Worm control in sheep for Better Returns
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As the UK sheep industry has intensified and become more reliant on pastures grazed by sheep alone, so the dependence on effective anthelmintics (wormers) has increased. Unfortunately this heavy use (and mis-use) of these relatively cheap products has led to the development of resistance. Producers need to take action NOW to make sure they can carry on controlling worms effectively.

The good news is that with using grazing management, knowledge of the anthelmintic resistance status of the farm and avoiding highly selective practices we can slow the development of resistance. Add to that the use of the two newest groups of anthelmintics (groups 4 and 5) as quarantine treatments and as a mid to late season dose for lambs, there is a real opportunity to maintain good worm control on the majority of farms for many years.

The SCOPS principles are key to being able to control worms in future. Based on sound, proven scientific principles, these recommendations have now been successfully taken out into the field and incorporate the practicalities of sheep farming and health planning.

This BRP manual has been updated to reflect the improvement in knowledge in recent years. It is based on experience on UK farms, further research and practical application. It will help farmers get to grips with the resistance status of their farm, improve lamb performance and profitability and ensure continued successful worming in the future.

Lesley Stubbings
Independent Sheep Specialist
Why good worm control is important

Good worm control is vital for the success of all sheep flocks. Any strategy that falls short will result in lambs growing more slowly than expected, leading to reduced profitability. Heavy worm burdens will result in stunted lambs or even deaths, but even at modest levels lambs will grow more slowly.

For example, a weaned lamb that only grows at 100g/day will need nearly twice as much energy to reach the same weight as a lamb growing at 300g/day (see Graph 1). This is because the efficiency with which it uses its feed is halved.

So, if a weaned lamb needs to put on 10kg it will take 14 weeks at 100g/day and eat 120kg of feed dry matter (DM). If it grows at 300g/day, it will take five weeks and eat just 65kg of feed DM.

Even a modest decrease in price per lamb over the additional nine weeks of 30p/kg would reduce the value of the lamb by £5.70 (for a 19kg carcase).

Add to this the cost of the additional feed, eg extra grazing, competition for grass with ewes, possibly some concentrate supplement as grass quality declines and the costs escalate, reducing the financial returns by £10/lamb or more.

How worm burdens affect lambs

Depressed appetite which reduces feed intakes and growth rate.

Permanent damage to the gut which reduces the absorption of nutrients and causes diarrhoea.

Impaired mineral retention causing a small skeleton and exacerbating any trace element deficiencies.

Reduced protein metabolism reducing muscle growth and carcase quality.

Graph 1: Efficient lamb performance

Feed use efficiency %

0 2 4 6 8 10 12 14 16 18

Growth rate g/day

0 100 200 300 400

18

16

14

12

10

8

6

4

2

0

Graph 1: Efficient lamb performance
Successful worm control

The priority for worm control is to minimise the effect internal parasites have on lamb performance. However, farmers must also consider the long term sustainability of any control programme.

To achieve this various management tactics must be employed along with careful use of anthelmintics (wormers).

**Sheep farmers should not rely on wormers as the sole means of control**

A good control plan includes:
- A long term worming strategy which is reviewed regularly and can be adapted to cope with changing patterns from year to year
- Appropriate grazing management to reduce or avoid high worm burdens on pastures
- Minimum risk of importing new parasites or anthelmintic resistant parasites with bought-in sheep
- Knowledge of the different species of worms, when they are a threat and why, using freely available regional forecasts and warnings, eg from the Sustainable Control of Parasites in Sheep (SCOPS) website [www.scops.org.uk](http://www.scops.org.uk), or the National Animal Disease Information Service (NADIS) [www.nadis.org.uk](http://www.nadis.org.uk)
- Monitoring worm burdens, using Faecal Egg Counts (FECs) and planning ahead
- Provision to allow lambs, particularly breeding replacements, to develop immunity to worms
- Ensuring treatments are always effective and testing for resistance

**Worm challenges through the season**

The challenge to sheep from worms builds over the season. A successful control strategy takes these dynamics into account. Here is an example for a spring lambing flock.

