Worm control in sheep

QMS
QUALITY MEAT SCOTLAND

Contents

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Introduction

As the UK sheep industry has become more reliant on pastures grazed only by sheep, dependence on anthelmintics (wormers) has increased. The heavy use and misuse of these relatively cheap products has led to the development of resistance. Sheep farmers must act now so they can control worms effectively in the future.

Various tools are available that allow sheep farmers to both improve worm control and slow the development of anthelmintic resistance. These include tools to understand life cycles, grazing and pasture management, knowledge of farm anthelmintic resistance status and avoiding highly selective practices. The two newest groups of anthelmintics (4-AD and 5-SI) can maintain good worm control for many years if they are integrated strategically into worm control plans, both as a quarantine treatment and a mid to late season annual dose for lambs.

Sustainable Control of Parasites in Sheep (SCOPS) is an industry-led group, which was formed to develop sustainable parasite control strategies for sheep. Based on scientific evidence, the SCOPS recommendations incorporate the practicalities of sheep farming and animal health planning. SCOPS facilitates the delivery of these recommendations and ensures that new research and development is incorporated into advice given to the sheep industry.

scops.org.uk

Lesley Stubbings
LSSC Ltd.

The principles for best practice and responsible control of worms are to:

1. Always ensure that any anthelmintic treatment given is fully effective. Choose the right product, at the right time, for the right animal and at the right dose rate.
2. Try to reduce your reliance on anthelmintics using management options and monitoring strategies, such as faecal egg counts (FECs), where possible.
3. Avoid bringing resistant worms and other parasites on to the farm by following a robust quarantine routine.
4. Minimise selection for resistant worms when sheep are treated with anthelmintics by avoiding highly selective practices such as ‘dose and move’.

Why do we need to control worms?

Worm control is vital for good growth rates and profitable sheep systems. Heavy burdens result in stunted or dead lambs. Even a modest worm burden, with no clinical signs of infection in lambs, can reduce performance and increase costs.

How worm burdens affect lambs

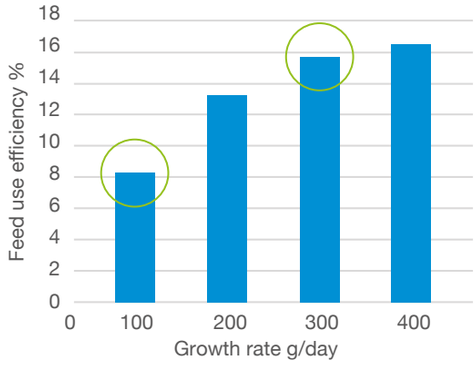
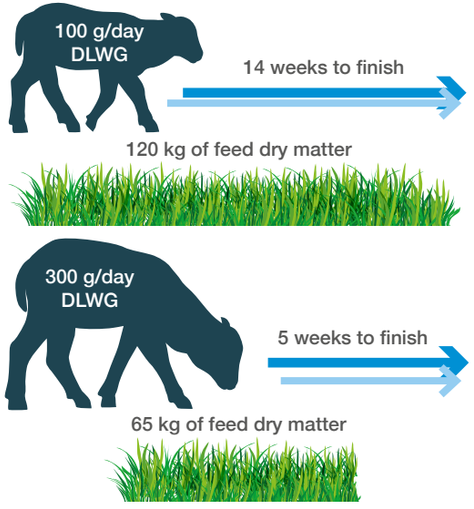


Figure 1. Efficient lamb performance

A weaned lamb growing at 100 g/day needs nearly twice as much energy to reach the same weight as a lamb growing at 300 g/day.

Both lambs need to gain 10 kg to finish.



This is because the feed efficiency is halved, from 16% to just 8%.

Prices could also decrease over the additional nine weeks. A 30p/kg reduction would lower the value of the lamb by £5.70 (for a 19 kg carcase). Combined with the additional costs of feed and grass, the financial cost quickly reaches £10 per lamb.

Look for signs of worms in your flock

- Depressed appetite reduces feed intake and growth rate
- Impaired mineral retention causes a small skeleton and exacerbates trace element deficiencies
- Poor protein metabolism reduces muscle growth and carcase quality
- Permanent gut damage reduces nutrient absorption and can cause diarrhoea

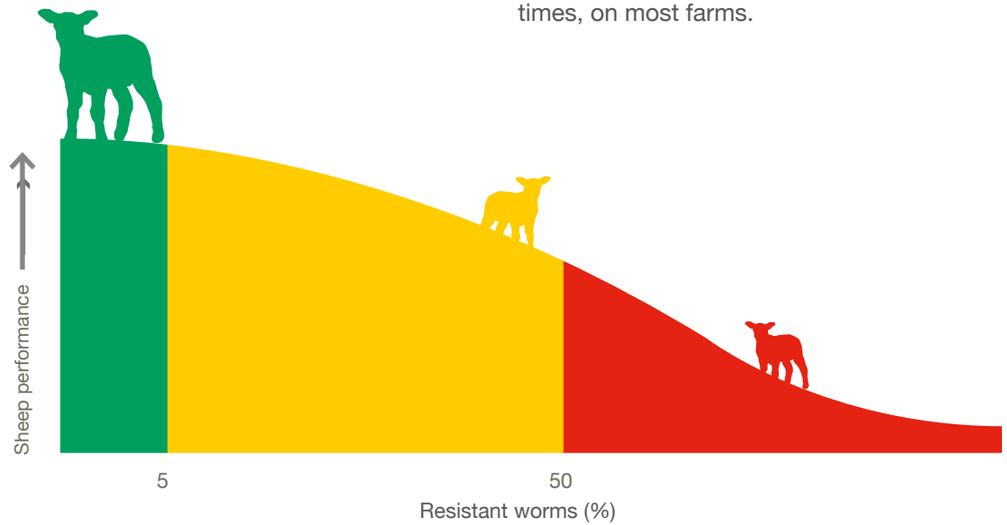
The impact of anthelmintic resistance (AR)

What is anthelmintic resistance?

A worm is said to be resistant when it can survive exposure to the recommended dose of an anthelmintic (wormer). This ability to survive is genetic and is inherited by the next generation. Over time, the proportion of worms carrying resistance genes increases and once this reaches over 50%, the process is irreversible. Routine treatment of sheep with anthelmintics worked well for many years, but on many farms, one or more of the three older, broad-spectrum chemical groups (1, 2 and 3) are no longer fully effective.

Resistance builds gradually

Resistance does not happen overnight – it builds up gradually over time. Many farmers are unaware that their anthelmintic treatments are losing effectiveness and reducing lamb performance until the 50% point is reached – by which time, it is too late to reverse. This is why testing for resistance is so important. Testing gives us an early warning that resistance is starting to develop to an anthelmintic group, so lamb performance can be maintained by swapping to another group. Careful and regular checking, combined with reducing our reliance on anthelmintics, can also mean that one or more of the older groups can still be used successfully, at certain times, on most farms.



