Managing Internal Parasites in Sheep and Goats

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Internal parasite management, especially of *Haemonchus contortus* (barberpole worm, stomach worm), is a primary concern for the majority of sheep and goat producers. These parasites have become more difficult to manage because of developed resistance to nearly all available dewormers. This publication discusses new techniques to manage parasites and to prolong the efficacy of dewormers. New management tools that remain under investigation are also discussed. A list of resources follows the narrative.

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Owners of this Katahdin ewe and her lambs are able to manage internal parasites using sustainable techniques. NCAT photo by Margo Hale.

Introduction

The management of internal parasites, primarily *Haemonchus contortus* (barberpole worm), is considered by many to be the biggest production concern for small ruminants. "There are many important diseases of sheep and goats," notes University of Georgia researcher Ray Kaplan, DVM, PhD, "but none are as ubiquitous or present as direct a threat to the health of goats as internal parasites." (Kaplan, 2004a). The cost of internal parasite infection includes treatment expense, reduced animal weight gains, and even animal death.

These parasites are difficult to manage because on some farms they have developed resistance to all available commercial dewormers. (Zajac, Gipson, 2000) Resistance to dewormers is now seen worldwide (Kaplan, 2004b). Producers can no longer rely on drugs alone to control internal parasites. Rather, an integrated approach that relies on sustainable methods to manage internal parasites should be employed.

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Most animals in a flock are not visibly affected by parasites and do not need to be treated with dewormers. Photo by Linda Coffey.

Parasite Primer

Internal parasites (worms) exist by feeding off of their host. Some types do this directly, by attaching to the wall of the digestive system and feeding on the host's blood. These types of parasites cause anemia in the host, as well as other symptoms. Haemonchus contortus (barberpole worm) is one example of this type. Others live off the nutrients eaten by the host; these cause weight loss but not anemia.

Mature parasites breed inside the host and "lay eggs," which pass through the host and are shed in the feces. After the eggs pass out of the host, they hatch into larvae. Warm, humid conditions encourage hatching. The larvae need moisture to develop and move. They migrate out of the feces and up blades of grass (usually 1 to 2 inches). When an animal (sheep or goat) grazes, they may take in parasite larvae along with the grass blade. An animal can also pick up parasite larvae by eating from a feed trough that is contaminated by manure.

Internal parasite numbers:

- Increase with number of host animals
- Increase during warm, humid weather
- Increase when pastures are grazed too short
- Decrease during hot, dry weather
- Decrease if a non-host animal (cattle or horses) graze the same pasture
- Decrease with pasture rest time, as the larvae naturally die off

Parasite numbers increase over time when conditions are favorable (warm, wet). Internal parasites get out of control and cause damage when their numbers grow beyond what the animal can tolerate. In order to manage internal parasites, it is important to understand the parasite cycle and factors that encourage their production.

Parasitism

Animals raised in confinement or on pasture-based systems will almost certainly be exposed to internal parasites at some point in their lives. Dry environments, such as arid rangelands, will pose less of a threat for parasite infections. Warm, humid climates are ideal for worms, and therefore animals will have more problems with internal parasites in these climates.

Sheep and goats should be managed so that parasitism is not evident. Sheep and goats will always host some level of parasite burden. Certain signs of parasitism are seen when the parasite load becomes excessive or when the animal's immunity can no longer overcome the adverse effects of the parasitism. (Scarfe, 1993) Young animals and those with weakened immune systems due to other diseases are most affected by internal parasitism. A combination of treatment and management is necessary to control parasitism so that it will not cause economic loss to the producer. (Scarfe, 1993)

While it is ideal to manage animals so there are no visible effects of parasitism, some will nonetheless succumb to the burden of internal parasites. Learn to recognize the signs of internal parasite infections and offer early treatment.

Due to lowered immunity, young stock and pregnant or lactating animals are more likely to be affected by internal parasites. Photo by Linda Coffey.

Loss of condition and rough hair coat indicate parasitism. Photo courtesy of Jean-Marie Luginbuhl.

Bottle jaw is a sign of parasitism. Photo courtesy of Jean-Marie Luginbuhl.

Signs of Parasitism

- Loss of condition
- Rough hair coat
- Scours, diarrhea
- Bottle jaw
- Pale mucous membranes (eyelids, gums), indicating anemia
- Death

Resistance to Dewormers

Producers were once instructed to deworm all of their animals every three to six months. Many producers dewormed even more often, as often as every four weeks in humid climates. It is now known that this practice is not sustainable.

