

American Consortium for Small Ruminant Parasite Control

Best Management Practices for Internal Parasite Control in Small Ruminants

MANAGING DEWORMER RESISTANCE

WHAT IS DEWORMER (OR DRUG) RESISTANCE?

Internal parasite infections can impact the productivity of grazing animals significantly. Years of overuse and misuse of available dewormers has led to the development of drug resistance in worm populations on many farms. Drug resistance occurs when a drug loses its ability to effectively kill worms, and the worms continue to survive in the presence of therapeutic levels of the drug (standard prescribed dose). Drug resistance is inevitable and cannot be prevented. However, its development can be slowed down.



Image by: Susan Schoenian

HOW DO I KNOW IF I HAVE RESISTANCE ON MY FARM?

Most producers start suspecting that there is a resistance issue on their farm when clinical signs persist and/or fecal egg counts (FEC) remain high following a properly administered drug treatment. The gold standard for determining dewormer resistance is the fecal egg count reduction test (FECRT).

With the FECRT, the effectiveness of a drug is determined by comparing the FEC of animals both before and 7 to 14 days after treatment or by comparing the FEC of treated and untreated control groups. It is recommended that at least 10 to 15 animals with a FEC of

250 eggs (or more) per gram (epg) be used to determine the effectiveness of a drug. This test is suitable for on-farm testing and can be conducted by trained producers, veterinarians, or extension personnel. Depending on the number of animals in a flock/herd, this might require multiple tests to determine resistance to all classes of dewormers.

A drug is considered to be effective if the FEC reduction is 95 percent or more. As the percentage goes down, the dewormer will become increasingly less effective as the sole treatment option.



HOW WIDESPREAD IS DRUG RESISTANCE ON US FARMS?

The results of numerous studies confirm the widespread existence of resistance to the three major classes of dewormers on sheep and goat farms in the US. These classes of dewormers along with their tradenames are included in Table 1. Dewormers are separated into classes based on their chemistries and modes of action. Dewormers in the same class can exhibit cross-resistance.

Table 1. Dewormers used in sheep and goats

Drug Class	Drug name	Tradenames
Benzimidazoles	Fenbendazole, albendazole, oxydendazole	SafeGuard®, Valbazen®, Panacur®, Synanthic®
Nicotinic Agonists	Levamisol, morantel, pyrantel	Prohibit®, Leva-Med™, Strongid®, Positive Pellet®, Rumatel®
Macrocyclic lactones	Ivermectin, doramectin, eprinomectrin, moxidectin	Ivomec®, Cydectin®, Quest®, Dectomax®, Eprinex®

Source: Adapted from Susan Schoenian, <https://www.sheepandgoat.com/underantheel>

In a drug resistance study on sheep (n=14) and goat farms (n=20) in the Mid-Atlantic area (2008-2009), the following results were obtained: benzimidazoles were not effective on any farm, most farms had resistance to ivermectin (82 percent, many had resistance to moxidectin (47 percent; Cydectin®), and several had resistance to levamisole (24percent). Drug resistance to all classes of drugs was present on four farms (12 percent).

More recently, sheep farms tested in Maryland, Virginia and Georgia had worms resistant to benzimidazole, ivermectin, moxidectin, and levamisole on 100%, 97%, 83%, and 50% of the farms tested, respectively. In addition, the percentage of farms tested with resistance to all tested drugs was 33 percent. These studies indicate the prevalence of drug resistance on farms and the need to continue efforts in getting more sheep and goat producers to employ sustainable integrated parasite management techniques on their farms in order to prolong available drug efficacy (Figure 1).

