THE CONTROL OF WORMS IN SHEEP IN IRELAND: AN EVER-EVOLVING CHALLENGE

Traditional approaches to the control of gastrointestinal nematode infections are now showing reduced levels of effectiveness. Charles Chavasse BVMS CertDHH MRCVS outlines why vets must become more involved with farmer clients in addressing this challenge and highlights control strategies that will deliver better results

Collecting dung samples is an important tool to inform dosing decisions.

Gastrointestinal nematode (GIN) infections are recognised as being responsible for significant reductions in production efficacy of sheep in Ireland and elsewhere in the world[1,2]. For many years now vets and farmers have been reliant on the use of effective anthelminthic drugs. In recent years, it has become apparent that many of these worm species are now showing significant levels of anthelminthic resistance[3,4]. To further complicate matters, some species of worm, e.g., *Haemonchus contortus*, that were either not present or were very rarely found in Ireland, are now causing significant disease on some farms[5] and other species, e.g., *Nematodirus battus*, have altered their seasonal infectious pattern. Some of these changes may be attributed to climate change and others are possibly associated with changes in farming practices.

For the reasons above, veterinary practitioners need to become more involved with their farm clients in helping to control these GIN infections. In addition, the recent changes in veterinary medicine legislation, where all anti-parasitic products in food producing animals are now prescription-only medicines (POM), mean that practitioners must be involved. It is essential that changes are made to how these GIN are controlled, as the traditional approaches have resulted in there being evidence of wide spread treatment failures and anthelminthic resistance on many Irish sheep farms[3,4].

GINs

The principal GINs that affect sheep at grass in Ireland are: *Teladorsagia circumcincta, Trichostrongylus axei, Haemonchus contortus,* and *Nematodirus battus*.

Teladorsagia and *Trichostrongylus* have a life cycle where the eggs, laid by adults in the abomasum and intestine of sheep, are shed in the faeces, and hatch and develop in the environment (warm, moist conditions) to infective L3 larvae. These L3s are ingested by sheep and develop into adults. Infectious levels generally build up gradually over a number of months and both the adults and the developing larvae can have a negative impact on the health of the sheep. This leads first to a reduced appetite and poor growth rates and, eventually, to scour and, in very heavy uncontrolled infestations, death. Regular faecal egg counts can be a useful tool in monitoring the level of infection in a group of sheep and, along with a knowledge of the stocking rate and grazing practices, can indicate how much the pasture is being contaminated by these parasities.

H. contortus and *N. battus* are similar in that they both can cause pre-patent disease. This is where disease occurs before the adults have started to lay eggs; as a result, faecal egg counts on their own are not a good monitoring tool.

H. contortus is often referred to as the 'barber's pole worm' due to its appearance, where its blood-filled intestine is

wrapped around the body of the worm. Both the adults and the larvae suck blood from the intestine and adults are reported to suck up to ~0.05ml per day[6], so a burden of a few thousand worms can lead to a loss of 30 to 60ml per day. As a result, anaemia is frequently the first clinical sign and if missed, death frequently occurs. Animals affected by *Haemonchus* generally don't scour and often have dry faeces. *H. contortus* has a very high fecundity, so faecal egg counts (FECs) are frequently into thousands to tens of thousands. However, FECs may not be the best way to monitor for *H. contortus* infection, as anaemia may develop during the pre-patent period before the eggs appear in the faeces. The FAMACHA system is based on a standardised five-colour chart: the chart colours are compared to the colour of the conjunctiva of the sheep and matching colours correlate to the level of anaemia[7]. It was developed by Francois Malan in South Africa in the late 1990s and has since been widely adopted where *H. contortus* is found.

N. battus infection, traditionally, had a seasonal occurrence. Hatching and release of infective larvae usually occurred after a period of cold weather followed by warm conditions in the spring when the temperature was above 10°C. Using this information and looking at weather reports and predictions, the Department of Agriculture and the Marine (DAFM), issue a *N. battus* forecast indicating when the likely increase in infective larvae on pasture is likely to occur for various parts of the country. In the past, it was regarded as a lamb crop-to-lamb crop infection, i.e., the eggs shed by the previous year's lambs survived the winter on the pasture and then hatched to infect the next year's lambs. Generally, it affects lambs that are six to 12 weeks of age – old enough to be grazing a significant amount of grass, but young enough not to have been previously exposed and, therefore, not to have developed any sufficient immunity. The larvae and adults cause damage to the small intestine and as there is often a sudden increase in the number of infective larvae on the pasture, due to the hatching requirements described above, this can result in sudden and severe scour, lethargy, dehydration, and death. The scour is often black and, clinically, can be difficult to differentiate from coccidiosis, which also occurs in young, grazing lambs in the spring. In recent years, unpredicted high levels of *N. battus* eggs have been found in older lambs and there has been evidence of disease in the late summer and early autumn. The reason for this is unclear and may be the result of evolution of the parasite or a reflection of climate change and changes to pasture management.