Drug resistance is the ability of worms in a population to survive drug treatments that are generally effective against the same species and stage of infection at the same dose rate. (Kaplan, 2004b) Over-use of dewormers has led to resistance, and available dewormers are now ineffective. In an article from 1993, David Scarfe predicted the development of drug resistance.

> Suppressive deworming is probably the most effective means of keeping parasite numbers lowered for a period of time. However, this method will also eventually lead to resistance to the anthelminthics(s) used much more rapidly than if other strategies of control are utilized. One point to consider here is alternating the use of different drugs.
>
> It is considered by this author, and several expert parasitologists, that rapid rotation of different drugs is ill-advised as this will lead to resistance of multiple drugs – something that the small ruminant industries certainly do not need. (Scarfe, 1993)

Scarfe recognized the unsustainable practices that were being used long before parasites were resistant to dewormers in the U.S.

Some farms still have dewormers that continue to work, while others have no effective dewormers. This is a problem because no new dewormersc for sheep and goats are currently under development. (Kaplan, 2004b)

Development of Resistance to Dewormers

Internal parasites, especially *H. contortus,* have developed drug resistance. Drug treatment gets rid of the worms that are susceptible to that particular drug; resistant parasites survive and pass on “resistant” genes.

Overview of Available Dewormers for Sheep and Goats

Several types of dewormers are available for use in sheep and goats. Many are not approved for use in sheep and goats, however, so work with a veterinarian to ensure proper "off-label" use. The different classes of dewormers have different modes to kill worms. The level of resistance depends on the class of dewormer and how often the drug was used on a particular farm.

Drug Class	Common Names/ Brands	Effectiveness
Benzimidazoles	Albendazole (Valbazen®), Fenbendazole (Safeguard®)	High prevalence of resistance
Avermectin/ Milbemycins	Ivermectin (Ivomec®) Moxidectin (Cydectin®)	Ivermectin— least effective of all available drugs Moxidectin—resistance becoming common where used frequently
Imidazothiazoles/ Tetrahydropyrimidine	Levamisole (Tramisol®), Pyrantel (Strongid®), Morantel (Rumatel®)	Low to moderate prevalence of resistance

Related ATTRA Publications

Integrated Parasite Management for Livestock

Goats: Sustainable Production Overview

Meat Goats: Sustainable Production

Dairy Goats: Sustainable Production

Sustainable Sheep Production

Dairy Sheep

Small Ruminant Sustainability Checksheet

Worms that are not treated are called "refugia." The concept of refugia has been largely overlooked in the past. Having some worms in refugia (not treated) insures that a level of genes remain sensitive to dewormers. (Kaplan, n.d.) A surviving population of untreated worms dilutes the frequency of resistant genes. Consequently, when a dewormer is required, it will be effective because the worms will be susceptible to treatment. (Kaplan, n.d.)

When fewer numbers of animals receive treatment, the refugia population remains large. The more refugia, the better. Sustainable techniques, such as FAMACHA©, fight drug resistance by increasing refugia.

In contrast, several practices accelerate drug resistance. They include frequent deworming (more than three times a year), underdosing (often caused by miscalculation of body weight), treating and moving to clean pasture, and treating all animals, regardless of need. These practices lead to resistance because they decrease the number of worms susceptible to dewormers (refugia).

Since no dewormer is 100 percent effective 100 percent of the time, worms that survive a dose of dewormer are resistant to that dewormer. Frequent deworming increases the rate resistance develops.

Each time animals are dewormed, the susceptible worms are killed. The strong ones survive and lead to a population of very resistant worms. Underdosing causes larger numbers of stronger worms to survive. The weakest, most susceptible worms are killed. But because of the weak dose, more of the stronger worms will be able to survive and reproduce, creating a population of stronger worms. Once an animal has been treated, only resistant worms remain. If the animals are moved to a clean pasture they deposit only resistant worms on the pasture. There are no susceptible worms to dilute the worm population. Treating all animals regardless of need ignores the importance of refugia and will lead, in time, to a population of worms unkillable by dewormers.

Pasture Management

Numerous techniques can be used to control parasitism. Pasture management should be a primary tool to control internal parasites. Sheep and goats ingest infective parasite larvae from pasture. The rate at which they are ingested can be controlled through pasture management.

Eating higher off the ground reduces the number of parasite larvae consumed. Photo by Margo Hale.