Green zone – treatment is effective, killing more than 95%of worms; optimum performance

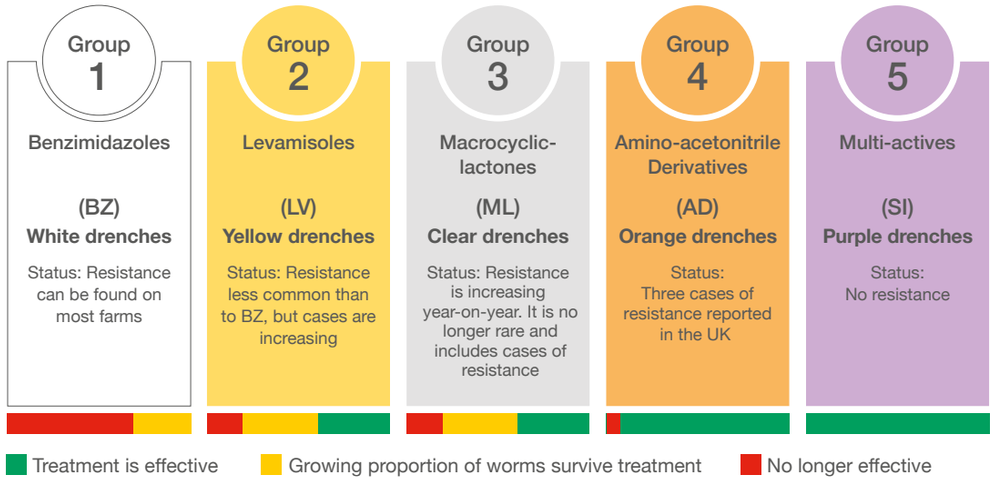
Amber zone – a growing proportion of worms survive treatment, but only testing will reveal the problem; reduced performance

Red zone – more than 50% of worms survive treatment; poor performance

Anthelmintic resistance in the UK

Surveys and reports from farms in the UK suggest that resistance to the first three groups of anthelmintics is increasing. Most farms have some resistance to the white (1-BZ) group; resistance to the other two older groups is less common, but increasing year-on-year.

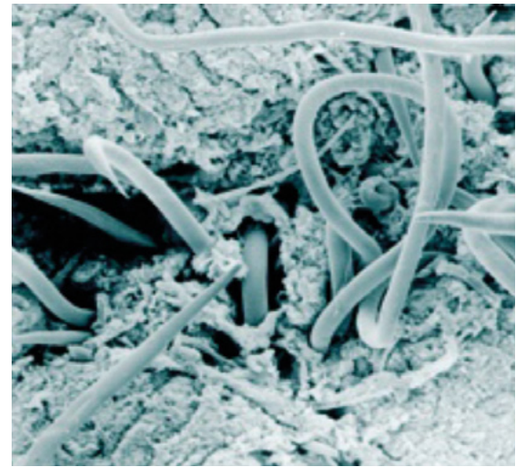
The diagram below shows the proportion of farms in each category in the UK.



Worm species and key actions

Teladorsagia – small brown stomach worm

Teladorsagia circumcincta, formerly known as *Ostertagia*, build up during late spring and into summer. At low-to-medium levels they depress appetite in lambs, which reduces growth rates and causes general ill thrift. Levels peak from mid-summer, increasing the risk of losses caused by heavy infestations.

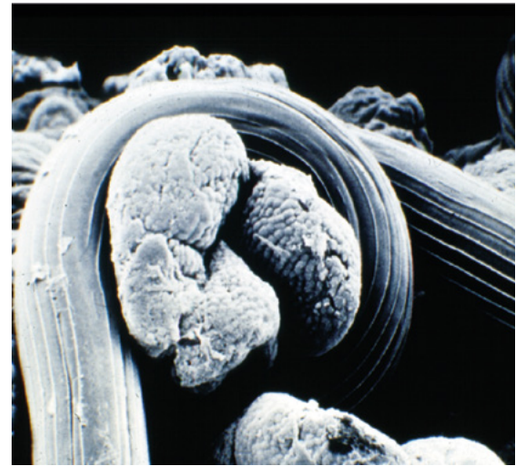


Key action

Use FECs to determine the need to treat and avoid peak infection levels by weaning and moving lambs to lower risk grazing.

Nematodirus (*Nematodirus battus*)

This worm has a longer life cycle than the other worms mentioned and it normally only affects young lambs. Eggs deposited in spring hatch the following year when larvae are picked up by six-to-twelve-week old lambs. A sudden, heavy challenge can result in significant losses. Due to the immature larvae that damage the lamb's gut, it is important to use forecasts and risk assessments to determine the timing and need to treat lambs.



Key action

Try to avoid putting young lambs on the same pastures each spring, particularly in areas of high challenge in the previous year. Use regional forecasts (scops.org.uk) to help predict when these worms will hatch, in conjunction with a risk assessment.

Trichostrongyles – black scour worm of the small intestine

Trichostrongyles (*Trichostrongyles* spp.) is most commonly seen in the autumn in lambs, but can occur earlier under the right conditions. It typically causes rapid weight loss, scouring and death, particularly in poorer lambs.

Key action

Try to avoid high-risk pastures. Grazing dry, fit ewes can reduce worm burdens on autumn-finishing pastures. Continue to monitor FECs throughout the autumn and winter.

Haemonchus – barber's pole stomach worm

Haemonchus (*Haemonchus contortus*) consumes large amounts of the host animal's blood, resulting in ill-thrift and anaemia, rather than scouring. Under the right conditions, heavy infestations can occur very quickly and may also affect adult sheep, making the worm more difficult to control. It is not as widespread as other worm species, so it is vital to know whether it is present on a farm.

Key action

Quarantine treatment is essential to prevent the introduction of Haemonchus. It is essential to investigate unexpectedly high FECs and/or loss of ewe body condition and anaemia.

Worm life cycle

Understanding the life cycle of worms is important if we want to predict when they are most likely to be a problem and when to take action.

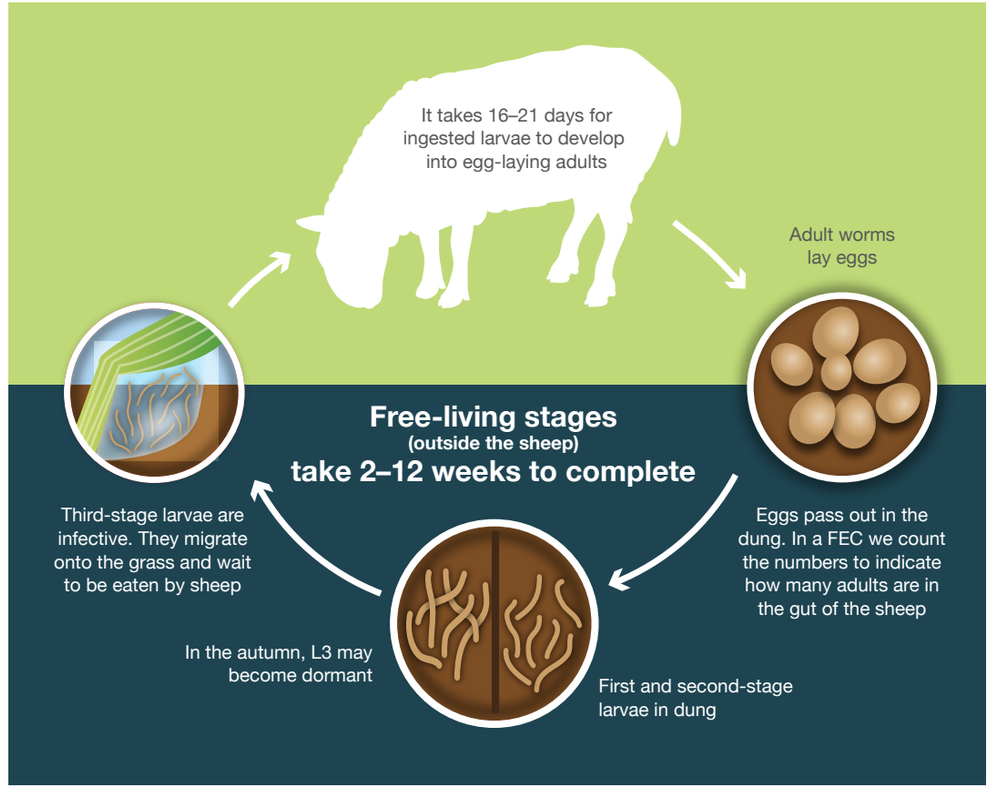
The life cycles of the main worm species are similar. Sheep (the host) pick up worms in the form of infective larvae living on the pasture. These larvae mature into adults in the sheep's gut and produce eggs, which are deposited back onto grass in the dung. The eggs hatch and develop into larvae in the dung. They then migrate onto the grass, where they wait in water droplets to be eaten by another sheep, thus continuing the cycle.

