

# 3. Principles of worm management

## CHAPTER OVERVIEW

*After reading this chapter you will understand how to apply the knowledge gained from chapters 1 and 2. The principles of worm management are derived from this understanding as well as from many research studies and the experience of researchers, vets and farmers.*

*When implementing the principles outlined in this chapter the issue of drench resistance must be kept in mind. This is discussed separately in chapters 3 and 4, which presents ways of reducing the risks of drench resistance development. At times this will involve compromise so the two chapters should be read in conjunction.*

- ▶ The purpose of any worm management programme is to maintain or enhance profitability by:
  - minimising contamination of pasture with infective worm larvae.
  - minimising uptake of infective larvae by susceptible stock,
  - monitoring the success of the worm management strategies.
  
- ▶ The main focus is to reduce exposure, especially of young animals, to worms by limiting the number of infective larvae on pasture.
  
- ▶ Many tools are available but the mix will vary from farm to farm. Every farmer should carefully consider all the available options for worm management and how best to integrate them on their property.
  
- ▶ A key factor in implementing any strategy is knowing what is happening with worms on your farm. Right now the key tools to determine this are, faecal egg counts (FEC) and the identification of worms present using faecal larval cultures. Monitoring production measures such as weight gain can tell you about the effects of worms on stock.
  
- ▶ **Worm management strategies may include:**
  - ▶ manipulation of pasture and stock management plans to reduce exposure of animals to worms at key times
  - ▶ ensuring animals are well fed and have adequate mineral status
  - ▶ minimising stress and attending to disease prevention
  - ▶ breeding resistant/resilient animals
  - ▶ appropriate drenching strategies

# Principles of worm management

The basis of a successful worm management strategy is to prevent their negative effects on animal health and production by:

- ▶ reducing the contamination of pasture with worms eggs shed by infected stock and
- ▶ restricting the exposure of susceptible stock to infective larvae.

Many tools are available but the mix will vary from farm to farm depending on what is most appropriate. Remember the situation is not static and your strategies need to be reviewed frequently to take advantage of changes in farm conditions and new control technologies. Farmers should consult with your veterinarian, or other animal health adviser.

A key factor in implementing a strategy is knowing what is happening with worms on your farm. Currently the key tools to determine the situation are faecal egg counts (FEC), and faecal larval cultures to identify the actual species present. Monitoring production such as weight gain and body condition score (BCS) are also important tools to monitor the effects on your stock. Remember there can be other causes of reduced production.

Each farmer needs to consider the options available for worm management and how they can best be integrated on their farm. Various tools are discussed briefly below. The benefits from some may be small but the overall benefit is the sum of all the parts. New developments will continue to appear and should be incorporated into the management strategy. Some possible future developments are discussed at the end of this section.

It is advisable to develop the farm programme in consultation with your animal health adviser.

The strategy requires planning effort but should result in a more efficient, cost-effective and productive farming. As experience develops it becomes easier. The strategy can be fine tuned for changing conditions.



# Key factors for a worm management programme

## Worm location

At any one time the vast majority of the worm population is on the pasture, rather than inside the gut of the host animal. Therefore, effective controls will minimise pasture contamination with eggs and minimise the exposure of susceptible stock to contaminated pasture. Keeping the worm challenge low by keeping low larval levels on pasture results in healthier more productive stock.

## Worm numbers

Worm numbers in pastures vary throughout the year, with peaks in spring and autumn, when the climate favours worm development and young stock are present.

## Larval removal

It is difficult to remove larvae without removing the affected herbage e.g. by cutting for hay or grazing with non-susceptible animals.

## Spelling period

Spelling pasture for short periods (less than three months) will not reduce numbers of infective larvae sufficiently. Larvae can survive for many months even years on pasture. Cold weather slows their development but does not kill them. Exposure to direct sunlight will dry out and kill some eggs and larvae. Worms can survive and develop in the moisture of a cow pat even in drought conditions.