Most worm larvae crawl up the plant only one to two inches from the ground. Preventing animals from grazing below that point decreases the number of worm larvae ingested. Animals that eat closer to the ground tend to have more problems with internal parasites. It is important to monitor animals and the pasture. Allowing animals to graze pastures too short results in more parasites consumed and reduced feed intake, therefore harming the animal in two ways. It also inhibits pasture regrowth.

Larvae migrate no more than 12 inches from a manure pile. Livestock not forced to eat close to their own manure will consume fewer larvae. Providing areas where animals can browse (eat brush, small trees, etc.) and eat higher off of the ground helps to control parasite problems.

Decreasing the stocking rate decreases the number of worms spread on a pasture. The more animals you have on one pasture, the more densely the worms are deposited. Animals on densely stocked pastures are more likely to have parasite problems. Grazing sheep and goats with cattle, or in a rotation with cattle, can also reduce internal parasite problems. Cattle do not share the same internal parasites as sheep and goats. Cattle consume sheep and goat parasite larvae, which helps "clean" the pasture for the small ruminants.

Sheep grazing at Maple Gorge Farm in Prairie Grove, Arkansas. Photo by Margo Hale.

Certain forages have also been shown to control parasite problems. Tannin-rich forages, such as sericea lespedeza, have been shown to help reduce internal parasite egg counts. (Min and Hart, 2003; Shaik et al., 2004) Other plants, including plantain, chicory, and wormwood, also have an anthelmintic effect, although wormwood also produces toxic compounds. Providing tannin-rich forages and diverse pastures can help animals battle internal parasites.

High levels of tannins in forages such as sericea lespedeza reduce worm burdens. Photo courtesy of Jean-Marie Luginbuhl.

New Techniques

FAMACHA©

FAMACHA© is a system for classifying animals into categories based upon level of anemia. (Kaplan, n.d.) It was developed in South Africa and has been validated in the U.S. (Kaplan et al, 2004)

This system identifies anemic animals on a 1 to 5 scale by examining the eyelids of sheep and goats (see photo next page). The system treats only animals that are anemic (a sign of parasitism). This reduces the use of dewormers, slows the development of resistant worms, and saves the producer money. Most importantly, it also allows the producer to select animals that are healthier. By breeding the healthiest animals and culling the weaker individuals, the flock or herd becomes stronger over time. FAMACHA© is only effective for

FAMACHA© System Saves Money and Reduces Stress

On Maple Gorge Farm, in Prairie Grove, Arkansas, busy schedules prevented the farmers from monitoring parasites. By late summer, the sheep had been grazing for months with no treatment. The farmers noticed a young lamb with bottle jaw and feared they had a huge problem on their hands.

They considered not bringing the animals in for treatment because they were low on dewormer. They knew they wouldn't have enough to treat all of the animals. Then they remembered the FAMACHA© system that they had recently been trained in. Using the FAMACHA© system, they decided to sort off, identify and treat only the 4s and 5s (anemic animals), and a few 3s that were thin.

To their surprise, only 9 of the 65 sheep actually needed treatment. Identification numbers and FAMACHA© scores were recorded. They decided any ewe scoring a 4 or 5 would not be kept in the flock.

This whole process took less than an hour. Treating only the animals in need reduced stress for the animals and farmers, and also saved money. After using the FAMACHA© system and seeing how easy it was and the impact it had on their flock, the farmers at Maple Gorge Farm are believers in the system.

Demonstration of the FAMACHA© technique. Photo by Margo Hale.

the treatment of *H. contortus*. Producers must be trained by a veterinarian or other trained animal health professional in order to use FAMACHA©. (Kaplan, n.d.) However, this technique is simple to learn and quick and easy to use. For more information on FAMACHA©, see *Other Resources*, page 8.

Other Techniques

Selecting Resistant Animals

Several other techniques can be used to help manage internal parasites. There are several breeds of sheep and goats that show resistance to parasites. There is something in their genetic makeup that causes them to host a smaller parasite load. Breeds such as Gulf Coast Native, St. Croix, Katahdin, and Barbados Blackbelly show an increased resistance to parasite loads. Spanish, Myotonic, and Kiko goat breeds have also shown a tolerance to parasites. Resistance will vary within breeds as well. Some animals, regardless of breed, will be more resistant to parasites than others. Having parasite-resistant animals will decrease the need for dewormers.

Sheep breeds such as Gulf Coast Native show resistance to parasites. Photo by Linda Coffey.

