life cycle*: Begins with definitive carnivore host passing oocysts/infective sporocysts. Sporocyst-contaminated feed eaten by intermediate herbivore host. Sporozoites (from sporocysts) penetrate host-intestinal mucosa and enter endothelial cells of blood vessels, where produce 3 cycles of merozoites, over 8-10 weeks. Finally, merozoites enter cardiac and skeletal muscle to develop into sarcocysts. Carnivore eats sarcocyst-infected herbivore.

“The goal of parasite control is to reduce pasture contamination.”

- Sheep or goat infection with sporocysts usually subclinical, but may cause abortion or neuromuscular weakness, poor growth, anemia. Depends on dose ingested and *Sarcocystis* species: disease more common with *S. tenella* (sheep), *S. capracanis* (goat).
- No approved treatment. Prevent carnivore consumption of raw carcasses and carnivore-fecal contamination of feeds.

Toxoplasma gondii: See Abortion in Part B of this section.

TREATMENT AND CONTROL OF EIMERIA

TREATMENT

Goals:

1. Prevent increased numbers of eggs in environment.
 - Address environment: improve sanitation, and use good management to reduce stressors.
2. Control infection in lambs until develop good immune system.
 - Supportive care for diarrhea and anemia (*Note*: intestinal lining damage), balanced electrolyte solution.
 - Antibiotics if bacteria invaded and have systemic infection.
 - Coccidiostat usually only useful to reduce additional cases.



CONTROL

Limit stress factors, esp. at weaning, *e.g.* ensure young are eating solid, nutritious feeds, avoid crowding and competition. Provide good housing, ventilation, handling facilities etc.

Prevent fecal contamination of feed and water:

- Feed off ground.
- Ensure animals cannot get into or defecate in feed or water, *e.g.* appropriately sized keyhole feeders.
- Ensure waterers don't leak and cleaning methods are not creating a wet environment with high humidity, which favours coccidial growth.
- Ensure young stock have clean, dry bedding.

PART C: PARASITES

Reduce stocking densities to reduce stress and to decrease the numbers of coccidia shed, especially where young-stock are housed.

Improve sanitation.

Caution: Young animals need to develop immunity from exposure to low levels.

If not exposed to low levels of coccidia when young, will develop disease at later age.

Use Coccidiostats, if necessary. Start before time of risk:

- If high stocking rate/ indoor facility: feed ewes coccidiostat prior to parturition + until weaning.
- For young stock: feed for 90 days beginning from 2-4 weeks of age.

Lasalocid = Only product licensed for sheep in Canada (dose at 36 mg/kg in the feed).

Other drugs require a veterinary prescription. Coccidiostats may be mixed with milk replacer, creep feed, water, mineral mix.

Note: For coccidiostat drugs:

- Prolonged Amprolium usage decreases thiamine uptake and causes polioencephalomalacia-like condition. However, adding thiamine to the diet will decrease the effect of amprolium.
- Excessive monensin is fatal. The drug has a low safety threshold. Highly toxic to horses.
- Long term sulphonamides cause kidney damage and may not work against resistant coccidias.



EXTERNAL PARASITES

INSECTS: FLIES, LICE, MITES, TICKS.

List of External Parasites

TYPE	SCIENTIFIC NAME	COMMON NAME
Lice	<i>Bovicola (Damalinia) ovis</i>	chewing lice
Lice	<i>Linognathus setosus</i>	sucking lice "long-nosed louse" "sheep-faced louse"
Mites	<i>Chorioptes bovis</i> (Also – <i>C. ovis, caprae, cuniculi, equi</i>)	leg and scrotal mange
Mites	<i>Psoroptes ovis</i>	"sheep scab" Notifiable
Mites	<i>Sarcoptes scabiei</i>	scabies
Wingless fly	<i>Melophagus ovinus</i>	"sheep ked"
Fly larvae	<i>Oestrus ovis</i>	"nose bot"
Myiasis (Fly Strike) (Maggots)	<i>Lucilia sericata, Calliphora spp, Phormia regina, Protophormia terranova, many other species</i>	greenbottle blowfly, bluebottle fly, blackbottle fly. Lay eggs in wounds

Flies

Sheep keds *Melophagus ovis*: 6-legged, wingless flies. Has blood meal and causes irritation. Lives on host. Common in sheep, not common in goats.

Nose bots *Oestrus ovis*: Flies lay eggs in nostrils. Fly larvae migrate to nasal cavity, then frontal sinus, where they grow to third stage. Then they pass out to pupate in soil. Larvae causes irritation, nasal discharge.

Fly strike or Myiasis: Blowflies lay eggs in wet areas of host. Maggots secrete enzymes and feed on damaged tissue (anus, wounds, prepuce, back).

Lice

Biting lice most common. *Damalina ovis* in sheep, *D. caprae* in goats. Causes itching. Lives on host.

Sucking lice *Linognathus setosus*: Sheep only. Mainly on face. Causes itching, possible blood loss.

Mites

Psoroptic mange *Psoroptes ovis* on sheep, **Notifiable** *P. caprae* on goats. Highly contagious. Causes severe itching, skin damage. Rare, perhaps gone from NA.

Foot scab *Chorioptes ovis* on sheep, *C. caprae* on goats. Causes itching, skin damage on lower limbs, scrotum, brisket, eyes.

PART C: PARASITES

Ticks 8-legged. Attach to host, feeds, then drops off. Feeds on mammal blood at several stages in life cycle.

TREATMENT AND CONTROL OF EXTERNAL PARASITES

Fly strike – clip wool/hair, kill maggots, treat wound, control for flies.

Keds – shear and treat with topical agents or avermectins *e.g.* Ivomec.

Nose bots – mid-summer and mid-winter treatments with avermectins *e.g.* Ivomec.

Lice – treat twice–14 days apart. Avermectins will treat sucking lice, but not biting lice.

External Parasite Products used in Sheep and Goats:

- Rotenone powder (Co-op Louse Powder) for sheep and goats
- Rotenone and Sulphur powder (Dri Kil Dust)
- Carbaryl powder (Dusting Powder)
- Carbaryl spray (Sevin)
- Permethrin (Doktor Doom, or Ectiban 25 Fly-Killer *Note:* 90 meat withdrawal).

Note: Pour on organophosphate products are **not** approved. Fly ear tags **not** approved.

See M. Smart and C. Clark for other external parasite products for animal and premises.