Limitations in the use of faecal egg counts

In recent years, there has been much discussion about FECs. It is far too simplistic to rely on using FEC alone for guiding treatment decisions. They are potentially a tool, but it must be recognised that there can be huge variation in FEC due to sample quality, from the initial collection and how it is handled and transported to the lab, to the techniques used within the lab and even within a group of similar sheep. It is recognised that 20 per cent of a group, may carry up to 80 per cent of the worm burden and that, in well-fed, highly immune individuals, the same adult worm population may produce significantly less eggs. As a result, FECs alone cannot be used as a measure of infective levels of an individual, but they are an indication of the degree of

Haemonchus contortus. Photograph courtesy of Maresa Sheehan.

contamination that is being shed onto a particular paddock. It should be remembered that different species have different levels of fecundity and that it is difficult to distinguish between the eggs of *T. circumcincta, H. contortus* and *T. axei.* Table 1, from the old SCOPS Manual (2012)[8], needs to be interpreted with great caution but it does highlight, that with the arrival of *Haemochus contortus* in many flocks, practitioners need to reassess how they view FECs in flocks where it is known to be present.

Worm Species	Faecal Egg Counts (FEC)		
	Low	Medium	High
Mixed (*H. contortus* absent)	<250	250-750	>750
Mixed (*H. contortus* present)	<500	500-1500	>1500
Haemonchus contortus	<500	1000-5000	>5000
Trichostrongylus spp.	100-500	500-1500	>1500
Nematodirus battus	50-150	150-300	>300

Table 1.

When vets advise farmers regarding the control of GIN in sheep, both the vet and the farmer must be fully aware that a plan has to be dynamic, and may need to change mid-season; it is flock-specific and it will almost definitely vary from year to year depending on both the weather and the rotation of the various paddocks that are available for the sheep to graze.

Anthelminthic drugs

Anthelminthic drugs will be part of the plan and how these are used can reduce the development of worms that are drug-resistant. This is critical, as currently there are only five categories of anthelminthic that are available to use in sheep, and it is unlikely another category will be available in the foreseeable future. In all five categories, even the most recent, there is evidence of varying degrees of resistance. The five categories are identified in Table 2.

Responsible use of anthelminthics implies having a plan that will use them effectively, both in controlling the parasite burden to allow for efficient production and in ensuring that the population of worms on the farm does not become

Group	Group name	Active Ingredients examples	Common name & presentation
1 - BZ	Benzimidazole	Fenbendazole, Albendazole	White Dose
2 - LV	Levamisole	Levamisole	Yellow Dose or injection
3 - ML	Macrocyclic lactones	Avermectins and milbemycins	Clear Dose or injection
4 - AD	Amino-acetonitrile derivatives	Monepantel	Orange Dose
5 - SI	Spiroindoles	Derquantel	Purple Dose

Table 2.

dominated by resistant individuals. To achieve these aims, many farms both here in Ireland and in the UK have been adopting the Sustainable Control Of Parasites in Sheep (SCOPS) principles[9]. In summary, these are:

1. Ensure any treatments used are fully effective
- Weigh animals: dose to the weight of the heaviest in the group, or split groups by weight to avoid under-dosing.
- Calibrate equipment: regularly check and calibrate drenching guns to ensure the correct volume of anthelminthic is delivered.
- Follow correct dosing technique: properly restrain sheep to ensure they swallow the full dose and avoid injury.
- Choose the correct product: use the appropriate wormer class for the target parasite.
- Test efficacy: use FECs post-treatment (drench check) to confirm the treatment worked.

2. Reduce the reliance on anthelmintics
- Use monitoring: use FECs to monitor worm burdens (and/or the FAMACHA system if *H. contortus* is known to be on the farm) and make informed treatment decisions, rather than relying on the calendar.
- Be aware of local weather conditions: in dry conditions, where there has been no rain fall for a few weeks and where there are still good grass covers, the risk of picking up worm infections is low, so dosing is less likely to be required.
- Targeted treatment: treat only animals that need it (e.g., lambs based on growth rates, ewes in low body condition), rather than blanket-treating the flock.
- Manage grazing: utilise rotational grazing and pastures with low worm larvae risks to reduce the need for chemicals.
- Monitor *N. battus*: use the DAFM *N. battus* forecast to treat only when the risk is high.

