PARASITE CONTROL IN DAIRY SHEEP

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Introduction

Internal parasites are a common health problem in sheep. The severity of the problem varies by geographic location and production system. Dairy ewes may be at high risk due to the stress of lactation. Dairy sheep lambs are more susceptible because of early weaning.

Many species of internal parasites can infect sheep. *Haemonchus contortus* (barber pole worm) is usually the most pathogenic. The barber pole worm is a blood-sucking roundworm that causes blood and protein loss in the host. Anemia (pale mucous membranes) is the primary symptom. Edema (bottle jaw) may also be observed. Sudden death is not uncommon, especially among young lambs.

There are several other roundworm species (e.g. *Trichostrongylus* spp. and *Teladorsagia*) that can impact the health of small ruminants. These are usually part of mixed infections with the barber pole worm, but unlike the barber pole worm, they are less likely to cause death. Production loss and digestive distress (diarrhea) are their more common symptoms and their effects are additive to the barber pole worm.

Tapeworms (*Monezia* sp.) are the only parasites that are visible in the feces. They are usually of little consequence, even in lambs. In fact, there is little research to support treatment for

tapeworms. Liver flukes can be a problem in some geographic locations. A snail or slug serves as the intermediate host, and anemia is a symptom. It is difficult to diagnose lungworm infection in live sheep, as symptoms are similar to other disease conditions affecting the respiratory system.

Sheep are an abnormal host for the meningeal worm *(Paralaphostrongylus tenius*). While the meningeal worm generally causes little damage to its natural host (white tail deer), when a sheep (or other abnormal host) ingests the intermediate host (terrestrial snail or slug), the parasite crosses the blood-brain barrier and causes damage to the central nervous system. Symptoms may start as simple limp or weakness in the hind quarters and escalate to complete paralysis. There is no known "cure," but treatment protocols recommend high doses of anthelmintics and anti-inflammatory drugs.

After the barber pole worm, coccidia (*Eimeria* sp.) is probably the most costly internal parasite affecting sheep, especially lambs. Coccidia are single-cell protozoa that damage the lining of the small intestines, thereby affecting nutrient utilization. Coccidiosis is characterized by poor performance, ill-thrift, weakness, and diarrhea. Sub-clinical disease is probably the most costly.

As compared to stomach worms, different drugs are necessary to control coccidiosis. It is recommended that a coccidiostat (lasalocid or Decoquinate) be included in the starter ration for lambs. A coccidiostat may also be included in the milk replacer diet. Clinical coccidiosis is treated with amprolium (Corid) or sulfa medications, both of which require extra-label drug use by a veterinarian.

While a simple fecal egg flotation (performed by most veterinarians) can differentiate among major egg types (Strongyle vs. tapeworms vs. coccidia), a larval culture must be done to determine the species of strongyle (round) worms present. The lectin staining test is a new test than can be used to determine the proportion of barber pole worm eggs in a sample.

A different fecal flotation media is needed to identify liver flukes. While lungworm larvae can be sometimes recovered in the feces, diagnosis is usually post-mortem. Since the sheep is a dead end host for the meningeal worm, no eggs are passed in the feces. Diagnosis is usually based on symptoms and case history.

Integrated parasite management (IPM)

Unfortunately, there is no simple way to control internal parasitism in small ruminants. What works on one farm may not work on another. What works one year may not work the next. There are variations ((including seasonal) in parasite life cycles. Sheep breeds and individuals vary in their ability to tolerate parasite infections.

Parasite control is further limited by the effectiveness of the anthelmintics (or dewormers). Over time, the repeated use of anthelmintics has allowed worms to develop resistance to the drugs. In some cases, a drug may not be effective enough to prevent production loss or death. Drug

resistance varies by farm and is based on past anthelmintic use. Resistance tends to be more of a problem in regions that experience longer periods of warm, moist weather.

Effective parasite control usually requires an array of management practices that collectively serve to minimize the need for anthelmintic treatment. In fact, anthelmintic treatment should be seen as the last line of defense against worm parasites. While some years require more frequent anthelmintic treatments, the need for frequent treatments should serve as a sign that management practices need to be altered to minimize treatment needs.

The most common method of non-pharmaceutical parasite control is rotational grazing. There are no set recommendations for pasture rest and rotation. The number of animal units, the length of the grazing period, and the duration of the rest period all impact the level of pasture contamination and the disease challenge. There are also seasonal differences to consider.

The use of safe pastures can minimize the amount of infective worm larvae that sheep ingest. A safe pasture is a pasture than is “free” from infective worm larvae. A pasture than has not been grazed for the previous 6-12 months by sheep (and/or other small ruminants) is considered to be a safe pasture for sheep. Newly-cultivated pasture is considered to be clean, as are pastures in which a hay or silage crop has been removed. A pasture that has been rested for several months, while lower in contamination, is not considered to be a safe pasture.