PART D: DISEASE INFORMATION SUMMARIES

Sheep and Goat Diseases – General Reference List

SHEEP & GOAT DISEASES/ PRIMARY AFFECTED SYSTEM(S). SHEEP/GOATS/BOTH. <i>(Note: Diseases may appear more than once by different names in the list)</i>	SKIN/HAIR-WOOL	OCULAR/ORAL	DIGESTIVE	RESPIRATORY	CARDIO-VASCULAR/ LYMPHATICS/ENDOCRINE	MUSCULO/SKELETAL	REPRO-ABORTION	REPRODUCTIVE (INCL. UDDER)	URINARY	NEUROLOGICAL	FOUND DEAD
Acute Bloody Enteritis/Enterotoxemia (<i>Clostridium perfringens</i> Types B & C)			Y								Y
Agalactia (lack of milk)								Y			
Atypical/Enzootic Pneumonia (<i>Mycoplasma ovinipneumonia</i>)				Y							
Big Head / Malignant edema (<i>Clostridium novyi</i> +)	Y										
Blackleg/Malignant Edema (<i>Clostridium chauvei</i>)						Y					Y
Bloat			Y								
Blue Bag Mastitis/Hard bag mastitis								Y			
Border Disease Virus/Hairy shakers	Y						Y			Y	
Braxy/Malignant Edema (<i>Clostridium septicum</i>)			Y								Y
Bronchopneumonia (Parainfluenza 3 virus-PI3 Adenoviruses Respiratory Syncytial Virus)				Y							
<i>Brucella</i> spp./Brucellosis/Epididymitis/Abortion							Y	Y			
Brucellosis – <i>Brucella ovis</i> , <i>B. mellitensis</i> , <i>B. abortus</i>							Y	Y			
<i>Campylobacter fetus</i> & <i>jejuni</i> /Vibriosis			Y				Y				
Caprine Arthritis & Encephalitis CAE				Y		Y				Y	
Caprine B mannosidosis										Y	
Caprine Herpes Virus 1							Y				
Caseus Lymphadenitis CL/Pseudotuberculosis	Y				Y						
Circling Disease/Listeriosis										Y	
<i>Chlamydophila abortus</i> /Ovine Enzootic abortion							Y				
<i>Clostridium chauvei</i> /Blackleg/Malignant edema						Y					Y
<i>Clostridium novyi</i> /Big Head/Malignant edema	Y										
<i>Clostridium perfringens</i> /Enterotoxemias/Yellow lamb											
<i>Clostridium tetani</i> /Tetanus						Y				Y	
Coccidiosis			Y								
Contagious Ecthyma/Orf/Soremouth	Y	Y									
Copper: Deficiency (Swayback/Enzootic ataxia) or Toxicity				Y	Y					Y	Y
<i>Coxiella burnetii</i> /Q Fever							Y				
<i>Cryptosporidium</i> spp.			Y								
Dental disease		Y	Y								

PART D: DISEASE INFORMATION SUMMARIES

SHEEP & GOAT DISEASES/ PRIMARY AFFECTED SYSTEM(S). SHEEP/GOATS/BOTH. <i>(Note: Diseases may appear more than once by different names in the list)</i>	SKIN/HAIR-WOOL	OCULAR/ORAL	DIGESTIVE	RESPIRATORY	CARDIO-VASCULAR/ LYMPHATICS/ENDOCRINE	MUSCULO/SKELETAL	REPRO-ABORTION	REPRODUCTIVE (INCL. UDDER)	URINARY	NEUROLOGICAL	FOUND DEAD
Enterotoxemia Type D/Pulpy kidney/Overeating disease			Y								Y
Enterotoxemia Type C/Acute bloody enteritis			Y								Y
Entropion		Y									
Enzootic abortion/ <i>Chlamyophila abortus</i>							Y				
Enzootic ataxia/Swayback/Copper deficiency										Y	Y
Enzootic Nasal Tumour (ENT virus)		Y		Y							
Enzootic/Atypical Pneumonia (<i>Mycoplasma ovipneumonia</i>)				Y							
Epididymitis/ <i>Brucella ovis</i>								Y			
<i>E. coli</i> (<i>Escherichia coli</i>)			Y								
Floppy kid syndrome			Y		Y						
Foot Abscess						Y					
Footrot						Y					
Foot scald						Y					
Gastro-intestinal Nematodes			Y		Y						Y
Goitre			Y		Y						
Grain overload/Lactic acidosis			Y		Y						Y
Grass Tetany			Y							Y	
Hairy Shakers/Border Disease Virus	Y						Y			Y	
Hard Bag Mastitis/ Blue bag Mastitis								Y			
Hypocalcemia/Milk Fever					Y					Y	
Jaagsiekte/Pulmonary Adenomatosis				Y							
Johne's Disease/MAP (<i>Mycoplasma avium paratuberculosis</i>)			Y								
Joint Ill/Navel infection					Y	Y					
Kertaoconjunctivitis/Pink eye		Y									
Ketosis/Pregnancy Toxemia			Y							Y	
Lactic Acidosis/Grain overload			Y		Y						
Leptospirosis (<i>Leptospira spp.</i>)							Y		Y		
Listeriosis/Circling disease (<i>Listeria monocytogenes</i>)										Y	
Liver Flukes			Y		Y						
Lung worm				Y							
Maedi Visna/Ovine Progressive Pneumonia				Y		Y				Y	
Malignant Catarrhal Fever (Ovine Herpes 2 Caprine Herpes 2)					Y						

SHEEP & GOAT DISEASES/ PRIMARY AFFECTED SYSTEM(S). SHEEP/GOATS/BOTH. <i>(Note: Diseases may appear more than once by different names in the list)</i>	SKIN/HAIR-WOOL	OCULAR/ORAL	DIGESTIVE	RESPIRATORY	CARDIO-VASCULAR/ LYMPHATICS/ENDOCRINE	MUSCULO/SKELETAL	REPRO-ABORTION	REPRODUCTIVE (INCL. UDDER)	URINARY	NEUROLOGICAL	FOUND DEAD
Malignant Edema/ Blackleg, Braxy (<i>Clostridium sordelli</i> , <i>septicum</i> , <i>chauvei</i>)	Y				Y						Y
MAP/Johne's Disease/Paratuberculosis			Y								
Mastitis (Also: Blue/Hard Bag mastitis)								Y			
Milk Fever/Hypocalcemia					Y					Y	
<i>Mycoplasma</i> spp.				Y			Y				
Navel Infection/Joint Ill					Y	Y					
<i>Neospora caninum</i>							Y				
Nose bots				Y							
Orf/Contagious ecthyma/Sore mouth	Y	Y									
Overeating Disease/Enterotoxemia (<i>Clostridium p.</i> -Type D)			Y								Y
Ovine Enzootic Abortion (<i>Chlamydomphila abortus</i>)							Y				
Ovine Herpes Virus 1				Y							
Ovine Progressive Pneumonia/Maedi Visna				Y		Y				Y	
Paratuberculosis/Johne's Disease			Y								
Pink eye/Kertaconjunctivitis		Y									
Pizzle Rot/Ulcerative Posthitis								Y	Y		
Pneumonic Pasteurellosis (<i>Mannheimia</i> (<i>Pasteurella</i>) <i>haemolytica</i>)				Y							Y
Polioencephalomalacia/Thiamine (Vitamin B1) deficiency										Y	Y
Pregnancy Toxemia/Ketosis			Y							Y	
Pseudotuberculosis/Caseous Lymphadenitis CL	Y				Y						
Pulmonary Adenomatosis/Jaagsiekte				Y							
Pulpy Kidney/Enterotoxemia (<i>Clostridium perfringens</i> Type D)			Y								Y
Q Fever/ <i>Coxiella burnetii</i>							Y				
Rabies										Y	
Rectal Prolapse			Y					Y			
Retained placenta											
Ring womb								Y			
<i>Salmonella</i> spp.			Y				Y				
Scours			Y								
Scrapie	Y									Y	
Sheep keds	Y										
Sheep measles/Tapeworm – dog						Y					

PART D: DISEASE INFORMATION SUMMARIES

SHEEP & GOAT DISEASES/ PRIMARY AFFECTED SYSTEM(S). SHEEP/GOATS/BOTH. <i>(Note: Diseases may appear more than once by different names in the list)</i>	SKIN/HAIR-WOOL	OCULAR/ORAL	DIGESTIVE	RESPIRATORY	CARDIO-VASCULAR/ LYMPHATICS/ENDOCRINE	MUSCULO/SKELETAL	REPRO-ABORTION	REPRODUCTIVE (INCL. UDDER)	URINARY	NEUROLOGICAL	FOUND DEAD
Sore Mouth/Contagious ecthyma/Orf	Y	Y									
Swayback/Copper Deficiency										Y	Y
Tapeworm – dog/Sheep measles						Y					
Tetanus/ <i>Clostridium tetani</i>						Y				Y	
Thiamine (Vitamin B1) deficiency/Polioencephalomalacia										Y	Y
Toxoplasmosis/ <i>Toxoplasma gondii</i>							Y				
Ulcerative Posthitis/Pizzle Rot								Y	Y		
Urinary Calculi (Urolithiasis)/Water belly									Y		
Uterine Prolapse								Y			
Vaginal Prolapse								Y			
Vitamin E & Selenium deficiency/White Muscle disease						Y				Y	
<i>Vibriosis/Campylobacter fetus & jejuni</i>							Y				
Water Belly/Urinary calculi (Urolithiasis)									Y		
White Muscle Disease/Vitamin E & Se deficiency						Y				Y	
Yellow Lamb Disease/ <i>Clostridium perfringens</i> Type A			Y		Y						

For more information on these diseases, See Bibliography, particularly:
 Canadian Sheep Federation (Virtual Tool Box and Food Safety – Producer
 Program) Ontario Sheep Marketing Agency.
 Schoenian, S.
 Smart, M.

