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FACT SHEET

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Strategies for Coping with Parasite Larvae on Pastures in the Springtime in Ohio

William P. Shulaw, DVM, MS, Diplomate ACVPM
Extension Veterinarian, Cattle and Sheep
Ohio State University Extension, Veterinary Medicine

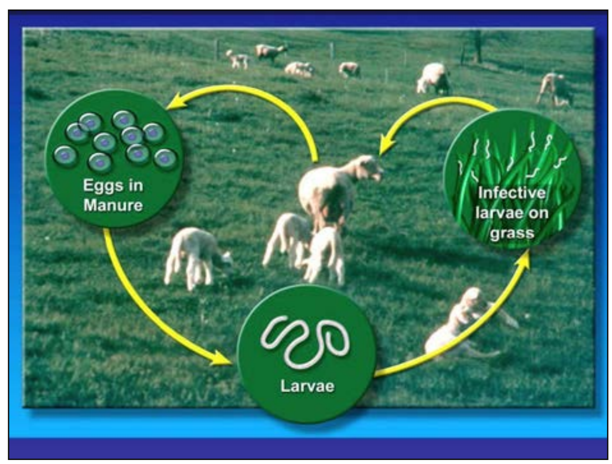
Jeff McCutcheon, MS
Extension Educator, Agriculture and Natural Resources
Ohio State University Extension, Morrow County

Rory Lewandowski, MS
Extension Educator, Agriculture and Natural Resources
Ohio State University Extension, Wayne County

Joyce G. Foster, PhD
Research Biochemist, USDA, Agricultural Research Service
Appalachian Farming Systems Research Center, Beaver, WV

INTRODUCTION

Contrary to what many people think, the infective larval forms of many internal parasites of sheep and goats can survive surprisingly well through our cold winters on typical pastures here in Ohio. On-farm research conducted in the past few years at several locations in Ohio has reconfirmed that overwintered larvae can create heavy worm burdens in ewes and lambs, and this can result in severe disease as early as mid-June. In addition, adult animals can provide a new generation of infective larvae in the spring with the eggs they deposit on pastures in their manure. For farms that use permanent pastures for lactating ewes and young lambs in the springtime, managing these larvae presents a serious challenge. Research conducted in the early 1980s in Ohio suggested several approaches to managing these parasites, but they relied heavily on routine use of dewormers on all animals at strategic time points.[1] We now discourage use of these approaches because they are known to select for dewormer resistant worms, a problem that is widely recognized as the most significant threat to raising sheep in pasture settings. Some alternative strategies incorporating newer concepts of parasite control may be sustainable with less potential for resistant worm selection.



The typical worm life cycle—eggs from adults pass out in the feces, eggs hatch into larvae that migrate to grass blades, and the larvae are ingested with the grass and mature to adults in the stomach and intestines.

BASIC BIOLOGY

The life cycle of the important worms inhabiting the stomach and intestines of sheep is relatively straightforward. The adult worms expel eggs that pass out of the sheep in the manure. Under favorable conditions, these eggs hatch into very small larvae that go through two molts to become third-stage larvae that are the only stage that is infective for sheep. The infective larvae move up the forage a short ways in films of moisture and are consumed with the herbage grazed by animals. In the animal's body, these larvae penetrate the stomach (abomasum) or intestinal wall and continue to develop for a short time. They then leave the tissue as immature worms and continue to mature into adults in the abomasum and intestines. Worms typically suck blood or damage the stomach and intestinal wall which leads to poor growth and diarrhea. For the most deadly worm we have to deal with, *Haemonchus contortus* or the "barber pole worm," the entire cycle can be completed in as little as 23–25 days.

Egg hatching, larval development, and survival outside the animal are dependent on warm temperatures and adequate moisture. These conditions are usually present from mid-April to October with the most favorable time being June through mid-September. Eggs deposited during cold weather usually do not hatch, and the first two larval stages after hatching are very susceptible to drying and cold. This is largely why we see a break in the cycle of parasitism during colder weather in temperate climates like ours.

Although the eggs and first two stages of larvae are very susceptible to drying and freezing temperatures on pastures, the third-stage infective larvae are more resistant. If they are protected from drying by soil moisture and organic debris from late fall through the winter, significant numbers of them may survive until spring. However, because they do not feed and must live on stored energy, most of these larvae will be dead by July of the year following their development from eggs.