Mixed or multi-species grazing has been shown to decrease parasite loads in small ruminants and other livestock. While sheep, goats, and camelids are infected by the same worm species, cattle and especially horses are affected by different parasites. Thus, sheep that ingest worm larvae that infects cattle and horses will not be affected. At the same time, cattle and horses will help to the remove the worm larvae that causes clinical infection in sheep. Multi-species grazing also improves forage utilization, as sheep and cattle have complimentary grazing behavior.

Forage type is another factor which influences internal parasitism. Some forages (e.g. Sericea lespedeza) contain condensed tannins (or other compounds) which have been shown to disrupt parasite life cycles, thereby reducing fecal egg counts and the need for frequent anthelmintic treatment. Sheep which browse or graze forbs or mixed swards tend to ingest fewer infective worm larvae than those which graze predominately grass pastures.

Grazing height is another important aspect of pasture management. Overgrazing (overstocking) is the primary cause of worm problems, As approximately 80 percent of worm larvae is found in the first two inches of plant growth, livestock should not be allowed to graze below 3-4 inches. Since worm larvae favor moisture, delaying grazing until after the dew has lifted in the morning may help to reduce the amount of infected larvae that are ingested.

Animals reared in confinement or dry lot usually experience fewer parasite problems. This is because grazing is the vector by which sheep ingest infective worm larvae. Zero grazing generally lacks a source of infection or re-infection. Housing sheep at night will reduce the

amount of pasture contamination. Coccidiosis can still be a problem in confinement, especially if the pens are overstocked and the conditions are not sanitary.

Nutrition is an important aspect of parasite control. Animals in better body condition and on a higher plane of nutrition are better able to withstand the effects of parasite infection. Increasing protein levels to ewes in late gestation has been shown to decrease fecal egg counts. Nutritional supplementation makes the most sense when pasture or forage quality is low.

Genetics probably offers the best long-term solution to internal parasite control in small ruminants. There are two traits to consider: resistance and resilience. Parasite resistance is when an animal is able to prevent (or limit) parasite infection. It is quantified by fecal egg counts (eggs per gram of feces), which are an estimate of the worm load that an animal is carrying.

Parasite resilience is when an animal is able to remain healthy and productive, despite carrying a worm load. For the barber pole worm, it is quantified by packed cell volume (PVC), which is a measure of the percent of red blood cells in whole blood. FAMACHA© (eye anemia) scores are used to estimate packed cell volume. Dag scores and body condition scores are other important evaluation criteria for parasite resilience. Parasite resistance is a moderately heritable trait and is usually positively correlated to resilience.

There is significant variation in parasite resistance and resilience among sheep of different breeds or types. Hair sheep, of tropical origin, tend to be more parasite resistant than conventional wooled sheep. The Florida or Gulf Coast Native is a wooled breed with demonstrated resistance to internal parasites.

Of more importance to dairy sheep producers, there is also considerable difference among sheep of the same breed. According to the 80:20 (or 70:30) rule, 20 percent of the animals in a flock or herd are responsible for 20 percent of the pasture contamination. Culling animals which have consistently high egg counts and/or frequent need for anthelmintic treatment will go a long way towards reducing future parasite problems on a farm.

Anthelmintics

While numerous drug formations are available for purchase and use in sheep, there are only three chemical families which offer a unique mode of action. The three groups are 1) benzimidazoles; 2) nicotine agonists; and 3) macrocylic lactones. Resistance to one drug is likely to result in cross resistance to another drug in the same family. Drug rotation should always be among families not individual drugs.

The benzimidazoles (white drenches) are the oldest anthelmintic family. They include fenbendazole (Safeguard® and Panacur®), albendazole (Valbazen®), and oxybendazole (Synantic®). Benzimidazoles are the only family with efficacy against tapeworms. Albendazole

is labeled for the control of adult liver flukes. Widespread resistance has been reported in benzimidazoles.

The nicotinic agonists include two groups of anthelmintics. Levamisol (Prohibit®) is classified as an imidazothiaole, whereas morantel (Rumatel®) and pyrantel (Strongid®) are classified as tetrahydropyrimidines. For many farms, levamisole remains the most effective dewormer. However, it has a narrower margin of safety as compared to other anthelmintics.

The newest group of anthelmintics (though not so new anymore) is the macrocyclic lactones, composed of two sub-groups: avermectins and milbimycins. Ivermectin (Ivomec®) and doramectin (Dectomax®) are classified as avermectins, whereas moxidectin (Cydectin®) is a milbimycin. The macrocylic lactones differ from the other anthelmintic families because they have some effectiveness against external parasites, especially nasal bots. Persistent activity is another characteristic of the macrocyclic lactones.

Widespread resistance has been reported among the avermectins, especially ivermectin. While moxidectin will initially kill ivermectin-resistant worms, resistance is likely to develop quickly with frequent use of the drug.

