



Managing Internal Parasites in Sheep and Goats

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Internal parasite management, especially of *Haemonchus contortus* (barber pole 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 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.



Owners of these lambs are able to manage internal parasites using sustainable techniques. Photo: Robyn Metzger, NCAT

Introduction

Many consider the management of internal parasites, primarily *Haemonchus contortus* (barber pole worm), 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” (2013). 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 many farms they have developed resistance to all available commercial dewormers (Howell et al., 2008). Resistance to dewormers is now seen worldwide (Kaplan, 2013). Producers can no longer rely on drugs alone to control internal parasites. Instead, they should employ an integrated approach that relies on sustainable methods to manage internal parasites.

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Tips for Preventing Internal Parasites
Tips for Treating Internal Parasites
Tips for Working with a Veterinarian
Tools for Managing Internal Parasites in Small Ruminants: Animal Selection
Tools for Managing Internal Parasites in Small Ruminants: Copper Oxide Wire Particles
Tools for Managing Internal Parasites in Small Ruminants: Pasture Management
Tools for Managing Internal Parasites in Small Ruminants: Sericea Lespedeza

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* (barber pole 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 and development. The larvae need moisture to develop and move. They migrate out of the feces and up blades of grass (usually one to two inches). When an animal (sheep or goat) grazes, it 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 or from bedding in a pen.

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. This can happen quickly: barber pole worm, for example, can complete development to the adult stage in two to three weeks, and then begin producing eggs. Mature female barber pole worms can produce up to 10,000 eggs per day (Zajac, 2013). Pastures can quickly become heavily contaminated if animals are not rotated frequently or if animals have a high level of worms.

Infective larvae survive on pasture for a time, and this period is dependent on environmental conditions. Very hot weather will cause them to die faster, and most larvae may be naturally killed off in three months (Zajac, 2013).

Cold weather is not going to “kill the worms,” unfortunately, because some internal parasites go into a kind of hibernation inside the animal until conditions are more favorable. This is called “hypobiosis” or “arrested” (terminology used on dewormer labels) and is the survival strategy for barber pole worm in the winter. In late winter and spring, the development will re-start, and this raises numbers of parasites just when lambing is happening (Zajac, 2013). To manage internal parasites properly, it is important to understand the parasite life cycle and factors that encourage multiplication of parasites.

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

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



Signs of Parasitism

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



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

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

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. Young animals and those with weakened immune systems due to other diseases are most affected by internal parasitism. One important time when immunity is weakened is at lambing time. This results in a periparturient (around birth) rise, and this weakened immunity coincides with the development of hypobiotic larva, which causes a release of more parasites into the environment (Zajac, 2013). Some breeds or animals within a breed are more resistant to parasites and do not display the periparturient rise (Notter and Burke, no date), which helps with control. A combination of treatment and management is necessary to control parasitism so that it will not cause economic loss to the producer.

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 and effective treatment.

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. Now we recognize that this practice is not sustainable because it leads to development of resistance.

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, 2013). Over-use and misuse of dewormers has led to resistance, and available dewormers are now ineffective in many instances.

Some farms still have dewormers that continue to work, while others have no effective dewormers. Although there are two new classes of dewormers available in some countries, they are not approved in the United States as of this writing, and even if they are eventually approved, "...the positive effect of such valuable resources for the control of parasites might not last long if used following the same application strategies as the three broad spectrum anthelmintic classes..." (Knox et al., 2012). In other words, new dewormers won't last very long unless we change our tactics. In fact, there are already reports of dewormer resistance

Table 1: 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	Common Names/Brands	Effectiveness
Benzimidazoles	Albendazole (Valbazen®), Fenbendazole (Safeguard®), Panacur®, Oxfendazole (Synanthic®)	High prevalence of resistance
Avermectin/ Milbemycins	Ivermectin (Ivomec®), Eprinomectin (Eprinex®), Moxidectin (Cydectin®), Doramectin (Dectomax®)	Ivermectin—High prevalence of resistance. Often the least effective of all available drugs Moxidectin—Resistance becoming common where used frequently
Imidazothiazoles/ Tetrahydropyrimidine	Levamisole (Tramisol®, Prohibit®), Pyrantel (Strongid®), Morantel (Rumatel®)	Low to moderate prevalence of resistance

Source: Adapted from Kaplan, 2013 and Williamson, 2013.

to the new drugs in New Zealand and Australia (Kaplan, 2013).