The time it takes for 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 takes longer.

Worms have developed a survival strategy, which allows them to halt their development as winter approaches. Some survive as larvae on pasture, while others become dormant in the gut of the sheep. The following spring, the larvae on pasture become infective and begin their life cycle as temperatures rise, while those in the gut of the sheep resume egg production. Both are a source of infection for young lambs.

Nematodirus is the exception because its larvae take much longer to develop: around eight to nine months.

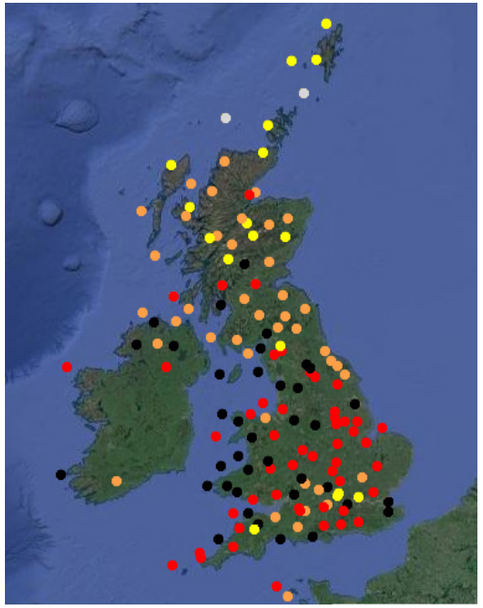


Elements of successful worm control

The priority for worm control is to minimise the effect of internal parasites on flock performance and safeguard the long-term sustainability of the control programme in terms of anthelmintic resistance. This means sheep farmers cannot rely on anthelmintics as the sole means of control and must integrate a variety of management actions into their strategy.

A successful control plan includes:

- A worm control strategy integrated into an animal health plan that is adaptable to changing patterns of worm challenge and reviewed regularly with the farm's vet or adviser
- Knowledge of the different worm species, when they are a threat and why, using freely available regional forecasts and warnings (for example, from SCOPS, **scops.org.uk**, or the National Animal Disease Information Service (NADIS), **nadis.org.uk**)



SCOPS Nematodirus forecast highlights low, medium and at risk areas

- Monitoring worm burdens, using FECs and planning ahead
- Reducing reliance on anthelmintics using grazing management, alternative forages and targeting treatments to those sheep that need it
- Using knowledge of contamination history and the farm map to avoid pastures where a high risk is predicted
- Minimising the risk of importing anthelmintic-resistant worms or new parasites with bought-in sheep with treatments in quarantine
- Ensuring any treatments administered are always effective and that their efficacy is tested regularly for evidence of resistance
- Allowing lambs, particularly breeding replacements, to develop immunity to worms and exploring the potential to breed for sheep with a higher immune response

Reducing reliance on anthelmintics

Anthelmintics are a vital worm control tool, but if we are to maintain the effectiveness of these products in the future, we must reduce our dependence on them.

There are several ways we can achieve this; for example, by:

- Understanding the worm species and challenges the flock will face to plan ahead (see Figure 2)
- Using FECs to monitor the worm burden in sheep and to help determine when to they need to be treated and the build-up of contamination on pastures, then testing the treatments that have been effective
- Using grazing management and alternative forages to avoid pastures with a high challenge
- Targetting treatments to those sheep that need to be de-wormed, rather than blanket-treat the whole mob or flock
- Harnessing the sheep's ability to develop immunity to worms, which allows them to manage their worm burden without disease or loss in performance

Worm challenges throughout the season

The challenge to sheep from worms builds up over the season. A successful control strategy considers these dynamics. Figure 2 is an example for a spring-lambing flock.

Optimising anthelmintic use in lambs

Lambs start to acquire immunity to worms when they are about five months of age but, in most cases, immunity will not be fully developed until they are at least 12 months old. This means that lambs are the most vulnerable sheep in the flock. Worm control largely revolves around minimising their performance loss caused by worms over the grazing season.

Grouping lambs by age after lambing makes treatment, management decisions and FEC results more accurate.

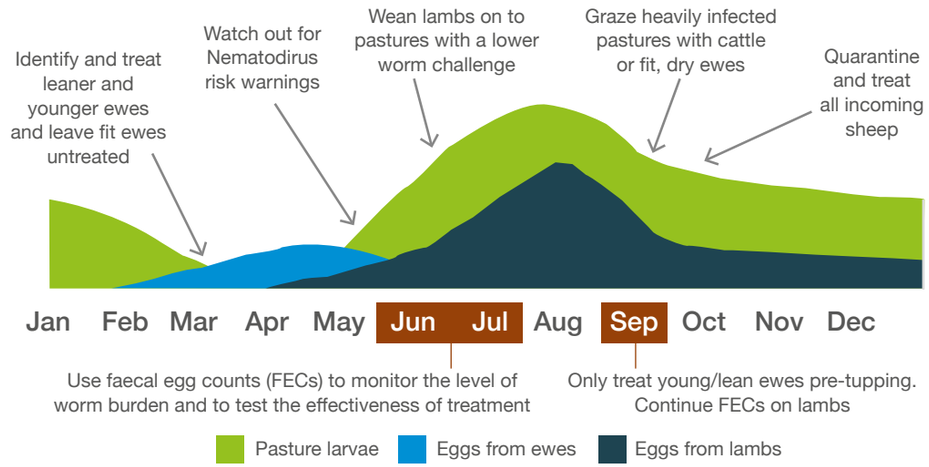


Figure 2. Diagram of worm challenges throughout the season

Strongyles

The build-up of these worm species can be monitored using FECs, starting when lambs are about 6 weeks old. Regular FECs not only reduces unnecessary drenching, but ensures that timing of treatment is more accurate.

This helps to build a picture of how worm burdens are developing on pastures. It is usually recommended to undertake a FEC every 3–4 weeks in each mob, plus drench tests after treatments to check the efficacy of the anthelmintic used.

Nematodirus

For lambs grazing pastures that carried lambs during the previous spring, Nematodirus is normally the first worm challenge (see page 11). Nematodirosis can strike very quickly and because the damage is caused by large numbers of immature larvae, FECs are not a reliable indicator of risk. Rapid action is often required and this must be based on a risk assessment and the forecast for your area.

Targeted strategic treatments (TSTs)

This approach is aimed at identifying lambs within a mob that do not need treatment, when the overall mob FEC indicates that treatment is necessary. This is based on the fact that the best-performing lambs are not being held back by a worm burden. The usual aim is to leave 10–20% untreated based on growth rate. However, lambs must be weighed regularly and targets should be set based on (for example) grazing and weather conditions.

Case study

Peter Eccles, East Lothian – The benefit of a sustainable roundworm control strategy in a commercial flock

Saughland Farm in East Lothian is an intensive sheep operation. Peter Eccles and his team are stretched at times during the summer when large numbers of lambs require dosing. Fears over the possible implications that anthelmintic resistance could have on the sheep enterprise at Saughland, as it becomes more intensive, prompted them to explore a more sustainable approach to worm control.

Dr Fiona Kenyon from Moredun Research Institute (MRI) introduced Peter to a targeted selective treatment (TST) strategy, which works by weighing the lambs at weaning and then measuring the feed available to these lambs to predict how they should perform.

