

Drug Resistance in Parasites of Sheep in Ontario?

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Sheep that are maintained on pasture commonly become infected with nematodes (roundworms) that live in their gastrointestinal tract. Recent work has shown that the three most important gastrointestinal nematodes (GINs) infecting Ontario sheep are *Haemonchus* (barber's pole worm), *Teladorsagia* (brown stomach worm) and *Trichostrongylus* (stomach hairworm). All three parasites live as adults in the abomasum and, in heavy burdens, have an impact on sheep health and productivity. Once mature, all three parasites produce GIN-type eggs that pass into the environment in feces. Thereafter, immature parasites hatch from the eggs, mature to the infective stage in feces, then migrate on to pasture to maximize the chance of ingestion by sheep. Thus, for all three parasites, the life cycle occurs partly in sheep and partly in the environment. In fact, on most farms the majority of the GINs are located in the environment and not in sheep.

For many years, sheep producers have commonly relied on the administration of dewormers to control parasite burdens in sheep. Within Canada, ivermectin drench or injectable are the only dewormers approved for use in sheep. However, a number of other dewormers are often used off-label (see Table 1); information on the appropriate dosage to use and withdrawal periods can be obtained from one's veterinarian. All the dewormers are safe to use at approved dosages in sheep; however, albendazole should not be administered to ewes during the first 30 days of pregnancy.

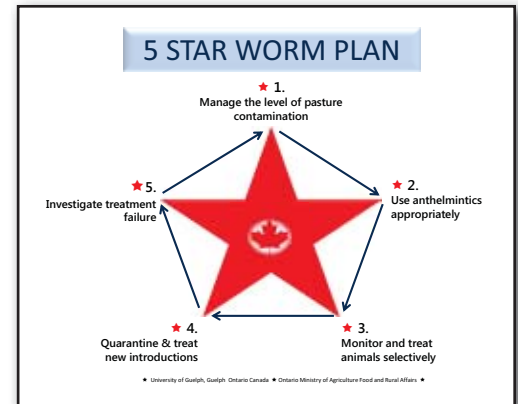
It is important to appreciate that the commonly used dewormers belong to just three drug classes (Table 1); drugs in the same class have essentially the same mechanism of action. Thus, if parasites develop resistance to a given dewormer, they typically develop resistance simultaneously to other drugs in the same class.

TABLE 1 – DEWORMERS MOST COMMONLY GIVEN TO CANADIAN SHEEP

Drug class	Drug name
1	Ivermectin*, Moxidectin
2	Fenbendazole, Albendazole
3	Levamisole
*Approved for sheep in Canada	

Drench failure versus Drench resistance?

When parasite fecal egg counts are not adequately controlled after drenching, it is tempting to assume that



the sheep are infected with drug-resistant parasites. However, it is important to appreciate that drench

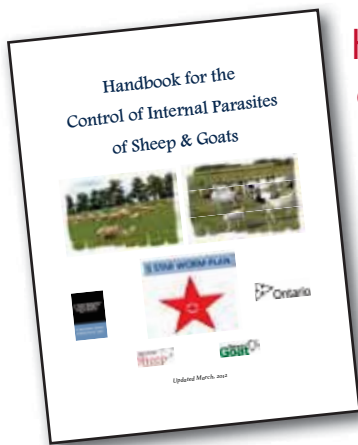
5 Star Worm Plan

failure can occur for a number of reasons that have nothing to do with resistance: (i) administration of insufficient drug, either deliberately or by underestimating the weight of animals, (ii) incorrect administration of dewormer, (iii) inappropriate calibration of the drench gun, and (iv) use of a dewormer after the expiry date. Only when these issues have been ruled out should one conclude that the drench failure is likely due to drench resistance.

Over the last two decades the development of drench resistance, and particularly resistance to drenches in multiple drug classes, has become a major constraint to sheep production in parts of Australia, New Zealand, South America and Europe. Excessive use of dewormers, inappropriate use of dewormers, and inadequate biosecurity practices, appear to be the primary driving forces for the establishment of drug-resistant parasites on farms. However, it is important to appreciate that the clinical impact of drug-resistant infections depends on the parasite burdens that develop on farms; low parasite burdens, even if drug resistant, do not have an impact on production.

How do you know if you have drug-resistant parasites on your farm?