DISEASES SHARED BETWEEN SPECIES

The following are examples of the infectious diseases that can be transmitted between species, e.g. “Sheep↔Goats” (between Sheep and Goats). These are listed to raise awareness that biosecurity considerations are necessary if multiple species are present on one farm.

Note: This is not an exhaustive list.

Examples of Diseases Transmissible Sheep↔Goat

Bluetongue
Caseous lymphadenitis <i>Corynebacterium pseudotuberculosis</i>

Bluetongue
Abortion agents <i>Chlamydophila</i> , <i>Coxiella burnetii</i> Q Fever, <i>E. coli</i> , <i>Salmonella spp.</i> , Leptospirosis, (possibly – <i>Mycoplasma spp.</i>)
Foot rot
Johnes <i>Mycobacterium avium paratuberculosis</i> (MAP)
Parasites: Gastro-intestinal and lung Nematodes, Trematodes, Cestodes, <i>Cryptosporidium sp.</i> , Chorioptic mange mites, Nose bots, Keds.
Caprine Encephalitis Arthritis virus (Goats), Maedi-Visna virus /Ovine Progressive Pneumonia (Sheep)

Some of Diseases Transmissible Sheep and Goats ⇔ Cattle

Bovine Virus Diarrhea Cattle ⇔ Sheep and Goats
Bluetongue Cattle ⇔ Sheep, Deer and other Ruminants. Must have specific midges!
Johnes <i>Mycobacterium avium paratuberculosis</i> (MAP) Cattle strain: Cattle ⇔ Goats, Cattle, Deer, rarely Sheep. Sheep strain: Sheep ⇔ Cattle (not infected but shed), rarely Goats.
Malignant Catarrhal Fever (MCF) Ovine herpes virus 2 (OHV-2) Sheep Sheep ⇔ Most Cattle fairly resistant, problem for farmed Bison, Deer.

Some of Diseases Transmissible Sheep and Goats ⇔ Other Animal Species

Bluetongue Goats ⇔ deer and other ruminants. Must have specific midges!
Johnes <i>Mycobacterium avium paratuberculosis</i> (MAP) Domestic ruminants ⇔ Wild ruminants. Also, Ruminant disease, shared by Non-ruminants (infected but may not be diseased).
Malignant Catarrhal Fever (MCF) Sheep and Goats ⇔ fatal disease for many Ruminants (deer, moose, elk etc) and Pigs.
Many parasites: Gastro-intestinal and Lung Nematodes, Trematodes, Cestodes, some Protozoa). Sheep and Goats ⇔ Deer and other wild Ruminants, incl. Llamas and Alpacas. <i>e.g. Tapeworms</i> <i>T. hydatigena</i> , <i>E. granulosa</i> , <i>T. ovis</i> Dog (canids) ⇔ Sheep, Goats, wild Ungulates. Toxoplasmosis Domestic cat ⇔ Sheep, Goats, other Mammals. Meningeal worm <i>Paralaphostrongylus tenuis</i> Eastern White-tailed deer ⇔ Sheep and Goats.
Salmonella spp. , Leptospira spp. , Toxoplasma gondii , Coxiella burnetii etc.: Can be spread by mammals and birds on the farm, <i>e.g.</i> by rats and mice ⇔ Sheep, Goats.

PART D: DISEASE INFORMATION SUMMARIES

SUMMARY OF POSSIBLE CAUSES FOR “DOING POORLY”

POSSIBLE CAUSES FOR ANIMALS DOING POORLY (CHRONIC WASTING)

Check for:

- Johne’s disease
- Dental disease
- Parasitism – usually gastro-intestinal parasites
- Ovine progressive pneumonia (Maedi Visna) or Caprine Arthritis Encephalitis (CAE)
- Caseous lymphadenitis (CL) abscesses – may be internal
- Scrapie
- Foot rot
- Malnutrition, nutritional deficiencies, toxicities.
- Other management problems *e.g.* housing, flock status and competition, etc.

DIAGNOSING CHRONIC INFECTIOUS DISEASES

The presence of chronic infectious disease in flock often difficult to determine:

- Diseases are relatively slow onset with long and variable periods of incubation in the animal and testing, even if available, may result in false negatives.
- Many animals in flock may be infected, while only a few will show clinical signs.

Treatment and control:

- Monitor health and body condition of animals in flock.
- Isolate animals showing signs of wasting and attempt to determine cause among list above.
- Evaluate management for precipitating causes of disease entry to, or spread within the flock and for sources of stress *e.g.* crowding, contamination, nutrition etc.
- Decide which diseases can be reduced or eliminated from flock and adopt suitable control protocols. For specific control protocols for the diseases below, *See* individual disease discussions in Part B of this Section:
 - Caprine Arthritis Encephalitis
 - Maedi Visna (Ovine Progressive Pneumonia)
 - Johne’s disease
 - Caseous lymphadenitis
 - Scrapie



SUMMARY OF RESPIRATORY DISEASE

RESPIRATORY DISEASE

Upper airway

- Enzootic Nasal Tumour – β -retrovirus
- Nose bots – *Oestrus ovis* fly
- Laryngeal chondritis – edema of larynx

Lung

Pneumonia

- Bronchopneumonia
 - Parainfluenza 3 virus
 - Adenoviruses
 - Respiratory Syncytial virus
- Atypical (enzootic) Pneumonia – *Mycoplasma ovipneumoniae*: Sheep
- Acute Severe Pneumonic Pasteurellosis – *Mannheimia (Pasteurella) haemolytica*
- Contagious Caprine Pleuropneumonia: Goats, v. rare disease in North America.

Chronic Progressive Pneumonia

- Maedi-Visna (Ovine Progressive Pneumonia)
- Ovine Pulmonary Adenomatosis – Jaagsiekte: Sheep retrovirus, contagious lung cancer.
- Caprine Arthritis Encephalitis (CAE): pneumonia, pneumonia form of disease.
- Parasitic pneumonia, uncommon.

Lung Abscess

- Caseous lymphadenitis

Treatment and Control

- Clinical and history: Age of animal, Upper vs. lower Respiratory, Acute vs chronic.
- *Oestrus ovis*: See Parasites.
- Enzootic Nasal Tumours: No treatment, cull.
- Pneumonias: **Note:** Attention to environment: housing, introductions, stressful conditions.

Acute pneumonia, young animals + fever:

- **Plan with veterinarian:**

PART D: DISEASE INFORMATION SUMMARIES

- When, which and with what to treat.
- How to assess response (or lack of response) to treatment.
- When to cull.
- If, when and what to use as prophylactic treatment.
- Watch for concurrent Coccidiosis.
- **Antibiotics:** Oxytetracycline LA (long-acting).
Tilmicosin (Micotil) For **Sheep only** (licensed),
TOXIC to Goats.
Ceftiofur (Excenel) Sheep (licensed).
- Necropsy animals that die for diagnostic results.

Chronic Pneumonia/Abscesses

- Check for respiratory conditions above.
- Limited, no treatments/cures: Supportive treatment and cull, especially Jaagsiekte sheep.