The lambs are weighed every three to four weeks and those not achieving their predicted weight are treated for roundworms. For any lambs that meet their target weight, it is assumed that their performance is not affected by roundworm burden, so they are released back to the field untreated. By only treating the underperforming lambs, this approach has been shown to produce multiple benefits. It:

- Reduces the use of anthelmintics with no reduction in lamb weight gain
- Provides an economic benefit from reduced anthelmintics use and time
- Helps to slow the development of roundworm resistance

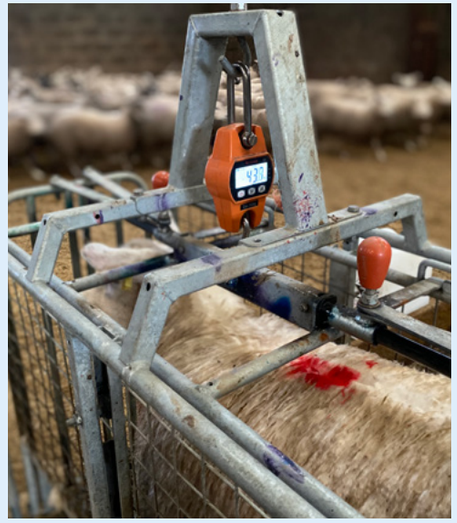
Roundworm resistance is widespread in sheep flocks throughout the UK and we urgently need to address this by using more sustainable control strategies. TST is one such strategy.

As the untreated lambs are released back to the field, they continue to shed non-resistant roundworms, which then compete and suppress the resistant roundworms in the pasture. If all the lambs were dosed, only the resistant roundworms would survive, which are then shed onto the pasture. With less competition from non-resistant roundworms (because these were killed when dosed) the resistant roundworms thrive and continue to build the resistant roundworm population.

Results of using TST at Saughland:

- 60% of lambs did not need dosing
- 60% saving in product
- Lamb weight gain remained stable
- Less physical work
- Equipment works well – an electronic weigh crate and electronic ID (EID) tag reader, which can record animal numbers and link to animal weight
- Time and labour saving

Installation of the sheep-handling system at Saughland to record data and run the TST programme has enabled knowledge exchange with the wider farming industry. Currently, TST takes time to set up and manage, and the calculations for each group require input from MRI. However, MRI, along with partner farmers and consultants, is looking to further develop and automate the TST algorithm. The results generated by this case study at Saughland will directly contribute to the commercialisation of this process,



which – in time – will lead to wider uptake within the farming community.

Peter is also taking part in an MRI study to develop and improve the best practice advice for worm control. Peter sends faecal samples to MRI every time he treats his sheep for roundworms. At MRI, an FEC is taken, the worm species are identified and the results are fed back to Peter in near-real-time. Because these samples are collected throughout the year, the results provide a huge amount of information about the worm species present on the farm: how well the anthelmintic drugs are working and, importantly, which worm species, if any, are surviving the treatment. This project is funded by the Veterinary Medicines Directorate and is led by Queens University, Belfast. These projects have demonstrated the mutual benefits of farmers engaging and collaborating with MRI to develop real solutions, which can be implemented on commercial farms.

Reducing anthelmintic use in ewes

Fit, healthy, mature sheep have good immunity to most worm species, so the need to treat adult sheep is limited. The immune system of a fit ewe works by suppressing most of the worms she ingests, only allowing a few to establish in her gut and then reducing their egg producing capacity so we see very few worm eggs in the faeces. Unnecessary treatment of adult sheep speeds up the development of anthelmintic resistance, so it is important to minimise the number of ewe treatments given.

The key to knowing whether a ewe requires treatment is her body condition. If she is in good body condition, then her immune response will be strong and she is unlikely to require treatment.

Traditionally, sheep farmers have wormed ewes twice a year: pre-tupping and around lambing.

Ewes pre-tupping

Only a small proportion of ewes will benefit from treatment before tupping*. These are lean or immature sheep (i.e., ewe lambs and shearlings) whose immune systems may not be fully effective.

Ewes at lambing

The stress of late pregnancy and early lactation can reduce the ewe's immune response, which allows the worms she is carrying to produce more eggs and these are then deposited in her dung. This is known as the 'peri-parturient rise' and together with overwintered larvae, is a source of contamination on pasture for lambs later in the season.

At this stage, it is important to find the right balance between identifying and treating leaner and younger ewes that are likely to be shedding a lot of eggs and leaving the fit ewes that are shedding fewer eggs untreated**. Leaving a proportion of ewes in a flock untreated slows the development of anthelmintic resistance, while still reducing contamination out on the pastures.

- Leave fit, healthy ewes untreated. Aim for at least 10% of each grazing mob – more if possible
- Make sure the right dose is given and correctly administered
- 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 anthelmintics (moxidectin) with care. They should not be used year after year and a proportion of ewes should always be left untreated. If moxidectin has been used for sheep scab control (see page 24), then it should not be used in ewes at lambing or vice versa

* Consult a vet if the farm has a history of haemonchus

** If treating for liver fluke or sheep scab, all animals should be treated

Harness immunity and breeding

The strength of the immune response to worms varies from sheep to sheep. Part of this variation is known to be genetic. This means it is possible to selectively breed for sheep that are more resistant to internal parasites.

Selecting rams within a closed flock with highly negative FEC estimated breeding values (EBVs) means:

- Lambs have the potential to perform better; for example, in terms of lamb growth rate, therefore require less frequent treatment with anthelmintics
- Lambs shed fewer nematode eggs in dung, thereby reducing the levels of larval challenge for other sheep (whether these have also been selected for worm resistance or not)
- Ewes sired by more resistant sires shed fewer worm eggs at lambing time, reducing pasture contamination and improving lamb growth rates
- The worm burden on heavily stocked pastures can be reduced over time

Breeding for worm resistance in Signet-recorded flocks

Selective breeding for low FEC EBVs (estimated breeding values) is practised in some Signet-recorded Lleyn, Exlana and Romney flocks, with nearly 30,000 records included within Signet's genetic evaluations.

Progress has been challenging. The collection of FEC samples is time-consuming, expensive and comes at a cost to the enterprise in terms of lamb performance. However, at a breed level, progress is being made and within dedicated flocks genetic change is even faster.

How much is the variation in faecal egg count influenced by genetics?

Research using the Lleyn data set indicates approximately 7% (Strongyles) and 21% (Nematodirus) of the variation between animals can be explained by their genes.

Genetic relationships within the data set indicate that selection for either worm species will also reduce some of the challenge posed by the other.

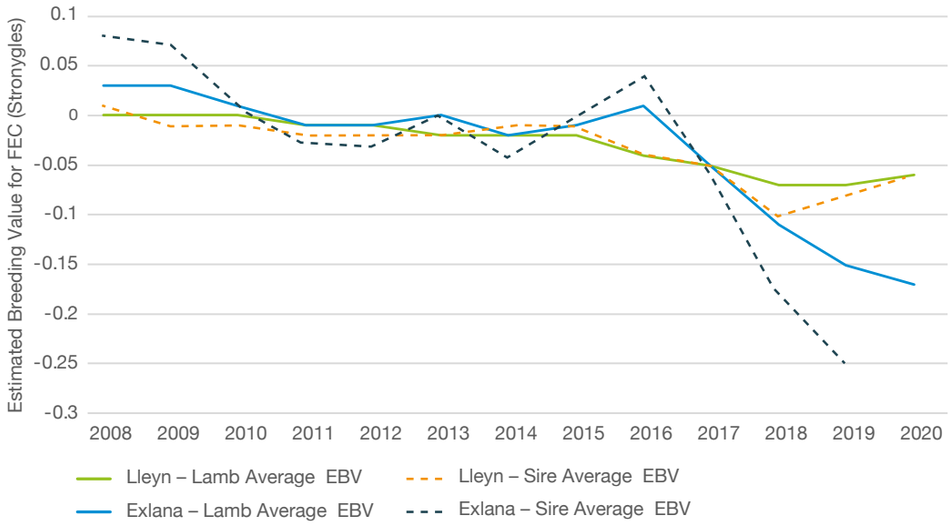


Figure 2. Genetic progress for FEC (Strongyles) EBV in Signet-recorded Lleyn and Exlana populations

New ways to assess worm resistance

Breeders are interested in new ways to assess worm challenge as the use of FEC to assess individual animals can be challenging, given the cost, impact on animal performance and the low repeatability sometimes observed, particularly if lambs have watery faeces.