Development of Resistance to Dewormers

Internal parasites, especially *H. contortus*, have developed drug resistance (Howell et al., 2008). Drug treatment gets rid of the worms that are susceptible to that particular drug; resistant parasites survive and pass on “resistant” genes. No dewormer is 100% effective, and we know that worms that survive a dose of dewormer are resistant to that dewormer. Therefore, each time you deworm, the proportion of resistant worms increases, and consequently, frequent deworming greatly increases the rate at which resistance develops.

Each time animals are dewormed, the susceptible worms are killed. The resistant ones survive and will reproduce, thus leading to a population of very resistant worms. Meanwhile, underdosing causes larger numbers of the intermediate-strength 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 in the next generation. Once an animal has been treated (if dosed properly), only resistant worms remain. If the animals are moved to a clean pasture they deposit only resistant worms on the pasture, and there are no susceptible worms to dilute the worm population.

Refugia

Worms that are not treated are called “refugia.” Refugia includes both worms and their consequent eggs in animals that were not treated, as well as eggs and larvae that were on the pasture at the time of deworming and thus not exposed to the dewormer. There is no change in the dewormer-resistance status of these worms. However, in animals that were dewormed, all the worms that survived are obviously resistant to the dewormer. Having some worms in refugia (not treated) ensures that drug-susceptible worms will be maintained in the population (Van Wyk, 2001; Kaplan, no date). A surviving population of untreated (drug-susceptible) worms dilutes the population of resistant worms. Consequently, refugia help ensure that when a dewormer is required, it will be effective because most of the worms will be susceptible to treatment (Kaplan, no date). The concept of refugia has been largely overlooked in the past (Van Wyk, 2001).

When fewer numbers of animals receive treatment, the refugia population remains large. When it comes to slowing the rate with which resistance develops, the more refugia, the better. Sustainable techniques, such as FAMACHA®, reduce the development of drug resistance by increasing refugia.

In contrast, several practices accelerate drug resistance. These include frequent deworming (more

than three times a year), underdosing (often caused by miscalculation of body weight), treating before 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.

Treating all animals regardless of need ignores the importance of refugia and will lead, in time, to a population of worms that cannot be controlled by dewormers. Preserving refugia is one principle of sustainable internal parasite control. Knowing what dewormers work on your farm and how to preserve their efficacy is another. Learn more about using dewormers wisely from “Extending the Efficacy of Anthelmintics” at www.acsrpc.org/#!2013-conference/c1bp4 (Williamson, 2013).

Assessment of Animals

In order to preserve refugia, it is important to treat only the animals that need it. Producers need to be able to identify the animals that need deworming. One way to assess the parasite load in animals is to take a fecal sample and examine for parasite eggs, using a quantitative method. This is called a “fecal egg count” (FEC), and it is a good method. However, it is time-consuming and requires a microscope. Producers can learn to do this themselves. This training is often a part of internal parasite workshops, and online tutorials are available, including one from Langston University: www2.luresext.edu/goats/library/fec.html. You can also get training in doing fecal egg counts by watching a video or reading the resources found at www.acsrpc.org/#!fecal-egg-counting/c24s2.

Visual examination of animals also provides diagnostic help, and is more immediate. Observing the flock or herd daily enables a producer to notice animals that are separating from the group, lagging behind, showing a lack of energy and vitality, have diarrhea or bottle jaw, and are losing weight. Those animals should be examined and dewormed if needed. Two more systematic methods of visual examination are described below: FAMACHA and the Five Point Check[®].

FAMACHA

FAMACHA is a system for assessing the degree of anemia in animals. It works in diagnosing infection with barber pole worm because anemia is the major symptom of the barber pole worm. The FAMACHA system classifies animals into

categories (1 to 5) based upon level of anemia (Kaplan, no date). The system was developed in South Africa and has been validated in the United States (Kaplan et al., 2004).

To use the system, you examine the eyelids of sheep and goats (see photo), then treat only the animals that are anemic. 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 (Burke and Miller, 2008). Breeding the healthiest animals and culling the weaker individuals makes the flock or herd stronger over time. Note that FAMACHA is only effective for the treatment of *H. contortus* (barber pole worm) because other worms do not cause anemia and so are not detected by this method. Producers must be trained by a veterinarian or other FAMACHA-trained animal health professional in order to use FAMACHA (Kaplan, no date). However, this technique is simple to learn and quick and easy to use. More information on FAMACHA is online at www.acsrpc.org/#!famacha/c9i, including a very helpful video.