## Immunity

Sheep and cattle (but not goats) develop a level of natural immunity to worms. Sheep begin to develop an effective immunity at around eight to nine months, while cattle over 18 months do not usually develop obvious signs of worms infestation. Therefore, it is important to avoid exposing young stock to high levels of infective larvae.

## Nutrition

Animals under stress are less able to counter the effects of a parasite challenge. It is vital to maintain good levels of nutrition to meet the seasonal needs of the animal. Remember adult stock under stress, animals suffering a mineral deficiency and stock that have recently calved or lambed may also release more worms eggs onto the pasture.

## Scouring

Although worms can cause animals to scour, there are other causes of scouring that are unrelated to worms.

# Tools for worm management

The main focus of any worm management programme is to reduce animals' exposure, by limiting the number of infective larvae on pasture. If young animals get wormy use drenches to kill the worms. The main aim of a management programme should be to limit the development of larvae on pasture.

To achieve this farmers need to:

- ▶ investigate all options available,
- ▶ not be afraid to seek advice,
- ▶ watch out for new developments.

Keeping stock healthy is important to reduce the effects of worms. Minimising stress and paying attention to disease prevention will mean stock are better able to deal with worm infestations, and will deposit fewer eggs on pasture.

The tools available for you to use any control programme include: farmer knowledge, pasture management, stock management, on-farm diversification, drenching and the use of genetics.

## Knowledge

Here are some of the things you need to know.

- ▶ What worms are prevalent in your area?
- ▶ How do they affect sheep and cattle?
- ▶ What are their life cycles?
- ▶ When are they important?
- ▶ What factors favour larval challenge?

## Pasture management

- ▶ Pasture length: keep covers long – most worm larvae are in the bottom 2cm of pasture.
- ▶ Pasture species: tannin rich pasture species may decrease the rate of larval establishment.
- ▶ Hay and silage aftermaths (preferably closed up for three months or longer): most worm eggs and larvae will not survive.
- ▶ Fodder crops and new pasture will be free of worm eggs and larvae.
- ▶ Spelling pasture (preferably for three months or longer) will reduce the level of eggs and larvae.
- ▶ Use of rotation or set stocking will depend on individual circumstances.

## Stock management

- ▶ Stocking rate: the size of the worm problem largely depends on grazing animal density. The higher the stocking rate for a particular stock class, the higher the potential for worm problems.
- ▶ Graze young ahead of older stock.
- ▶ Inter species grazing: grazing interchange systems incorporate cattle, deer and adult non-lactating sheep. Pasture can be pre-grazed with resistant stock (for example cattle can be used to prepare pasture for lambs). It may take 4-16 or more weeks depending on initial contamination levels of grazing to make a pasture safe for the next stock class. Goats cannot be used to clean pasture for sheep because they share the same worm species.
- ▶ Alternation of species: any age class of cattle can prepare safer pasture for lambs. Any age class of sheep can prepare safer pasture for cattle.
- ▶ Use immune stock e.g. older animals that have developed age resistance to worms to prepare pasture for young stock. Below are some general guidelines based on pasture and stock management principles. These are examples of worm management strategies but this is not an exhaustive list or designed to apply to all farms.



### Sheep

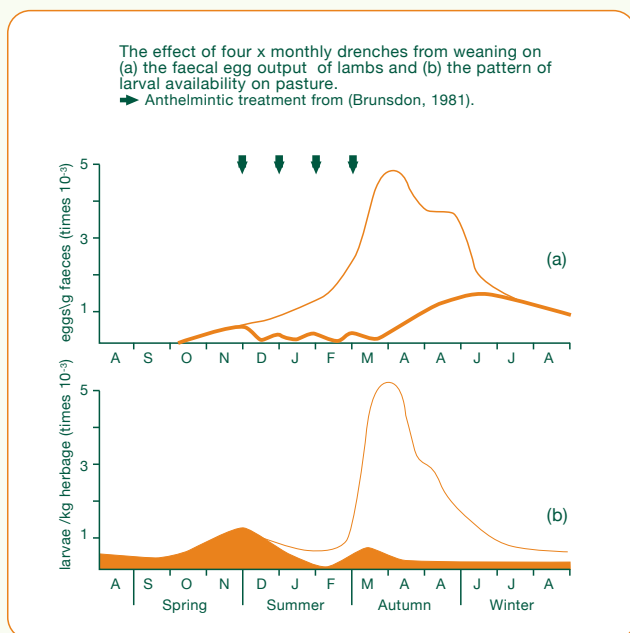
- ▶ Shift lambs off weaning areas for autumn.
- ▶ Avoid or minimise grazing lambs on lambing areas in autumn.
- ▶ Renew pastures after two years on summer/autumn lamb systems.
- ▶ Summer crops create cleaner grazing.