Research at the University of Glasgow has shown the antibody responses against the larval stage of *Teladorsagia circumcincta* (an important member of the Strongyles family) can be used as a biological marker for host response to infection.

This potential phenotype provides a new way to identify genetic differences between sheep in their resistance to worm challenge. High levels of IgA have been shown to regulate both worm growth and fertility – leading to a decrease in egg output. These differences are useful in a breeding programme where they can be converted into EBVs.

Blood serum IgA – a new AHDB-funded research project

We cannot directly measure the amount of IgA in the intestine mucosa, but it can be detected in saliva and serum. Breeding programmes focused on IgA levels in saliva have run for several years, but genetic influences still only account for 11% of the variation between animals.

In 2020, a new project was launched to see if IgA levels in blood serum can be used as a more accurate and reliable attribute to assess individual sheep. Results are due for release in 2021.

The breeders' view of breeding for resistance

Tim White, member of the Sheep Improvement Group, breeding Exlana sheep

"The Exlana breeding policy is focused on reducing the labour requirements of the commercial ewe, without detriment to flock performance. Our breeders place considerable emphasis on the selection of performance-tested rams with superior worm resistance EBVs. In recent years, this has really started to pay off – a genetic benefit we are delighted to pass on to our customers."

George Cullimore, member of the Performance Recorded Lleyn Breeders

"Ram-buying clients want to purchase sheep that are both resistant and resilient to internal parasites. Signet's breeding values indicate important genetic differences between animals that have helped inform our breeding policy.

Initial work using FEC was encouraging, but I believe the use of new phenotypes (like serum IgA) will provide the breakthrough we need to enable genetic solutions to play a greater role in worm control."

Where can I find breeding information to locate genetically resistant rams?

Breeding values for a series of worm resistance traits are published on the Signet website, available at **signetdata.com**

Commercial flocks retaining female replacements in the flock will benefit most from access to these EBVs.

Advice to commercial ram buyers:

By using 'EBV Search' on the Signet website, you can generate lists showing those sheep within a breed with the best breeding values for FEC and IgA (**signetdata.com/sheep-search/ebv-search**).

If you are interested in the trait, find a flock actively recording FEC and IgA

- Use the 'Accuracy Values' published alongside each EBV to indicate the degree of recording taking place
- Remember for FEC EBVs, a negative value (less eggs) is a positive attribute

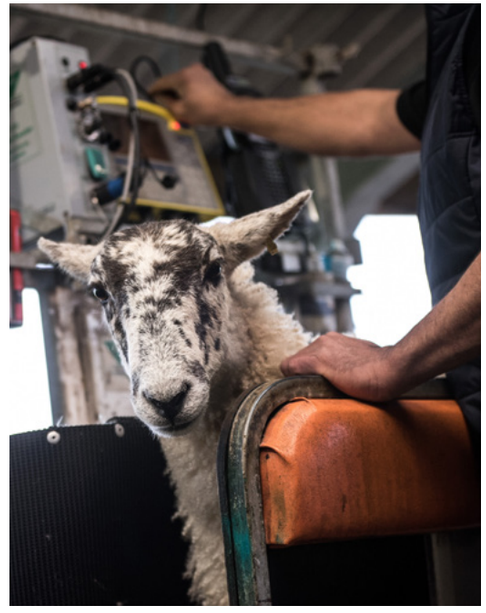
Effective treatment

Worm control is important for lamb growth rates. Anthelmintics (wormers) are an integral part of a good worm control programme. To ensure the dose given is effective and to minimise any selection for resistance in the worm population, treatment must be given correctly.

Dose rate – weigh, don't guess

Always weigh the group to be treated and use the dose recommended for the heaviest sheep. Judging the weight by eye usually means that weight is underestimated. If there is a broad weight range, split the group and alter the dose. Remember to check the accuracy of the weigh crate.

Check dose rate.



Calibrate

Equipment should be calibrated before every use, as well as during sessions in which a large number of animals are to be drenched.

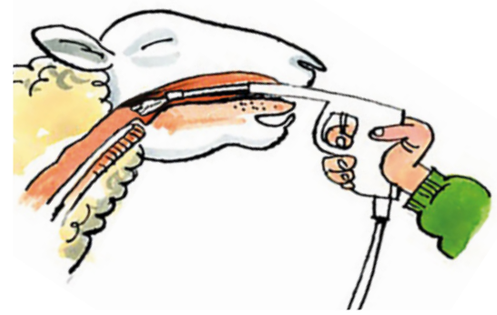
Drenching

Check the drenching gun by discharging several times into a measuring pot to make sure it is working properly and is calibrated to deliver the correct dose.

Administer correctly

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

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



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.

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.

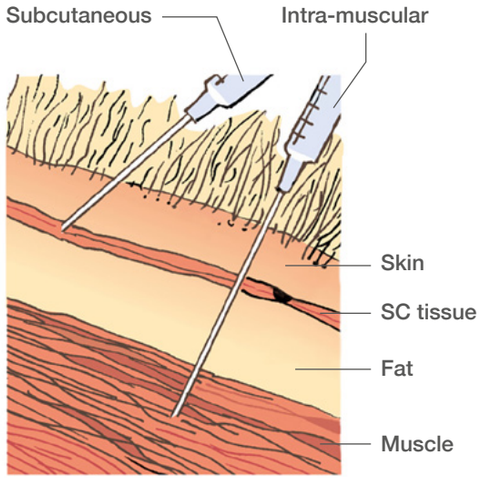
Injections

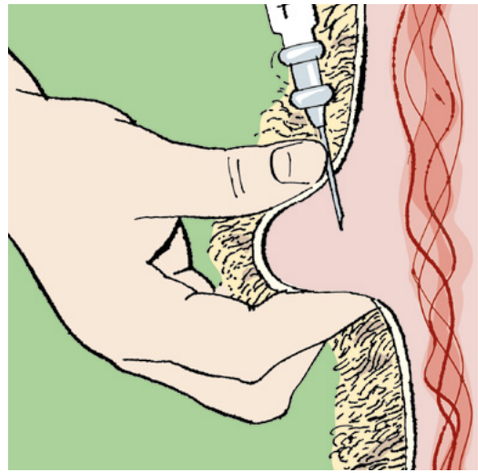
Subcutaneous injections

The product must be placed under the skin in the neck. 'Tent' the skin 10–15 cm below the ear and gently massage the site after administration. A 1.6 cm needle is recommended.

Intramuscular injections

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





Subcutaneous injection

If injecting for sheep scab, see page 22.

Remember

Do not dose and move. Return sheep to 'dirty' pasture. See page 27.

Choosing the right product

The best worm control is achieved by using the most appropriate product. This means taking into account the target parasite(s) and the resistance status to the different groups of wormer on the farm.

Farms may use several wormer groups in a year. It is no longer simply a case of rotating between groups of anthelmintics on an annual basis.