Within any breed, certain animals are more tolerant of parasite loads than others. These resilient animals can host a large parasite burden, yet show few signs of parasitism. Some animals will carry a heavier parasite load than others. Research shows that 20 to 30 percent of the animals carry 70 to 80 percent of the worms. (Kaplan, n.d.) Producers should cull animals that are always "wormy," and select for animals that have a natural resistance or tolerance to a slight parasite burden. The FAMACHA© system will help you identify those more tolerant animals.

Copper Wire Particles

Recent research has been performed on the use of copper wire particles to control internal parasites. Studies show that copper wire particle boluses administered to lambs decrease parasite loads. (Burke et al., 2004) However, higher doses may increase the risk for copper toxicity in sheep. Copper wire particle treatments do not appear to be effective in mature sheep (Burke et al., 2005), but may work in mature goats. (Chartier et al., 2000)

Smart Drenching

Smart Drenching refers to the ways producers can use dewormers (drenches) more selectively and effectively.
—Southern Consortium for Small Ruminant Parasite Control, SCSRPC, n.d.

Used in conjunction with FAMACHA©, Smart Drenching helps slow the development of parasite resistance. The components of Smart Drenching are:

1. Find out which dewormers work by performing a fecal egg count reduction test or a DrenchRite larval developmental assay.

2. Weigh each animal prior to deworming. Double the cattle/sheep dose when deworming goats for all dewormers, except Levamisole, which should be dosed at 1.5 times the cattle/sheep dose in goats.

3. Deliver the dewormer over the tongue in the back of the throat with a drench tip or drench gun.

4. Withhold feed 12 to 24 hours prior to drenching with benzimidazoles, ivermectin, doramectrin, and Moxidectin, if possible.

5. Benzimidazole efficacy is greatly enhanced by repeating the drench 12 hours after the first dose. Albendazole should not be used during early pregnancy (during buck/ram exposure and up to 30 days after their removal).

6. Simultaneously use two classes of dewormers if resistance is suspected.

7. Drench only the animals that need treatment . (SCSRPC, n.d.)

Research is still underway on this technique, especially for long-term studies to determine the copper levels that are toxic to sheep.

Nematode-Trapping Fungus

Another tool currently being researched is the use of nematode-trapping fungus. This fungus traps parasite larva in the feces, interrupting its life cycle. Research has shown that it is "effective in significantly reducing development of L3 and appears to be an effective tool for biocontrol of parasitic nematodes in goats" (Terrill et al., 2004). The use of these fungi is still being researched.

Conclusion

Control of internal parasites in sheep and goats can be a daunting task. Previous control methods are no longer viable, so new techniques must be used Techniques such as increased pasture management, Smart Drenching, FAMACHA©, and selecting parasite-resistant animals can help to manage internal parasites. These techniques reduce dependence on dewormers and lead to a more sustainable parasite management program. New techniques, such as copper wire particles and nematode-trapping fungus, are being researched and developed. These developments may increase the tools available to battle internal parasites of small ruminants.

Resources

The following publications are available from ATTRA. These publications are free of cost. Copies can be requested by calling 800-346-9140 or at our website: *www.attra.ncat.org*.

- Goats: Sustainable Production Overview
- Meat Goats: Sustainable Production
- Dairy Goats: Sustainable Production
- Sustainable Sheep Production
- Dairy Sheep
- Small Ruminant Sustainability Checksheet
- Small Ruminant Resources
- Integrated Parasite Management for Livestock
- Predator Control for Sustainable and Organic Livestock Production
- Multispecies Grazing
- Matching Livestock and Forage Resources
- Rotational Grazing
- Pastures: Sustainable Management

Other Resources

Southern Consortium for Small Ruminant Parasite Control, *www.scsrpc.org*

Association of Small Ruminant Practitioners
1910 Lyda Avenue, Bowling Green, KY 42104-5809
Phone: 270-793-0781, *http://aasrp.org*

Management of Barber Pole Worm in Sheep and Goats in the Southern U.S.
www.attra.org/downloads/goat_barber_pole.pdf

Maryland Small Ruminant Page
www.sheepandgoat.com

FAMACHA© Information
www.vet.utk.edu/departments/LACS/pdf/FAMACHA.pdf
www.scsrpc.org/SCSPRC/FAMACHA/famacha.htm

Langston University, Oklahoma:

- E. (Kika) de la Garza Institute for Goat Research *www.luresext.edu/goats/index.htm*
- Information about Internal & External Parasites of Goats, *www.luresext.edu/goats/training/parasites.html*

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