SUMMARY OF SCOURS (DIARRHEA)**SCOURS/DIARRHEA***Nutritional scours***Feed-related:**

- Due to feed composition (poor or inadequate colostrum, excess or inappropriate feed, feed deficiencies). *Note:* Possible milk-replacer scours
- Diet alterations
- Toxic plants
- Lush pasture

General stress – Weakening or predisposing conditions:

- Weaning
- Facility or handling problems (sanitation, crowding)
- Weather extremes
- Shipping

*Infectious scours***Younger lambs and kids:**

- *Escherichia coli*
- Rotavirus

- *Cryptosporidia* **Zoonosis**
- *Rare* - Salmonella
- *Giardia* **Zoonosis**

Older lambs and kids:

- Parasitism, including coccidia – *See* Parasites
- *Clostridium perfringens*, – *See* Clostridial Diseases

Diarrhea in older animals:

- Parasitism, *See* Parasites
- Johnes Disease, *See* Johnes
- Toxicity
- ... many others

Treatment and Control

Attention to management and environment:

- Improve sanitation
- Reduce stressors in management of nutrition, housing or handling

Supportive treatment for dehydration, *esp.* in young animals:

- Sterile polyionic fluid solutions intravenous or subcutaneous
- May use glucose, non-steroidal anti-inflammatory drugs
- May continue with milk if can drink, depending on intestinal damage
- Rarely antibiotics

Diagnosis of infectious scours in young kids requires laboratory fecal samples, and if available fresh necropsy samples. **Note:** Can be mixed infection with several agents.

Older animals: Treat parasitic problem or as necessary for specific disease condition.



PART E: MEDICATIONS

PART E: MEDICATIONS**BACKGROUND**

Few drugs are licensed for sheep and goats in Canada. This is not to make the life of a sheep/goat owner or veterinarian difficult, but to protect producers, consumers and the environment, from drug residues and drug resistance. Unfortunately, developing and licensing drugs for different species is a costly, time-consuming process.

See Bibliography – Medications section: Indicates sources that list medications for small ruminants.

Note: Regulations, types of drugs and drug availability changes, so best to check with veterinarians or other up-to-date sources for current product information.

Note: Medications are useful for specific diseases, under specific conditions. Where possible try to have a confirmed diagnosis before attempting treatment.

BANNED DRUGS

The following medications are NOT for use in food-producing animals;

- Chloramphenicol
- 5-nitrofurantoin compounds
- Clenbuterol (and salt or derivatives)
- 5-nitroimidazole compounds
- Diethylstilbestrol or other stilbene compounds

Also veterinarians are preferentially not to use **Category 1-III antimicrobials** due to human health importance: <https://www.canadianveterinarians.net/documents/antimicrobial-use-in-animals>

The Category 1 antimicrobials are considered of very high importance in human medicine as they meet the criteria of being essential for the treatment of serious bacterial infections, with limited or no availability of alternative antimicrobials for effective treatment in case of emergence of resistance to these agents.

Examples include:

- Carbapenems
- Cephalosporins – the third and fourth generations
- Fluoroquinolones
- Glycopeptides
- Glycylcyclines
- Ketolides
- Lipopeptides

- Monobactams
- Nitroimidazoles (metronidazole)
- Oxazolidinones
- Penicillin – β -lactamase inhibitor combinations
- Polymyxins (colistin)
- Streptogramins
- Therapeutic agents for tuberculosis (e.g., ethambutol, isoniazid, pyrazinamide and rifampin)

EXTRA-LABEL DRUG USE (ELDU)

Health Canada Policy on Extra Label Drug Use (ELDU) is to promote the prudent use of drugs in food-producing animals, while minimizing the risks to public health, animal safety, and the environment: http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/vet/pol_eldu-umdde-eng.pdf

Currently, there are **no federal Canadian regulations** defining the requirements for the practice of **ELDU**, with the exception of medicated feeds, whose requirements are described in the **ELDU** policy and could also be found in the *Food and Drug regulations* C.08.012. http://www.hc-sc.gc.ca/dhp-mps/vet/label-etiquet/faq_eldu-umdde-eng.php#q1

In Canada, extra-label uses of drugs, including medicated feeds, may be prescribed by a veterinarian as long as a valid **veterinary-client-patient relationship*** exists. This also applies to medicated feeds, if the medication is an approved product, but only for therapeutic use (not growth production or other production use) and all parties maintain a valid veterinary prescription on file.

Veterinarians are also responsible for assuring that there is an adequate **withdrawal time** for all extra-label use. The Canadian Global Food Animal Residue Avoidance Databank (cgFARAD) may be accessed by veterinarians to estimate withdrawal periods for unlicensed drugs in Canada <http://www.cgfarad.usask.ca/>.

*A valid “**Veterinary-Client-Patient Relationship**” exists when the following conditions apply:

1. The client [owner or owner’s agent of the animal(s)] has given the responsibility of medical care to the veterinarian and has agreed to follow the instructions of the veterinarian; *and*
2. The veterinarian has assumed the responsibility from the client for making clinical judgment regarding the health of the animal(s), the need for medical treatment, and for ensuring the provision of ongoing medical care for the animal(s); *and*

PART E: MEDICATIONS

3. The veterinarian has sufficient knowledge of the health status of the animal(s) and the care received or to be received. The knowledge has been obtained through a recent examination of the animal(s) and the premises where it is (they are) kept or through a history of medically appropriate and timely examinations and interventions; *and*
4. The veterinarian is readily available, or has made the necessary arrangements with another veterinarian, for ongoing medical care in case of adverse reactions or therapy failure.

RESPONSIBLE USE OF MEDICATIONS

Always read the label for:

- **Storage**
- **Expiry date**
- **Withdrawal time** = time, after use of drug in food-producing animals, until any drug residues are reduced to safe levels to allow the human consumption of meat or milk
- **Dosage**
- **Route of administration:** *e.g.* Oral, Subcutaneous, Intramuscular, Intravenous

Keep medications clean, *esp.* tops and **stored** in appropriate location *e.g.* refrigerator if necessary.

Identify animal treated.

Record all animal treatments: drug, amounts and administration routes used.

Record date-opened on drugs used.

Dispose of drugs, syringes, needles safely and appropriately.

METHODS OF ADMINISTRATION OF MEDICINES

ORAL

Drenching Liquids Small amounts given via ~60cc dose-syringe or drenching gun. Use proper-sized equipment for size of animal:

- Standing animal. Hold under jaw. May slight head tilt up at <45°.
- Gently insert **smooth-edged** syringe/gun into side of mouth over tongue. Do not force equipment to back of mouth. Hold jaw gently but securely while administering.

- Give liquid slowly, **allow animal to swallow**. May wish to trigger swallowing by adding 1 tsp (5 ml) powdered ginger to bland medications. Do not force into larynx or trachea!

Pills (bolus) with appropriate-sized balling gun:

- For small-ruminant-sized bolus: Insert **smooth-edged** balling gun with bolus into mouth towards throat, as with liquid-administration, *See* above. Depress gun lever to give bolus. Hold jaw, may gently massage throat. Wait and ensure animal has swallowed bolus.

STOMACH TUBE

Newborn stomach tubing, *See* Section 3 Newborn Hypothermia.

Adult stomach tubing *e.g.* for bloat: Use slightly larger tube, about 2 cm diameter.