3. Implement a robust quarantine protocol
- Treat *all* incoming stock: treat all incoming sheep (including rams) with products likely to remove resistant worms.
- Use recommended products: Use high-efficacy products, specifically 4-AD (monepantel) or 5-SI (derquantel), to quarantine. Consider using doses from two different groups.
- Implement correct quarantine procedure: house or hold sheep off pasture for 24 to 48 hours post-treatment to allow eggs to pass, then turn out onto an already contaminated pasture to dilute any resistant survivors.

4. Minimise selection for resistance
- Avoid "Dose and Move": do not move sheep to low-risk/clean pasture immediately after drenching. This leaves only resistant worms to populate the new pasture and has been responsible for the development of resistant worms on many farms.
- Leave some sheep untreated: when possible, leave a portion of the flock (e.g., 10 per cent of heaviest lambs) untreated to maintain a population of susceptible worms in "*refugia*".
- Use new products carefully: integrate Group 4-AD and 5-SI products strategically to protect their efficacy.

From these SCOPS principles, it is clear that it is not possible to produce an effective dosing plan/calendar, or even a written prescription, at the beginning of the year, without allowing for changes in the weather, grass growth, and stocking density.

H. contortus – 'the new kid on the block'

In recent years, many sheep farmers in Ireland have followed advise to stop dosing adult ewes for GIN, except in rare circumstances. With the arrival of *H. contortus* this approach may need to be reconsidered, as deaths and poor performance can be seen in both adult sheep and lambs. Farmers need to actively try and prevent it arriving on their farms and become much more vigorous in applying quarantine measures than has been the case in the past. On farms where it has slipped through these measures, regular monitoring is essential to prevent significant and sudden losses occurring in both lambs and ewes:
- conduct post-mortems on all sudden deaths;
- use FAMACHA system when any group of sheep are routinely being handled; and,
- perform FECs every three to four weeks in lambs and targeted sampling in ewes.

H. contortus is known to develop drug resistance more quickly than other species of GIN when anthelmintics are used. For this reason, consider using closantel when treating ewes and adult sheep. This is effective against *H. contortus* (and liver fluke) but has no effect against other GIN, thus reducing the selective pressure on the latter. When treating both lambs and ewes, consider a targeted

selective treatment (TST) approach. Treat only animals with poor growth rates, poor body condition scores or low FAMACHA scores. The advantage of TST is that the untreated sheep ensure that there is a population of worms that are *in refugia*, slowing the development of resistant worms on the farm.

In conclusion, in "the ever changing world" that we live in, there is nothing straightforward about the control of worms on sheep farms in Ireland. As the climate changes, as there is increased pressure for greater production, and as our knowledge increases, it is clear that to keep ahead of these evolving parasites, veterinary practitioners and sheep farmers are going to have to pool their knowledge, expertise, and skills to try to stay one step ahead of the "worms"!

References

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READER QUESTIONS AND ANSWERS

1. WHICH OF THESE WORMS CAUSE PRE-PATENT DISEASE?

A. *Teladorsagia circumcincta, Trichostrongylus axei*
B. *Haemonchus contortus, Nematodirus battus.*
C. *Nematodirus battus. Teladorsagia circumcincta, Trichostrongylus axei*
D. *Trichostrongylus axei, Haemonchus contortus*

2. WHICH WORM HAS THE GREATEST FECUNDITY?

A. *Teladorsagia circumcincta*
B. *Trichostrongylus axei*
C. *Haemonchus contortus*
D. *Nematodirus battus*

3. IN THE SUMMER IN A GROUP OF LAMBS AT GRASS WITH A MIXED GIN INFECTION, WHERE *H. CONTORTUS* IS NOT PRESENT, WHICH OF THE FOLLOWING IS LIKELY TO OCCUR FIRST?

A. Signs of scour/loose faeces
B. Increase in faecal egg count
C. Reduced growth rates
D. Anaemia

4. WHICH OF THE FOLLOWING CLASSES OF ANTHELMINTHIC HAVE NO REPORTED EVIDENCE OF RESISTANCE IN SHEEP GIN FOUND IN THE ISLANDS OF BRITAIN AND IRELAND?

A. Benzimadazoles and Levamisoles
B. Macrocyclic lactones and Levamisoles
C. Drequantel and Monepantel
D. None of the above

5. WHICH OF THE FOLLOWING ARE REGARDED AS BEST PRACTICE WITHIN THE SCOPS GUIDELINES?

A. Avoid "Dose and Move": do not move sheep to low-risk/clean pasture immediately after drenching
B. Treat all incoming sheep (including rams) with products likely to remove resistant worms
C. When possible, leave a portion of the flock untreated to maintain a population of susceptible worms in "*refugia*"
D. All of the above

ANSWERS: 1B; 2C; 3C; 4D; 5D.