

A Haemonchus contortus

Management Plan for Sheep and Goats in Texas

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Internal parasites represent the single largest threat to productivity and economic gain by Texas sheep and goat producers, challenged only by predators in certain regions of the state. Favorable environmental conditions for propagation and survival outside the host occur annually. Recently, incidence of internal parasite populations resistant to both label-approved and other available anthelmintics have increased. Best management practices for internal parasites in sheep and goats need to be identified and implemented.

Survey

A 1993 survey of 650 sheep and goat producers in Texas indicated that 473 (73 percent) raised finewool sheep, 136 (21 percent) raised medium wool sheep, 340 (52 percent) raised Angora goats and 237 (36 percent) raised meat goats. Although not all respondents indicated the number of animals they owned, those responding rep-



resented approximately 385,000 finewool sheep, 20,000 medium wool sheep, 285,000 Angora goats and 40,000 meat goats.

Ninety-nine percent of surveyed producers dewormed sheep and Angora goats while only 66 percent dewormed meat goats. Methods used to decide when to deworm were: at certain

times of the year or by the calendar - (43 percent); when weather conditions warrant - (40 percent); fecal egg counts - (36 percent); general appearance of livestock - (33 percent); and when gathering animals for another purpose (30 percent). Product rotation decisions were: once a year (38 percent); when product becomes ineffective (31 percent); and each time animals are treated (29 percent). Nine percent never rotate anthelmintics.

The percent of respondents using specified anthelmintics during the past five years were: ivermectin - 87 percent, levamisole - 74 percent, albendazole - 43 percent, fenbendazole - 42 percent, oxfendazole - 22 percent, thiabendazole - 20 percent and mebendazole - 11 percent. Other products were used by 4 percent or less of the producers. Anthelmintic efficacy is most frequently estimated by visual observation of livestock (82 percent), while fecal egg counts are used by 36 percent of the respondents.

Nineteen percent of producers used anthelmintics exclusively in parasite management. Eighty percent use some form of pasture rest and/or rotation, 31 percent graze fields, and 7 percent are attempting to select sheep and goats that are resistant to parasites.

Characterization of *Haemonchus contortus*

Although numerous gastrointestinal nematodes are present, *Haemonchus contortus* presents the greatest concern in Texas sheep and goats. Common names for *Haemonchus contortus*

include stomach worm, Barber's pole worm and wire worm. The adult worm, found in the abomasum, is 10 to 30 mm in length. Females are very prolific, each capable of producing as many as 5,000 eggs daily. The life cycle (egg to mature adult) is 17 to 21 days (Figure 1). Warm, moist soil surface conditions favor propagation while hot, dry or extremely cold conditions are detrimental to larvae survival.

An important adaptation of *Haemonchus contortus* is the ability to overwinter in the abomasum of its host in a dormant state known as hypobiosis. Ingested larvae

begin undergoing hypobiosis as they are acquired during the autumn, September and October. These larvae do not feed or lay eggs and do no damage to their hosts while in this state. However, when the ewe or doe reproduces, the worms receive signals that it will soon be spring and they resume development. The lactating ewe or doe is unable to rid herself of the now adult worms and large numbers of eggs are shed into the pastures. When the weather warms up, larvae will be waiting for the newborn as well as the ewe or doe to ingest them.

While most of the worms in hypobiosis survive, the larvae in the pastures die off, especially if it is a dry winter. Therefore, most of the worm population is in the host, not on the pasture as is the case during most of the year. The fact that lactating ewes or does are unable to control adult parasite populations as well as dry ewes or does enables the worms to produce more eggs over a longer time span further contaminating the pasture. The larvae develop more slowly in the late winter or early spring but survive until the really hot dry summer weather conditions desiccate them.

Signs of infection include acute anemia, edema (bottle jaw), weak and listless behavior, and ultimately death. Diarrhea frequently occurs with heavy infestations. Young animals and females 30 days either side of parturition are most vulnerable.