- Use mouth-device or speculum for tube to go through. Device is to stop adult chewing off and swallowing the tube:
 - Speculum: Length (25 cm) of smoothed PVC pipe or aluminum (Frick speculum) for insertion into mouth beside teeth, then pass tube through.
 - Mouth-gag: Perpendicular smooth device that sits across mouth, with hole for tube to pass through, often smooth wood.
- Lubricate stomach tube *e.g.* Vaseline or oil (warm tube, if necessary).
- Measure tube from mouth to just beyond ribs and **mark** tube.
- Pass tube gently into esophagus. Do not want fluids to go into trachea!
- Watch for tube on animal's left side. Should be able to:
 - See.
 - Feel (Can check – if neck rattles when gently shaken, tube is in trachea).
 - Blow down and listen for rumen gurgling.
 - Smell rumen contents.
- Attach syringe or funnel and give fluids slowly or for bloat may gently move tube and try to expel gas, before administering anti-froth solution (if necessary).

INJECTIONS

BE CLEAN:

- Wash hands.
- Use sterile needles and syringes
- Pick relatively clean injection site on animal.

Inject:

- <10 cc (ml) at any one site (subcutaneous or intramuscular)



PART E: MEDICATIONS

- Avoid using under elbow as injection site.
- Be aware of carcass damage if give injection into hind limb muscle mass.

Subcutaneous (under skin)

- Subcutaneous is method for most vaccines: Under skin, above muscle.
- Choose site with less hair and loose skin, *e.g.* neck, flank, over ribs.
- Needle: 20-21 gauge, 1-1½ inch long.
- Lift skin into tent. (Helps to tell if skin is loose at this site.)
- Insert needle on angle to go under (tenting) skin.
- Draw back gently on plunger to check to see if in blood vessel. If blood enters syringe, begin again.
- Inject drug. Withdraw needle and dispose of needle in safe, marked container.
- Gently massage of area of injection.

Intramuscular (into muscle)

- Want the injection site to be a large muscle mass:
 - Middle of lower neck in front of shoulder blade is preferred.
 - Rump, back of hind leg. **Avoid** hind leg in meat animals as possible damage to carcass from sterile abscess or muscle-scarring.
- Needle: 18-20 gauge, 1-1½ inch long.
- Insert needle into muscle. If using leg, direct needle slightly backward toward tail, to avoid vessels and nerves.
- Draw back gently on plunger to check to see if in blood vessel. If blood enters syringe, begin again.
- Inject drug. Withdraw needle and dispose of needle in safe, marked container.
- Gently massage of area of injection.

Intravenous (into vein)

- Use only if experienced and only for “intravenous products” and emergency treatment.
- For instructions *See Bibliography Health and Disease: Ontario Sheep Marketing Agency, Sheep Flock Health, p.164. Smart, Goat production, p. 47.*

Intraperitoneal (into abdomen)

Use only in emergency as a last resort. *See Section 3 Newborn Hypothermia.*



UDDER INFUSION

For Mastitis: Read infusion label! *See:* Section 4 Part B Mastitis.

- Use appropriate size or infusion tip for teat. Cattle teat infusion tube may be too large for sheep or goat teat orifice.
- Be very clean. Wash udder and teat, disinfect teat-end with alcohol.
- Insert tube into teat orifice, infuse dose, withdraw and discard tube safely and appropriately.
- Gently massage udder.

MEDICATIONS FOR USE IN SHEEP AND GOATS

Regulations, types of drugs and drug availability changes, so best to check with veterinarians or other up-to-date sources for current product information.

Web sites are available that indicate products for use in sheep and goats in Canada:

Sheep <http://www.drugs.com/vet/sheep-a.html>.

Goats <http://www.drugs.com/vet/goats-a.html>.

See Bibliography – Medications for other sources of information about medications for sheep and goats.

Health Canada can provide necessary information about medications:

- Health Canada http://www.hc-sc.gc.ca/dhp-mps/vet/related-connexes_sites-eng.php
- Veterinary Biologics <http://www.inspection.gc.ca/english/anima/vetbio/vbpbve.shtml>
- Veterinary Drugs <http://www.hc-sc.gc.ca/dhp-mps/vet/index-eng.php>

ANTIBIOTICS

See above for Web sites describing antibiotic products for use in sheep and goats.

Always check for most recent antibiotic information from veterinarian.

Note: Always check milk and meat withdrawal times!

For antibiotic use for Mastitis, *See:* Section 4 Part B Mastitis.

Examples of antibiotic products licensed in Canada:

- Ceftiofur *e.g.* Excenel (Sheep)
- Neomycin, Sulfathiazole, Sulfamethazine *e.g.* Neorease oral (Sheep), Scour Treat oral (Sheep and Goats)
- Penicillin *e.g.* Pen G Injection, Duplocillin LA (Sheep)
- Tetracycline *e.g.* Oxytetracine 100 LP, Noromycin LP 100mg/ml (Sheep)
- Tilimicosin *e.g.* Micotil (Sheep ONLY) **Toxic to goats!**

PART E: MEDICATIONS

VACCINES

Vaccine Use:

- Always watch withdrawal times when administering vaccinations prior to slaughter.
- Read storage requirements and date for expiry.
- Handle vaccines hygienically and with care.
- Purchase only the quantity needed.
- Store appropriately *e.g.* refrigerate, or vaccine probably will not be effective!

WHAT to vaccinate for:

- **Minimum: Clostridial vaccine:** To protect from: *Clostridium tetani*, *Cl. perfringens* C & D. Other Clostridial organisms may be prevalent in environment. Can use a multi-valent vaccine (includes several Clostridial species).

Note: If using multi-valent product, check which organisms are included.

- **CL already present in flock:**
Caseous lymphadenitis (CL) *Corynebacterium pseudotuberculosis*: For use if CL in flock, and not able to cull animals to reduce risk of CL, or if attending shows and thus are always at risk. Vaccination will reduce the disease level in the flock but will not eliminate infection. CL bacterin (Comes packaged with Clostridia).
- **Abortions or abortion storms diagnosed:**
Campylobacter jejuni or *Chlamydia abortus*: For use if either of these organisms were diagnosed by a veterinary lab, as the cause of abortion in flock. Separate vaccines available.
- **Additional vaccines** are available in other countries and some may be used if severe problems are diagnosed in flock, check with veterinarian, *e.g.* Rabies: For use if in high rabies area and flock ranges and may contact wildlife.

WHEN to Vaccinate:**Clostridial disease and caseous lymphadenitis vaccines:**

- **Young stock:**
 - 1st vaccination, need to wait until antibodies obtained from the dam's colostrum have waned at about six weeks of age. Give before 3-4 months.
 - Then give one or more boosters, beginning ~4 weeks later. Check vaccine label details.
- **Dams:**
 - Best to give 3-4 weeks prior to parturition (giving birth). Antibodies are then at high levels in colostrum for offspring.

- **Males:**

- Vaccinate yearly, may be convenient to vaccinate males when doing adult females.

Note: *Clostridium perfringens* vaccine in Goats is considered to have a short half-life. May need to vaccinate 3-4 times/year.

Abortion-agent vaccines:

- Usually given prior to breeding with booster 1-3 months later as indicated on vaccine instructions.

Other vaccine times and instructions: Always check vaccine package materials.

Note: Vaccines are licensed for **Sheep only**, use in Goats is Extra-Label Drug Use (ELDU), See ELDU above. Also, there may be adverse reactions in goats, as vaccines may not have been tested, or may have had problems in goats.

Overview of Various Vaccine Products

VACCINE PRODUCTS Licensed for Sheep in Canada http://active.inspection.gc.ca/scripts/database/vetbio_submit.asp?lang=eandspecies=8andmanufacturer=all

Caseous Lymphadenitis Vaccine

Corynebacterium pseudotuberculosis: Caseous lymphadenitis in Sheep and Goats.

Bacterin = formalin-killed whole cells of *C. pseudotuberculosis* +Toxin

Available by itself or with the Clostridial vaccine.

Goats: Not licensed for goats by the company due to unacceptable reactions: lameness 1-30 days, injection site swelling up to 14 inches, fever, lethargy, decreased milk production.

Not recommended in pregnant animals.