### Cattle

- ▶ Shift weaners off spring areas for summer and off summer areas for autumn.
- ▶ Avoid grazing weaners in autumn where they will spend winter.
- ▶ Create new grazing for younger cattle (new grass, crops).

## On-farm diversification

- ▶ Use other species of animals: diversification into other types such as cattle and deer can effectively reduce the stocking rate of each species.
- ▶ Cropping or including grapes and flowers.



## Drenching

The different drenches are discussed in detail in the next chapter. Here discussion is restricted to drenching programmes.

### Drenching sheep

**Preventative drenching** is a programme of four or five drenches given to lambs at four-weekly intervals starting at weaning. An additional drench about three weeks before weaning may be needed on farms that have problems with *Nematodirus*. Additional drenches may be needed in the autumn if climatic conditions favour larval development on pasture. The effect of this preventative programme on the build up of infective larvae on pasture is shown in the graph opposite. The advantage of preventative drenching is, it is an easy programme to follow, but it may not always be the most effective use of drench.

The alternative is to monitor and treat. Use faecal eggs counts (FEC), body condition, live weight, pasture length - quality, and larval contamination of pasture to decide when to drench lambs. The higher the FEC of the grazing stock, the higher the pasture contamination with larvae. Consider past experience of worm biology, which involves more work but can be effective for some farmers. As a general rule, ewes should not need drenching, but there are circumstances when drenching ewes may bring production or animal health and welfare benefits.

### Drenching cattle

Young cattle are susceptible to the production limiting effects of worms. The need for drenching is related to the intensity of the farming operation. Calves raised intensively on centre pivot irrigated pasture are likely to be more highly challenged by worms than calves grazed more extensively. The principles of preventative drenching outlined for sheep also apply to young cattle.

### Factors to consider when drenching sheep or cattle

- ▶ Adult stock should not require routine drenching.
- ▶ Worms are only one reason stock may be thin or scouring – make sure you know what you are treating.
- ▶ Drenching intervals should seldom be less than 28 days (except in the case of *Haemonchus* outbreaks).
- ▶ Aim to keep drenching to a minimum.
- ▶ Consider stock age/class, condition, feeding levels, stress.
- ▶ Drenching needs to be combined with appropriate grazing management.
- ▶ Drenching plays a valuable role in animal health. It needs strategic decision-making and should be part of a worm management plan. Get advice from your animal health adviser.

## Quarantine drenching

All new stock both sheep and cattle, brought onto a farm should be quarantine drenched. A drench check by faecal egg counting is advised 10 days later (see next chapter).

## Genetics

There are differences between individual animals, and also between breeds in their susceptibility, or tolerance of, worms. For example, Merinos are generally more susceptible to worms than the downland Romney or Composite breeds of sheep. These differences are inherited and can be selected.

Research on breeding and selection for resistant or tolerant animals has identified sires that will produce progeny more resistant or tolerant to worms. Although much progress has been made in breeding resistant or resilient stock, the focus of this Handbook is on management principles and genetic selection discussion is outside the scope of this handbook.

“Tail end” selection is practised by many farmers when they remove the more susceptible animals from their breeding programmes.