- **Pasture larvae**
- **Eggs in ewes**
- **Eggs in lambs**

**Treat 90% of ewes to relax egg output**

**Watch out for Nematodirus risk warnings**

**Wean lambs on to pastures with a lower worm challenge**

**Graze heavily infected pastures with cattle or fit, dry adults**

**Quarantine treat all incoming sheep**

**Use FECs to monitor level of worm burden and do drench tests to test effectiveness of treatment**

**Only treat young/lean ewes pre-tupping. Continue FECs on lambs**
The life cycle of worms

The life cycle of the main worm species is similar. It is important to understand this so the risks can be assessed and predictions made when they are most likely to be a problem.

The sheep (the host) picks up worms in the form of infective larvae living on the pasture. These develop into adults in the sheep’s gut and lay eggs which are then deposited back onto the grass in the dung.

The eggs hatch and develop into larvae in the dung and migrate onto the grass, where they wait in water droplets to be eaten by another sheep.

So the cycle begins again.

The time it takes for the eggs to develop into infective larvae varies according to ambient temperature and moisture. In a warm, wet summer it can be very quick (less than two weeks); in spring and autumn when it is colder, it will take longer.

Some species halt their development as winter approaches, surviving on pasture during the coldest weather, before reactivating as temperatures rise the following spring. These larvae are then a source of infection for young lambs.

Some worms may also overwinter in a suspended state inside the gut wall of the sheep, maturing and laying eggs when spring arrives.

*Nematodirus* is the exception because its larvae take much longer to develop – around eight to nine months.
Know the enemy

Key differences between the main problem worm species

**Nematodirus (Nematodirus battus)**
Has a longer life cycle than the others. Eggs do not normally develop into infective larvae until the following spring, when they can be picked up by six to twelve-week old lambs and cause significant losses.

**Action:** It is the larvae that cause the damage in the lamb’s gut, so predicting when a hatch will occur is the key to knowing when to treat.

**Teladorsagia (Teladorsagia circumcincta, formerly known as Ostertagia) small brown stomach worm**
Populations of this worm build up through the late spring and into the summer. At medium/low levels they reduce appetite in lambs, which lowers growth rates and causes general ill-thrift. Levels peak in mid-summer, increasing the risk of diarrhoea and death.

**Action:** Move weaned lambs off pasture that has carried sheep in the early part of the season.

**Haemonchus (Haemonchus contortus) the barber’s pole stomach worm**
This worm consumes large amounts of the host animal’s blood, resulting in anaemia rather than scouring. Heavy infestations can occur very quickly in the right conditions. Adult sheep do not build up such a good immunity to this species, so knowing if it is present on the farm is vital.

**Action:** Haemonchus is not present on all farms, so quarantine treatment is essential to prevent importation. Investigate if suspected.

**Trichostrongyles (Trichostrongylus spp.) the black scour worm of the small intestine**
This is most commonly seen in the autumn in store lambs, but can occur earlier. It typically causes rapid weight loss, scouring and death, particularly in poorer lambs.

**Action:** Use fit, dry ewes post-weaning to reduce worm burdens on autumn finishing pastures. Monitor FECs to see what level of infestation is occurring. Keep monitoring into the winter months.
Reducing the worm burden on pasture

Anthelmintics play an important part in controlling worms. However, the highest levels of lamb performance can only be achieved if they are not exposed to high worm burdens during their first grazing season.

This can be difficult to achieve where sheep are the only livestock. However, even on these farms, options such as integrating hay or silage making or using dry, mature ewes to ‘hoover’ larvae off highly infected pasture, are available.

The table below summarises the type of situations that result in high, medium or low risk pastures in the spring, summer and late season/autumn.