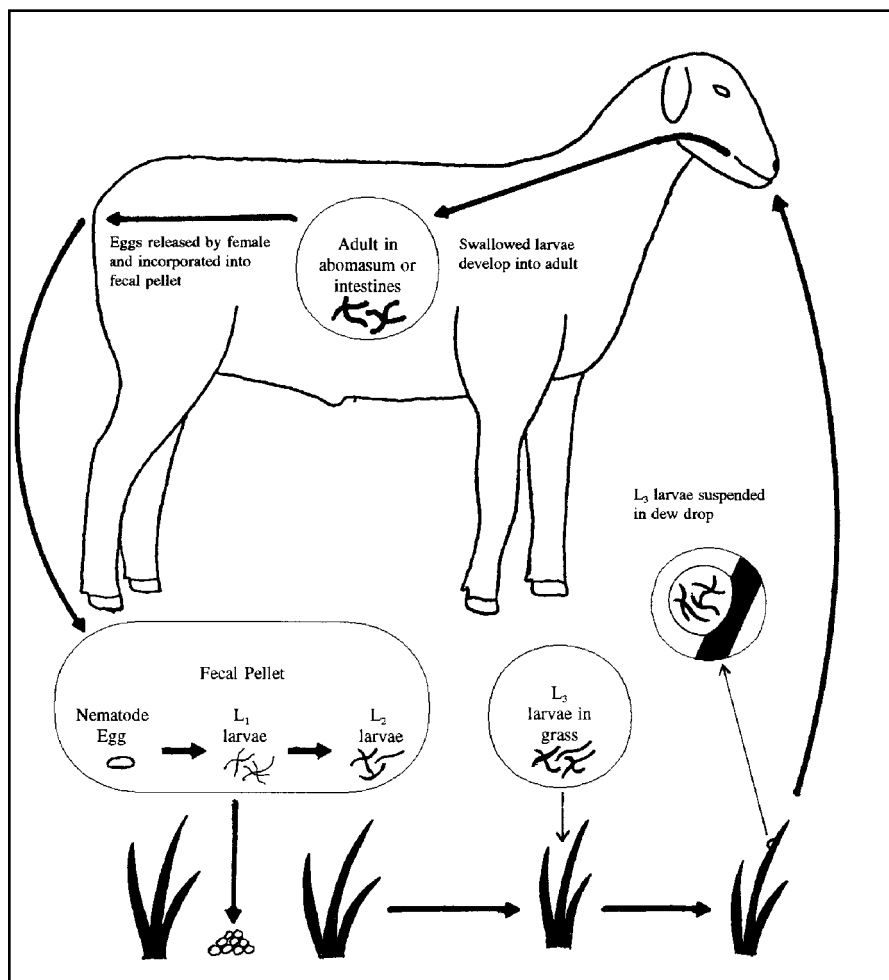


Figure 1. Life cycle of *Haemonchus Contortus*

Sources of Resistance

Anthelmintic products available to Texas sheep and goat producers are limited in number. New product development, relative to the size of its market, is cost prohibitive. Frequency of documented cases of resistant populations is increasing. Therefore, resistance management warrants serious consideration.

Several scenarios can result in resistance development. These include:

1. **Insufficient dose.** The margin of safety for all approved products is wide, at least twice the recommended dose. Therefore, the dosage selected for all animals should be appropriate for the heaviest animal in that group (grouped by weight). Once an appropriate dose is selected, equipment should be checked periodically to calibrate the amount of product being delivered. Delivery should always be checked when changing to a product of different consistency. Underdosing might save a few cents in the short term but can be quite costly should resistance develop.
2. **Inappropriate route of administration.** Anthelmintics available to livestock producers may be delivered in one or more of the following forms: oral dose, subcutaneous injection, pour-on, or feed additives. The appropriate method for sheep and goats is oral administration of products designed for oral delivery. Follow label directions.

3. Ineffective compound.

Anthelmintics available to U.S. producers can be divided into three groups according to active ingredient (Table 1). Since two of the groups contain only one compound, the concern of using an ineffective compound is potentially more important in the benzimidazole group. Use of an ineffective product is a waste of producer's money and could lead to the development of resistance.

Rotate products annually or until resistance develops. When rotating products, the appropriate rotation is across classes of compounds (not within a class of compound). For example, rotate from a benzimidazole to avermectin to imidothiazole, not from thiabendazole to fenbendazole to oxfendazole.

4. Massive re-exposure.

Deworming animals and returning them to a heavily infested pasture is an exercise in futility. Animals will immediately begin the reinfection process. Grazing management (pasture rotation) is an integral part of an internal parasite management plan. Animals with significant worm burdens can continue to shed viable eggs for several hours or days after anthelmintic administration. If possible, hold treated animals in the pen for 48 hours post-treatment and then release them to an uncontaminated pasture.

