Fact Sheet Series on Meat Goat Herd Management Practices

#5 – Dewormer Resistance - Part 2

By tatiana Stanton

This is the second part of a two part fact sheet on dewormer resistance in Northeast goat herds. The first part presented the results of two studies on the prevalence of dewormer resistance in Northeast meat goat herds. This second part will focus on the influence of various herd management practices on dewormer resistance.

Dewormer or anthelmintic resistance occurs in a goat herd when a dewormer loses some or all of its effectiveness against a worm population because more and more of the worms remaining in that population are no longer susceptible to poisoning by that particular compound. What can farmers do to slow the rate of dewormer resistance in their herds? There are three major considerations, 1) use an integrated approach toward worm control that includes a range of management practices to discourage stomach and intestinal worms, 2) try to avoid using deworming practices that insure the survival of only those worms that are genetically resistant to dewormers, and 3) avoid bringing in dewormer resistant worms via animals from other farms.

Integrated management practices

There are several facts to consider when planning management programs to reduce the impact of worms in a herd or flock and thus cut down on the need for deworming. First, worms are basically a pasture problem. They are susceptible to ammonia and do not survive well in the deep bedding pack of most winter barns. In hoop houses or greenhouses with shallow or no bedding, worm larvae survival is also reduced by drying out of the fecal pellets. Instead, worm larvae thrive on pastures and in

barnyards where grazing material is present and manure contamination is significant. Secondly, small ruminants can build up their own immunity to worms. However, young animals, lactating animals, stressed animals and very old animals are least likely to have effective immune systems against worms, and all animals can be damaged by worms if the worm population becomes overwhelming.

Certain management systems are inherently less likely to be impacted by worms. For example, farms that kid or lamb in the fall and winter and wean prior to the grazing season and then raise weaned young animals in a drylot while pasturing the dry ewes and does have less exposure to worms and the exposure in dry females is at a stage where their immune system is at its strongest. Farms that drylot their animals or offer supplemental hay year round also have less exposure to worms. Management systems where worms are likely to be the greatest problem are 1) pasture-based systems where lambing and kidding occurs in the spring or summer and the grazing period supports highly susceptible lactating females, suckling young and weaned young; 2) organic goat dairies mandated to provide their milking herd with access to grazing throughout the grazing (and lactating) period; and 3) farm rescue operations working with geriatric animals and providing them with year-round grazing paddocks or barnyards for a natural life.

Few management systems have the option of changing completely to another management system. However, it is important to determine the risk of your management system and to plan accordingly. Farmers using management systems with low exposure to worms may want to use fecal analysis to confirm the need for deworming rather than automatically deworming the entire herd at certain stages of life. They may want to wait

1 to 2 weeks after weaning to take fecal samples from dry does to see if the immune response in these does has been adequate enough to eliminate the need for deworming at this time. Repeated unnecessary dewormings in these situations can lead to dewormer resistance but the occurrence is unlikely to be noticed because the effectiveness of the dewormer is not critical given the low worm load in the herd.

