Understanding the Risk Factors

American Consortium for Small Ruminant Parasite

A central concept in the development of a sustainable parasite management plan is the maintenance of a refugia parasite population within a given farm. A refugia population is one less exposed to anthelmintic drugs (dewormers). The refugia population acts as a reservoir of parasites with gene frequencies for resistance alleles that are lower than those that survive dewormer treatment. These populations then mix and mate, effectively diluting the resistance genes within a particular parasite population. This dilution effect helps to maintain dewormer efficacy.

A major challenge faced in modern parasite management is how to maintain refugia without compromising flock/herd health and well-being. A key factor in maintaining this balance is understanding host susceptibility to parasite infection. By understanding host susceptibility, one can target animal classes of greatest susceptibility for anthelmintic treatment while maintaining refugia by not treating those classes that have lower susceptibility. This is a central concept of targeted selective treatment or smart drenching.

The good news is that host susceptibility can be predicted well by examining both the physiological state of the animal (stage of production) and its plane of nutrition (how well an animal is fed). Both plane of nutrition and physiological state impact host susceptibility separately but also can have profound additive effects.

Production or physiological state of the host animal

The productive or physiological state of the animal is a key consideration in infection susceptibility. Immunity to gastrointestinal nematode infection starts

Understanding the risk factors for infection is essential in developing a sustainable parasite management plan. This is a flock of prolific, fall lambing ewes on pasture. In this population, an example of a target population for parasite refugia would be ewes raising singles.

Image by Richard Ehrhardt

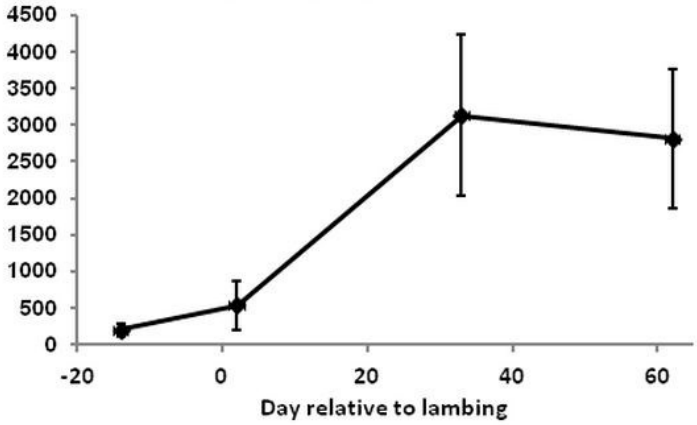

Figure 2. *The immunity of the dam to parasites becomes much lower during early lactation and produces a phenomenon known as the "periparturient rise in fecal egg count". This is quite evident in this figure showing the changes in fecal egg count of adult ewes (n=47) housed indoors and lambing in a Michigan winter (Bronkema and Ehrhardt, unpublished). This exemplifies the concept that certain productive states such as lactation are high risk for infection.*

to decline just prior to parturition and reaches a peak in early lactation (day 15-40) and then becomes increasingly re-established as lactation wanes. This results in a rise in fecal egg count especially evident in early lactation (see Figure 2) which creates a dangerous situation on these pastures for their highly susceptible offspring.

This effect is undoubtedly exacerbated by undernutrition during lactation and is also related to age of the dam. So, collectively a ewe or doe giving birth at 12 months of age, raising twins or better without access to a grazing diet rich in energy and protein will be at high risk for infection. This animal will deposit a lot of eggs on pasture as the adult worms thrive in her gut resulting in a highly contaminated pasture that will place lambs/kids in the mob at even higher risk for infection as they start to graze around 4-5 weeks of age.

Animal age and previous exposure to parasites and also key factors affecting immunity. A best management concept in young animals is allow them a "safe" exposure to parasites to allow them to build immunity. The balance between safe and unsafe exposure however can be tricky to manage in the field. Again, careful monitoring of preweaning animals on pasture is critical along with more aggressive treatment schedules than used in adults with relatively high immunity (well fed, dry ewes or does).

Plane of nutrition

Another major determinant of parasite susceptibility is the animal's plane of nutrition. Animals that are fed below their nutrient requirements have lower immunity to infection when everything else is equal. Plane of nutrition and productive or physiological state are separate factors influencing parasite infection susceptibility but they commonly interact in the field thus compounding infection risk.

It is very challenging to meet the nutritional needs of young, prolific lactating sheep and goats on pasture. These animals will be in a state of nutritional deficit in most pasture rearing conditions and when they animals are grazed on pasture highly contaminated with parasitic larvae, the combination often results in a high degree of infection. These animals therefore must be a target for more aggressive monitoring and

Figure 3. Example of the interplay between plane of nutrition, age, and productive state in influencing susceptibility to parasite infection within a given flock. Immunity to gastrointestinal parasite is relatively high in mature, non-lactating ewes but low in lambs, young prolific lactating ewes and mature ewes rearing a large number of lambs.

AGE	PRODUCTION STATUS	PLANE OF NUTRITION	RELATIVE IMMUNITY
Lambs	< 5 months parasite exposure	Well-fed	++
		Underfed	+
	> 5 months Parasite exposure	Well-fed	+++
		Underfed	++
Ewes 12-24 months	Dry, non-lactating	Well-fed	++++++
		Underfed	++++
	Lactating, single	Well-fed	+++
		Underfed	++
	Lactating, twins	Well-fed	++
		Underfed	+
Ewes 2 years and older	Dry, non-lactating	Well-fed	+++++++++++++++
		Underfed	++++++++++++
	Lactating, single	Well-fed	+++++
		Underfed	+++
	Lactating, twins	Well-fed	+++
		Underfed	++
	Lactating, triplets	Well-fed	++
		Underfed	+

*0-40 days lactating

anthelmintic treatment. Older dams raising singles will be at far lower risk.

Summary

Recognizing the factors that determine parasite infection risk is critical in developing an effective and sustainable parasite control program. Infection monitoring frequency (via FAMACHA© and/or fecal egg counts) must be greater in animals with greater susceptibility. A grazing management program should also seek to create or reserve pasture lower in contamination risk for these susceptible animals. Finally, in many small ruminant grazing programs, a more aggressive treatment program using an effective drug treatment (often a combination of drugs) will need to

A mixed age set of ewes and their lambs grazing an intensively managed pasture during a humid, wet season. Aggressive monitoring and treatment of the most susceptible animals in this group is necessary for an effective and sustainable parasite management plan.

Image by Susan Schoenian

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