

Internal parasites in your small ruminants: Management is on the outside

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Sheep and goats that graze or eat near where their feces are kept moist and warm will become infected with internal parasites. Once infected, the ingested larvae implant and develop in the animal's gastrointestinal tract to an adult stage. This can take about 3 weeks. The adult worms shed eggs that are extremely protected against outside weather extremes and hatch when the conditions are right for further larval stage development. It may take as little as 5 days to reach an infective stage. In milder climates, like Great Britain, the eggs may survive for a year on pasture. Virtually all the larvae stages are susceptible to dry, hot and anaerobic conditions and, in the animal the adult worms are acted on by the animal's immune response. The animal's immune system is thought to affect implantation of the larvae and the egg shedding ability of the worm. Young animals with underdeveloped immune systems are more easily infected – like coyotes going after the young lambs because they can't defend themselves as well. Older animals are more resistant to infection than younger ones – a fact to hold onto. In some cases, the animal is housing worms that shed lots of eggs, meaning there are lots of worms inside, but the animal seems unaffected. This is called a resilient sheep or goat. A sheep or goat that decreases implantation or egg shedding is called a resistant sheep or goat. Which type of sheep or goat would you like to have?

Think on that question and let's talk about what benefits there might be to checking the fecal egg counts in your herd or flock. People examine the feces microscopically to determine what type and infection level of internal parasites. The big reason to do egg counts instead of only identifying an egg is that, at a certain worm load, the animal could die. From spring time until July 4, about 1,000 eggs per gram (epg) for adults and 500 epg for yearlings and younger is the trigger to deworm or to change your feeding management. And you can see if some animals carry a higher burden than others.

Animals contaminate pasture with worm eggs as they graze. If animals are concentrated in an area, near the barn, for example, the potential larval count will be much higher per unit of grass than in a less densely populated area. Management intensive grazing is great for amount of protein and energy harvested per unit of land but it can maximize parasite contamination, too. And, once the warm season has started, you will always have infective larvae on the grass and the numbers will increase as time goes on. The first few stages of larval development are free-living. One expert I talked with said that she kept a Petri dish of worm larvae and water in her lab and the wee ones stayed alive for weeks if not months. However, the third larval stage that is infective, often called L3, is parasitic and the larvae must survive on their own food reserves until they enter a host.

If there are always infective larvae in pastures, what can you do? Exposing the sheep or goat to lighter loads of larvae allows the small ruminant to mount an immune response over a period of time, similar to how a vaccine works, making them more resistant to parasites. You can use many management techniques to decrease the egg/larvae load on your pasture by:

- only passing through once with your sheep or goats
- decreasing the stock density to below maximum levels
- following the small ruminants with cows or horses,
- mixing cows/horses with small ruminants (cows can transfer Nematodirus infections to small ruminants)
- cultivating the land
- making hay after one or two grazings
- not grazing below 2-4 inches
- not grazing in high manure areas
- having pasture plant diversity.

When feces hit the ground, temperatures need to only reach maybe 14°F for the larvae to start to develop, with the best range of larval number explosion being between 61-68 °F. From then, it takes, on average, 10 days for most species to change into their infective larval stage that then moves up the blades of grass to a height of about 2 inches.

So, mid-June is when people start seeing a rise in fecal egg counts since animals start grazing in May when temperatures are warm enough for larvae to be on the grass. The infective larvae are aided by moisture in moving up the grass, so some folks refrain from grazing until after the morning dew has burned off. Also, larvae move up blades of grass easily but are hampered by the condensed tannins contained in other plants. You could have a browse area (shrubs, small trees like staghorn sumac or poplar, wild plants like meadowsweet and bramble) or a field dominant with taller legumes like red clover or alfalfa which will host fewer larvae. Ann Wells, DVM with the National Center for Alternative Technology suggests grazing sage, oregano, chives, birds foot trefoil, lespedeza, sanfoin, and dock which have shown zero to low larval infestation when sampled. The condensed tannin content of these plants is also thought to contribute to the low larval load by inhibiting the hatching of eggs and development of larvae in the feces of animals that have been consuming the plants.