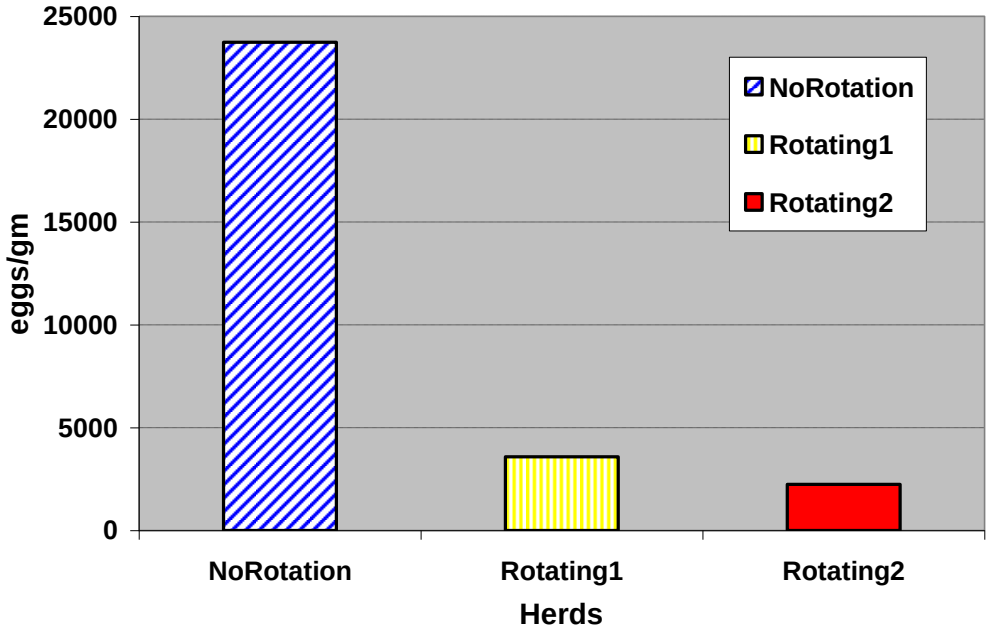
In contrast, the effectiveness of specific dewormers is very important in high risk herd environments. Fecal sample monitoring in these herds may indicate the need for several dewormings during the grazing season. This repeated exposure to particular dewormers encourages dewormer resistance because the only worms that repeatedly survive are those that are genetically less susceptible to the dewormer. In order to reduce the number of dewormings and hence the rate of dewormer resistance, an integrated approach to worm control will be necessary.

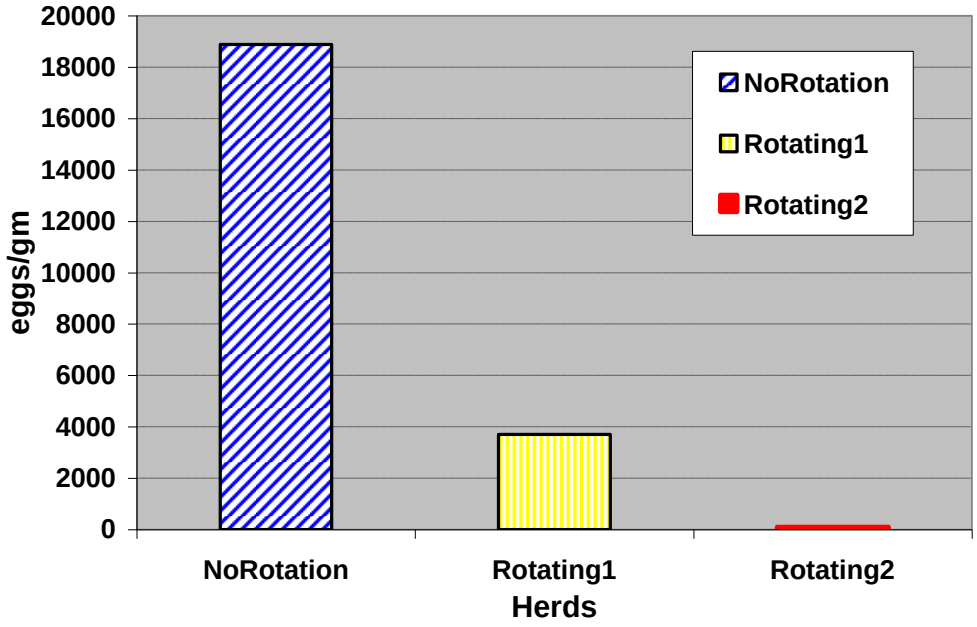
Many worm control programs are focused on controlling a stomach worm known as the barber pole worm (*Haemonchus contortus*), one of the deadliest internal parasites in goats and sheep. It takes about 5 to 7 days in moist, warm conditions for this worm to evolve from an egg defecated onto a pasture by a goat or sheep to an infective larva. Although individual larvae can survive for many months on a pasture, the population is usually substantially reduced by 55 to 75 days under moist, warm conditions. Similar to other worms, the larvae can only get about two inches high on plants. They are susceptible to freezing and can not over-winter outside the goat or sheep in the NE US. A primary symptom of barber pole worm infection is anemia.