Products:

Case-Bac Sheep

Caseous D-T Sheep *Note:* comes with Clostridial vaccines.

Campylobacter Fetus-Jejuni Abortion Vaccine

Campylobacter jejuni and *Campylobacter fetus* (formerly *Vibrio*): Abortion in Sheep.

Bacterin of inactivated cultures of *C. jejuni* and *C. fetus*

Given if Campylobacter abortion is a flock problem.

Product:

Campylobacter Fetus-Jejuni Bacterin-Ovine Sheep

Clostridial Disease Vaccine

Clostridium tetani: Tetanus

PART E: MEDICATIONS

Cl. perfringens type D= Pulpy kidney, *Cl. perfringens* type C= Acute bloody enteritis.

Note: Ensure formulation of Clostridial products has both *Cl. perfringens* C and D and tetani.

Given to dam 3-4 wks prior to parturition: offspring get colostral protection for ~1st 60 days, then 2 boosters and annual revaccination.

Products:

Clostri Shield 7 Sheep (no tetanus)

Covexin 8 Sheep

Tasvax 8 Sheep

Ultrachoice 7 or 8 Sheep (no tetanus)

Vision 7 or 8 Sheep (no tetanus)

Caseous D-T Sheep

Clostridium Perfringens Types C & D Antitoxin Sheep and Goats – for temporary prevention (lasts approximately 3 weeks) or treatment of Clostridial enterotoxemia during an outbreak of disease.

Note: 2 Clostridia with Caseous lymphadenitis vaccine.

Tetanus antitoxin

May be given to an un-vaccinated animal after a penetrating injury. Animal should also receive veterinary attention and antibiotic treatment.

Product:

Tetanus antitoxin (two brands available – Pfizer and Colorado Serum)

Footrot Vaccine

Fusobacterium necrophorum and *Dichelobacter nodosus* (*Bacteroides nodosus*) in wet conditions can result in footrot in sheep.

Vaccine must be part of a complete flock treatment plan. See Part B Footrot above.

Non-vaccination recommendation at: <http://www.ablamb.ca/documents/factsheets/ASWCWebFootrot.pdf>

Dichelobacter nodosus bacterin. Not licensed in Canada.

Products:

Footvax 10 Strain (USA)

Re: Obtaining in Canada

Veterinarians can obtain Footvax for a specific producer, by requesting importation of the product through CFIA. Veterinarians are not able to hold stock of this vaccine, and each request is considered independently.

The procedures for obtaining Footvax are:

1. Contact your veterinarian
2. Have veterinarian check the availability of the vaccine. They will then send out an information package, which must be followed exactly, in order to import the vaccine.
3. Information about importing this and other vaccines is available on the [CFIA website](#). There is a cost associated with application, and there can be delays in receiving the vaccine, so ensure that your veterinarian requests Footvax before your entire flock is affected.

Orf Vaccine

Orf virus (Parapox Genus) causes Contagious ecthyma/Soremouth in sheep and goats.

Vaccinate is a Live virus. Used where virus is present and a serious problem. Little-to no transfer of protective antibodies via colostrum. *See*, Part B Orf above.

Not licensed in Canada.

Products:

Ovine Ecthyma Vaccine (USA)

Scabivax (United Kingdom) http://www.msds-animal-health.co.uk/products_public/scabivax_forte/overview.aspx

Ovine Enzootic Abortion Vaccine

Chlamydophila abortus (Formerly classified with *Chlamydia psittaci*) cause of abortion in sheep and goats.

Product:

Chlamydia Psittaci Bacterin *Sheep*

Rabies Vaccine

Rabies is rare in ruminants, but a risk for animals where rabies is prevalent.

Products:

Defensor 3 Sheep

Imrab 3 Sheep

Imrab Large Animal Sheep

Other Vaccines

Other vaccines are occasionally used, but are **not licensed in Canada** for sheep or goats:

- Nasally administered cattle IBR + PI3
- *E. coli*
- Epididymitis

PART E: MEDICATIONS

- *Toxoplasma*
- *Mannheimia/Pasteurella*

OTHER MEDICATIONS

As noted previously, the following are Web sites indicating products for sheep and goats. The flag indicates those licensed in Canada:

Sheep <http://www.drugs.com/vet/sheep-a.html>

Goats <http://www.drugs.com/vet/goats-a.html>

See Bibliography – Medications for other sources about medications for sheep and goats.

Also See Part B Parasite treatment.

TYPES OF MEDICATIONS SHEEP AND GOAT OWNERS MIGHT CONSIDER FOR A TREATMENT KIT

Examples of each category are listed, but for other products See Websites listed previously in this section and Bibliography.

Bold type are Licensed in Canada for Sheep, or for Sheep and Goats as indicated.

Allergy

- **Antihistamine** (Sheep)
- **Shock** – Epinephrine (Sheep)

Antibiotics See previous pages.

Anti-bloat. *e.g.* **Bloat Eaze** (Sheep and Goats)

Anti-fungal *e.g.* **Kopertox**, **Foot-cure** (Sheep and Goats)

Anti-inflammatory *e.g.* Flunixin meglumine Banamine, Meloxicam Metacam

Anti-parasitic drugs See Part B – Parasites, above

Antiseptic/Wound dressing, cleansing

- Cleanser – **Chlorhexidine Solution** (Sheep and Goats)
- Topical treatment – spray Scarlet Oil
– cream **Sulfa Urea Cream** (Sheep)

Calcium for Hypocalcemia *e.g.* Calcium Borogluconate 23%, Mag-CalT, Supercal, Cal Mag Phos, Cal-Plus

Deficiency/Supplement

- Vitamin **ADE ADE Solution EquiSol** (Sheep and Goats)
- Vitamin B *e.g.* Race Vite, Newcells, Thiamine (Sheep)
- Vit E Selenium: Dystosel (Sheep)



Electrolytes

- Oral *e.g.* Electrolytes Plus (Sheep and Goats)
- Injectable *e.g.* Electrolyte Infusion, Lactated Ringers Injectable

Ketosis/Hypoglycemia Treatment

- Oral *e.g.* Glycol P, **Ketamalt** *Sheep*
- Injectable *e.g.* Dextrose 50%

Parturition

- Oxytocin *e.g.* **Oxytocin Injection** *Sheep*
- KY Jelly
- Doxapram *e.g.* Dopram

PART F: LABORATORY TESTING

PART F: LABORATORY TESTING**LABORATORY DIAGNOSTIC TESTING SERVICES AND COSTS FOR SMALL RUMINANTS****MINISTRY OF AGRICULTURE ANIMAL HEALTH CENTRE (AHC)**

1767 Angus Campbell Road
Abbotsford BC V3G 2M3

<http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/animal-health/animal-health-centre>

(604) 556-3003

1-800-661-9903 toll free (BC)

Costs listed include HST. Prices are current as of February 2, 2016. Please consult the AHC website or call the laboratory for more current information.

Post-mortem

A complete post-mortem examination includes gross examination. Up to 5 other tests such as microscopic evaluation of tissues, bacteriology, virology, mineral analysis, parasitology, etc. are included in the post mortem charge, if they are necessary, to arrive at a diagnosis.

Animal necropsy: \$140.00

Abortion: \$ 80.00 (includes up to 3 fetuses from same dam).

See website list for individual tests if not part of post-mortem. Other fees may be added if deemed necessary by the pathologist.

Milk samples

Culture and sensitivity (1-4 samples) \$33.00

Culture and sensitivity (>4 samples) \$ 8.25/sample.

Parasitology

Routine fecal flotation \$27.00

Baermann examination for lungworm \$27.00

Direct smear for Cryptosporidium \$27.00

Specific Laboratory Testing

Fees as indicated on the website per test.