Table 1. Anthelmintics available to U.S. sheep and goat producers. Only three compounds are approved for use in small ruminants.

Class of Compound Active Ingredient	Trade Name	Efficacy against <i>Haemonchus contortus</i>
Avermectin		
ivermectin*	Ivomec®	+++
Benzimidazoles		
albendazole	Valbazen®	+++
fenbendazole	Safe-Guard®, Panacur®	++
mebendazole	Telmin®	++
oxfendazole	Synanthic®, Benzelmin®	++
oxibendazole	Anthelcide®	++
thiabendazole*	TBZ®	+
Imidothiazole		
levamisole*	Tramisol®, Levasol®	+++

*These products are approved for use in sheep and/or goats.

Resistance Management Strategies

Prevention, rather than cure, is the philosophy used in developing management programs for *Haemonchus contortus*. It must be assumed that this parasite cannot be eradicated but can be limited to the extent that it does not cause economic loss to the producer. The following strategies attempt to take advantage of livestock management and parasite population dynamics when implementing a management plan.

Strategic – when an anthelmintic is administered while the parasite population is concentrated in the host, transmission rate is very slow and pasture contamination is at an annual low. In Texas, the most appropriate time of year for implementing a strategic treatment is after the first hard killing frost and before spring

greenup. The ideal treatment window for most of the state is December 15 - February 15. The primary targets of this mid-winter treatment are the hypobiotic larvae in the host. Therefore, a product labeled for inhibited larvae (L₄ stage) must be used.

Another appropriate time for strategic treatment is when animals are being moved from a contaminated pasture to an almost parasite-free pasture. A pasture can be considered relatively free of *Haemonchus contortus* larvae if: 1) it has been tilled since sheep and/or goats last occupied the pasture or, 2) the pasture has been completely vacant of sheep and/or goats for at least three months during the spring/summer or early fall or for at least six months during the fall and winter. For many sheep and goat operations with native range as a production base, deferring pastures for this length of time may not be feasible.

Tactical – when weather conditions have been favorable for development of parasites. Moisture (heavy dew or rain) must be present on the soil surface to facilitate larvae movement from the fecal pellet to the forage. The purpose of the tactical treatment is to eliminate the active worms in the gut before they have the opportunity to further contaminate the environment. Timing of the tactical treatment may then be based on 1) recent precipitation and warm weather or, 2) increasing fecal egg counts.

Fecal Egg Counts

Frequently during the spring, summer, and early fall, based on subjective observations, internal parasites are cited as the cause of poor livestock performance. While parasites are frequently the culprit, other performance inhibitors do exist. Fecal egg counting is a practical, cost-effective diagnostic tool for determin-