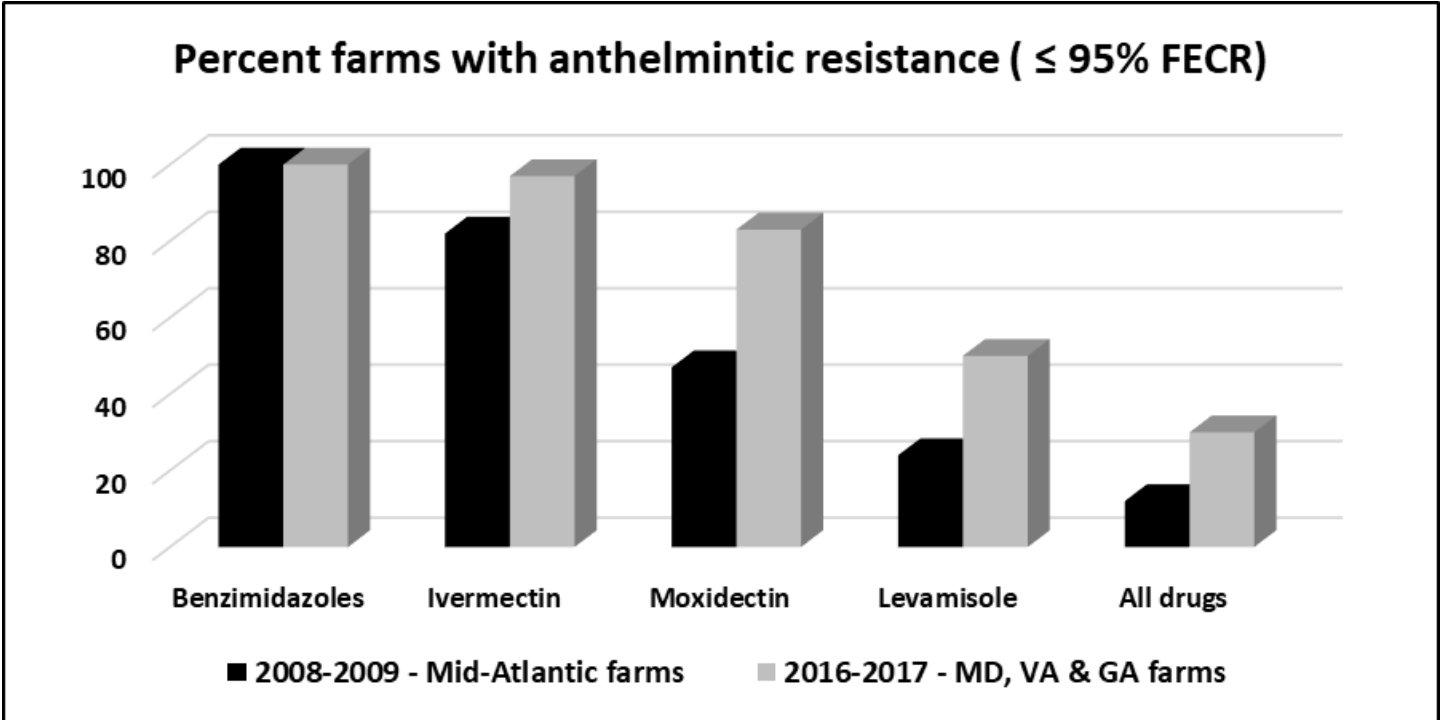
Drug resistance is not only an issue in the US. In other parts of the world such as New Zealand, Australia and South Africa, drug resistance has also become a major threat to the sustainability of their sheep and goat industry. Within 5 years of its introduction, resistance to Zolvix® (monepantel) was reported. This emphasizes



Image by: Susan Schoenian

es the point again that drug resistance is inevitable. If and when new dewormers become available to US producers, an integrated approach to parasite control, such as targeted selective treatment to promote refugia, would still be vital to preserving efficacy.

Figure 1.



I HAVE DRUG RESISTANCE: HOW CAN I MANAGE IT?

Internal parasite infections are a major cause for reduced productivity in the sheep and goat industry. While we’re aware of the potentially devastating clinical effects that result from infection with the barber pole worm and others, most of us fail to realize that subclinical effects are much more common and could result in a greater loss in production. This is exacerbated when the worms on a farm have developed resistance to the drugs that are being used in a control program.

With an increasing number of farms experiencing drug resistance in the US, there has been research into and the promotion of alternative strategies that support sustainability and slow down the rate of drug resistance on farms. Strategies including targeted selective treatment, combination treatments, animal nutrition, pasture management, genetic selection, copper oxide wire particles, condensed tannins (e.g., Sericea lespedeza) and others are now being recommended to manage drug resistance on farms. In the wake of drug resistance, the ultimate goal of any worm control program should be reducing the deworming/drug use fre-

quency and slowing down the rate at which further resistance is occurring to all drugs.

TARGETED SELECTIVE TREATMENT (TST)

Simply put, targeted selective treatment (TST) means deworming only those animals that require treatment or would benefit from treatment. Not only does this strategy help to manage drug resistance and decrease deworming frequency, it also helps identify animals that are susceptible (or not) to worm infections. This technique slows down resistance by increasing “refugia” (number of worms left in refuge from the drug).

