

ANTHELMINTIC DRUGS FOR SHEEP AND GOATS

Currently in Canada, there is only one anthelmintic drug licensed for use in sheep, specifically ivermectin, and none for goats. Ivermectin is licensed both as a drench and an injection for sheep. However, veterinarians licensed by the province in which they practise, have the ability to prescribe anthelmintics that are licensed for use in other livestock species. But with this ability comes the responsibility for assuring safety (human and animal), efficacy and appropriate withdrawal times for meat and milk.

In 2009, the Small Ruminant Veterinarians of Ontario (SRVO) sought advice from the Canadian Global Food Animal Residue Avoidance Database (CgFARAD) for appropriate withdrawals. SRVO will make those guidelines available to licensed veterinarians on request to help them in their recommendations. Anthelmintics are divided into broad spectrum - i.e. those able to kill a wide variety of parasites, and narrow spectrum - those only able to kill one or two types of parasites.

BENZIMIDAZOLES (BZ)

These are also known as “white” drenches. These chemicals are effective against all GIN and adult tapeworms. The drugs are deposited in the rumen and are slowly released into the gastrointestinal tract. They act on the intestinal cells of the nematode and the skin cells of the tapeworms, inhibiting uptake of glucose and causing starvation. They kill not only the adult forms but also the immature stages. They are also ovicidal - with activity against eggs being passed by the nematodes and tapeworms.

Currently, fenbendazole is the chemical most commonly used from this group for sheep (Safeguard 10% suspension, Intervet Schering-Plough Animal Health) followed by albendazole (Valbazen, Pfizer Animal Health). Both of these products are available as drenches and are licensed for cattle but not sheep or goats. Albendazole also has activity against adult flukes, but should not be used during breeding or the first trimester of pregnancy because of toxicity to the foetus in early gestation. Generally, however, the BZ class of drugs are very safe with low levels of toxicity. The dose used in sheep is the same as the cattle dose but goats metabolize the drug quickly and require the dose to be doubled.

IMIDAZOTHIAZOLES (LV) AND TETRAHYDROPYRIMIDINES

This group contains levamisole, pyrantel and morantel. They are also known as “yellow” drenches. Levamisole is no longer licensed in Canada (2005) but is still in use in other countries. It is also used as an immunomodulator in humans and for the treatment of specific types of cancer. It is not ovicidal and the difference between animal toxicity and efficacy is very narrow making overdose and poisoning a potential issue. Prior to this drug not becoming available, the most commonly reported adverse drug reaction in goats and sheep was from the use of levamisole.

Levamisole works by paralysing the parasite so that it is removed rapidly from the gut. It works well against a broad range of adult worms but less so against the immature stages (e.g. L₄). However, it is particularly effective against lungworm. Signs of toxicity in animals include salivation, slow heart rate and muscle tremors with occasional death. Morantel can be used to treat GIN but is not effective against the immature forms. Pyrantel is rarely used in livestock.

MACROCYCLIC LACTONES (ML)

This group contains the avermectins (ivermectin, doramectin, eprinomectin) and the milbemycins (moxidectin). These compounds are derived from specific species of the *Streptomyces* genus and all act similarly. ML's have activity against most nematodes including the L₄ stage, but not tapeworms or flukes. They are not ovicidal. They also have activity against some arthropod ectoparasites, specifically sucking lice and nose bots (*Oestrus ovis*), as well as some activity against keds (*Melophagus ovinus*) and mange (*Chorioptes*, *Sarcoptes* and *Psoroptes*). Because of this spectrum of activity, drugs in this class are sometimes called endectocides.

When administered, the drugs are stored in fat tissue and then slowly released into the body. These pharmacokinetic properties result in long meat and milk withdrawal times (Ivomec, Merial = 15 days meat withdrawal for sheep drench and 35 days for injectable). Moxidectin however, is the only drug in this class which is considered to have significant prolonged activity - approximately 35 days when administered as an injection, and 21 days when administered as a drench, against *Teladorsagia* and *Haemonchus*. The mode of activity is believed to be largely against neurotransmitter receptors specific to invertebrates. But they are considered quite safe for mammals.