Table 1 shows the five groups of broad-spectrum products that are currently available and their activity against the main worm species. The use of Groups 4-AD and 5-SI is very specific (see page 26).

Combination products contain two different wormer groups (for example, a 2-LV + 3-ML, or 1-BZ + closantel). To avoid over-use, they should only be used when it is necessary to treat liver fluke and worms at the same time. Where possible, choose a narrow-spectrum product to target specific parasites, such as liver fluke or *Haemonchus contortus.*

For more information on products, see the ***Parasite control guide*** available at **ahdb.org.uk**

This publication is updated annually.

Injectable forms of the 3-ML group can also be used to control sheep scab and in recent years, the use of these products for this purpose has increased considerably.

Table 1. The five wormer groups

Group	Chemical	Spectrum	Teladorsagia and Trichostrongylus	Haemonchus	Nematodirus
1-BZ White (Group 1)	Benzimidazoles	Broad	✓	✓	✓*
2-LV Yellow (Group 2)	Levamisole	Broad	✓	✓	✓
3-ML Clear (Group 3)	Avermectin Moxidectin	Broad	✓	✓	✓
4-AD Orange (Group 4)	Monepantel	Broad	✓	✓	✓
5-SI# Purple (Group 5)	Derquantel with abamectin	Broad	✓	✓	✓
	Closantel	Narrow	✗	✓	✗
	Nitroxynil	Narrow	✗	✓	✗

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

Only available as a dual active

Two areas of concern result from the heavy use of injectables for sheep scab control. Firstly, each time they are used, the worm population in the treated sheep is also exposed to the 3-ML group, which risks speeding up the development of resistance in the worm population. Secondly, it has resulted in confirmed cases of resistance in scab mites. The only other treatment for sheep scab is an OP plunge dip – many have preferred the use of an injection.

Sheep scab

Testing for anthelmintic resistance

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

Resistance develops gradually, over several years. As the efficacy of an anthelmintic group reduces, lamb growth rates are increasingly compromised until, eventually, it is obvious that worms are not being controlled. By this time it is too late to retain any useful function for that group because resistance is irreversible.

Drench test

A drench test is a practical and relatively simple way of indicating whether the wormer group being used is starting to lose effectiveness. A drench test can be done by simply taking a FEC at a specific interval after drenching (see Step 3 below); however, the result is much more accurate if an FEC is also carried out on the day of drenching because this allows the reduction to be calculated.

Step 1
Take a dung sample before treating lambs and use a FEC to establish the initial egg count.

Step 2
Treat all the lambs in the group, taking extra care to ensure that the correct dose rate and administration technique is used (see page 19) – if not, the test results will be misleading.

Step 3
Wait for seven days (for group 2-LV yellow products) or 14 days (for group 1-BZ white or group 3-ML clear products) and re-sample the same group of treated lambs.

Is the product working?

A reduction in FEC of 90% or more means that the drench given has done its job. For example, if the initial pre-treatment FEC was 500 eggs per gram (epg), then the post-test FEC should be no more than 50 epg.

If the value is higher, talk to your vet or Responsible Animal Medicines Advisor (RAMA) about changing to a different product group and what further action they would advise. Further action may include undertaking a more accurate faecal egg count reduction test (FECRT), or hatching collected larvae to establish the specific worm species involved.

How often should a test be done?

The resistance status of the various worm species will vary and different worm species dominate at different times of year. This means it is important to carry out regular drench tests throughout the year to establish what groups work best on the farm and when. Do not abandon a particular group of wormers completely until you have the full picture because there may be times when that group might still be used effectively.

Think about sheep scab control

The injectable forms of the 3-ML group can also be used to control sheep scab. However, in recent years, use of these injectables has significantly increased, which has sparked growing concerns.

Sheep farmers must consider their use of the injectable for sheep scab control in conjunction with their use in worm control. This is because when one of these products is administered to a sheep, the worm population the animal is carrying is also exposed to the 3-ML group. This is likely to speed up the development of resistance in the worm population. Recently, cases of resistance in scab mites have also been confirmed following repeated use. With only one other treatment for sheep scab available – a plunge dip in OP (organophosaphate) – we must reduce our reliance on these products.

Four key actions are required to tackle reliance on injectables:

Step 1 – Reduce the risk of sheep scab entering the flock

- Quarantine for all incoming and returning sheep is the first line of defence (see page 30)
- Contractors/vehicles etc., are a potential risk so make sure they adhere to vehicle/equipment cleaning protocols
- Double fencing is useful where there is a boundary with a risky neighbour

Step 2 – Avoid unnecessary use of injectables – get a diagnosis before treating

These products are not effective against the biting lice found in the UK. Before treating, a diagnosis of itchy suspect sheep is essential to make sure that lice are not the cause. This can be done in two ways:

- Skin scrape taken by the vet, or
- A blood (ELISA) test, which can detect exposure to scab mites from as early as two weeks after infestation

Step 3 – Administer effectively and follow instructions carefully

- Follow the instructions carefully and make sure each sheep in the group is treated accurately
- For non-persistent products (ivermectin or doramectin), sheep must be moved to pasture that has not carried sheep for at least three weeks to avoid re-infection

Step 4 – Consider using an OP plunge dip as an alternative (never a shower or jetter)

This is particularly important where the 3-ML group has been used heavily for worm control. Moxidectin injection should not be used for both purposes in a flock.

Double fencing

When to use 4-AD and 5-SI anthelmintics

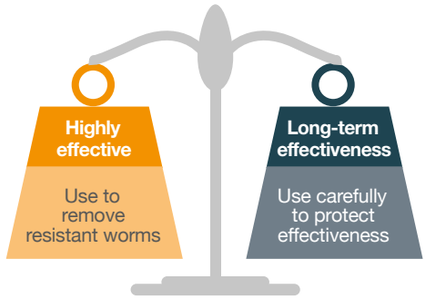
These two groups are the most recent additions to the anthelmintic range, so worms that are resistant to them are extremely rare. This makes products in these groups highly effective when used correctly and very valuable in worm control programmes.

However, it is important to strike a balance. We need to harness the effectiveness of these two newer groups to help us sustain the older products but, at the same time, protect them from over-use and the risk of developing resistance.

Striking the balance

To achieve this balance, there are only two occasions when one or other of the group 4-AD or 5-SI anthelmintics should be used:

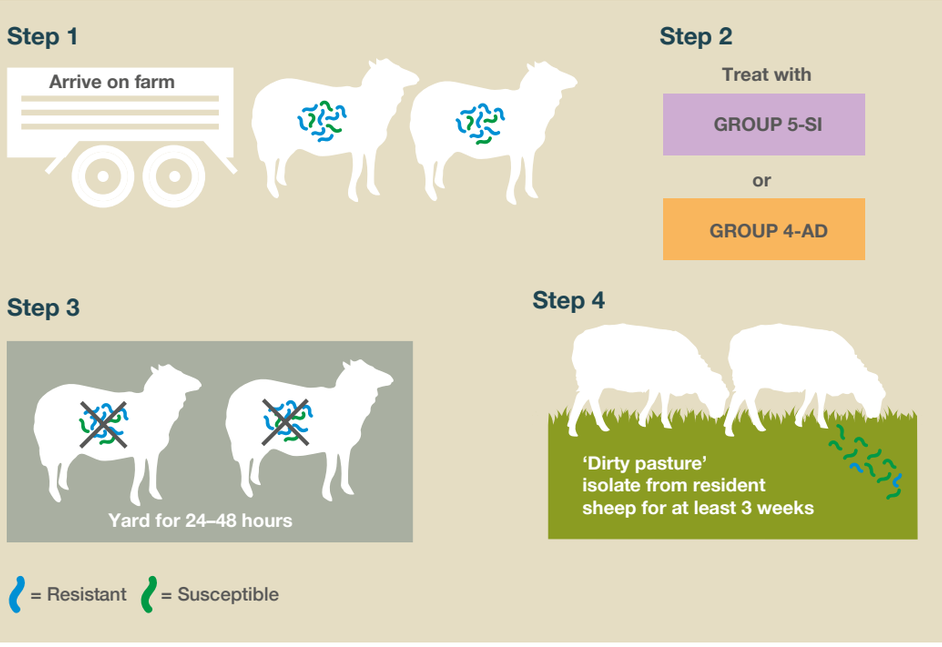
1. As a quarantine treatment to ensure any worms that are resistant to the older groups are removed and not brought onto the farm.