Laboratory Submission Forms

Mammalian Submission Form: <http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/animal-and-crops/animal-health/ahcform-mammalian.pdf>

Serology Submission Form: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/animal-and-crops/animal-health/ahc_serology_lab_fees.pdf

OTHER LABORATORIES OFFERING DIAGNOSTIC SERVICES FOR BC

*Private Veterinary Laboratories:***True North Veterinary Diagnostics Inc.**http://www.tnvd.ca/site/view/179135_LaboratoryServicesandInformation.pml

#320 6325-204 Street

Langley, BC V2Y3B3

(604) 539-5550

Fax: 1-888-336-9408

8626 Commerce Court

Burnaby, BC V5A 4N6

(604) 444-4479

Fax: 1-888-318-5350

IDEXX Reference Laboratories Ltd<https://www.idexx.com/livestock-poultry/ruminant.html>

1595 Cliveden Avenue - Unit 10

Delta, BC V3M 6M2

(604) 525-1700

(604) 533-0289

Washington State Washington Animal Disease Diagnostic Lab<https://waddl.vetmed.wsu.edu/>*Scrapie Testing*

Flock, Animal: Biopsy 3rd eyelid lymphoid tissue, rectal tissue

Necropsy: Obex of Brain stem.

Obex removal technique: <http://www.scrapiecanada.ca/images/brain.pdf>**Scrapie Laboratories for Obex brain samples:****Manitoba Agriculture, Food and Rural Initiatives** Livestock Knowledge Center Farm
Production Extension 545 University Crescent Winnipeg, MB R3T 5S6 Phone: 204-
945-4174 Fax: 204-945-8062**Prairie Diagnostic Services** 4840 Wascana Parkway, Regina, SK S4S 7J6Phone: 306-787-6435 www.usask.ca/pds/index.htm Sample Submission Formavailable online at: <http://www.usask.ca/pds/Forms/GenSubmissionForm.pdf>**Animal Health Laboratory**, University of Guelph Building 49, OVC, Box 3612,
Guelph, ON, Canada, N1H 6R8 Phone: 519-824-4120 X: 54544 Fax: 519-821-8072
www.ahl.uoguelph.caSample Submission Form available online at: [http://www.uoguelph.ca/ahl/Forms/
Ruminant-1.pdf](http://www.uoguelph.ca/ahl/Forms/Ruminant-1.pdf)**Alberta Agriculture** Post Mortem Room O.S. Longman Building 6909-116 Street
Edmonton, AB Canada, T6H 4P2 Phone: 780-422-1923

PART F: LABORATORY TESTING

POTENTIAL FLOCK SCREENING TESTS FOR DISEASE CONTROL IN SHEEP AND GOATS

See Part B for individual disease Control Protocols.

Caseous Lymphadenitis CL

Palpate all external lymph node sites checking for abscesses.

Blood test: ELISA is limited by the disease organism's behaviour and animal's immune response. Can be used as an indicator: A negative test result does not guarantee no 'internal' abscesses, but an animal with a positive test should be culled.

- Currently no local lab testing, sent to Davis, California, expensive (\$70.00/test)

Johne's Disease

Blood test: Test is not effective to manage two flocks (positive and negative flocks). May be used to eliminate animals heavily shedding bacteria, as overall flock tests or to test animals if showing initial signs of doing poorly. If test positive, then cull.

Fecal culture or PCR: Fecal culture (Radiometric-BACTEC). Takes 2-3 months, may be as good as a flock- screening test. Sheep strains tend to be hard to grow. PCR is much faster and has similar sensitivity; however, false negatives are still common particularly in younger animals or animals in earlier stages of infection.

Maedi Visna (MV)/Caprine Arthritis Encephalitis (CAE)

Blood Test: Animals >6months of age (some recommend >1 year). For new animals quarantined, test twice 8-12 weeks apart, using Enzyme Linked Immunosorbant Assay 'ELISA' test. New ELISA tests being tested, will be available locally soon. Reasonable for flock screening.

Scrapie

Testing through Voluntary Scrapie Surveillance Program.

Q Fever (Coxiella burnetii)

Blood Test: Immunofluorescence Assay. Reasonable to eliminate test positive animals through culling, but animals may not have developed a blood antibody level and still be shedding Coxiella organisms. These animals are missed with testing.

Gastro-intestinal parasites and lungworm

Fecal flotation for Flock screening. Highest levels of fecal parasite eggs likely to occur near parturition in females (2 weeks before to 2 months after giving birth) and when young animals have been at pasture 2 to 4 months.

New animals could be tested, or if purchased during winter, may be treated, prior to quarantine. Animals should be re-fecal-checked in quarantine 2 weeks later and treated if necessary.

External parasites

External examination, treat if necessary.



APPENDIX

CFIA BACKGROUND INFORMATION

(Current as of March 15, 2012)

Canadian Food Inspection Agency <http://www.inspection.gc.ca/english/animal/disemala/guidee.shtml>

REPORTABLE DISEASES

These diseases are outlined in the *Health of Animals Act* and *Regulations* and are usually of significant importance to human or animal health or to the Canadian economy. Animal owners, veterinarians and laboratories are required to immediately report the presence of an animal that is contaminated or suspected of being contaminated with one of these diseases to a CFIA district veterinarian. <http://www.inspection.gc.ca/english/animal/hasan/offbure.shtml>

Control or eradication measures will be applied immediately.

IMMEDIATELY NOTIFIABLE DISEASES (FOR LABORATORIES ONLY)

In general, immediately notifiable diseases are diseases exotic to Canada for which there are no control or eradication programs. The CFIA can undertake control measures for such diseases when notified of their presence in Canada. This category also includes some rare indigenous diseases. A herd or flock of origin must be certified as being free from these diseases in order to meet import requirements of trading partners.

Only laboratories are required to contact the CFIA regarding the suspicion or diagnosis of one of these diseases. Information must be forwarded by e-mail to the [Epidemiology and Surveillance Section](#). E-mail: notification@inspection.gc.ca
Fax: 450-768-0064 (attention: notification)

ANNUALLY NOTIFIABLE DISEASES (FOR LABORATORIES ONLY)

Annually notifiable diseases are diseases for which Canada must submit an annual report to the World Organisation for Animal Health (OIE) indicating their presence within Canada. In general, they are diseases that are present in Canada, but are not classified as reportable or immediately notifiable.

All veterinary laboratories are required to comment on Canada's report to the OIE, which is prepared each February by the CFIA's Epidemiology and Surveillance Unit.

APPENDIX

For more information, you can visit the [CFIA Website](http://www.inspection.gc.ca) at www.inspection.gc.ca, or contact the nearest [CFIA](#) district veterinarian using the listing in the blue pages of your local telephone directory. You can also submit a question or comment by e-mail to the [Epidemiology and Surveillance Section](#).

IMPORTATION OF ANIMAL PATHOGENS

The importation and use of animal and zoonotic pathogens is regulated by the *Health of Animals Act* and *Regulations*. Facilities working with animal or zoonotic pathogens must comply with the “Containment Standards for Veterinary Facilities”. This can be found at: <http://www.inspection.gc.ca/english/sci/bio/bioe.shtml>.

Import permits and facility certification can be obtained from the Biohazard Containment and Safety Division of the Laboratories Directorate of the [CFIA](#).

For more information please contact: **Biohazard Containment and Safety Division**
1400 Merivale Road

Ottawa, Ontario K1A 0Y9

Phone: 613-773-6520 Fax: 613-773-6521

To prevent the transmission of animal diseases in Canada, the Canadian Food Inspection Agency (CFIA) must be notified of the introduction or presence of certain animal diseases in the domestic population, as outlined in the *Health of Animals Act* and *Regulations*.