When worm populations are resistant to all available drug families, a short-term strategy is to use anthelmintics from two or three chemical families. Combination treatments have been shown to have a synergic effect.

A new anthelmintic with efficacy against worms that are resistant to the currently available drugs may eventually become available to U.S. sheep producers. Monepantel (Zolvix®) represents a new chemistry and mode of action.

At the present time, no “natural” products (e.g. garlic and DE) have been scientifically proven to be consistently effective at killing worms (i.e. reducing fecal eggs and improving packed cell volume). Producers who use natural products should continue to monitor animals for signs of clinical parasitism and the need for deworming with an anthelmintic. Considerable research is being conducted in the area of natural anthelmintics and bioactive forages. Perhaps, the use of natural “anthelmintics” may serve to reduce the number of animals requiring treatment.

On the other hand, various scientific studies have demonstrated the effectiveness of copper oxide wire particles (COWP) as an anthelmintic for the barber pole worm. In order to use COWP as a dewormer, the cattle dose of the commercial product (Copasure®) must be repackaged into smaller doses for small ruminants. COWP should only be given to sheep showing clinical signs of barber pole worm infection (i.e. anemia and/or bottle jaw). Repeated doses could predispose sheep to copper toxicity. Some inspectors may allow COWP for use in certified organic production.

Deworming

In the past, sheep and lambs were dewormed at regular intervals with little regard for the necessity of treatment of the individual animal. Due to the widespread development of drug-resistant worms, this strategy is no longer recommended. Nor is it recommended that treated animals be moved to a clean pasture.

Instead, it is recommended that prophylactic treatments be replaced with therapeutic treatments. In other words, only animals displaying clinical signs of internal parasitism should be given an effective anthelmintic. Exceptions to this rule would include treatment of pregnant ewes to counter the periparturient rise in worm eggs and treatment of newly acquired animals with multiple drugs to prevent the introduction of drug-resistant worms to the farm.

The FAMACHA© system is an effective method of monitoring barber pole worm infection in small ruminants and identifying the animals that require deworming. A FAMACHA© card depicts varying levels of anemia. A treatment recommendation accompanies each eye anemia score. The Five Point Check© is an expansion of the FAMACHA© system that includes evaluation criteria for animals with FAMACHA© scores of 3 (no treatment recommendation), as well as other parasites, such as coccidia and the scour worms. The five evaluation points are: 1) eye, FAMACHA© score; 2) jaw, bottle jaw; 3) back, body condition score; 4) hindquarters, dag score; and 5) nose, nasal bots.

Another valuable diagnostic tool is fecal egg counting (EPG). While not a good diagnostic test for a single animal, fecal egg counts help to quantify the level of pasture contamination. They can also be used to determine the effectiveness of anthelmintic treatments. The fecal egg count reduction test (FECRT) involves taking a fecal sample at the time of anthelmintic treatment and 7 to 14 days later. An effective treatment should reduce fecal egg counts by 95 percent or more. Severe resistance exists when fecal egg counts fail to decrease by more than 60 percent.

A DrenchRite test (or larval assay) can also be used to determine the effectiveness of anthelmintics. Unlike the fecal egg count reduction test, the DrenchRite test determines drug effectiveness for all drugs using the same pooled fecal sample. It is difficult to effectively control internal parasites if the efficacy of the anthelmintics is unknown.

Deworming

Sheep should always be dosed orally with drench formulations of anthelmintics. Oral drenches clear the animals' systems faster and have shorter withdrawal periods, whereas injectable dewormers leave a residual which accelerates the development of drug-resistant worms.

A syringe with a long metal nozzle should be used to deliver the drug over the tongue into the esophagus. Depositing the drug in the animal's mouth may stimulate the sucking response, which could cause the drug to by-pass the rumen (and be less effective). Dosing should be based on accurate weights. When using an automatic drench gun, the dosage should be set for the heaviest animals in the group (not the group average).

Anthelmintics which lack FDA approval for use in sheep may not be used without prior approval of a licensed veterinarian. Only a veterinarian is allowed to use drugs extra-label. Extra-label constitutes any use of a drug which is not indicated on the product label, i.e. different species or class, different dosage, or different route of administration.

None of the anthelmintics currently FDA-approved for use in sheep (Valbazen®, Prohibit®, Ivomec®, or Cydectin®) have been labeled for lactating dairy ewes. Nor has a milk withdrawal period been established. Thus, dairy sheep producers must work with their veterinarian to establish safe milk withdrawal periods.

All of the approved anthelmintics may be administered to pregnant ewes with the exception of albendazole (Valbazen®) which should not be given during the first 30 days of pregnancy of within 30 days after ram removal.

Be sure to visit the web site of the American Consortium for Small Ruminant Parasite Control at www.acsrpc.org, controlworms.org, wormcontrol.org, or wormx.org. The web site contains more detailed discussion of the topics in this manuscript.