

PREVENTION AND TREATMENT OF DAIRY SHEEP DISEASES

**Mary C. Smith DVM
Ambulatory and Production Medicine Clinic, Cornell University
Ithaca, NY 14853 USA**

You Need a Veterinarian for Your Flock

The relative importance of health problems in dairy sheep flocks will depend on where you live, what you feed your sheep, and many aspects of your management, including where the sheep originated. You need a veterinarian who can visit the farm, examine the animals and their environment, and give you advice on how to keep the sheep healthy and the dairy products produced on the farm safe and wholesome.

Your veterinarian can make a more accurate diagnosis than can Dr. Google. Your veterinarian can submit samples to a diagnostic laboratory for correctly identifying problems and for monitoring disease status of animals within the flock. Your veterinarian can help you to establish prevention, treatment, and eradication protocols and to monitor the success of those protocols, with the intent to refine them as needed.

If you do not yet have a flock veterinarian, consider these approaches to locating one:

- 1) contact large animal veterinary practices in your area and ask for the clinician with an interest in small ruminants - this may be one of the younger associates in the practice, or the older veterinarians may have sheep flocks of their own.
- 2) contact your extension agent or other sheep owners in your area for suggestions
- 3) use the Find a Veterinarian function at <www.aasrp.org>, the American Association of Small Ruminant Practitioners. The members of this organization cared enough about sheep and goats to pay annual dues and they have access to a listserv to get specific questions answered by their colleagues if they encounter an unfamiliar situation on your farm.

Veterinarian Client Patient Relationship

You and your veterinarian need to establish a VCPR, a veterinarian client patient relationship, and renew it annually. This is a legal requirement for obtaining prescription drugs, for the use of any extralabel drugs an animal may require, and for obtaining a veterinary feed directive if drugs need to be added to the feed of the sheep. The veterinarian supplies directions for the dose and duration of treatment and specifies milk and meat withdrawals that will be required. The owner must agree to follow the veterinarian's directions. This veterinarian must see the animals being treated or regularly visit the farm, to be able to accurately assess the situation. This veterinarian must be readily available if follow-up is needed. A veterinarian at a drug supply house elsewhere in the country cannot be part of a valid VCPR.

Meat and Milk Withdrawals

Very few medications are approved by the Food and Drug Administration (FDA) and labeled for dairy sheep. Any drugs that are needed but not labeled for sheep or for the condition being treated are extralabel, and their use requires a VCPR. The veterinarian needs to contact FARAD, the Food Animal Residue Avoidance Databank <<http://www.farad.org/>> to obtain advice on meat and milk withdrawals for the drug treatment regimen prescribed. You must keep a treatment list that specifies what drug was given to what sheep on what date(s) and when milk or

meat can be used from this animal. Records of all extralabel drug use must be kept for at least 2 years (3 years in New York).

A list of drugs approved for sheep, from the FARAD website (<http://www.farad.org/vet-gram/sheep>) is shown in Table 1. Many products listed at the site are off the market. Availability of the drug reflects changes in the law that take effect January 1, 2017, when many previously over the counter drugs become prescription only. Even though Vetgram may indicate approval for 'sheep all classes', in most instances this predates the concept of dairy sheep in the United States. A table entry of n/v means that FARAD cannot give a blanket milk withdrawal time because the drug has not been specifically approved for lactating sheep (Webb et al. 2004). The veterinarian for the herd will have to contact FARAD directly in order to obtain the recommended milk withdrawal interval.

Table 1. Drugs approved for use in sheep from the FARAD website.

Drug	Brand	Availability	Milk WD	Meat WD
oxytocin	various	Rx	(zero)	zero
proparacaine	Ophthaine®	Rx	??n/v	zero
oxytetracycline/ polymyxin B	Terramycin® eye ointment	OTC	??n/v	zero
selenium sodium	BoSe®	Rx	??n/v	14 days
oxytetracycline soluble powder	Terramycin® Tetroxy® 343	Rx	??n/v	5 days
oxytetracycline for feed	Terramycin®	VFD	??n/v	5 days
chlortetracycline for feed	Chlormax®, Aureo- mycin® Deracin® etc	VFD	??n/v	zero (80 mg/hd/day)
penicillin G, procaine	various	OTC	??n/v	9 days (3000 units per pound)
tilmicosin	Micotil®	Rx	??n/v	28 days
ceftiofur sodium	Naxcel®	Rx	zero	zero
neomycin sulfate oral liquid	Biosol®	OTC???	??n/v	2 days
neomycin sulfate, sol- uble powder	Biosol®, Neomix®, etc.	Rx	??n/v	2 days
neomycin/oxytetra-cy- cline, in feed	Neo-Oxy®, Neo-Terramycin®	VFD	??n/v	5 days
decoquinatate	Deccox®	OTC	do not use	(zero)
lasalocid	Bovatec®	OTC	??n/v	zero
levamisole	Prohibit®	OTC	??n/v	3 days
albendazole	Valbazen®	OTC	??n/v	7 days
ivermectin oral drench	Ivomec® and others	OTC	??n/v	11 days
cydectin oral drench	Moxidectin®	OTC	do not use	7 days
progesterone	EAZI-BREED CIDR	OTC	??n/v	(zero?)
follicle stimulating hormone	F.S.H-P injectable®	Rx	??n/v	zero