Many producers have been trained in this technique, and more than 20,000 FAMACHA cards have been sold in the United States since 2003. In a survey of farmers who were trained in integrated parasite management, including FAMACHA, respondents identified the following benefits (Terrill et al., 2012):

- helped control internal parasitism—94%
- had less parasite problems after training—74%
- saved money in the first year after training, through reduced drug use and fewer animal deaths—88%

*Demonstration of the FAMACHA technique.
Photo: Robyn Metzger, NCAT*



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.

Similar results were found in another survey (Whitley et al., 2014), confirming that using integrated parasite management does help producers save money and avoid problems with internal parasitism.

Five Point Check

Five Point Check is a system for identifying animals that need treatment for internal parasites. This system was developed by the same researchers that developed FAMACHA (Bath and Van Wyk, 2009). While FAMACHA is used for identifying only animals that are suffering from *H. contortus*

infection, Five Point Check identifies symptoms of other internal parasites, as well. The five points are areas of the animal to observe. It is important to note that each of these symptoms can also be caused by other parasites, or by causes not listed.

Dewormer Assessment

Once you know who to treat, you need an effective dewormer to use. There are a couple of methods that can be used to determine whether a dewormer is effective against the parasites on your farm. The DrenchRite® Assay is a test performed to detect drug resistance in *Haemonchus contortus* parasites in your herd or flock. A fecal sample is sent to a laboratory for this test. The results will tell you what parasites are present in your herd or flock and what drugs are effective against those parasites (Howell and Storey, 2012). For more information on the DrenchRite Assay, visit the American Consortium for Small Ruminant Parasite Control website at www.acsrpc.org/#!storeyhowell2012/c4qh.

Another tool that can be used to determine dewormer efficacy is a fecal egg count reduction test (FECRT). This test involves collecting fecal samples from animals, treating those animals with a dewormer, and then taking fecal samples from those same animals 10 to 14 days later. By measuring the reduction in fecal egg counts from the first sample to the second, you can determine the effectiveness of your dewormer. For more information on fecal egg counts and conducting a fecal egg count reduction test, consult the American Consortium for Small Ruminant Parasite Control website at www.acsrpc.org/#!fecal-egg-counting/c24s2.

Table 2. Five Point Check

Point		What to check	Parasite possibility
1	Eye	Anemia (FAMACHA score)	Barber pole worm
2	Back	Body Condition Score	All
3	Rear	Dag Score	Brown stomach worm
4	Jaw	Bottle jaw	Barber pole worm
5*	Nose	Nasal discharge	Nasal bots
5*	Coat	Coat condition	Barber pole worm

*This system was developed for sheep. Goats are not affected by nasal bots, so the coat condition checkpoint is used instead.

Source: Adapted from Susan Schoenian www.sheep101.info/201/parasite.html and www.slideshare.net/schoenian (The Five Point Check).

Management Techniques for Controlling Parasites

Pasture Management

Producers can use numerous techniques to control parasitism. Pasture management should be a primary tool that producers use to control internal parasites. Sheep and goats ingest infective parasite larvae from pasture, so the rate at which these are ingested can be controlled through pasture management.

Most worm larvae crawl up the plant only one to two inches from the ground. A small percentage will crawl up as much as four inches, but very few get higher than this. 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 the height of forages in the pasture. Allowing animals to graze pastures too short results in more parasites consumed and in reduced feed intake, therefore harming the animal in two ways. It also inhibits pasture regrowth. So, for the good of the pasture and the animals, do not graze below four inches.

Most 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, either by reducing the number of animals or reducing the amount of time animals spend on a pasture, decreases the number of worms spread on that 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



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

have parasite problems, unless they are rotated away from the parasites before they can consume larvae. That means within three to four days in ideal conditions (Zajac, 2013). 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. For more information on using pasture management techniques for parasite control, consult ATTRA’s publication *Tools for Managing Internal Parasites in Small Ruminants: Pasture Management*.

Certain forages have also been shown to control parasite problems. Tannin-rich forages, such as sericea lespedeza, 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. ATTRA’s publication *Tools for Managing Internal Parasites in Small Ruminants: Sericea Lespedeza* provides a more detailed discussion of this topic.



At left: Eating higher off the ground reduces the number of parasite larvae consumed. Photo: Margo Hale, NCAT

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

Sheep breeds such as Gulf Coast Native show resistance to parasites. Photo: Linda Coffey, NCAT



Selecting Resistant Animals

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. Sheep 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 among individuals within breeds as well. Some animals, regardless of breed, will be more resistant to parasites than others. Research shows that 20% to 30% of the animals carry 70% to 80% of the worms in a flock or herd (Kaplan, no date). Having parasite-resistant animals will decrease the need for dewormers.