AMINO-ACETONITRILE DERIVATIVES (AAD)

The first product from this new class of drugs (monepantel) was released March 31, 2009 in New Zealand and the UK (Zolvix, Novartis Animal Health) but not yet here. This is the first new class of anthelmintics developed in 25 years and appears to have excellent activity against resistant strains of GIN as well as immature forms of nematodes, and in particular *Haemonchus*. The drug is also of low toxicity as it targets a unique, nematode-specific class of acetylcholine receptor subunits.

NARROW-SPECTRUM DRUGS

These drugs only act against a few types of parasites.

CLOSANTEL

This drug is effective only against internal parasites that suck blood. In sheep and goats, this is *Haemonchus* (including larval stages) and the liver fluke *Fasciola hepatica*. It also has persistent activity by binding to the host's plasma proteins. We are hoping to bring it to Canada for research.

PRAZIQUANTEL

This drug acts against the adult and immature stages of tapeworms and is of most use for control of tapeworms in guardian and working dogs.

ROUTE OF ADMINISTRATION

DRENCH VERSUS INJECTION

Drenches are deposited in the rumen so that proper absorption can occur. Injection of anthelmintics has been shown to result in a longer action - which may be favourable in some instances, but may select for resistant nematodes because of prolonged sub-therapeutic drug levels. Drenches are therefore preferred to injectable products.

USE OF POUR-ON ANTHELMINTICS

There is evidence that pour-on products are not as well absorbed in sheep and goats as in cattle. Because of the risk of sub-therapeutic dosing by this route, they are not recommended for use in either sheep or goats.

USING AN ANTHELMINTIC BY A ROUTE OTHER THAN INDICATED ON THE LABEL

Use of pour-on products as an oral medication is not recommended as the absorption, efficacy, duration of action and withdrawal times are not predictable and may increase the risk of anthelmintic resistance. Additionally, use of injectable products as a drench may not be advisable as they have a different carrier that can affect a drug's effectiveness.

APPROPRIATE DOSE OF AN ANTHELMINTIC

In table 1 is a listing of those anthelmintics that may be available for use in sheep and goats in Canada, all of which are considered broad spectrum. The dosages provided are based on licensed recommendations from other countries where the drug is approved, or from the literature. Please note, anthelmintics not approved for that species should only be used on the advice of a licensed veterinarian and with a valid veterinary-client-patient relationship.

Table 1. Suggested dosages of anthelmintics for treatment of GIN infection (bw = body weight)

	Benzimidazoles	Avermectins	Moxidectin	Levamisole
Sheep	5 mg/kg bw	0.2 mg/kg bw	0.2 mg/kg bw	7.5 mg/kg bw
Goat	10 mg/kg bw	0.3 mg/kg bw	0.4 mg/kg bw	12 mg/kg bw

Very Important: Please note that all doses listed above are based on the amount of the active ingredient to be given per kilogram of body weight of the animal. Various formulations of the drugs have different concentrations of the active ingredient, and so the actual volume of drug delivered to the animal must be calculated based on the dose, the concentration of the drug, and the weight of the animal.

EFFICACY AGAINST...

Table 2. Activity of Anthelmintics against the Different Parasite Classes

	Benzimidazoles	Avermectins	Moxidectin	Levamisole
Hypobiotic Larvae	+	++	++	+/-
Persistent Activity	-	+/-	++	-
Tapeworms	+	-	-	-
External Parasites	-	+	+	-
Liver Flukes	+/- *	-	-	-

+ = good activity; ++ = much activity; - = no activity; +/- = slight activity

* = albendazole has activity against adult flukes but only at double-dose (10 mg/kg bw sheep)

Benzimidazole = fenbendazole and albendazole

Avermectin = ivermectin, doramectin, eprinomectin