<table>
<thead>
<tr>
<th>Season</th>
<th>HIGH</th>
<th>MEDIUM</th>
<th>LOW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring</strong></td>
<td>Ewes and lambs grazed in the previous year</td>
<td>Grazed only by adult non-lactating sheep the previous year</td>
<td>New leys or forage crops\Grazed by cattle or cut for silage or hay in the previous year (no sheep)</td>
</tr>
<tr>
<td></td>
<td>High risk of <em>Nematodirus</em> if pasture carried ewes and lambs in the previous spring</td>
<td>Grazed by ewes and lambs the previous spring, but then conserved and aftermath not grazed by sheep (NB <em>Nematodirus</em> still high risk)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Goats grazed the previous year</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Store/ewe lambs grazed the previous autumn/winter</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Summer</strong></td>
<td>Ewes and lambs grazed in the spring</td>
<td>Grazed only by adult non-lactating sheep in the spring</td>
<td>Grazed by cattle or cut for silage or hay only in the first half of the grazing season</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grazed by cattle or cut for silage or hay in the spring</td>
<td>Forage crops or arable by-products grown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forage crops or arable by-products grown</td>
<td></td>
</tr>
<tr>
<td><strong>Late season/autumn</strong></td>
<td>Stocked with ewes and lambs all season</td>
<td>Grazed by cattle since mid-season</td>
<td>Grazed by cattle or cut for silage or hay only in the first half of the grazing season</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grazed by fit, mature dry ewes since weaning mid-season</td>
<td>Forage crops or arable by-products grown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forage crops or arable by-products grown</td>
<td></td>
</tr>
</tbody>
</table>
Other management options
There are a number of other actions that will improve worm control if integrated into the overall plan.

Group lambs by age
Keeping lambs in tight age groups at turnout makes treatment decisions more accurate and FECs more meaningful for the group. Other management decisions are also easier, eg weaning and withdrawal periods post-treatment before marketing.

Weaning
Provide pasture of lowest risk for weaned lambs. Be prepared to wean lambs early (down to about 12 weeks of age) and move them to low risk areas to avoid high larval levels that can build up over the season.

Mixed grazing and reduced stocking densities
Where grazing options are limited, pasture contamination can be reduced by grazing cattle and sheep together, but not goats. This reduces the stocking density of the host species, but can make pasture utilisation more difficult. Rotating grazing between cattle and sheep during the season is another way to dilute the worm burden.

Grazing quality
Good quality grazing (nutrition) is essential for high lamb growth rates and also makes lambs more resilient to worms as the season progresses. Avoid making lambs graze very low sward heights (below 4cm) to reduce their intake of infective larvae, which are concentrated in the bottom of the grass.

Grazing by mature ewes
Mature ewes, in good body condition, can be used post-weaning to reduce the level of contamination on high risk pastures that have carried ewes and lambs since spring. They ingest large quantities of infective larvae, killing them off and lowering the challenge. This can be very useful for all sheep farms looking to reduce worm burdens the following spring. (NB this does not apply to Nematodirus.)

Alternative and bioactive crops
Research has shown that grazing on bioactive forages, such as chicory and birdsfoot trefoil, can reduce the negative effects of worms in sheep.

Breeding for resistance to worms
Some pedigree producers are breeding for a FEC Estimated Breeding Value (EBV). This means the progeny of their rams has an enhanced ability to resist worm challenges once their immune system starts to work. This is particularly useful when breeding female replacements.
Routine treatment of sheep with anthelmintics has worked well for many years. However, on many farms in the UK, one or more of the three older broad-spectrum chemical groups is no longer working effectively enough to fully control all the worms. This means that the proportion of worms killed by treatment is decreasing because they are resistant to the wormer used.

**Resistance builds up gradually**
The problem is that resistance does not happen overnight. It builds up gradually. Most farmers are unaware that their anthelmintic treatments are losing their effectiveness and as a result are losing lamb performance.

It is only when the level of resistance exceeds 50%, with over half of the worms surviving the treatment, that it becomes very obvious. Fortunately, farmers can maintain performance if they get an early warning of resistance by testing for it. Once it is known that a group is not fully effective farmers can change to another. However, it is important that measures are put in place to protect those groups which are still working on the farm.

**What is Anthelmintic Resistance?**
A worm is said to be resistant when it can survive exposure to a dose of an anthelmintic that would normally kill it. This ability to survive is genetic. This means it is inherited by the next generation, so when these worms are left alive in the sheep, the eggs shed in the dung will contain only resistant genes.

