INTRODUCTION

Gastrointestinal parasites pose a serious health threat to small ruminants, especially those living in the humid environments of the Southern and Eastern United States. Because the nature of parasites is to steal nutrients from their host, infected small ruminants will have decreased growth and milk production and lower feed efficiencies, if these internal worms are not effectively managed. Small ruminant producers may also experience decreased profitability due to increased treatment costs and animal mortalities.

Many gastrointestinal parasites that affect small ruminants have built up a resistance to all three major classes of dewormers (Howell et al., 2008). Therefore, the goal of any small ruminant producer should be to reduce the exposure of their animals to gastrointestinal worms through proper pasture management. The objective of this fact sheet is to discuss several strategies that will help accomplish this goal as it relates to the principal stomach and intestinal worms of small ruminants (Haemonchus contortus, Trichostrongylus spp. and Teladorsagia circumcincta).

A producer must first understand the parasite life cycle to be able to effectively manage the parasites in pasture systems. Adult parasites live and breed in the abomasum and intestines of small ruminants, potentially producing thousands of eggs per day. As sheep and goats graze, eggs are shed in fecal pellets deposited on the pasture. Under ideal temperature and moisture conditions (warm and wet), the eggs hatch, go through two molts, and develop into the infective L3 larval stage within 3 to 4 days (Zajac, 2013).

Dew or rain drops may assist these infective larvae in migrating several inches up the blades of grass. When animals graze near the bottom of the plant, they ingest the larvae and re-infect themselves. Infective L3 larvae are very active in hot climates and may only have a life span of one to three months in tropical areas, while larvae in more temperate areas may be able to persist for six months or longer (Torres-Acosta and Hoste 2008; Waller, 2006).

ROTATIONAL GRAZING

When implemented correctly, rotational grazing can decrease the exposure of livestock to parasites and provide high quality forage. If small ruminants are forced to graze the same pasture continuously, they will repeatedly return to desirable areas, potentially re-infecting themselves with parasites. Constant grazing pressure will also weaken forage plants leading to lower forage quality and more weeds.

Rotational grazing allows producers to control how short plants are grazed, the length of time animals graze in a paddock, and the length of time in between grazing events. The majority of infective larvae will be found within the bottom three inches of the plant.
Animals should be moved to fresh forage before they graze plants below this height and before they re-infect themselves with parasites.

Because it could take as few as 3 to 4 days for a parasite egg to develop into an infective L3, it is recommended that animals be moved to a new paddock within 1 to 3 days, before reinfection occurs (Burke et al., 2009). If not moved regularly between pastures/paddocks, animals will spend extended periods of time in the shade or near water sources where parasites thrive. Moving animals every 1 to 3 days will discourage this behavior and decrease subsequent parasite loads.

Under ideal moisture conditions, forage is generally ready to re-graze within 21 to 28 days. Unfortunately, the larval population on pasture may reach peak in-

If small ruminants are forced to graze the same pasture continuously, they will repeatedly return to desirable areas, potentially re-infecting themselves with parasites.

fectivity near that same time in temperate conditions (Coffey and Hale, 2012). A longer rest period between grazing events can lower the parasite load in a pasture as infective L3 larvae may use their stored energy and die while waiting for a suitable host to ingest them. One disadvantage to a longer rest period is that the overall forage quality may decrease as the plant matures (USDA, 2006).

**MANAGING GRAZING HEIGHTS OF DIFFERENT GRASS SPECIES**

Small ruminant producers can reduce the risk of parasite infections to their animals by properly managing the grazing heights of the forages. Common cool-season perennial grasses such as tall fescue, orchardgrass, Kentucky bluegrass and ryegrass can be easily overgrazed, if the producer leaves their animals in the pasture for too long. It is recommended that animals begin grazing these grasses when they are 6 to 8 inches tall and end grazing when they are 3 to 4 inches tall.

Warm-season perennial grasses such as eastern gamagrass, big bluestem and indiangrass can provide good quality forage during the summer months if they are grazed from a starting height of 18 to 20 inches down to an ending height of 8 to 10 inches. Grazing of warm-season annuals such as millet, sudangrass and sorghum-sudan hybrids should begin when the plants are 18 to 24 inches tall and end when they are 6 to 8 inches tall (USDA, 2006).
USE OF ANNUAL FORAGES

Incorporating annual forages into the pasture system can reduce the risk of parasite infection in multiple ways. Warm-season annuals such as pearl millet, sudangrass, and sorghum-sudan hybrids can meet the energy and protein requirements of many classes of small ruminants, if they are managed properly and grazed at the correct heights. Before planting annuals, a producer may disk the soil or spray herbicide on the existing vegetation. These practices will dry out the parasites’ environment leading to their death. It may take 45 to 60 days of plant growth before the annuals are at the correct height to begin grazing. It is likely some larvae would die during this time period, even if the producer did not disk or spray the area before planting.