Table 1. Drugs approved for use in sheep from the FARAD website.

Drug	Brand	Availability	Milk WD	Meat WD
zeranol	Ralgro® implant	OTC (off market)	do not use	40 days
[permethrin - not FDA product]	Ultraboss, and others	OTC	(zero)	Zero

- Rx means by prescription.
- OTC means over the counter.
- VFD means veterinary feed directive, and no extralabel use of drugs is allowed in feed.
- ??n/v means that FARAD must be contacted, as there is no specific approval for dairy sheep.

Basic Disease Prevention - Biosecurity

Infectious diseases are bought and paid for. You must know what diseases sheep get and how they are spread. You should avoid buying or borrowing animals that carry these diseases, but even if you ask all the right questions the seller may be unaware and a purchased ram or ewe could be an inapparent carrier. Always quarantine new purchases (rams, ewes, lambs) and show animals for at least three weeks and examine or test them at the beginning and end of the quarantine period. Treat new animals for internal parasites and for footrot before releasing them from quarantine. Some diseases with long incubation periods can still slip past the quarantine, so buy from disease-free flocks.

Basic Disease Prevention - Vaccination Programs

The most basic vaccine is a combined tetanus-enterotoxemia product, which requires two initial doses three or four weeks apart and then boosters. Tetanus protection probably lasts at least a year, but a booster vaccination to the ewe in late pregnancy will maximize antibodies in the colostrum to protect the lambs. Vaccines are permitted and encouraged in organic programs but typically have at least a 21 day meat withdrawal. The enterotoxemia protection probably lasts 6 months or less. If you feed high levels of concentrates or lush grass more than 6 months after the last booster was given, another booster is indicated. If the lactation is relative short and the forage is not lush in late lactation or gestation, then you can probably get by with only giving prelambling boosters. In some parts of the country other clostridial infections are a problem and your veterinarian may recommend an 8-way clostridial product that contains tetanus. Many 7-way cattle clostridial products do not contain a tetanus component.

Other vaccines that might be given will depend on the disease status of the flock and are discussed below under specific conditions. These include vaccines for abortion diseases (*Campylobacter* and *Chlamydia*), sore mouth, and caseous lymphadenitis. There is NO vaccine available in the United States for pneumonia in sheep, for footrot in sheep, for pinkeye in sheep, or for ovine progressive pneumonia, toxoplasmosis, or scrapie.

Basic Disease Prevention - Nutrition

Many diseases of sheep have a nutritional component. These include the metabolic diseases pregnancy toxemia and hypocalcemia, lactic acidosis, and copper poisoning and copper deficiency. Furthermore, an appropriate nutritional program is necessary if the sheep is to have a functional immune system to resist disease challenges. Forages need to be tested for quality; this requires sampling multiple bales of hay or haylage and submitting the representative combined

sample to a testing laboratory such as DHIA - Dairy One. Tags should be dated and retained from each purchase of concentrates or minerals. If grazing is an important part of the diet, pasture samples may also be required. A nutritionist with experience with sheep can help you to design an appropriate diet based on the forages available to feed. Forages should be the basis of the dairy sheep's diet, for profitability, rumen health, and milk components.

Feed availability at the bunk is an important part of the nutrition program. The sheep should be able to all eat at one time without smothering each other in their excitement to reach the feed. Be especially careful after an 'out of feed' incident, or deaths will occur. Smaller, younger, or more submissive animals must have free access to the feed. This is often achieved by penning them separately from the large adults.

Basic Disease Prevention - Parasite Control

Parasite programs must be designed with consideration for the climate and the exposure of the sheep to worms. In southeastern regions where worm larvae survive on pasture year round, pasturing may not be possible. This is because there are no effective dewormers for use in dairy sheep. Many, many parasitologists have proven that diatomaceous earth is not effective. Copper oxide wire particles will help to control *Haemonchus* but not other worms. The minimal dose should be used and at most twice a year, and only if the copper status of the herd is known. Forages rich in condensed tannins such as *Sericea lespedezia* can be helpful for parasite control where available.