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. 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 resistant or more tolerant animals. The ATTRA publication *Tools for Managing Internal Parasites in Small Ruminants: Animal Selection* provides information on selecting animals for parasite resistance and building a stronger herd or flock.

Nutrition

Research shows that animals are more tolerant of internal parasites, and perhaps more resistant, when their immune systems are supported with good nutrition (Knox et al., 2012; Turner et al., 2012; Coop and Kyriazakis, 2001). Better health and better production are likely when animals are provided adequate energy, protein, minerals, and water. More information on this topic is included in the ATTRA publication *Tools for Managing Internal Parasites in Sheep and Goats: Pasture Management*.

Treatment

Copper Wire Particles

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 are effective against barber pole worm but not other genera of worms and

Smart Drenching

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

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
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, no date.)

only against the mature parasite (Bang et al., 1990; Chartier et al., 2000; Burke et al., 2005; Burke et al., 2007b). The copper particles will increase concentrations of copper in the blood, so it is important to use low doses (0.5- to 1-gram doses for lambs or kids less than one year of age; 1- to 2-gram doses for ewes or does older than one year of age) (Burke and Miller, 2006; Burke et al., 2007a). Refer to the ATTRA publication *Tools for Managing Parasites in Small Ruminants: Copper Oxide Wire Particles* for more information on how to use copper wire particles to treat internal parasites.

Nematode-trapping Fungus

Another parasite-management tool currently being researched is the use of nematode-trapping fungus. This fungus traps parasite larva in the feces, interrupting the parasite's life cycle. Research has shown that the fungus 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. The fungi is not yet available in the United States but may become available in the near future. You can read more about it at www.acsrpc.org/#!fungus/cp9i.

Alternative Treatments

There are many other alternative treatments that sheep and goat producers have used to manage internal parasite infections. Some of these alternatives have been researched, while others are used based on anecdotal information. The researchers of the American Consortium for Small Ruminant Parasite Control (ACSRPC) have investigated many alternative treatments. You can find information about many of these on the ACSRPC website, at www.acsrpc.org/#!alternatives/cyv8. Garlic, papaya, and the herbal dewormers tested by Burke et al. did not control internal parasites (2009a and 2009b). Escobar (2013) reviewed other alternatives in www.acsrpc.org/#!2013-conference/clbp4.

Conclusion

Control of internal parasites in sheep and goats can be a daunting task. Previous control methods are no longer viable, so other techniques must be used—techniques such as increased pasture management, Smart Drenching, FAMACHA, the Five Point Check, and selecting parasite-resistant animals can help to manage internal parasites. Attention to nutrition and to pasture management will also help control levels of infection. These techniques reduce dependence on dewormers and lead to a more sustainable parasite-management program. Combining many of these techniques in a program will be much more effective than only relying on any one. ATTRA publications on this subject can help in assessing and improving the health of sheep and goats.

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Further Resources

ATTRA Resources

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

- Meat Goats: Sustainable Production
- Dairy Goats: Sustainable Production
- Tips for Marketing Sheep and Goat Products: Live Animals
- Tips for Marketing Sheep and Goat Products: Meat
- Tips for Marketing Sheep and Goat Products: Dairy

- Tips for Marketing Sheep and Goat Products: Fiber
- Tips for Marketing Sheep and Goat Products: Vegetation Management Services
- Dairy Sheep
- Predator Control for Sustainable and Organic Livestock Production

Other Resources

American Consortium for Small Ruminant Parasite Control (ACSRPC)

www.acsrpc.org

Packed with a wealth of up-to-date information for producers, this site also holds the Proceedings of the 10th Anniversary Conference of the American Consortium for Small Ruminant Parasite Control. Find the papers at www.acsrpc.org/#!2013-conference/c1bp4.

Association of Small Ruminant Practitioners

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<http://aasrp.org>

This site includes a listing of members and an opportunity to subscribe to Wool and Wattle and to the listserv. Find a veterinarian, or refer your veterinarian to this page for more support in working with sheep and goats.

Maryland Small Ruminant Page

www.sheepandgoat.com

This is an enormous collection of articles, presentations, and archived webinars on any topic you can think of related to sheep and goats.

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

Explore this site for Goat Field Day Proceedings, online tutorials for fecal egg counting, information about nutrition and a Web-based training course.

Managing Internal Parasites in Sheep and Goats

By Margo Hale, NCAT Agriculture Specialist

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