2. As a single treatment for lambs in the mid-to-late grazing season to remove worms selected for resistance to the three older groups through doses given earlier in the season.

Quarantine drench

Using either a 4-AD or 5-SI for all incoming sheep prevents the sheep from bringing resistant worms in from another farm (see below).



Mid-to-late season treatment for growing lambs

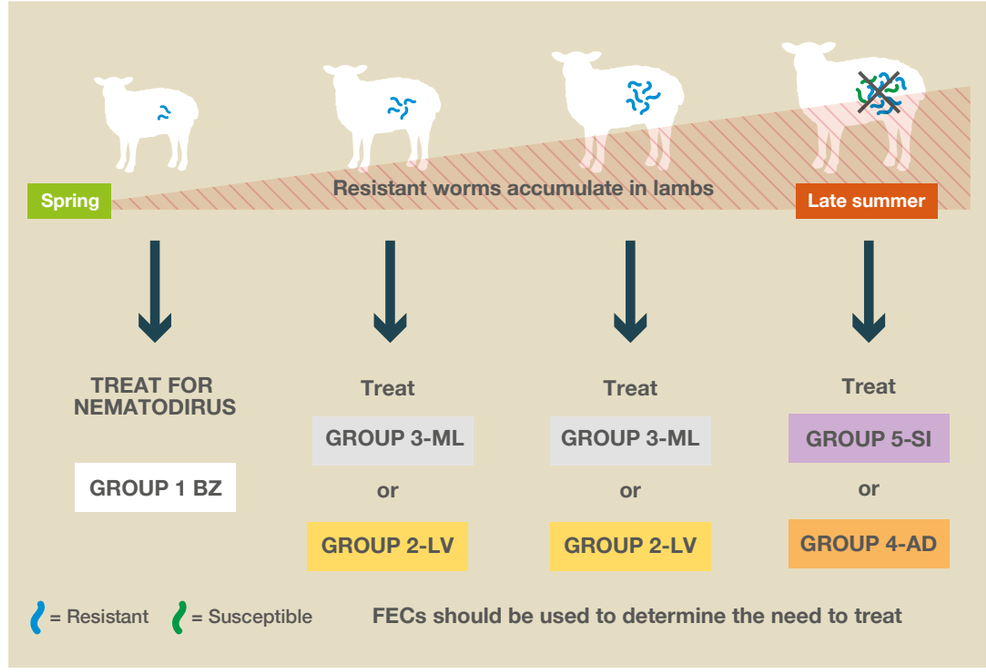
If an FEC indicates the need to treat, then using 4-AD or 5-SI products as a single 'one-off dose for all lambs' on the farm later in the grazing season has two important benefits:

- Improved lamb performance, because all the accumulated worms in the gut that have survived previous treatments are killed
- Killing worms means they cannot breed, so do not add their resistant genes to the farm's worm population. This helps slow the development of anthelmintic resistance to other groups

The diagram below illustrates how this works in a typical situation in which lambs on permanent pasture, which were treated for Nematodirus in the spring, then receive another two treatments when FECs were high.

Remember

Do not move lambs directly on to fields with very low worm burdens (e.g. aftermaths and new leys) after treatment. Leave them where they are for 4–5 days and then move.



Case study

Emlyn Roberts, North Wales – Strategic use of group 4 product

Emlyn Roberts and his family farm in North Wales on a 1,136 acre (460 ha) hill farm. The farm runs 35 Welsh Black cattle and 830 Welsh ewes on a closed hill. The aim of the farm is to produce a hardy Welsh ewe to breed lambs that can thrive and produce a good-quality carcase on the mountain land with minimal input. The sheep flock is run as a closed flock, with the exception of buying in rams.

The family are members of the Flock Health Club with their farm vet practice in Dolgellau and are also part of the HCC Red Meat Development Programme's flock and herd health planning project, Stoc+. These initiatives identified that one of the key health concerns of the farm was the need to review products used to treat worms in the sheep flock. There were two main areas to focus on this farm: ewes returning from winter grazing and growing lambs in mid-season.

Two years ago, the farm predominantly used a white drench routinely and regularly through the grazing season with the lambs. A faecal egg count reduction (FECRT) test revealed resistance to the white worm drench (group 1). This resulted in a change in product use to group 2 or 3 during the season. A white drench is still used to effectively tackle early-season Nematodirus, but all subsequent drenching is based on faecal egg counts (FECs) rather than routine treatment for finishing lambs.

Fewer, more strategic treatments are now used, including the introduction of a mid- season group 4 orange product. In order to reduce the risk of further resistance to other groups and retain the efficacy of the group 4 product, this treatment is only utilised when there is a high faecal egg count in the lambs. Emlyn is keen to ensure that his sheep don't carry resistant worms and regularly monitors this using advice from the vet.

Ewe lambs are away-wintered and return to the farm in the spring. Before the review of worm control in the health plan, these sheep were returned to the main flock untreated. The policy has now changed to introduce a 'quarantine' treatment of group 4 to these sheep to protect the rest of the flock from any incoming resistant worms and worm burdens. Bought-in rams are also routinely quarantined and drenched with group 4 orange product before mixing with his flock.

As a result of health-planning initiatives, the drenching protocol has become more structured and based on the results of faecal egg counts. Strategically alternating the wormer groups has helped to reduce the number of drenches used overall, but to achieve this there was a need to introduce a new quarantine drench.

As part of the changes, ewes were not wormed at all in 2018 or 2019, with the exception of a dose of white drench post-lambing this year. This was helped by the improved weather conditions, but the situation was monitored using FEC.

It was the regular reviews of the farm's animal health plans and use of FEC to reveal resistance to white drench that prompted Emlyn to review the strategy for worm control in the sheep flock and to include groups 4 and 5 for returning ewes and mid-season drench for finishing lambs.

*The Red Meat Development Programme is a five-year strategic initiative funded through the Welsh Government Rural Communities – Rural Development Programme 2014–2020, funded by the European Agricultural Fund for Rural Development and the Welsh Government.

Quarantine

Effective quarantine and treatments will remove any resistant worms carried by incoming sheep and eliminate the risk of them bringing in sheep scab. Worming treatments can be selected from Gold (both a 4-AD and 5 SI wormer), Silver (either a 4-AD or 5-SI with moxidectin) or Bronze (a 4-AD or 5-SI only).

For sheep scab, actions and treatment options are based on an initial risk assessment.

Choose your scab risk category and then either a gold, silver, or bronze option and carry out all the treatments shown in that list.