Worm burdens can be monitored with quantitative fecal exams. Body condition scoring, FAMACHA scoring for anemia, and observations for diarrhea can help the owner and veterinarian decide if an individual animal needs to be dewormed. Much information on parasite control is available at <http://www.wormx.com/>. If treatment of an individual is deemed necessary, the withdrawals in Table 2 have been suggested.

Table 2. Anthelmintics.

Drug	Brand name	Milk withdrawal	Meat Withdrawal
Levamisole	Prohibit®	??n/v	3 days
Albendazole	Valbazen®	??n/v	7 days
Fenbendazole	Safeguard®, Panacur® (EL)	??n/v	Extralabel
Ivermectin	Ivomec® drench	??n/v	11 days
Moxidectin	Cydectin® drench	??n/v	7 days
[Ivermectin]	Ivomec® injection - Do Not Use		

Abortion Diseases

Sheep are susceptible to many different abortion diseases and most of these are zoonotic, meaning that people can be infected. Laboratory assistance will be required to identify the agent causing the abortions and your veterinarian can assist you in establishing a control and prevention program. In the past high doses of tetracyclines in the feed for the last two months of gestation have been used to prevent chlamydial abortion, but unless a new regulation is passed that practice will be illegal as of January 1st. Chlortetracycline is labeled for prevention of *Campylobacter* abortion in sheep but at a level in the feed (80 mg/head/day) that is too low to be effective against *Chlamydia*, plus extralabel use of drugs in feed is illegal. Many *Campylobacter* strains

are resistant to tetracyclines, so vaccination and exclusion will be the best way to prevent these abortion diseases.

Listerial abortions can be limited by not feeding spoiled haylages and silages and toxoplasmosis abortions by keeping young kittens out of the feed and the hay mow. Purchased ewes or ewe lambs should be bred to lamb later than the rest of the flock, to avoid an outbreak if they are carrying chlamydia.

When abortions do occur, remove the aborting female and the fetuses and placentas from the group of pregnant animals at once. Wear gloves when handling these items and burn, bury, compost deeply, or send to the landfill any fetuses and placentas that are not needed for laboratory diagnosis.

Pregnancy Toxemia

Sheep late pregnant with multiple lambs may develop a metabolic disease characterized by ketones in the urine and blood as well as acidosis in the blood. Initially the sheep is lethargic and eating poorly, perhaps with swollen lower legs. It may have some other problem such as indigestion or pneumonia that initially put it off feed, or it may be blind from polioencephalomalacia as a sequella to indigestion or it may be hypocalcemic from not eating. Treatment is difficult (intravenous and oral fluids, oral propylene glycol, calcium, dextrose, B vitamins, force feeding, 20 mg of dexamethasone to induce parturition, or a C section) and often unsuccessful, depending on how close the ewe is to her due date. Fluid from inside the eye can be checked for elevated ketones (beta hydroxybutyrate) to confirm the diagnosis if the sheep dies.

As it is common for the ewe and the lambs to all die as a result of pregnancy toxemia, each case should be evaluated closely for underlying causes that can be prevented in the other ewes. Have they been allowed to get too fat, so they cannot physically eat enough ration to meet the needs of the developing lambs? Is the hay of poor quality, again limiting consumption? Is there too much grain in the diet that has caused an indigestion? Is it an individual animal problem because that ewe was old with bad teeth and could not chew her hay? Closer observation of other late pregnant ewes will allow more timely intervention.

Hypocalcemia

This is another metabolic problem, most common in late pregnant or peak lactation animals. An inadequate dietary supply of calcium or magnesium, excess dietary potassium, off feed event, or excessive exercise may cause the sheep to be stiff and then go down because its muscles are weak. The ewe may turn its head around towards its udder or lie with the head and neck outstretched, appearing to breathe hard. The diagnosis can be made with a blood test or by response to therapy, typically 60 cc of 23% calcium borogluconate injected under the skin, with 15 cc given in each of 4 spots. A veterinarian could give the calcium very slowly in the jugular vein, and if no injectable calcium is immediately available, TUMS® tablets orally will supply some calcium to the ewe. The calcium concentration in the diet should be checked and corrected if necessary with additional dicalcium phosphate in concentrates or salt or by feeding more legumes high in calcium after parturition.