At the present time, the Fecal Egg Count Reduction Test (FECRT) is the primary method that is used around the world to determine if GIN infections in sheep are drug resistant. For this method, a minimum of 30 lambs or young adults (first grazing season) are required with GIN fecal egg counts that are at least 150 eggs per gram of feces (epg). Ten to 15 lambs are then randomly assigned to control and treatment groups. After ensuring that animals are accurately dosed, fecal samples are collected from the same animals 14 days following treatment (if susceptibility to ivermectin or fenbendazole is being evaluated). The average GIN egg counts for each group before and after treatment are then compared; parasites are considered drug resistant if the average fecal egg count decreases by less than 95% following treatment.



How common is drench failure and drench resistance in Ontario?

Prior to 2010, anecdotal reports suggested that multiple producers across Ontario had experienced drench failure. However, the true prevalence of this problem and how much

was due to drench resistance was unclear. As a result, a study was carried out in the summers of 2010 and 2011 by researchers at the Ontario Veterinary College (OVC) to determine the prevalence of ivermectin drench failure and ivermectin drench resistance in Ontario sheep flocks. In total, 47 sheep producers were recruited for the study from across the province that had a minimum of 30 lambs or ewe lambs in their first grazing season. Beginning in May/June each year, fecal samples were collected every 3-4 weeks from 15 lambs/ewe lambs and analysed individually for parasite eggs. When the average GIN egg count attained at least 200 epg, producers were asked to treat their animals with ivermectin drench and collect fecal samples 14 days later from 15 animals for analysis; if the average fecal egg count did not decrease by at least 95% following treatment, ivermectin drench failure was demonstrated on that farm. On all farms with drench failure, a FECRT was subsequently carried out by OVC researchers to evaluate susceptibility to ivermectin. In addition, if animal numbers allowed, susceptibility to fenbendazole and levamisole was also determined.

Among the 40 farms on which an ivermectin drench check was carried out, drench failure was a common occurrence. Furthermore, on most farms with ivermectin drench failure, the FECRT indicated that parasites were resistant to ivermectin and also fenbendazole. Thus, most ivermectin drench failure was associated with ivermectin resistance. It should, however, be noted that there was large variation in the level of resistance to both ivermectin and fenbendazole on different farms. Finally, and of particular concern, most of the resistance was associated with *Haemonchus* – the most pathogenic of the parasites that infect sheep.

Why is drench resistance so common on Ontario farms?

We do not know. However, deworming all ewes at lambing time in the spring, rather than just those that have high egg counts in the feces, is likely a practice that selects strongly for the development of resistance on farms.

What can be done to prevent the current situation worsening and impacting sheep health?

Farms need to start using an integrated parasite management program in which multiple methods are used for controlling GINs on farms, i.e. not just dewormers. One such program – the “5 Star Worm Plan” - has been developed for Canadian farmers. The 5 points are:

1. Manage the level of pasture contamination:

- Careful attention should be given to the adoption of pasture management strategies that help reduce parasite burdens.

2. Use anthelmintics properly:

- Management practices should be adopted that reduce the risk of development of dewormer resistance. These include the following:
 - ◆ Use a drench formulation and not an injectable formulation. Never use a pour-on.
 - ◆ Ensure all animals receive the correct dosage of dewormer, e.g. estimate weight to the heaviest sheep in a group, ensure the drench gun is regularly calibrated.
 - ◆ Avoid unnecessary treatments (e.g. ewes pre breeding).

3. Monitor and treat selectively:

- Shedding of parasite eggs in feces should be monitored each year in lambs and ewes (ideally in early July and June, respectively) to determine whether the control program is working.
- The drug resistance status of a farm should be determined on a regular basis.
- Reduce reliance on dewormers:
 - ◆ Only deworm animals that require treatment (e.g. treat just scouring lambs, just light-weight lambs).

4. Quarantine and treat new introductions

5. Investigate treatment failure

Comprehensive information on all the parameters that should be considered when designing a sustainable parasite control program for Ontario sheep farms is available in the “5 Star Worm Plan”, part of the “**Handbook for the control of internal parasites of sheep & goats**” developed for the Small Ruminant Internal Parasite Seminars held in Floradale, Napanee and New Liskeard in 2012. **Additional copies can be obtained from the Ontario Sheep Marketing Agency. OSN**

Reference:

Mederos, A., Fernández, S., VanLeeuwen, J., Peregrine, A.S., Kelton, D., Menzies, P., LeBoeuf, A. and Martin, R. (2010) Prevalence and distribution of gastrointestinal nematodes on 32 organic and conventional commercial sheep farms in Ontario and Quebec, Canada (2006 – 2008). *Veterinary Parasitology* 170, 244-252.