UTILIZING BROWSE

Allowing animals to browse on woodlot vegetation encourages them to eat higher in the canopy where there is less chance of picking up parasites. This also gives permanent pastures time to rest and provides an additional feed source while warm season annuals are growing. Silvopasture, the practice of integrating livestock, forage production, and forestry, can also provide high quality feed while keeping animals from continuously grazing on the ground. Stands of black locust, honey locust, and mimosa have been successfully incorporated into silvopasture systems for small ruminants (Addlestone, et al., 1998).

INCLUSION OF FORAGES RICH IN CONDENSED TANNINS

Numerous research studies have shown that forages containing high levels of condensed tannins can reduce fecal egg counts and inhibit larval development of Haemonchus contortus (Hoste et al. 2006). Sericea lespedeza, birdsfoot trefoil, chicory, sainfoin, certain browse species, pine bark, black locust trees, and tropical legumes could be incorporated into the diets of small ruminants to decrease parasite risk (Burke et al., 2012; Hoste et al., 2006, Marley et al., 2003; Min et al., 2015). Sericea lespedeza has been extensively researched. More information on this topic can be found at https://www.wormx.info/sl.

GRAZING MULTISPECIES OF ANIMALS

In general, cattle and horses do not share the same gastrointestinal parasites as sheep and goats, therefore grazing them in the same pastures as small ruminants could help manage internal parasites. When cattle or horses ingest the infective L3 larvae that infect small ruminants, the parasites die because they cannot complete their life cycle in the foreign host. These other livestock species help “clean” the pastures before the small ruminants re-graze the area (Coffey, 2001). The popular leader-follower system allows the sheep or goats to graze the taller, higher quality vegetation first. Cattle or horses then follow and graze the remaining vegetation closer to the ground. Mixed species grazing can also lead to better utilization of vegetation in a pasture due to the animals’ differences in grazing preference (Luginbuhl et al., 2000).
HARVESTING HAY

Harvesting hay is another way to increase the time between grazing events on a pasture. Producers who rotationally graze their pastures may have extra forage due to the increased forage utilization. By making hay on this land rather than grazing animals, producers can increase the length of time the land is without animals. Hay mowers usually cut the forage shorter than grazing animals. This allows sunlight and heat to penetrate to the soil surface causing larvae to dry out and die (Coffey and Hale, 2012).

INCREASING FORAGE QUALITY

Livestock fed a diet that meets or exceeds their nutritional needs, especially the protein requirement, have better resilience against parasite infections (Hoste et al., 2005; Kahn et al., 2003). Including legumes in pasture systems will increase the protein content of the diet. Common cool-season legumes include white clover, red clover, crimson clover, crown vetch, hairy vetch, and birdsfoot trefoil. These could be interseeded into perennial or annual grass pastures. Legumes that could be grazed during the summer months include alfalfa, sunn hemp, cowpeas, forage soybeans and sericea lespedeza.

Forages in the leafy, vegetative state are higher in crude protein than those in the stemmy (with seedhead), reproductive state. Rotationally grazing helps keep the pastures from getting too mature or stemmy. Applying the recommended amounts of lime and fertilizer to pastures will encourage high yield and high quality of desirable forage species. Cool-season forages are generally regarded as being higher quality than warm-season forages.

PASTURE MANAGEMENT PRACTICES FOR PARASITE CONTROL

- Rotational grazing
- Follow recommended grazing heights
- Using annual forages
- Including browse
- Incorporating tannin rich forages
- Grazing multispecies of animals
- Harvesting hay
- Increasing forage quality
LITERATURE CITED


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Fact sheets in the Best Management Practices for Internal Parasite Control in Small Ruminant series were written and reviewed by members of the American Consortium for Small Ruminant Parasite Control. They are for educational and informational purposes only. No practice described in the fact sheets stands alone as a method to control internal parasites. Each producer needs to implement the appropriate combination of practices that will achieve satisfactory control of internal parasites in their flock or herd. The fact sheets are not meant as a substitute for professional advice from a veterinarian or other animal science professionals. Some treatments described in the fact sheets may require extra label drug use, which requires a valid veterinarian-client-patient relationship. For a complete list of fact sheets, go to https://www.wormx.info/bmps.