CFIA REGIONAL, AREA AND DISTRICT OFFICES**Regional Office:**

BC Coastal and BC Mainland/Interior (includes Yukon)
4321 Still Creek Dr., Suite 400 Burnaby, British Columbia V5C 6S7
Tel: 604-666-6513 Fax: 604-666-1261

Area Office

Western Area Office
1115-57th Avenue
North East Calgary, Alberta T2E 9B2
Telephone: 403-292-4301 Facsimile: 403-292-6629

British Columbia District Offices

<i>Abbotsford</i>	Suite 102, 30585B Progressive Way Abbotsford, British Columbia V2T 6W3 Telephone: 604-557-4500 Facsimile: 604-557-4502
<i>Cranbrook</i>	108-1525 Cranbrook Street North Cranbrook, British Columbia V1C 3S7 Telephone: 250-417-2293 Facsimile: 250-417-2292
<i>Dawson Creek</i>	Unit 2, 12008-8th Street Dawson Creek, British Columbia V1G 4Y5 Telephone: 250-719-6855 Facsimile: 250-719-6849
<i>Oliver</i>	34577-91st Street, Post Office Box 1530 Oliver, British Columbia V0H 1T0 Telephone: 250-498-5301 Facsimile: 250-498-5303
<i>Osoyoos</i>	202-97th Street Osoyoos, British Columbia V0H 1V1 Telephone: 250-495-6574 Facsimile: 250-495-3255
<i>Surrey</i>	17735-1st Avenue, Room 175 Surrey, British Columbia V3S 9S1 Telephone: 604-541-3364 Facsimile: 604-541-3375
<i>Vancouver/Richmond</i>	4831 Miller Road, Floor 2, Room 201 Richmond, British Columbia V7B 1K7 Telephone: 604-666-7042 Facsimile: 604-666-6027
<i>Vernon</i>	4708-34th Street, Unit 103 Vernon, British Columbia V1T 5Y9 Telephone: 250-260-5030 Facsimile: 250-260-5031
<i>Victoria</i>	103-4475 Viewmont Avenue Victoria, British Columbia V8Z 6L8 Telephone: 250-363-3618 Facsimile: 250-363-0144
<i>Williams Lake</i>	35-2nd Avenue South, Room 307 Williams Lake, British Columbia V2G 3W3 Telephone: 250-305-3004 Facsimile: 250-305-3003

APPENDIX

CMT PROCEDURE

The procedure for performing the California Milk Test (CMT) has been adapted from:

<http://www.drugs.com/vet/cmt-california-mastitis-test.html>

Designed for CATTLE

Note: Results not as clearly defined for sheep or goats.

CMT PROCEDURE:

1. Dilute CMT concentrate product as per instructions:

KEEP AWAY FROM CHILDREN

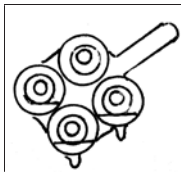
- 1 bottle concentrate = 1 gallon reagent

Either: Add CMT Concentrate to lower line on dispensing bottle and add water to fill line at top, *or*

add entire CMT Concentrate contents to ten bottles of water, making one gallon of solution.

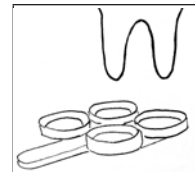
2. Collect milk into paddle:

- Discard first stream of milk. Do not conduct CMT on colostrum (milk from dams <3 days post-partum) or at drying off.
- Draw foremilk from each half into 2 of the cups of the testing paddle.
- Tilt testing paddle to pour off excess milk. Remaining milk should be level with the outside (largest) circle in the cup.



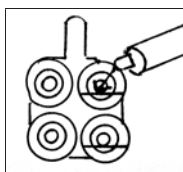
Collect milk from individual halves

Pour off excess milk to outer circle



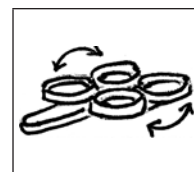
3. Add dilute CMT to milk:

- Tilt testing paddle until milk is halfway between the inner and outer circles.
- Add dilute CMT solution into each cup until mixture is even with the inside circle of each cup.
- Gently rotate the paddle, keeping the paddle horizontal, to mix the CMT and the milk.
- Observe the reaction (should occur almost immediately). Look for thickening and gel formation, which indicates a high somatic cell count likelihood of mastitis. A thin mixture (no thickening) indicates low SCC and no mastitis.



Add and equal amount of CMT working solution (to inner circle).

Rotate paddle.



4. Evaluate Results:

CMT Scores, Description of Paddle Contents, and Conclusion (Based on dairy cow)

CMT SCORE	DESCRIPTION OF PADDLE CONTENTS	ESTIMATED SCC (CELLS/ML) FOR COWS	CONCLUDING DIAGNOSIS
Negative	<ul style="list-style-type: none"> Mixture of milk and reagent remains liquid. No evidence of thickening or precipitate. 	<200,000	No mastitis
Trace	<ul style="list-style-type: none"> Slight thickening. Rotating paddle causes thickening to disappear. 	150,000 to 500,000	Suspicion of mastitis
1/Weak	<ul style="list-style-type: none"> Distinct thickening, not gel formation. Rotating paddle continuously may cause thickening to disappear. 	400,000 to 1,500,000	Suspicion of mastitis
2/Distinct	<ul style="list-style-type: none"> Mixture thickens straight away. Rotating paddle causes thick mixture to move to centre and leaves outer edge of cup-bottom exposed. 	800,000 to 5,000,000	Mastitis
3/Strong	<ul style="list-style-type: none"> Distinctive gel forms into mass with rotation of paddle. Gel tends to adhere to bottom of paddle. 	Over 5,000,000	Mastitis

CALIFORNIA MASTITIS TEST KITS

Available from:

Island Dairy Services Ltd.

4561 Koksilah Rd., Duncan, BC

(250) 748 2188

J and D Farmers Dairy Service Ltd.

1160 Riverside Road, Abbotsford, BC

(604) 853 2372

Otter Co-op <http://otter-coop.com/index.php?id=20>

Home office:

3600 248 St. Aldergrove, BC

(604) 607-6909

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Individual Animal Health Issue Record

Animal ID:				
Health Issue	Date Day/Month/ Year	Description	Treatment	Result

Individual Animal Reproductive Record

[illegible]

ANIMAL HEALTH PRODUCT USE RECORD

Producer/Farm Name: _____

Date Day/Mo/Yr	Animal/ Group ID	Reason for Treatment	Name of Product Used	Circle the Route of Injection or Delivery ¹	Weight of Animal	Amount/ Dosage Given	Withdrawal Period/Date for Slaughter or Milking	Treatment Failures (i.e. Broken Needle)	Initials
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
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				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					
				IM SC Skin Mam FB Oral					

(1) IM = intramuscular SC = subcutaneous Skin = pour-on, dip Mam = intramammary infusion FB = foot bath Oral = by mouth, feed, water

Flock Body Condition Score Record

Female

[illegible]

Flock Body Condition Score Record

Male

[illegible]

Monthly Inspection

Location/Building: _____

Check off the areas inspected and that meet the criteria

	DRAINAGE	YARD	EXTERNAL & INTERNAL BUILDING			LIGHTING		
Month/ Year	Proper Drainage, No Leaks or Standing Water	Weeds Trimmed/ Debris Removed/ Equipment Properly Stored	No Crevices or Holes in Floors, Walls or Ceilings For Pest Access	Garbage/ Debris Removed	Doors, Windows and Screens Intact and Working Properly	Lighting Adequate Protected and Intact	Comments	Initials
JAN								
FEB								
MAR								
APR								
MAY								
JUN								
JUL								
AUG								
SEP								
OCT								
NOV								
DEC								

Individual Animal Internal Parasite Record

[illegible]

Worker Training Record

Type of Training											
Date of Training	Initial	Refresher	Name of Trainer	Name of Worker	Training Topic	Worker Initials					

Visitor Log

[illegible]