A special feature of the life cycle typically begins in late summer and fall. At this time infective larvae consumed by sheep, especially adult and young adult animals, may penetrate the wall of the abomasum (fourth stomach compartment), but then they go into a resting phase instead of continuing to develop. They are then referred to as larvae in "arrested development" or in "**hypobiosis**," and they do not suck blood or feed on gastrointestinal tissues. In studies conducted in 1977–1979 near Wooster, Ohio, as much as 90% of the *Haemonchus* worm burden in sheep was in hypobiosis by late November.[2,3] These "hypobiotic" larvae typically resume their development and become adult, egg-laying worms in the spring—especially around lambing time when milk production begins and the ewe's immune system isn't fully functional. This phenomenon is called the "**periparturient rise**" in worm egg counts. These newly developed adult worms produce eggs that contaminate spring pastures and thus ensure a new generation of worms for lambs and ewes to acquire.[4] As milk production decreases approaching weaning, egg counts in ewes usually fall rapidly to low levels as the ewe's immune system returns to normal.

As a result, worm larvae can survive our winters in two ways: as third stage larvae in the top inch of the soil and plant debris and as hypobiotic larvae in the gut of the sheep. These two survival mechanisms make springtime parasite management a demanding task.

POTENTIAL STRATEGIES TO MANAGE PARASITISM IN THE SPRING

Each farm has a different pasture resource base, lambing time, grazing plan, and marketing plan. This means a worm control plan cannot have a "one size fits all" approach. This fact sheet deals with managing parasitism in a spring lambing flock that will use pastures for a significant part of the diet for lactating ewes and young lambs which are the animals at most risk for severe parasitism. ***Remember that the goal of a sustainable parasite control program is to limit the economic and animal welfare effects of internal parasitism, not to kill every worm***. Generally, the best overall program will use multiple strategies.

Managing lactating ewes

Background

As discussed earlier, in most flocks lactating ewes will experience a periparturient rise in adult worm numbers resulting in many more worm eggs in their manure. In some seasons, this can result in some ewes showing the effects of these newly developed adult worms with weight loss and "bottle jaw" and heavy contamination of the pastures with worm larvae. These pastures may remain heavily contaminated for the remainder of the grazing season and may be dangerous if used by young, susceptible lambs. In the older research cited above,[1] it was suggested that all ewes be treated in the lambing pens, or at turnout to pasture, to prevent their contaminating pastures with a new generation of worm larvae. Additionally, it was recommended that all ewes subsequently be treated at 21-day intervals thereafter for a total of four treatments with the last treatment usually being in June. This strategy will kill worms that have developed from larvae surviving on spring pastures ingested by the ewes and before those worms have a chance to contaminate the pastures with a new generation of larvae. Because most overwintered larvae will be dead by July, this approach was very effective in keeping pastures and sheep free of worm burdens for much of the summer, but it certainly helped select for dewormer-resistant worm populations.

Targeted selective treatment (TST)

Not treating newly lambed ewes for the periparturient rise in egg excretion may leave many ewes at risk of severe parasitism in some years and will result in contaminated pastures virtually every year. For the last three years we have suggested treating periparturient ewes with twins and triplets, and ewes in thin body condition, but leaving the barren ewes and those with single lambs untreated. In our experience with participating farms thus far, this approach results in treating about 75% of the ewe flock near lambing. The untreated animals are those at least risk of severe parasitism and will deposit smaller numbers of eggs on the pastures. Importantly, these eggs will be from worms that have not been selected by exposure to dewormer. The larvae developing from these eggs will provide a dilution effect against those that develop from worms that have survived the deworming. Consequently, this will slow down the rate of development of dewormer resistance. This approach to treatment is referred to as "**targeted selective treatment (TST)**" and the worms in the untreated sheep and their subsequent larvae on pasture are referred to as "**refugia**."[5] Refugia are the populations of worms on a farm that escape dewormer selection pressure. These worms can be in the gut of animals or on pastures in larval form where they are available for reinfecting sheep. The concept of retaining refugia of unselected worms on a farm to slow down development of dewormer resistance is central to developing sustainable strategies for parasite control in ruminants and is inherent in TST approaches to treatment.

Another approach to TST with which you may be familiar is the FAMACHA system where only sheep with evidence of anemia, as determined by varying degrees of paleness of the eyelids, are treated.[6–8] However, this system only addresses the blood sucking worm, *Haemonchus contortus*. TST approaches other than FAMACHA are being explored as ways to reduce selection for dewormer resistance and still provide sustainable control of multiple species of worms including *Haemonchus*.