Another management focus is to be aware of what helps your lambs or kids develop well so that they have strong immune systems. Examples are real milk from dams, clean conditions, good nutrition, etc. For example, animals that have had a coccidia infection are more susceptible to roundworm infection. Active soils, with lots of earthworms, good pH, lots of organic matter, etc, provide lots of available minerals and those like copper, selenium and molybdenum, and zinc become more available in your forages. Copper is a required nutrient for sheep and goats, but its absorption and toxicity level are affected by the interaction of many other minerals present and by the genetic propensity of the animal. A deficiency of copper shows up as swayback, lack of muscle coordination in lambs, anemia and poor growth and steely or stringy wool in adults as well as lack of pigment in black sheep. In Australia, author Pat Coleby says that worms are prevalent in sheep where there is a deficiency of copper or at blood serum levels below 500 to 1100 mL per litre. Copper is added to the diet with dolomite to minimize toxicity risk. She notes that some plants, like St. John's Wort concentrate copper and sheep grazing on that show little worm problems.

Dairy, meat and fiber goats can graze like sheep but the goats are more susceptible to worm infestation. When egg counts reach 1,000 eggs/gm, it is time to do something as the goat can die at 2,000 eggs/gm. The most serious worm is *Haemonchus contortus*, or the barberpole worm, which implants in the stomach and sucks blood so much that the animal can become anemic and die without any signs of diarrhea. Each worm can shed up to 6,000 eggs per day. For the lactating animal, the dewormers that your veterinarian might choose to prescribe are Panacur (fenbendazole), Valbazen (albendazole), Eprinex (eprinomectin) and Rumatel (morantel). Ivermectin and Cydectin are secreted in the milk for a long time and should never be used in lactating dairy animals. Another thing you want to keep in mind is that these chemicals have effects on the environment as they are eliminated from the animal. Ivermectin has a negative effect on the dung beetle, your manure dispersing friend, and so you should consider using this only in the winter. Relying on chemical dewormers alone will tend to encourage the development of chemical resistant parasites; better to combine strategic use of dewormers with good nutrition and pasture management. If you do rely solely on chemical dewormers, they will become ineffective, as researchers have found in small ruminant populations around the world, including the United States.

If the worms remaining in your animals are the resistant ones, they will be shedding eggs to infect all the other animals grazing with them. It helps to leave animals with only a mild infestation untreated so that unselected worms remain in the population. Remember that you can buy in animals with resistant worms which will be shared with your herd or flock.

In other parts of the world, the fungus *Duddingtonia flagrans* has been isolated and is fed to livestock so that the fungi form nets in the feces that trap and kill many stages of larvae. Feeding 100,000 to 1,000,000 fungal spores per kg of body weight to infected sheep results in a reduction in number of infective larvae by 70-95%. The fungus does not deworm the sheep or goat, it starts to break the cycle after the eggs hatch in the feces. Research is being done at Louisiana State University on *D. flagrans* for use in the US.

While you are implementing management techniques, you may find still you are having a problem with some animals. It has been noted that 20% of the differences in resistance to parasites is due to differences in the genetic makeup of the animal. In cattle, differences of 30-40% are due to differences in genetics. In your own herd or flock, you might start selecting animal offspring from animals with lower fecal egg counts (including the rams and bucks on pasture). However, in the short term, with high egg counts one recommendation is to deworm only the symptomatic animals (high egg counts, diarrhea, less thrifty, anemic), hold them in an area for 24 hours and then move them to a clean area. The drug will be retained in the body and work better if the animal is held off feed overnight (like getting ready for a shearing). Follow the proper dosage. Goats usually require higher doses than sheep probably due to metabolic differences. If you are having a serious 'epidemic' bloom with sick animals, I would suggest removing them from pasture that is so infective and putting them on dry hay for a while just to stop the constant barrage of infective larvae. In Chinese medicine, conditions associated with

gastrointestinal parasite infection are described as a very moist, watery environment in the body. Dry hay passes through the gastrointestinal tract more slowly and can have good results in decreasing or stopping diarrhea which causes loss of electrolytes and decrease in the absorption of other nutrients. Try offering good quality dry hay or forage with some concentrate, if necessary in very weak animals.

