

Internal Parasite Control for Meat Goats

Dr. Dave Sparks

Oklahoma State University

Introduction

Two of the most common questions on the minds of many goat producers are; “when should I deworm my goats?”, and “what should I use to do so?”. Unfortunately, there are no simple answers to these questions because all production programs differ in many ways. Therefore, we will look at some of the factors that affect these answers so you can better make the decisions for your herd.

When it comes to internal parasites, goats have special problems. In cattle, roundworms are usually an economic problem in that they waste feed inputs and decrease growth and production. In goats, these same considerations are valid, but the very life and health of the animal may be threatened by *Haemonchus contortus*, or the “barber pole worm.” It bleeds the goat and causes death by anemia. In addition there is a serious lack of parasiticide drugs that are labeled for legal use in goats. Only two such drugs exist at this time and research has shown that neither is very effective on Oklahoma goat farms. While there is a strong temptation to use drugs labeled for cattle or sheep according to the dose and route of administration for these species, goats are actually very different. Using cattle or sheep doses and routes will likely not be effective and can lead to resistance problems.

The reason for the lack of research and availability of legal drugs for use in goats is simple economics. A market of one million goats just can't support the research and development costs that a market of 100 million cattle can. For this reason, many of the drugs used today are used “off-label”. This means that in order to be legal they must be prescribed by a licensed veterinarian who has first hand knowledge of the animals. Because all goat operations are different and any effective program will probably involve usage of off-label drugs, your local veterinarian is the best source for helping you set up a comprehensive treatment and management parasite control protocol for your farm.

Life Cycle of Roundworms

Although there are many different roundworms that live within livestock, they all have very similar life cycles. A common characteristic is that part of the life cycle takes place inside the host animal and part of it is lived in the environment. Although details will vary between parasites, the cycle can be broken down into three stages: a developmental period, a prepatent period, and a patent or adult period. Understanding what happens in each period will help to understand how management practices can reduce parasite burdens.

The developmental period is the time that the parasite lives in the environment. This period starts when the eggs passed in the host animal's manure hatch and the larvae crawl away into the grass. In the environment the larvae undergo several maturation changes, until the infective larvae (also called L3 or 3rd stage larvae) are able to climb up vegetation, on films of moisture, to await ingestion by a grazing animal. The rate at which this period progresses is determined by environmental conditions. Parasites prefer warm, wet conditions, so the cycle progresses faster and survivability is greatest in the early summer. This is the time of greatest pasture contamination. L3 can survive freezing conditions, but are very susceptible to drying. The eggs do not handle freezing well, but can survive drought conditions.

The prepatent period is extends from the time the L3 are ingested by a grazing animal until the mature worms start to lay eggs in the digestive tract. During this period the parasite develops through the L4 and

L5 or young adult stages, and may migrate through various tissues of the body during these stages before taking up residence inside the digestive tract. The preferred area of residence in the gut will vary with the species of worm. The prepatent period usually lasts from 2 to 3 weeks in young animals. Due to the higher level of immunity in adults, the prepatent period may last longer. This is important in timing parasite control program as this is how long it takes from ingestion until that animal starts contributing to pasture contamination. It is also possible for the L4 to enter an arrested development phase by burrowing into the wall of the gut if environmental conditions are not conducive to starting another generation. This allows the parasite to over-winter in the goat as well as in the environment.

The adult or patent period is the time when adult worms are present in the gut and shedding eggs into the environment via the stool. This is the time when the worms are most susceptible to control by parasiticide drugs. In the case of *Haemonchus*, this is also the time that the adult worm is attached to the gut wall and sucking blood from the host. Adult *Haemonchus* females can produce up to 5,000 eggs per female per day, and go through as many as 4 generations in one season. The adult barber pole worm population in the digestive tract of the goat can consume up to 1/10th of the goat's total blood per day.

Deworming Programs

Parasite control programs can be categorized as either therapeutic, tactical or strategic. Implementing the right program will have a tremendous impact on the level of rewards you reap from your goat operation.

Years ago all parasite programs were therapeutic programs. These involved treating the animals only when the condition progressed to the point where it caused clinical disease. At this point the program becomes an effort to salvage the affected animals. Therapeutic programs do nothing to address the subclinical losses such as decreased performance, nor do they address the problem of pasture contamination.

Tactical parasite control programs involve treating all animals in the population, often when it is convenient for the herdsman. Tactical programs help to minimize subclinical losses, but they probably do not minimize recontamination and may, in fact, contribute to parasite drug resistance problems.

Strategic parasite control programs involve a combination of management, responsible drug usage, and proper timing to ensure that animals are grazing "parasite safe" pastures for most or all of the year. Strategic programs usually take less drug inputs but require more in management, observation and herdsmanship. They address all the issues of clinical disease, subclinical losses, and contamination of the environment with subsequent reinfestation.

Parasite Control Drugs

Drugs available today for parasite control fall into four classes. It is important to know which active ingredients are in which classes because usually, when resistance occurs to one drug it confers to other drugs within that class. The main concern with parasite resistance to drugs that we have today is due to the fact that there are no new drugs on the horizon. It takes up to 10 years to get approval for a new drug and there are currently no parasite control drugs in development. Most of the drugs on the market today still work very well in cattle. Since this is the major market for food-animal drugs, there is no incentive for drug companies to undertake the massive cost of getting new drugs on the market at this time.