There are two tools that were developed to help producers identify animals that require deworming. These tools include the FAMACHA© system and the Five Point Check©. FAMACHA© assesses *Haemonchus contortus* (barber pole worm) infection in sheep and goats by allowing the producer to assign an eyelid anemia score. The FAMACHA© card uses a scale of 1 to 5; with 1 being red and healthy and 5 being white and in danger of dying if not dewormed immediately with an effective drug.



Image by: Susan Schoenian

The Five Point Check© addresses limitations of the FAMACHA© system by determining the need for deworming for all internal parasites (not just blood feeders like the barber pole worm) that impact sheep and goats. In addition to the eyelid (anemia) score, it has four other check points including nasal discharge (can substitute coat condition in goats), back (body condition), tail (fecal soiling), and jaw (swelling, “bottle jaw”). This tool is also helpful in deciding whether or not to deworm animals with borderline FAMACHA© scores of 3. Every sheep and goat producer should be using these tools on their farms to manage drug resistance.

To receive a FAMACHA© card, you must attend a training or consult with your veterinarian. You can contact your local extension office or check www.wormx.info/workshops for any upcoming classes in your area. Online FAMACHA© certification is available (<https://www.wormx.info/online-famacha-certification>).

What about FEC?

Can FEC be used to determine the need for individual deworming? The simple answer is (most often) no. Quantitative egg counts are important in any internal parasite control program and can aid producers in

monitoring the rate of pasture contamination. FEC can also be used to determine drug resistance as described above and also in selecting or culling particular animals. However, most of the time, FEC should not be used as the only indicator of when to deworm individual animals.

If FEC are available, they should be used in conjunction with FAMACHA© and the Five Point Check© to determine the need for treatment. If an animal has an extremely high FEC (more than 4000 epg) and no other indicator of parasitism, it is still advisable to deworm. This will limit pasture infestation and exposure of more susceptible animals (young, sick, old) to worm larvae. Goats might need more frequent monitoring than sheep do as they tend to go downhill faster.

In addition to these tools, some sheep and goat experts advocate for the use of the “happy factor” in determining the need to deworm individual animals. For instance, if an animal has decreased performance indicators, such as low average daily gains or no weight gain, then they might benefit from dewormer treatment.

INCREASING DRUG EFFICACY

To effectively manage drug resistance, care must be taken to ensure that when individual animals are treated, they receive the correct dose and are not under-dosed. Under-dosing is a major contributor to resistance. To avoid this, sheep and goats should be weighed before being treated. If you do not have a livestock scale, then at a minimum you should be using a weight tape or measuring tape to estimate body weight, even if just on your heavier animals. Also, animals should always be drenched over the tongue towards the back of the mouth with a dosing syringe that has a long metal nozzle. Depositing the drug over the tongue increases drug efficacy by preventing the drug from bypassing the rumen.



COMBINATION TREATMENTS

We now know that rotating between dewormers will not aid in managing drug resistance or prevent it from worsening. As stated previously, with FEC reduction below 95 percent, the dewormer will become increasingly less effective as the sole treatment option. Combination dewormers (products with more than one drug) are available in other countries but not in the US. Dewormers can be used at the same time (not in a single dosage but each drug given separately) to increase treatment efficacy when individual dewormers are no longer effective. There is an additive effect when dewormers are given in combination.

On some farms, however, individual drug efficacy could be so low that even combination treatments will not be an effective treatment. In these cases, a producer might consider combining an alternative treatment, such as copper oxide wire particles (COWP) with a dewormer for increased treatment efficacy. A recent study in lambs showed that when combined, COWP and Valbazen® resulted in a 99 percent FEC reduction whereas individually they resulted in only a 58 percent and 20 percent FEC reduction, respectively. The researchers believe that a combination of levamisole and COWP would also result in a more effective treatment than when either product is used individually.

ANIMAL NUTRITION

One major implication of parasite infections in small ruminants is the reduction of nutrients that the animal needs for growth and maintenance. We know that improved nutrition can reduce production losses and mortality rates associated with worm infections.

Field trials in Australia have shown that the nutritional status of ewes impacts their ability to fight worm infections around the time of lambing. These trials suggest that increasing the protein intake of ewes during the last six weeks of pregnancy is effective in reducing the peri-parturient rise in FEC typically observed.

Maintaining females at a body condition score of 3 (compared to 2) was also effective in reducing the rise

of FEC around the time of giving birth. In addition, studies have shown that lambs supplemented with protein have increased immunity and resistance to worm infection. Therefore, ensuring that your animals are receiving good nutrition and are fed a balanced ration with proper mineral supplementation will aid in reducing deworming frequency and subsequently slowing down the rate at which drug resistance is developing on your farm.