Young stock (anything below 1 year of age) are the most susceptible to infection. In France, they followed the counts of eggs per gram of feces (epg) from lambs on continuous grazing with ewes. In May, the eggs of feces from lambs were near zero and by September, the eggs were at the 3,000 level. The researchers sacrificed lambs and found over 30,000 adult worms in their GI tracts in September. Supplementing lambs at crucial infestation times can give them more ability to resist some infestation. Feeding higher protein supplements (increase total diet protein to 18%) to ewes at lambing and to challenged lambs has resulted in lower fecal egg counts. Lush pastures are often 20-30% protein so this supplementation is debatable unless the type of protein is important. Perhaps, dam's milk is the best antidote and it is hard to mimic. Lambs start to develop immunity to some parasites starting at 4 months but, again, need a low level of infection for it to be useful and not detrimental.

Now, if you want to check to see what your ewes/does and lambs/kids might have for worm load, there is a well-tested home procedure. I would recommend that you check out the website at the E Kika de la Garza Institute for Goat Research at <http://www2.luresext.edu/goats/index.htm> and click on the On-line Manual for Conducting Fecal Egg Counts in Goats. (It will work for sheep, too.)

You will need to arm yourself with a 4X and 10X power microscope (borrow from your local school?), a McMaster slide (order from Chalex Corporation, 5004-228th Ave SE, Issaquah, WA 98029, 425-391-1169, www.vetslides.com, chalexcorp@att.net), a solution of sugar (1lb sugar in 12 ounces water or 454 gms in 355mls – will need heating to dissolve and will grow mold after) or salt-NaCl (400gms in 1000 mls water) or Epsom salts (400gms in 1,000 mls water), a pipette or dropper, a small cup sized sieve, a small bowl, a scale to weigh in grams and something to measure milliliters. Some tips on this procedure: If you count below 200 eggs, the counts are not considered accurate. Ideally, you need to check at least 20 animals in your herd to get a representative sampling of the group. Another option is to sample the animals that are most likely to be having worm problems (young animals, does that are nursing triplets, skinnier animals). When you have a fecal sample, mix and mash it together before you weigh it out.

If you don't want to do fecal egg counts but want to deworm before the barberpole worm takes deadly hold, you can check the lower eyelids on your sheep or goats to see if or how anemic they are. Go to the Souther Consortium for Small Ruminant Parasite Control website <http://www.scsrpc.org/FAMACHA/famacha.shtml> to see the card that was developed to teach you to evaluate anemia visually.

Going back to an earlier question, would you like a resilient animal or a resistant animal? For me, a resistant animal seems to make more sense as they are able to break

the cycle of the parasite which will mean fewer eggs deposited on pastures. Also, there will be less damage to the gastrointestinal tract and the feed conversion should be more efficient, meaning lower feed costs. Regardless of the resistant status of your sheep or goat, work on outside management to control internal parasite infection first and use dewormers judiciously.

Sources

Goat Field Day Proceedings, 2003, Langston University, "Forage Based Dairy Goat Management" by Steven Hart and BR Min.

Healthy Sheep, Naturally, Pat Coleby, 2nd Edition, 2000, Landlinks Press, Collingwood, Australia.

Nutrient Requirements of Sheep, 1985, National Academy Press, Washington, DC.

Parasites and Parasitic Diseases of Domestic Animals, Dr. Colin Johnstone, Principal Author, <http://cal.vet.upenn.edu/merial/>

Positive health: Preventive measures and alternative strategies, Proceedings of the 5th NAHWOA Workshop, Rødding, Denmark – November 2001. The University of Reading.

"Roundworm control in organic sheep systems", Soil Association Technical Guide for organic crop and livestock production, 2000, ISBN 0-905200-74-8

Vermont Grazing Conference, 2004, Talk by Dr. Ann Wells.

Veterinary Clinical Parasitology, 1994, 6th edition by Sloss, Kemp and Zajac, Iowa State University Press