Most practices to control the barber pole worm and other stomach and intestinal worms center around reducing the concentration of feces in grazing areas or disrupting

the life cycle of the worms. To reduce fecal contamination, it is important to avoid stockpiling manure in barnyards or areas that readily drain into adjacent pastures. Spreading uncomposted manure on pastures and overstocking pastures are two other sources of fecal contamination.

Barnyards and pastures adjacent to barns tend to have high concentrations of feces. Rotational grazing early in the grazing period can help reduce the build up of worms by forcing animals to graze in outlying areas. In the summer of 2005, the Cornell Department of Animal Science with funding from the Northeast Sustainable Agriculture Research and Education Program (NE SARE) compared worm counts for different types of pasture management systems. Two farms that did not rotate pastures but instead allowed their goats to roam on large parcels surrounding barn areas were each compared to two similar farms in their region that practiced pasture rotation on the spring and early summer. Farm managers observed that suckling kids tended to graze close to the barns where fecal contamination was intense unless they were in a pasture rotation system. Worm counts were far higher for the two farms that did not rotate and kid loss to worms and coccidia were observed by early to mid July (Figures 1 & 2).





<u>Figures 1&2.</u> Comparisons of worm egg counts per gram of feces in goat kids in early July in two herds that rotated versus a similar herd that did not in two different regions of the Northeast US.

This barnyard effect can be reduced by 1) rotating pastures; 2) graveling barnyards, treating them with herbicides, or making them small enough that grazing material does not survive in them; 3) eliminating barnyards by using lanes to move animals from barn to pasture or leaving animals in pasture 24 hr/day; or 4) making sure there is hay in the barn whenever animals are brought back to barnyards so that animals spend their time eating in the barn rather than grazing in the barnyard.

Recommended pasture management to control barber pole worm in small ruminants include reducing the consumption of infectious worm larvae by 1) removing animals from a grazing paddock before the pasture is less than 3 inches tall (not as critical during the first rotation cycle after winter); 2) removing animals from a grazing paddock within 4 to 7 days; and 3) not returning to the same paddock for at least 55 to 75 days. To maintain forage quality, most pastures will probably need to be mowed or grazed by an unrelated species between grazings to keep them from becoming too mature. There are additional advantages for parasite control from either mowing the paddocks or grazing them with an unrelated livestock species during the "rest" period. In hot dry weather, close mowing of pastures shortly after removal of the goats or sheep serves to dry out fecal pellets and, thus, reduce larva survival. Harvesting a hay crop from a pasture will substantially decrease larva survival. The specific stomach and intestinal worms that infect sheep and goats can not complete their lifecycle in cattle or horses. Therefore, rotating cattle or horses through a pasture between the grazing intervals for small ruminants can help "vacuum up" larvae and reduce worm populations especially if timed to follow a warm rain.

However, pasture rotation can actually increase worm problems especially if the periods between grazing intervals are not long enough. This is because the stocking density and hence the fecal contamination under intensive grazing programs is usually quite high. In our 2005 study, worm counts in the herds rotating through pastures tended to be substantial by late summer and the farm managers opted to break the worm cycle at this time of year by changing their rotations to browse pastures, hay fields or pastures that had not been grazed yet by goats and sheep. The effectiveness of pasture management practices such as these can be evaluated by regularly monitoring fecal worm egg counts for specific goats within the herd and keeping track of body condition scores and herd productivity.