Mastitis

This is a very important disease of dairy sheep, causing decreased production, increased somatic cell counts, and deaths. It is discussed elsewhere in this symposium. Milk cultures will be necessary to identify the organisms involved. Prevention will require establishment of proper

milking routines and milking equipment settings and maintenance. Ewes with mastitis or teat lesions should be milked last.

Listeriosis

This infectious disease can cause abortions in ewes, deaths in neonatal lambs marked by liver infections, and eye infections, however neurologic disease is seen most commonly. Possible signs include circling, drooling, weak jaw or tongue hanging out, and inability to blink. The sheep can die very quickly, even if you use extralabel antibiotics prescribed by your veterinarian and fluid therapy. It is especially important to monitor the quality of silages, as they can be heavily contaminated with listeria organisms if not maintained at a pH of 5 or below until fed. There must be no holes in silage bags. Manger sweepings from dairy cows are a common source of the disease. The organism grows well at cold temperatures, and many outbreaks occur in confinement animals in the winter, but listeriosis can also strike sheep grazing on wet pastures. Laboratory confirmation will be required to rule out other neurologic diseases such as rabies and deer-worm migration in the brain. Sheep with typical neurologic signs must not be slaughtered for food.

Ovine Progressive Pneumonia

This is a chronic viral infection of adult sheep that most commonly causes respiratory difficulty/exercise intolerance and weight loss but can also cause a very hard udder with very little milk available or swollen joints, especially the front 'knees'. The virus is most easily spread through respiratory secretions in housed sheep but can be passed in milk or spread by reusing needles or surgical equipment contaminated with blood. Milking machines can spread the virus by allowing milk from one ewe inside the teat cup to go up into the udder of the next ewe milked with that cluster.

Infected sheep never clear the virus and there is no vaccine. Blood tests are available, although the one most commonly used in the United States is directed against the closely related caprine arthritis-encephalitis virus. Most herds will not be able to afford culling all infected sheep, but a long term control program could involve raising replacement lambs separate from the adults after weaning (or from birth, if raised artificially) and testing these animals at 6 months of age. Positives are removed from the group. Negative ewe lambs are never allowed to mix with the original, infected herd and are milked before the original herd, to avoid spread by the milking machine. They should be tested several times a year, in case a lamb seroconverts late or the virus gets into the group because of a lapse in biosecurity. Positive animals are relocated into the original, infected herd. Another tool that may become useful but has not been evaluated in dairy sheep is to select for genetic resistance to the virus, using a commercial test offered by several laboratories.

Caseous Lymphadenitis

Contagious abscesses caused by *Corynebacterium pseudotuberculosis* develop in external lymph nodes, especially in front of the shoulder and on the flank just in front of the hind leg of sheep. The infection spreads to other sheep when an abscess comes to a head and breaks open, contaminating the environment, or when opened by shearing equipment. Lice or keds that cause the sheep to rub on posts or fences also contribute to introducing the organism into the skin of another sheep. The incubation period can be 6 months or longer, and it is easy to introduce the infection to a farm with animals, including goats, that appear healthy.

Some sheep have internal abscesses, in lungs, liver or kidneys. These animals will eventually produce poorly and lose weight. They also will shed the germ in respiratory secretions or feces. If the abscesses are in two body cavities the carcass will be condemned at slaughter. Blood tests are not reliable for identifying infected sheep, so herds experiencing losses from this disease should consider vaccinating twice, a month apart, then annually. Reaction to the vaccine may cause a temporary drop in appetite and milk production, especially in infected sheep.

Footrot

Two bacterial organisms, *Dichelobacter nodosus* and *Fusobacterium necrophorum*, work together to cause a moist dermatitis between the toes that often progresses to underrunning of the sole from the heel and severe lameness. There is a bad odor from the foot. Affected sheep may hold up a foot or walk on their knees. This painful condition is a serious welfare issue and must be addressed. The disease is typically bought and paid for with hours of work inspecting and treating feet. Any sheep or goats acquired from a farm that has footrot can introduce the disease to a sheep dairy, even if they appear normal on arrival. Incoming animals should be treated during the quarantine period as if they were infected. Systemic antibiotics might be used in replacement animals or dry ewes, under the advice of the herd veterinarian with due attention to meat residues. To avoid the need to discard milk, lactating ewes can be treated with one hour soaks in a 10% zinc sulfate solution with an added laundry soap wetting agent. Culling is indicated for sheep with deformed feet from chronic footrot. There is no effective vaccine available in the North America.