Over time the proportion of the worm population carrying these genes increases and the process is not reversible beyond the point where they represent more than about 50% of the population. This is because there are not enough susceptible genes left to dilute the resistant ones when the worms mate.
Surveys and reports from farms in the UK suggest that resistance to the three older groups of anthelmintics is increasing. The diagram below illustrates the proportion of farms in each category – the green represents no resistance (<5% of worms survive treatment), amber where resistance is building and red where there is a high level of resistance. Most farms will have some resistance to the white (1-BZ) group; resistance to the other two older groups is less common, but increasing year-on-year.

There are three key steps involved in managing the speed that resistance develops on a farm.  

1. **Do not import problems – quarantine and treat**  
   If there are no resistant worms on the farm, keep them out by using treatments and quarantine procedures to stop them coming in.

2. **Make sure any treatments given are always fully effective**  
   An effective treatment is essential, not only to maximise performance, but to slow down the speed that genes for resistance build up in the worm population on the farm.

This includes making sure:
- The dose rate is right
- The treatment is administered correctly
- The right product is chosen
- Testing for resistance to make sure the product is working

3. **Avoid unnecessary treatments and practices that select heavily for resistance**  
   Make sure sheep are not treated unnecessarily, in particular fit, healthy adults. This will significantly reduce the selection pressure on the worms on the farm. Use FECs to target treatments and avoid highly selective practices such as ‘dose and move’ on to clean or low challenge pastures.
Step 1 – Effective quarantine

Take every precaution not to bring resistant worms onto the farm in purchased or returning sheep. Quarantine treatment will also remove *Haemonchus contortus* worms.

The objective of quarantine treatment is to remove any resistant worms (and sheep scab). To achieve this, two wormer groups with the least chance of having any resistance, are required. Choose the best treatment option from the table below.

Step 2 – Treat

As soon as possible the sheep should be treated – the table below offers options based on whether or not sheep scab is a risk.

Step 3 – Quarantine

After 24-48 hours, turn out onto pasture that has carried sheep in the current season and keep isolated from the resident flock for at least three weeks.

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### SCOPS quarantine treatment options

Choose your risk category from the three options below and then carry out ALL the treatments shown in your choice of either the Gold, Silver or Bronze columns.

<table>
<thead>
<tr>
<th></th>
<th>SCAB RISK (No Dip)</th>
<th>SCAB RISK (Dip)</th>
<th>NO SCAB RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-AD</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>5-SI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Mox (Inj)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Do</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>OP</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Mox (oral)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

**KEY:**
- **Gold Standard**
- **Silver Standard**
- **Bronze Standard**

- 4-AD = Monepantel (Zolvix™)
- 5-SI = Derquantel/abamectin (Startect™)
- Mox (Inj) = Moxidectin injection*
- Do = Doramectin (Dectomax™)
- OP = Organophosphate plunge dip
- Mox (oral) = Moxidectin oral drench

* 1% preferred but seek advice.
**Step 2 – Treat effectively**

Making sure that the full dose of an anthelmintic is given every time sheep are treated is essential. Failure to do so will not only reduce performance, it also speeds up the development of anthelmintic resistance. Under-dosing means partially resistant worms survive.

**Drenching**

Always weigh the group to be treated.

Judging weight by eye nearly always underestimates an animal’s weight. Weigh the largest sheep and use the dose recommended for the heaviest in the group.

Where there is a wide range of weights, split into tighter weight groups and dose to the heaviest in each.

Remember – check the weigh crate’s accuracy before starting!

**Check the drenching gun**

Discharge the drenching gun several times into a measuring pot, or syringe to make sure it is working properly.

**Injections**

**Subcutaneous injections**

The product must be placed under the skin. ‘Tent’ the skin 10-15cm below the ear and gently massage the site after administration. A 1.6cm (5/8”) needle is ideal.

**Intramuscular injections**

The product must go into the muscle 10-15cm in front of the shoulder on the neck, well above the jugular vein. A 2.5cm (1”) needle is ideal. Insert at a 60° angle, aiming inwards and upwards towards the head.

**Maintain dosing guns and injectors**

Clean all equipment with warm soapy water after use. Check springs and tubes to make sure there are no kinks that could allow air bubbles to form. Replace regularly for reliable performance.

**Administer correctly**

Correct drenching is vital. Restrain sheep to avoid injury and ensure the full dose is swallowed.