Deworming practices

Goats appear to metabolize dewormers more rapidly than sheep. Thus, the prescribed dose of a dewormer for sheep may not have as good a kill rate in goats. This means that worms that are only partially resistant to the dewormer but able to tolerate a moderate amount of the dewormer may be able to survive as well as worms that are completely resistant to that dewormer. The net effect of this will be to increase resistant genes in the worm population. This is especially true when the mechanism of genetic resistance by a specific worm for a specific dewormer is due to the influence of several genes (because the worm does not need to inherit all of the genes for resistance to that dewormer to be partially resistant) or when there is codominance or incomplete dominance (because the genotype Aa will be a blending of genotypes AA and aa with the result that worms that are heterozygous for dewormer resistance, Aa, may be partially resistant).

The Southern Consortium for Small Ruminant Parasite Control recommends avoiding the application of dewormers to goats as injections or pour-ons because in these application methods low amounts of dewormer linger in the goat for a long period of time, allowing worms that are partially resistant to the dewormer to survive in the goat and continue egg laying. They also recommend that heavier oral dosages of dewormers (2 times the sheep dosage for Safeguard, Valbazen and Ivermectin, and 1.5 times the sheep dosage for Levamisole) be used on goats compared to sheep***. Please keep in mind that not all these drugs are labeled for use in goats. Also, the above recommendations contradict label directions. Therefore, you need to check with a veterinarian to get dosages approved prior to using them.***

For best effect, dewormers should be given orally far back in the mouth using a drenching gun or syringe extender rather than a syringe alone. This is to make sure that the dewormer is delivered to the rumen where it will bind to rumen particulates and exposure will be optimal rather than being delivered directly to the abomasum (simple stomach) where exposure may be too short. Even when some resistance to a particular dewormer is observed, the effectiveness of the dewormer may be prolonged by fasting goats 12 hours prior to deworming or by repeating the dose of dewormer 12 hours after the first dose. This is particularly true in the case of dewormers such as albendazole and fenbendazole that are members of the benzimidazole family of chemicals. Avoid fasting female goats in late pregnancy/early lactation as fasting may result in ketosis.

Paradoxically, using your dewormers in a highly effective manner can also hasten dewormer resistance. Unfortunately, the genetic make-up of worm populations is often so diverse that a large worm population will contain at least some individuals that are

genetically resistant to the dewormer even at recommended high dosages. Thus, these "super" worms will survive deworming and continue egg laying. Repeated deworming of the goats will kill more and more of the susceptible and somewhat tolerant worms and increase the concentration of these super worms in the surviving population. A recommended practice for many years for herds wanting to severely reduce worm loads was to move goats into a clean area for two to three days after deworming to eliminate from the goats' digestive tracts any worm eggs that were laid prior to the dewormer killing the adult worms. The goats were then moved onto clean pastures with the assumption that they were no longer shedding worm eggs. The problem with this two or three day "clean out" period is that the worm eggs that then survive to be shed on the new clean pasture are only those from the 'super" worms that survived deworming. Thus, this practice can lead to a concentration of "super" dewormer resistant genes in the worm population.

Aiming for complete elimination of worms is not an option in most herds. Instead, it is important to bring the worm population down to a low and tolerable level while maintaining a reservoir of susceptible genes to dewormers in the worm population. This balance is very difficult to achieve especially when the worm problem is acute. In emergency situations a farm manager may have to adopt practices that in the short term save animals but in the long term increase dewormer resistance. Under these critical situations, farm managers must use their own judgment to decide how to maintain this balance. For example, deworming goats in late summer and moving them through sections of harvested hayfields every 6 days without coming back to previous sections is

one way to handle heavy worm infestations without worm eggs from super worms multiplying much in the goat herd.