Only two of the drugs in the table above, albendazole and morantel, are labeled for legal use in goats. All other parasite control drugs, when used in goats, constitute "off label use" which is the domain of licensed veterinarians. As stated above, goat dosages are not the same as for sheep and cattle because their metabolism is not the same. Goats have larger livers as a percent of their body weight so they clear the drugs faster. The route of administration may also be different. Goats do not absorb drugs as easily through their skin as do other food animals. In addition to providing the correct dosage and route of administration instructions,

the prescribing veterinarian must also address the correct withdrawal time requirements for goats. Goats, when slaughtered, are randomly sampled for drug residues, and any violations are attributed to the producer who originally marketed the goat. Violations can lead to federal prosecution, stiff penalties, and for repeat offenders even incarceration.

Examples of active ingredients in the different classes of de-wormer medications.			
<i>Benzimidazoles</i>	<i>Imidazothiazoles</i>	<i>Macrocylic Lactones</i>	<i>Tetrahydropyrimidines</i>
Albendazole	Levamisole	Doramectin	Morantel
Fenbendazole		Eprinomectin	
Oxfendazole		Ivermectin	
		Moxidectin	

Drug Resistance

Not many years ago we began to hear of farms in Australia and New Zealand where they could no longer graze small ruminants because of the resistance of the parasites to parasite control drugs. Today we have farms in the Southeast United States that have the same problem. A recent study done by Langston University shows that serious resistance to parasiticides is developing on most goat farms in Oklahoma. Although there is nothing we can do to completely eliminate this resistance, today's parasite control programs must be designed to slow and delay it as much as possible. We can achieve this by proper use of the drugs we have, incorporating management practices into the plan, and selecting the right individuals to build our future herds on.

The following chart shows the degree of resistance found on several Oklahoma farms to Ivermec, Valbazin, Levisole, and in one case Cydectin. The numbers in the respective columns represents the percent kill the drugs achieved based on the results of fecal egg count reduction tests.

FARM	IVM	VAL	LEV	CYD
1	12	87	98	
2	37	88	99	
3	7	67	99	
4	63	85	92	
5		55	99	100
6	46	42	98	
7	41		91	
8		0	97	
9	69	74	94	

We get drug resistance because we select for it, or because we pay good money for it and bring it home in animals we purchase from other farms who have selected for it. When we deworm using drugs that are not completely effective, or when we use dosages that are too low, we kill the more susceptible worms and leave the more resistant worms. These resistant worms then become the parents of the next generation of worms. Over time as our program selects for more and more resistant worms, the drugs are less and less effective.

When deworming, it is important to leave some susceptible worms to provide competition for the resistant ones. It is also important to know what drugs are or are not effective on your farm. When half of the worms are killed you will see a good clinical response, but it will be short lived and deworming will get more and more frequent. If anything less than 95% of the worms are killed, resistance is developing. This means that by the time that you are aware clinically that the drug you are using is no longer effective, the kill rate has dropped to less than 50% and the use of this drug is lost to you. Once parasites are resistant to a drug, the resistance lasts for many years. A means to measure the effectiveness of parasiticide drugs is discussed later in this paper.

Newly purchased animals should be quarantined and aggressively dewormed in a dry lot until stool samples are shown to be clean. This prevents introducing someone else's resistance problems into your goats and across your pastures.

Management as a Parasite Control Tool

There are several ways that proper management and grazing techniques can help to control parasite problems on Oklahoma goat farms. When goats are allowed to browse as they do in nature they have few parasite problems. When we mold them to domestically managed situations we often cause these problems. Grazing and browsing systems that mimic nature as closely as possible will usually reduce the degree of parasite problems experienced.

One management technique that helps is to closely monitor the grazing height. This is not the same as the height of the vegetation. You need to actually watch and see at what level the goats are eating when they select their plants to consume. As previously stated, the L3 climb on a film of water up the vegetation so that they can be ingested. Their ability to climb, however, is not limitless. Eighty percent of the infective larvae are located in the lower 2 to 3 inches of vegetation. The goats will get almost no infective larvae if they are grazing at or above the 4 to 5 inch level. Time of grazing also is important. The film of water is vital for the larvae to climb. Producers with heavily contaminated pastures during warm and wet times of the year may consider confining the goats at night and turning them out to graze after the dew is off the plants. This greatly reduces the infestation rate.

Pasture rotation is beneficial to improve pastures and maximize utilization of the forage. It is commonly thought that this practice also reduces parasite problems, but this may or may not be true. In order to be effective as a parasite control technique, rotational grazing must be timed to break up the life cycle of the roundworms. If the animals stay in one paddock long enough for the eggs to hatch and mature to the L3 stage, or if they go around the system and return as the larvae mature to the L3 stage, the rotation doesn't help with control. Additionally the timing will change as the season, and thus the maturation process, changes.