Pink Eye

Several organisms, but especially mycoplasma and chlamydia species, can cause an infectious keratoconjunctivitis in sheep. Animals that have been previously infected but seemed to recover will shed the organisms again when stressed, especially after moving to a new herd. Mild cases show tearing of the eyes and squinting while in severe cases the clear outer surface of the eye (cornea) becomes cloudy, white or red, and central ulcers may form and perforate. Blood vessels grow in from the edge of the cornea to try to heal the lesions. This painful condition will decrease feed consumption and milk production. Your veterinarian may prescribe oxytetracycline by injection or as an eye ointment for individual animals. Treatment of mild cases is not advised as the antibiotics cannot eradicate the infection and the sheep needs to develop local immunity in the eyes, which takes time. If young lambs are suspected to have pinkeye they must be examined very closely to rule out entropion, an inward rolling of the eyelid margin. There is no effective vaccine for pink eye in sheep.

Sore Mouth

This viral skin disease is also known as contagious ecthyma or orf. It typically causes proliferative scabs on the lips and face of young lambs but when first introduced to a naive flock can cause skin lesions in adults also. These are especially serious if they develop on the teats of ewes, because staphylococcal bacteria in the scabs will travel up into the udder, causing mastitis, including fatal gangrenous mastitis. Lambs with lip lesions can spread the virus to their dam or to other ewes from which they try to steal milk. Skin lesions typically last four or five weeks but heal without a scar. People are susceptible to this virus and should wear disposable gloves when handling infected animals.

A commercial vaccine is available from Colorado Serum Co, <http://www.colorado-serum.com/csc/ovine_ectmya.html> or an autogenous live vaccine can be made by grinding up scabs and rubbing the suspension into the skin of lambs on the inside of the thigh or ear. Vaccine should not be used in uninfected flocks, as it consists of live virus and will introduce the disease to the farm. The virus can persist for many months in bedding, and the disease is mostly likely to remain a problem on the farm if there is a steady flow of new, susceptible lambs into the pens. Some adults are inapparent carriers of the virus, with purchased rams most often being blamed for an outbreak.

Johne's Disease or Paratuberculosis

This is a chronic bacterial infection of the intestine with *Mycobacterium avium* subsp. *paratuberculosis* that interferes with absorption of nutrients. The affected sheep is at least a year old (up to 8 or more years) when signs first develop even though it probably was first infected as a young lamb. The disease is spread by the fecal oral route, so crowding the sheep or not bedding them deeply may increase the number of infected lambs. Although cattle with Johne's disease typically have profuse diarrhea and a good appetite, most clinical sheep have no diarrhea and just milk poorly and get thin. They may have a picky appetite. There are no good tests to identify infected sheep before clinical signs appear, and even when the animal is emaciated, microscopic examination of the intestines (ileocecal junction) and intestinal lymph nodes is usually needed to confirm the diagnosis.

There is no treatment for this disease, and if the affected animal is allowed to remain in the herd it will shed millions of organisms that can infect other sheep and can survive on pasture or wherever the manure is spread, for a year or more. Thus an important part of control is to keep thin animals out of lambing pens and cull them promptly. Johne's disease can also be introduced to the farm with colostrum or manger sweepings or manure spread on pasture from an infected dairy cow farm.

Most sheep dairy farmers do not know if they have this disease or not. In a study of dairy flocks in Ontario, Canada, about 2/3 were judged to have Johne's disease on the farm and almost half of the sheep on the infected farms were thought to be infected (Bauman et al. 2016). There is no vaccine available in North America to protect sheep against this infection.

References

- Bauman C.A., A. Jones-Bitton, P. Menzies, N. Toft, J. Jansen, and D. Kelton. 2016. Prevalence of paratuberculosis in the dairy goat and dairy sheep industries in Ontario, Canada. *Canadian Vet J.* 57(2):169- 175.
- National Research Council. 2007. *Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids.* National Academies Press, Washington DC.
- Pugh, D.G. and Baird N. 2011. *Sheep & Goat Medicine*, 2nd edition. Elsevier/Saunders, Maryland Heights MO.
- Sheep Industry Development Program: S. I. D. *Sheep Production Handbook* [choose 'shop'], 2015 Edition, Vol 8. now with USB drive. Available at 9785 Maroon Circle, Suite 360, Englewood, CO 80112 phone 303-771-3500 ext 108 for \$89.95.
- Webb, A.I., R. E. Baynes, A. L. Craigmill, J. E. Riviere, S. R. R. Haskell. 2004. Drugs approved for small ruminants. *J Amer Vet Med Assoc* 224(4):520-523.