A single TST at spring turnout with an effective dewormer will provide immediate benefit to the ewes and reduce pasture contamination, but if the animals are grazing pastures grazed the previous fall or late summer, it is likely they will still consume overwintered worm larvae. It is not unusual to see the effects of a developing burden of worms by late May or early June if the pastures had significant overwintering larvae. For this reason it is important to watch the ewes for signs of weight loss, and possibly implement the FAMACHA system, to identify any ewes that need deworming before lambs are weaned. This should be done at weaning as well.

The FAMACHA system is used to identify animals that need deworming by comparing their eyelid color to a color chart. A pale red color indicates the animal is anemic.

Pasture based strategies

Farms that have limited pasture acreage, or no other grazing animal species, have little flexibility. Continued monitoring with the FAMACHA system during lactation usually works quite well in our region where *Haemonchus contortus* is the major problem, especially for small flocks, but it is important to monitor frequently, at least every two weeks, as spring approaches summer. For some flocks, there may be other options. For example, if hayfields can be grazed in the spring, thus effectively harvesting "the first cutting" with the sheep, they usually provide a worm larvae-free place to put the animals. If combined with strip grazing and back fencing, hayfield grazing can be even more useful for worm control and be more efficient in forage usage. *It takes at least 3–4 days under the most ideal weather conditions for a worm egg to hatch and reach the infective larva stage.* If the fences are moved across the clean hayfield at 3–4 day intervals, and the back fence prevents sheep from grazing where eggs may have been deposited, both ewes and growing lambs will not acquire new infections as long as these larvae-free fields are available. Given the difficulty of making good quality first cutting hay in Ohio because of typical weather conditions, this can be a very efficient way of utilizing the forage. If the hay is predominantly alfalfa, a strategy to manage bloat will need to be developed. If the hayfield is not grazed again during the summer or fall, it should be larvae-free by the next spring because most infective larvae will use up their stored energy over the summer, and hay making will expose them to drying out. On some farms, annual forages such as cereal rye, or even wheat, can be used similarly in the spring.

For farmers that use permanent pastures to graze cattle or horses in addition to the sheep, or that can work with a neighbor who does, they may be able to take advantage of the fact that with relatively minor exception, sheep worms do not infect cattle or horses and vice versa. This means that pastures used by cattle or horses the previous fall will not be infective for sheep grazing there in the spring. A TST of the ewes followed by strip grazing of these pastures could provide a period of worm-free grazing. Because springtime is often when our cool season grasses are most productive, and it can be hard to use up all the forage growth, some farmers may be able to first graze a pasture with one species and then harvest the regrowth from that pasture with the other. This rotation can be repeated as long as weather conditions favor forage regrowth. This approach can provide relatively worm-free pastures for both species and both receive benefit by having access to more pasture land.

Supplemental nutrition

There is a nutritional "cost" to the effects of parasitism, and adequate nutrition in the form of protein and energy is needed for a normal response. Researchers have demonstrated that providing supplemental protein and energy to lactating ewes on pastures in the spring can improve their resilience to, or ability to withstand, a parasite burden.[9] However, we have little USA data from which to base recommendations for amounts and for how long it should be provided. Anecdotally, it appears that 0.5 to 1 pound of a corn/soybean meal supplement per ewe daily for the first 4 weeks of lactation can help limit weight loss and reduce the effects of parasitism in ewes. Soybean hulls and dried distillers grains with solubles are other non-starch concentrates that can be used to supplement pasture.

Managing preweaned lambs

Background

With the exception of *Strongyloides*, which is not a common problem in sheep, lambs do not acquire gastrointestinal worms while in the uterus or through the colostrum or milk. They acquire them at pasture just as their mothers do. However, they do not consume much forage during the first couple of weeks of life. We usually do not see worm eggs in lamb feces much before they are about six weeks of age. *Because it takes about 19–21 days for eggs to appear in the feces after ingesting infective larvae*, this means lambs really don't eat much forage until about three weeks of age. There is some evidence that a milk diet is somewhat protective against worm infections,[10] but experience in Ohio with late March and April born lambs at pasture with their mothers has shown that severe worm infections can appear in lambs by mid-June to early July if they are consuming contaminated forages with their mothers. This contamination may be recent, from the lactating ewes, and/or from surviving overwintered larvae depending on the pastures that were used by the flock.