Cutting down on the number of times per year the entire herd is dewormed can help encourage the survival of susceptible worms while keeping the overall worm population fairly low. When possible, identify and deworm only those goats most in need of deworming. **You do not need to deworm goats whose immune systems are doing a good job of controlling worms.** One tool to identify goats in need of deworming for barber pole worm is to use a FAMACHA card to score goats for anemia based on the color of the membrane on the inside of their eyelid. In this case, only the goats exhibiting some anemia are dewormed. Keep in mind that while anemia is a very good indicator of barber pole worm infection, it is not necessarily an important symptom of infection by other worm species. Instead, tools to help identify intestinal worm problems often include body condition scoring, presence of diarrhea, and fecal sampling for worm eggs. Goats with severe intestinal worm loads often exhibit weight loss and poor hair coats because the worms contribute to malnutrition. These monitoring techniques are often taught during FAMACHA certification or Integrated Parasite Management workshops.

Monitoring practices can be very helpful at reducing pasture contamination while combating dewomer resistance. This is because, if monitoring is done frequently enough (this can be as much as weekly during the peak parasite period from mid June to late July), only the small number of animals responsible for the vast percentage of the worm eggs will be dewormed. Additionally, these identification tools can help determine which animals repeatedly need of deworming. For example, if does nursing large litters seem to be most affected you may need to consider how critical large litters are to the profitability

of your herd or manage these does and their litters inside. Some organic farmers may find that breeding doelings to kid for the first time at 18 to 24 months of age will help them combat worms better than breeding doelings to kid at 12 months of age. Organic meat goat farms may find that leaving market kids on their dams until slaughter rather than putting them through the stress of weaning may help reduce parasite problems in kids.

However, the genes for building up immunity to worms in goats often are unrelated to the milk or meat production ability of a goat. Therefore, it is possible to identify goats that exhibit poor immunity to worms without having an environmental excuse such as nursing a large litter for why they have difficulty combating worms. These goats are ideal prospects for culling from the herd. Parasite resistance appears to be a moderately inherited trait in goats with promise for genetic selection if those goats that are genetically more susceptible to worms can be accurately identified.

Introducing dewormer resistant worms

Whenever a new goat is introduced to the herd genetically different worm eggs are shed by that goat into your worm population. Those worm eggs have the potential to grow into larvae that will be consumed by your goats, mature into adult worms, and shed eggs onto your pastures.

The Southern Consortium for Small Ruminant Parasite Control now recommends deworming new goats with three different dewormer classes prior to introducing the goats to the herd. The goats should be fasted if possible for 12 hours prior to worming and dosed with each dewormer separately (do not mix them together) immediately. The goal of this approach, absolute elimination, is probably realistic when adding a small number of goats to the herd. However, if a large number of new goats are added to the

herd at a time of year when they are likely to have a large worm load, this approach may be somewhat optimistic and might potentially hasten the development of "super" worms. In these situations, it may be prudent to invest in testing fecal samples from new goats for dewormer resistance using a DrenchRite® larval development assay to determine what dewormers are still highly effective in these goats. They can then be dewormed with an effective combination of dewormers and fecal samples compared to see how effective deworming was. It is very important to keep new animals off pastures and in areas where manure is unlikely to contaminate grazing material for many weeks after purchase. They should then be mixed into the herd on pastures the herd is already grazing or in winter barns so that any worms remaining in their systems after deworming are diluted by cross breeding with the herd's worm populations.

The herd management strategies you choose to adopt can have a major effect on controlling parasites and dewormer resistance in your herd. It is important to evaluate what parasite management practices appear to work best under your own herd environment to keep your herd sustainable.

Our funding agencies need to evaluate whether this fact sheet was useful to you. If you are a meat goat producer, we ask that you take the time to complete the following questions and return to tatiana Stanton, Rm 114 Morrison Hall, Cornell Univ., Ithaca, NY 14853 or TLS7@cornell.edu.

Dewormer Resistance Questionnaire

1. What sort of management practices have you used in your herd in the past that may encourage dewormer resistance? Give specific examples.

2. Do you plan to change any of your parasite management practices? Why or why not? Give specific examples.

3. Did reading this article have any effect on your decision? Please explain.

4. How informative would you rate this article on a score of 1 to 5 (with 1 = not informative at all and 5 = very informative). ____