Place a hand under the head tilting it slightly to the side. Insert nozzle between molar and incisor teeth so the liquid goes over the back of the tongue.

**Store products correctly**

Keep products at 4-25°C and away from direct sunlight. Always check the ‘use by’ date. Once opened, use within the time stated on the label. Shake white group (1-BZ) products before use.
Choosing the right products

The best worm control is achieved if the most appropriate product is used. This means taking into account the target parasite(s) and the resistance status of the various groups on the farm.

It is no longer simply a case of rotating between three groups of wormers on an annual basis.

The table shows the groups of broad spectrum products available and their activity against the main worm species (and fluke). Wherever possible, choose a narrow spectrum product to deal with specific parasites and avoid combination products unless they are necessary.

### Chemical Spectrum Teladorsagia and Trichostrongylus Haemonchus Nematodirus Fluke

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Spectrum</th>
<th>Teladorsagia and Trichostrongylus</th>
<th>Haemonchus</th>
<th>Nematodirus</th>
<th>Fluke</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. White Group 1-BZ</td>
<td>Broad</td>
<td>✓</td>
<td>✓</td>
<td>✓*</td>
<td>✓**</td>
</tr>
<tr>
<td>Benzimidazole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Yellow Group 2-LV</td>
<td>Broad</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Levamisole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Clear Group 3-ML</td>
<td>Broad</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Avermectin/moxidectin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Orange Group 4-AD</td>
<td>Broad</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Monepantel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Purple Group 5-SI#</td>
<td>Broad</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Derquantel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closantel</td>
<td>Narrow</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Nitroxynil</td>
<td>Narrow</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Still the preferred treatment for Nematodirus in young lambs, even where resistance to other worms exists.

** At a higher dose rate for adult fluke only.     # Only available as a dual active.

For more information on worming products see the BRP Cattle and Sheep Parasite Control Guide at beefandlamb.ahdb.org.uk or the SCOPS leaflet available at www.scops.org.uk

Getting the best from the 4-AD and 5-SI groups

These most recent additions to the wormer groups are very important because worms that are resistant to them are still extremely rare. This means when used correctly, they are highly effective, with kill rates approaching 100%.

For them to fulfil their potential to help maintain effective anthelmintics in the future, farmers must begin to use them now and not wait until all the older groups fail.

However, this does not mean they should be used as a routine treatment over a whole season.

There are two occasions during the season when most of sheep farmers should be using one or other of these products:

- As part of a quarantine treatment to ensure no resistant worms are imported onto the farm
- To help break the cycle of selection for wormer resistance to the three older groups – by using one of them in the mid/late period of the grazing season, as a single treatment for lambs

Products in the 4-AD and 5-SI groups are only available on prescription through your vet, who can discuss their use in more detail.
Step 3 – Avoiding unnecessary treatments

An FEC gives an indication of the number of adult worms in the gut of a sheep. It is measured as eggs per gram (epg) of faeces.

FECs can be used to:

• Help determine the need to treat
• Provide information about the level of contamination on pasture
• Test the efficacy of a worming treatment (drench test)

FECs are a monitoring tool and should not be used as a diagnostic tool. The results must be interpreted in conjunction with other information about the group of lambs and the pasture they are grazing, such as:

• Age
• Stocking density
• Time of year
• Performance levels

Seek help with the interpretation of the results with a vet or adviser.

Taking FECs

Samples must be collected fresh from the field on the same day, making sure they are from lambs, not ewes (unless samples from the latter are required).

It is very important that samples are taken randomly. DO NOT seek out scouring lambs or dry lambs, as this will give a false result.

• Loosely gather lambs into a corner of the field for a few minutes, then pick up samples after they move off.

or

• Walk around the group and collect fresh samples as they get up and move away.

Normally ten samples per group of lambs are collected. These will be pooled by the laboratory to give a single result.

Some vets now offer clients a faecal egg counting service with advice on interpreting the results. Other commercial companies offer a similar service. Alternatively farmers can also set up their own microscope with the help of their vet or advisor. Commercial DIY kits are also available.
Testing for resistance to wormers

Detecting resistance of worms to anthelmintics at an early stage, allows farmers to maintain good worm control and avoid losses in production associated with declining product efficacy.