Step 1. Yard or house ALL incoming sheep

Step 2. Assess scab risk

High scab risk

Low/medium scab risk

No scab risk

Step 3. Treat Yarded or housed 24–48 hours

Choose Gold, Silver or Bronze treatment

Worm and scab treatment	Gold	Gold	Silver	Silver	Bronze	Bronze
4-AD	■	■	OR	OR	■	
5-SI	■	■				■
Mox (oral drench)			■			
Mox (injection)		■		■		
OP dip	■		■			
Doramectin (injection)					■	■

Choose Gold, Silver or Bronze treatment

Worm treatment	Gold	Silver	Silver	Bronze	Bronze
4-AD	■	■		■	
5-SI	■		■		■
Mox (oral drench)		■	■		

ELISA blood test for scab after 2 weeks

Positive: Treat for sheep scab

Negative

Step 4. 3–4 weeks isolation: Turn out to pasture previously grazed by resident flock

Active ingredient	Method of application
Diazinon	Plunge dip
Ivermectin	Injection (2 doses required)
Doramectin	Injection
Moxidectin 1%	Injection (2 doses required)
Moxidectin 2%	Injection

Step 5. Join home flock

4-AD = monepantel (Zolvix™): 5-SI = derquantel/abamectin (Startect™): Mox (inj) = moxidectin injection (1% preferred): Mox (oral) = moxidectin drench: Doramectin (Dectomax™); OP = organophosphate plunge dip

Assessing and reducing pasture risk

Although anthelmintics are a key part of worm control in most systems, research shows that lambs with a high worm challenge that are regularly drenched with a fully effective anthelmintic grow half as well as lambs with no challenge.

Where sheep are the only livestock, avoiding high worm burdens can be challenging. However, there are options to graze lower-risk pastures, such as hay and silage aftermaths, or to use dry, mature ewes to 'hoover' larvae off infected pasture. See Table 2 for examples.

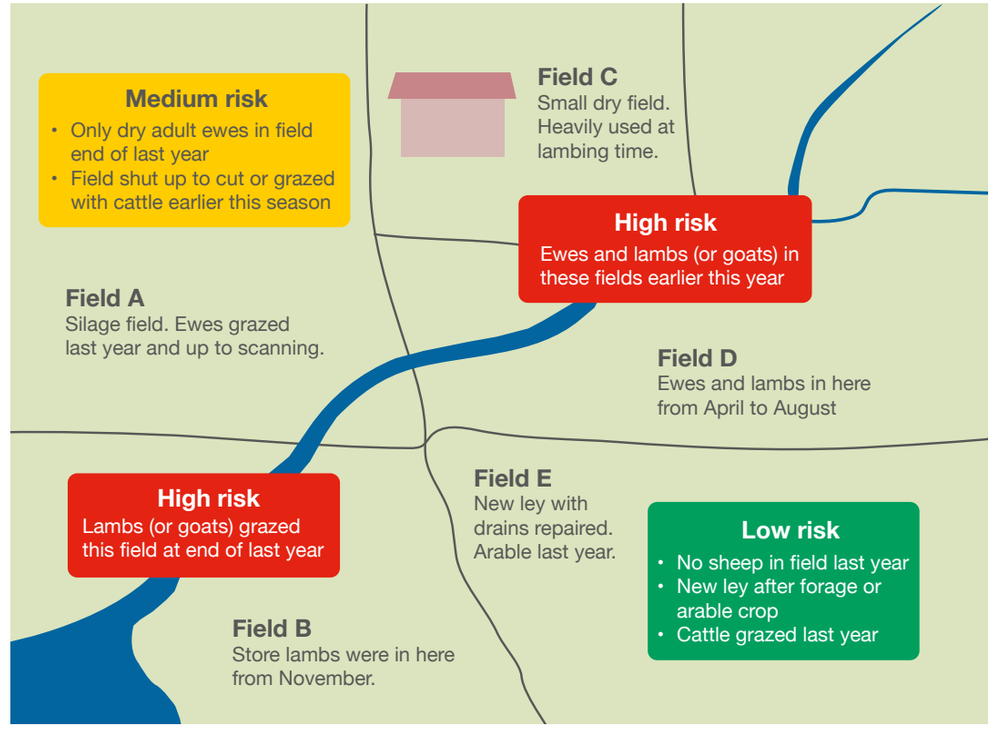
By using the farm map to identify which fields have held which class of stock over the last 12 months, it is possible to highlight the level of risk in each field, as shown in the example below.

With careful planning, the risk associated with each field can be reduced for vulnerable stock. Strategies to achieve this can be as simple as ensuring that ewes and young lambs are not spread across the whole farm.

Table 2. Examples of situations of high, medium and low-risk pastures

Season	High	Medium	Low
Spring	Ewes and lambs grazed in the previous year High risk of Nematodirus if pasture carried ewes and lambs in the previous spring Goats grazed the previous year Store/ewe lambs grazed the previous autumn/winter	Grazed only by adult non-lactating sheep the previous year Grazed by ewes and lambs the previous spring, but then conserved and aftermath not grazed by sheep (NB: Nematodirus still high risk)	New leys or forage crops Grazed by cattle or cut for silage or hay in the previous year (no sheep)
Summer	Ewes and lambs grazed in the spring	Grazed only by adult non-lactating sheep in the spring Grazed by cattle or cut for silage or hay in the spring	Grazed by cattle or cut for silage or hay only in the first half of the grazing season Forage crops or arable byproducts grown
Late season/ autumn	Stocked with ewes and lambs all season	Grazed by cattle since mid-season Grazed by fit, mature, dry ewes since weaning mid-season	Grazed by cattle or cut for silage or hay only in the first half of the grazing season Forage crops or arable byproducts grown

Risks vary in different fields across the farm



Grazing and management tools

There are actions we can take to try to reduce lambs' exposure to high worm burdens.

Good quality grazing needed for high lamb growth rates also improves resilience to worms during the season. Maintain optimum sward heights and avoid grazing below 4 cm to minimise ingestion of infective larvae at the base of the sward.

Grouping lambs by age at turnout makes treatment and management decisions more accurate and FECs more meaningful for the group.

Weaning is an important management tool, allowing lambs to be moved to lower risk grazing, such as aftermath, to avoid the high challenge that has built up on pastures they have been grazing with their mothers. Consider weaning as young as 10–12 weeks if low risk grazing is available.

Mixed grazing with cattle reduces pasture contamination through lower sheep stocking density. It is harder to achieve efficient grassland utilisation, as targets for each species are different. Rotating cattle and sheep grazing is another way to dilute the worm burden.

Use dry ewes post-weaning to reduce larval levels on heavily contaminated pastures. Ewes in good body condition will ingest infective larvae, killing many off, which reduces the number of larvae on pasture that could overwinter until the following spring. (This does not apply to Nematodirus.) Monitor ewe FECs to ensure they are not dropping many eggs in their dung.

'Bioactive' crops such as chicory or bird's-foot trefoil and sanfoin are also options to reduce worm challenges for weaned lambs. Swards containing plantain, chicory and considerable amounts of clover will also improve protein nutrition and reduce the negative effects of worms on lambs.

Forage crops provide low-risk grazing for lambs in the autumn. There are increasing opportunities within arable rotations; for example, for green cover crops.

Checklist for improving worm control

	Yes	No	Page number
Is worm control a key part of the animal health plan you have drawn up with your vet?			10
Do you check that you are using the right product?			21
Do you always treat correctly and at the right dose rate?			19
Do you avoid highly selective 'dose and move' actions?			27
Have you used FECs to monitor worm burdens and contamination levels?			23
Do you have an effective quarantine strategy in place?			30
Do you know the anthelmintic resistance status on your farm? 1-BZ 2-LV 3-ML			23
Could you use management to reduce the use of anthelmintics in adult sheep? • Could you weigh lambs more regularly and use their growth rate in combination with FEC/pasture risk to target dosing where it is needed? • Have you assessed the different levels of pasture risk across the farm and matched lower risk areas to the most vulnerable stock? Could you include clovers or bioactive forages like chicory or sainfoin in any of your new leys for grazing sheep?			13 32–34

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