Perhaps the most important management tool in controlling parasites is to treat only the individual goats that need help. This helps to maintain a base population of susceptible worms to compete with resistant worms. It is equally important to identify and cull those animals that repeatedly have problems. Eighty percent of the eggs that contaminate the pastures are passed by 20% of the goats. There is a good economic reason for culling these problem individuals as well. A culled goat is worth a lot more than a dead goat.

Larger commercial producers should consider a multiple species grazing program, usually involving goats with cattle or, less frequently, horses. Although all domestic animals have roundworms that are closely related, the actual species of worms are host specific. This means that cattle worms cannot develop in goats and goat parasites cannot develop in cattle. When one type of animal ingests the infective larvae of another type of animal, those larvae are essentially cleaned up or eliminated. There are economic benefits as well because cattle are grazers and prefer grass, while goats are browsers and prefer weeds, shrubs, and brush.

There is limited overlap of their preferred food supplies and it is possible to realize two income streams from one land resource, which is usually one of the highest input costs for the operation.

Parasite Resistance and Parasite Tolerance

Some goats have more problems with parasites than others, while some goats are relatively problem free under proper management. There are actually two phenomena at play here, parasite resistance and parasite tolerance. Parasite resistance is the goat's ability to suppress the population of worms that is trying to develop in the digestive tract. This is a function of the individual goat's immune system. Some individuals may have stronger specific immunity to the worms while others just have stronger ability to respond to any immunological challenge. Both genetics and nutrition play a roll here. Parasite tolerance is the individual goat's ability to carry a given parasite load with minimal impact on the goat's system. Again, both genetic and nutritional factors come into play.

These characteristics are very desirable in Midwestern goats. Researchers at Tennessee State University have shown that there are definite differences expressed between breeds. In general, breeds that were developed in wet, rainy climates have an advantage over breeds that were developed in hot, arid climates for production of goats in areas of significant rainfall. Differences between individuals within a given breed exist as well. Record keeping is important to eliminate genetics that are predisposed to parasite problems while propagating genetics associated with fewer problems.

Evaluating Parasite Problems

In order to tailor a parasite control program for your herd, it is necessary to be able to quantify what problems you are having, how serious they are, and which individuals are having the problems. Some of the tools that facilitate this quantification are fecal egg counts, fecal egg count reduction tests, DrenchRite test, and the FAMACHA system.

Fecal egg counts are conducted by mixing a known quantity of stool into a known quantity of flotation solution and examining the resulting mix microscopically in a special egg counting slide. The result is the number of worm eggs per given quantity of stool and serves as a measure of the number of adult egg laying worms that are present in the animal. This is also an indicator of how much pasture contamination is occurring, but it doesn't give any indication of the health status of the animal.

The fecal egg count reduction test measures the effectiveness or resistance to specific parasiticide drugs. To conduct this test a sample containing at least 10 randomly selected animals serves as a control, while 10 other animals are treated with a given drug. It is important that all animals in the test be of similar age, sex, and condition. After 10 to 14 days, pooled stool samples are taken from both groups and fecal egg counts are done on both. If the drug is effective the treated group will have at least a 95% reduction in fecal egg count as compared to the control group. Reductions less than 95% indicate the severity of the resistance of the parasites on your farm to that drug. It is possible to test several drugs simultaneously with the addition of more animal groups. Once you have the required equipment, consisting of a microscope and McMasters counting slide, the test is very inexpensive. You can either have it performed by any veterinary clinic or do it yourself with minimal training. This test will help you determine which drugs to avoid, which to use, and which to save for the future.

The DrenchRite test was developed in Australia and is currently being conducted at the University of Georgia, College of Veterinary Medicine. For this test a pooled stool sample is collected from a minimum of 10 animals and sent to the lab. There the parasites are hatched and the efficacy of the various drugs is measured on the worms in a laboratory environment. The results are then reported back to you for all the various drugs tested. This is an accurate and simple measure of the parasiticide resistance status of your

herd. The lone drawback is that it is somewhat expensive, but it may well save significant losses and wasted drug expense in the long run.

The FAMACHA system was developed in South Africa as a way to determine which individuals needed to be treated for parasites. It compares the color of the animal's mucous membranes, such as the inside of the eyelids, to a standardized color chart. By detecting anemia in the individual you can treat only those animals that are in danger of clinical disease or death. By keeping a record of the findings on the individuals within the herd you can recognize which goats are perpetual problems and should be culled, and which goats are relatively trouble free and should be perpetuated. This is a good test for the barber pole worm, but doesn't address the problem of other worms which do not suck blood, but may be lesser problems by robbing the goat of nutrition.

Conclusion

Today's major challenge for goat producers is to provide a parasite safe environment for their goats while minimizing the development of parasiticide resistance. Achieving these goals requires an understanding of the parasites, selection of the right goats, and incorporating the right management practices. Your local veterinarian can be your ally in combining these considerations into the right program for your operation.

The proper citation for this article is:

Sparks, D. 2007. Internal Parasite Control for Meat Goats. Pages 119-124 in Proc. 22nd Ann. Goat Field Day, Langston University, Langston, OK.