Waiting until a wormer group is obviously not working means lamb growth has been compromised for many years and it is too late to retain any useful function for that group, because the process cannot be reversed.

Drench test
A drench test is a practical and relatively simple way to see whether the product group being used is starting to lose its effectiveness.

1. Take a dung sample before the lambs are treated to establish the initial egg count.
2. Treat all the lambs in the group, taking extra care to ensure dose rate and administration technique are correct – if not the test results will be misleading.
3. Wait for seven days (for Group 2-LV products) or 14 days (for Group 1-BZ or Group 3-ML products) and re-sample the same group of treated lambs.

Is the product working? 
A reduction in FEC of 90% or more means the drench given has done its job.

For example: if the initial pre-treatment FEC was 500epg then the post-test FEC should be no more than 50epg.

If it is higher, talk to your vet or adviser about changing to a different product group and what further action to take. This may include a more accurate Faecal Egg Count Reduction Test (FECRT), or hatching collected larvae to establish which specific worm species is involved.
Reducing anthelmintic use in ewes

Fit, healthy mature sheep have good immunity to most species of worms, so the need to treat adult sheep is limited.

Traditionally, sheep farmers have wormed ewes twice a year; pre-tupping and around lambing time. However, this is usually unnecessary, adding cost and speeding up the development of anthelmintic resistance on the farm.

The key to knowing whether a ewe needs worming or not is her body condition.

Fit ewes use their immune system to minimise the number of worms establishing in their gut. This also means there are very few worm eggs in their faeces.

Ewes pre-tupping

The only ewes that may benefit from being wormed before being mated are those that are lean or immature, ie ewe lambs and shearlings.

Ewes at lambing

The stress of late pregnancy and early lactation can reduce the ewe’s immunity which means she sheds more worm eggs in her dung. This is known as the 'peri-parturient rise' and is the main source of contamination of pasture for lambs later in the season.

Treatment at this stage is about finding the right balance so that ewes shedding a lot of eggs are treated, while those shedding less eggs are not. The ewes that do not shed many eggs are those that are well fed and in good body condition. These do not require treatment*.

Leaving a proportion of ewes untreated reduces selection for wormer resistance because not all the worms are exposed to the treatment, but we still reduce contamination on pastures.

The way to achieve the balance is to:

• Leave fit, healthy ewes untreated. Aim for at least 10% of the flock but more if possible
• Make sure the correct dose is given and administered correctly
• Treat ewes as close to lambing as possible. If FECs are being used to monitor the rise in egg output, use the results to plan the right time to treat
• Use persistent wormers with care. They should not be used year after year and a proportion of ewes should always be left untreated

* NB If a liver fluke or haemonchus treatment is being given then all animals should be treated.
Avoid highly selective practices

When sheep are wormed properly, the only worms surviving the treatment will be resistant to the chemical group that was used. If these animals are then put on a pasture which is clean (for example a new ley), the only eggs that will be dropped on that pasture will also be resistant. So the worm population that subsequently develops on that pasture will be resistant.

Even on pastures that are not clean, but have a very low worm burden, the effect is significant. This is because the resistant worms, introduced with the sheep, will be a large proportion of the next generation of worms and are much less likely to mate with a susceptible worm.

This is why these practices are so dangerous

Whenever there is a larger proportion of the worms in the sheep rather than on the pasture, the selection for resistance is much greater. Sometimes worms on pasture are referred to as ‘in refugia’. This simply means they are outside the sheep and not exposed to any treatments. When the population of worms ‘in refugia’ is low, then treating requires even more planning and care.

To avoid this very heavy selection for anthelmintic resistance, there are two practical options:

- Leave 10% of the biggest/fittest sheep
- Treat the whole group, but leave them on the dirty pasture for four to five days to pick up a few susceptible worms

### Improving worm control – checklist

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
<th>Page number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you know the resistance status on your farm?</td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Do you have an effective quarantine strategy in place?</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Do you ALWAYS treat correctly at the right dose rate?</td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Have you used FECs to monitor worm burdens and contamination levels?</td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Could you reduce your use of anthelmintics in adult sheep?</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Could you use management to reduce your reliance on anthelmintics?</td>
<td></td>
<td></td>
<td>6 &amp; 7</td>
</tr>
<tr>
<td>Do you avoid highly selective ‘dose and move’ actions?</td>
<td></td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>
On a farm in southern England with a flock of 1,200 ewes, there were problems with poor ewe body condition and low lamb growth rates at grass.