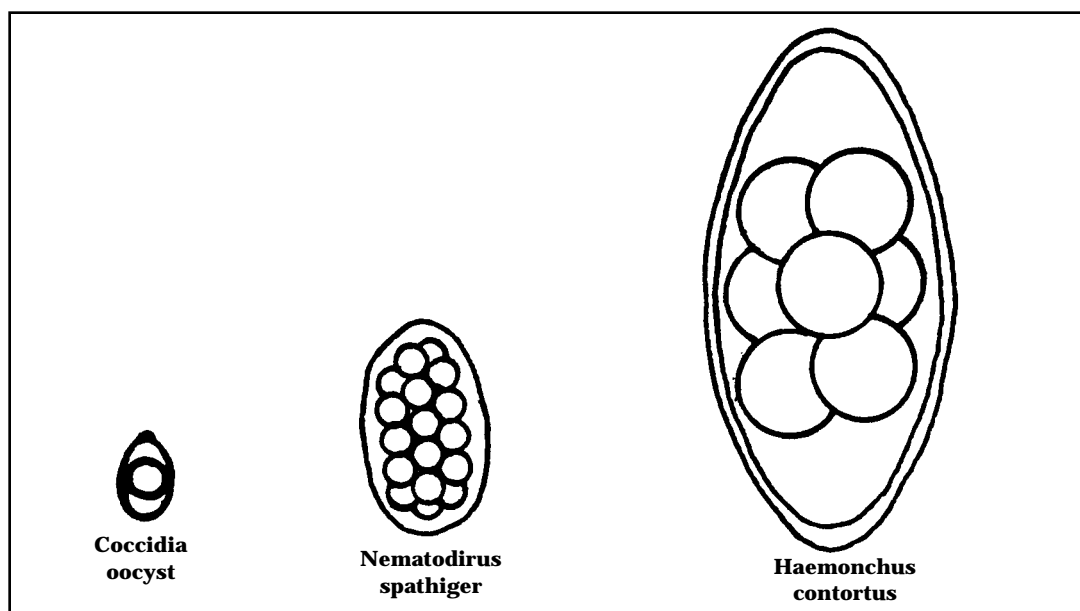


Figure 2. Common parasite eggs and oocysts found in sheep and goat feces.

ing parasite burden. This procedure involves collecting a fresh fecal sample, mixing 2 grams of the fecal material in a flotation solution and examining a known quantity of that solution under a microscope. For details on the egg counting procedure, see TAEX leaflet L-5094, Monitoring Internal Parasite Infection in Small Ruminants. For reference, sketches showing the relative sizes of eggs from commonly observed parasites are shown in Figure 2. Several points concerning fecal sample collection warrant further consideration.

1. Fecal pellets may be taken from the rectum or picked up off the ground. An excellent opportunity for sample collection is early in the morning as the animals are leaving their bed-grounds. Fresh samples are easily distinguished from older, weathered droppings.
2. Collect 8 to 10 warm, moist, soft pellets per sample and place them in a sealable plastic bag (to protect against dehydration). Samples should be kept cool (<50° F) until analysis. If immediate or same day analysis is not possible, samples may be refrigerated (not frozen) for up to 72 hours.
3. Collect at least 6 individual samples per parasite management unit prior to anthelmintic administration. Management units might be pastures, flocks, separate ranches, etc. Collection of a composite sample, while better than no fecal egg count at all,

yields a less accurate assessment of parasite burdens.

4. Early detection of resistance development and evaluation of anthelmintic efficacy involves fecal collections and analysis 7 to 10 days post-treatment. Again, a minimum of 6 samples is suggested. Post-treatment samples verify product efficacy.

Results of the analysis should be reported in eggs per gram of feces. Need for treatment can be based on the "rules of thumb" listed in Table 2.

These rules of thumb are not etched in stone for every Texas sheep and goat producer. They are merely benchmarks for producers to use in the development of their specific IPM program. These rules are most applicable to spring lambing/kidding operations. The reasoning behind these guidelines includes:

- During spring and early summer, nutrient requirements for ewes and does are high due to lactation, thus toler-

ance of parasites is less than later in the year when nutrient requirements are lower. In addition, resistance of ewes or does to *Haemonchus contortus* is weakened at the time of kidding and during early lactation.

- Many offspring are weaned and sold by mid-summer. Those remaining in the flock have increased in size and age such that they can tolerate a larger parasite burden.
- As a compliment to animal management, another objective of these guidelines is to minimize pasture contamination (tactical treatment) during the early part of the parasite season. The lower thresholds of 500 and 1,000 help to reduce such pasture contamination.
- Relative to parasite management, there is nothing significant about July 4 other than it is a mid-summer date that is easy to remember.

Table 2. Treatment Thresholds for Internal Parasites in Sheep and Goats

Time of Year	Mature Animals	Yearlings and Younger
Spring Greenup - July 4	1000 epg*	500 epg
July 4 - First Frost	2000 epg	1000 epg
*epg = eggs per gram of feces Egg counts equal to or above these levels warrant anthelmintic administration.		

Summary

Development of an effective management plan for *Haemonchus contortus* involves correctly answering three simple questions:

Question: When do I treat?

Answer: Absolutely implement a strategic, mid-winter treatment. Other treatments should be coordinated with pasture management and justified by fecal egg counts.

Question: Which animal do I treat?

Answer: If fecal egg counts or visual observation indicate significant parasite burdens in some animals, all animals in that management group should be treated. Failure to treat animals continues the pasture contamination process, reinfests treated animals, and contributes to resistance development.

Question: What do I use?

Answer: An efficacious product. Rotation among products should be done across groups and not within a group of products (specifically the benzimidazoles). Strategic mid-winter treatments must involve a product labeled for inhibited larvae. Fecal egg counts are the only practical management tool for assessing product efficacy.

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