PASTURE MANAGEMENT

Good pasture management practices, such as maintaining low stocking rates, rotational grazing to manage grazing heights, multi-species grazing can help to control worms, reduce deworming frequency and keep sheep and goats healthy.



Image by: Susan Schoenian



GENETIC SELECTION

Resistance is the ability of the animal to limit infection. FEC is the easiest way to determine resistance as these animals will consistently demonstrate low FEC when measured. Even though some breeds are more “resistant” than others, there will be variability within every breed and some individuals will not have this trait. The same goes for the breeds considered “not resistant.” Therefore, individual animals should always be monitored for their own merit.

Studies in both sheep and goats have demonstrated that this ability to regulate worms is under genetic control and that it is a moderately heritable characteristic (20 to 40 percent). This means that resistant dams and sires will most likely produce resistant kids/lambs. The sire/male contributes 50 percent of the flock genetics. Therefore, selecting resistant sires may be the most cost-effective and efficient method of making improvements in herd/flock resistance.

It is critical to remember the 80/20 rule. Worms are not evenly distributed in a herd/flock and approximately 80 percent of the worms will be shed from 20 percent of the herd/flock. Therefore, it is important to monitor animals and identify those with the most worms and cull them (remove from the breeding herd) in order to reduce pasture contamination, thus reducing deworming frequency. This allows you to select for those animals that are more ‘resistant’ to internal parasites.



Image by: Susan Schoenian

counts were significantly reduced after two weeks when pumpkin seeds were fed to lambs for 21 days; however, more recent studies have not been able to support this claim.

Overall, when it comes to herbal dewormers, there is insufficient scientific data supporting claims of effective parasite control. Therefore, herbal products alone should not be relied on for controlling/treating worms. If their use is desired, they should always be

HERBAL DEWORMERS

Over the last few years, a number of studies have been done to test the effectiveness of commercially available herbal dewormers. Results have been contrary to claims made by the manufacturers and none have been proven to be effective in reducing worm loads in the animals studied.

Results from studies looking at the effectiveness of ginger, papaya, pumpkin, and garlic have lacked consistency. For instance, one study found that worm

COPPER OXIDE WIRE PARTICLES (COWP)

It has been discovered that a low dose of COWP (0.5 - 1 g) can be effective at controlling the barber pole worm in sheep and goats. Caution should be taken to not over dose, especially in sheep, and when other sources of dietary copper are available. For information on the efficacy, use and dosage recommendations of COWP, see the Best Management Practices Fact Sheet on COWP.

CONDENSED TANNINS (*SERICEA LESPEDEZA*)

Forages such as sericea lespedeza and sainfoin have been shown to reduce indicators of worm infection in sheep and goats. What these plants have in common is the presence of condensed tannins. It is believed that when animals consume these legumes, there is a disturbance in the biology of the worms and the way in which they cause infection, thereby promoting the health of sheep and goats.

Sericea lespedeza has been extensively studied in the US and has been shown to reduce FEC when grazed and also when fed as a hay or pellets in many (but not all) studies. It is not only effective against the barber pole worm, but has also been shown to reduce coccidia eggs as well. As noted with the use of COWP, *sericea lespedeza* can be used as part of an integrated parasite control strategy to reduce pasture infestation, subsequent worm loads in the animals, and slow down the rate at which resistance develops to available drugs.

Sheep grazing *sericea lespedeza* *Image by Joan Burke*



ALTERNATIVE STRATEGIES

A number of other alternative strategies, such as the use of diatomaceous earth, and the development of vaccines has also been studied. Another method that holds promise for US producers is a nematode trapping fungi (*Duddingtonia flagrans*). This fungi, when fed, survives passage through the digestive tract of livestock, germinates and spreads on fresh feces producing specialized nematode trapping structures that restrict the development of parasite larvae. For information, see the Best Management Practices Fact Sheet on Worm-Trapping Fungus.

SUMMARY

In summary, finding out that the worms on your farm have resistance to multiple drugs is not a death sentence. There are multiple practices/tools, as described above, which can be adopted to effectively manage dewormer resistance on your farm. Keep in mind that the ultimate goal should be reducing your reliance on drugs by efficiently managing your available resources and selecting and breeding to develop a more worm resistant flock/herd.

**Drug resistance is inevitable and cannot be prevented.
However, its development can be slowed down.**

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Written April 2018. Reviewed and updated November 2024.

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