Targeted selective treatment (TST)

Our experiences suggest that parasite burdens in spring-born lambs grazing pastures contaminated by ewes or overwintered larvae do not build to dangerous levels until mid-June to late June. To avoid significant losses in productivity, or deaths, it is advisable to anticipate this problem. One way to do this is by using the FAMACHA eyelid scoring system referred to previously. This system is specific for *Haemonchus contortus* because it estimates anemia in the animals occurring as a result of the blood feeding activity of this worm. Animals scoring a 1 are not anemic and those scoring a 5 are severely anemic and at risk of immediate death. In our region, farmers should usually begin scoring lambs in May if they determine that their pastures may present a worm risk. Scoring should then be repeated on lambs at least every two weeks. Weekly scoring is needed if stocking density or worm challenge is high. As worm populations build, severe anemia can develop in as little as 7–10 days. We strongly advise keeping some records to track changes over time. In the example shown below in the figure, you can see that although there was no clinical disease in lambs in May and early June, the change in the FAMACHA scores from a predominance of animals scoring 1 to a predominance scoring 2 shows that anemia was developing. By the third week of June, as much as 20% of the lambs were in need of treatment (score of 3). Using FAMACHA scoring routinely and keeping good records can (1) provide a "red flag" for a worsening parasite situation in the lambs and allow a farmer to make a management adjustment, such as a change in pasture; and can (2) provide prompt treatment for animals that need it. The TST approach of FAMACHA means that not all animals will be treated thus leaving a refugia of worms to reduce selection for resistance.

Another approach might be to anticipate the typical buildup of a parasite burden in late May or early June and move lambs and their mothers to a clean pasture. At the time they are moved, all lambs can be treated ***if the ewes remain untreated***, assuming that the ewes were selectively treated as described above, because the eggs being shed by the ewes will provide the refugia on the next pasture. If it is near weaning and the lambs will be moved without their mothers, consider treatment of all lambs except the heaviest 10–20%. Work performed recently in New Zealand has suggested this can provide adequate worm control and lamb performance without selection for resistance by keeping a refugia in the untreated lambs.[11,12] However, if only the lambs will be moved to the clean pasture, treatment of all of them just before the move, as was once recommended,[1] ***should not*** be done as this will definitely select for resistant worms on the new pasture because only "survivors" of the treatment will repopulate the pasture with their eggs.[13]

NCR SARE Farmer/Rancher Project – 2008

~65 lambs per group

FAMACHA percentages over time (early weaned)

score	5/5/08	6/5/08	6/23/08	7/8/08
1	0.77	0.36	0.29	0.09
2	0.23	0.64	0.65	0.42
3	0.00	0.00	0.05	0.42
4	0.00	0.00	0.02	0.05
5	0.00	0.00	0.00	0.02

FAMACHA percentages over time (late weaned)

score	5/5/08	6/5/08	6/23/08	7/8/08
1	0.56	0.27	0.24	0.22
2	0.42	0.71	0.55	0.65
3	0.01	0.03	0.20	0.13
4	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00

Keeping good records of FAMACHA scores can provide an "early warning" system for developing parasitism.

Pasture-based strategies

Pasture-based strategies that benefit preweaned grazing lambs are outlined above in the lactating ewe section. Lambs need a high-quality diet if they are to be expected to grow well. High-quality hayfields can support good growth, but bloat must be managed if alfalfa is used. On some farms and in some years, it may be possible to plant an annual crop, such as turnips, early enough that it can provide additional larvae-free pasture for ewes and their lambs. A winter annual such as cereal rye can also provide larvae-free pasture in the spring. Some nontraditional pasture plant species may offer some physical or chemical protection against parasite infection and some of these will be discussed in other fact sheets.

Early weaning to dry lot

Some farmers have relatively little flexibility with respect to pasture acreage, alternating species grazing, and labor for FAMACHA. Because grazing lambs usually don't begin to suffer severe parasitism until June, the simplest parasite control program for these farms may be to wean lambs early, put them in a dry lot setting, and feed them concentrates. Alternately, they may be sold as feeder lambs. When ewes are no longer producing much milk, their immune system quickly responds and they are more capable of withstanding a parasite challenge. Thin or anemic (based on FAMACHA scoring) ewes can be treated at weaning leaving ewes in good condition untreated. The group can then be put on forage of a quality suitable for them to regain their weight to desirable breeding condition.

SUMMARY

Managing internal parasitism in sheep or goats by just regularly giving a dewormer to all the animals is no longer sustainable, and the now frequent observation of worm populations that are resistant to all the chemical classes of dewormer currently available warns us of the need to develop, and adopt, additional strategies if we intend to continue using pasture-based systems. It is likely that no single strategy will be completely successful, but rather, the most successful approach will use several different strategies that integrate knowledge of parasite biology with available farm resources and a season-long planning process.

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