In 2007 the farmer joined the SCOPS monitoring project and was able to establish that there was a significant level of *Haemonchus contortus* on the farm AND some resistance to all three groups of anthelmintics was established, as shown on the graph (right).

With this knowledge, a plan was put together to maintain good worm control using the SCOPS principles. This is summarised below:

<table>
<thead>
<tr>
<th>SCOPS principle</th>
<th>Adoption by case study farmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drench correctly</td>
<td>Equipment always checked and calibrated. Dosing to the heaviest animal and good technique. Electronic Identification (EID) and auto-draft/weigh facility greatly enhances ability to dose to weight.</td>
</tr>
<tr>
<td>Quarantine treatments for all incoming sheep</td>
<td>SCOPS recommendations fully adopted for incoming sheep and updated.</td>
</tr>
<tr>
<td>Test for anthelmintic resistance</td>
<td>AR status investigated over the past six years and taken into account within the strategy. Ongoing drench tests every year and Faecal Egg Count Reduction Test (FECRT) carried out when possible.</td>
</tr>
<tr>
<td>Use anthelmintics only when necessary</td>
<td>FEC monitoring used to determine the need to treat lambs. Routine pre-tupping drench removed. Moving away from whole-flock treatments. Now using growth rates to help determine the need to drench individual lambs.</td>
</tr>
<tr>
<td>Select the most appropriate product</td>
<td>Different products now used within the season. Use of narrow spectrum products whenever possible (not combinations) such as closantel for <em>Haemonchus</em> control. Integration of new groups (4-AD and 5-SI) underway but very carefully with good monitoring.</td>
</tr>
<tr>
<td>Maintain a susceptible population of worms in refugia (ie outside the sheep)</td>
<td>Partial flock treatments a vital part of this objective. Moving away from whole-flock treatment at housing a major step. Delay the move or partial group treatment when going on to new leys or low challenge aftermath.</td>
</tr>
<tr>
<td>Reduce dependence on anthelmintics</td>
<td>Use of FECs/grassland improvement/rating challenge for different pastures/avoidance strategies including earlier weaning/use of dry sheep. Possibly look at resistance/resilience in breeding policy in the future.</td>
</tr>
</tbody>
</table>

* Moxidectin was still fully effective
Other BRP publications available

Sheep BRP

Manual 1 – Marketing prime lamb for Better Returns
Manual 2 – Buying a recorded ram to generate Better Returns
Manual 3 – Target lamb management for Better Returns
Manual 4 – Managing ewes for Better Returns
Manual 5 – Growing and finishing lambs for Better Returns
Manual 6 – Target easier management for Better Returns
Manual 7 – Reducing lameness for Better Returns
Manual 8 – Worm control in sheep for Better Returns
Manual 9 – Improving ewe breeding for Better Returns
Manual 10 – Controlling external parasites for Better Returns
Manual 11 – Target ewe fertility for Better Returns
Manual 12 – Improving ewe nutrition for Better Returns
Manual 13 – Improving sheep handling for Better Returns
Manual 14 – Reducing lamb losses for Better Returns

Joint Beef and Sheep BRP

Manual 1 – Improving pasture for Better Returns
Manual 2 – Assessing the business for Better Returns
Manual 3 – Improving soils for Better Returns
Manual 4 – Managing clover for Better Returns
Manual 5 – Making grass silage for Better Returns
Manual 6 – Using brassicas for Better Returns
Manual 7 – Managing nutrients for Better Returns
Manual 8 – Planning grazing strategies for Better Returns
Manual 9 – Minimising carcase losses for Better Returns
Manual 10 – Growing and feeding maize silage for Better Returns

See the AHDB Beef & Lamb website beefandlamb.ahdb.org.uk for the full list of Better Returns Programme publications for beef and sheep producers.

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