## Other ideas, developments and research

- ▶ Maintaining susceptible worms in refugia (see next chapter).
- ▶ Different delivery systems are being developed for the administration of anthelmintics or drench and new combinations of anthelmintics. Boluses (capsules) are the most recent introduction to the market.
- ▶ Better or cheaper diagnostic tests for identifying worms.
- ▶ Better or cheaper diagnostic tests for drench resistance.
- ▶ Vaccination: currently there are no commercially available vaccines that are effective against worms in ruminants.
- ▶ Integrated use of anthelmintics with vaccines.
- ▶ Nematode trapping fungi: these fungi have been trialled and could be effective as a slow release device if the technology can be made to work.
- ▶ Feed-lots: bringing the feed to the animals rather than taking the animals to the feed can avoid infection with worms.
- ▶ New methods for assisting genetic selection for resistance, including gene markers.
- ▶ New chemical families of drenches.

## Organic production

This can incorporate any of the tools listed above except drenching. There are some so-called organic drenches but little is known about their efficacy.

# Monitoring the success of the management programme

There is a saying: “If you can’t measure it, you can’t manage it”. Monitoring is an important part of any management programme.

The specific tests used in monitoring are:

- ▶ Faecal egg counts (FEC) including DrenchCheck
- ▶ Faecal egg count reduction test (FECRT), or DrenchTest
- ▶ Worm counts
- ▶ Faecal larval culture and identification

The key tools are trend information around faecal egg counts and faecal larval cultures. These diagnostic tests will tell you how successful are your management strategies. Unfortunately there are no reliable methods to diagnostically measure infective larvae on pasture.

The emphasis here is on the specific diagnostic tests for worms but also important are:

- ▶ Good observational skills, and
- ▶ Regular weighing of stock or indicator mobs and herds.



## Faecal egg counts

Faecal egg counts estimate the worm burdens of sheep or cattle. For flock examinations, faecal samples from a minimum of 10 animals are required because of the way worms are distributed in a sheep population.

However, faecal egg counting has limitations:

- ▶ Only mature adult worms lay eggs, so immature worms are not detected.
- ▶ Identification of worms is limited because the eggs of several species are indistinguishable.

## Faecal larval cultures

Larval cultures involve hatching the eggs in faeces, growing the worms to the infective stage in the laboratory, and identifying them. This is the only way to identify the worms present in an animal without killing it. Although the eggs of *Nematodirus* are distinctive, the eggs of the other economically important worms e.g. *Ostertagia*, *Trichostrongylus*, *Cooperia* and *Haemonchus* are virtually identical and are reported in faecal egg counts as Strongylate eggs. Only when the identity of resistant worms and their seasonal pattern is known, can a farm-specific sustainable control programme be designed.

Surplus faecal egg count material from several animals in a mob is usually pooled for a larval culture, so this test cannot give a measure of the worms burden.

A limitation of faecal larval culture examination is that it takes about ten days.

## When to use faecal egg counts and larval cultures

### Testing drench effectiveness (DrenchCheck)

Collect ten fresh faecal samples off the ground seven to twelve days after drenching with an oral drench (preferably the lamb weaning drench).

If eggs are found by FEC, then either the drench is not being administered correctly or drench-resistant worms are present. A positive test should be followed by a DrenchTest.

### Investigating suspected drench failure (DrenchTest FECRT)

Use this test:

- ▶ if eggs are present following DrenchCheck,
- ▶ if drench resistance is suspected at any time,
- ▶ to check the effectiveness of a particular drench, or
- ▶ to look at the extent of drench resistance on a property.

This test is also known as Faecal Egg Count Reduction Test (FECRT) and should be conducted by an appropriate adviser to ensure faulty drenching practices are not the cause of the problem. Divide animals into groups of ten to fifteen individually identified animals. Check FEC test to ensure that egg counts are sufficiently high to give a meaningful result. Weigh animals and drench individually at the recommended dose rate for the drench(es) being evaluated. Collect faecal samples, (from the rectum of each participating animal and conduct a FEC). Seven to twelve days later for orally drenched lambs, or twelve to fourteen days later for calves treated with pour-ons

Larval culture will tell which worms are present and therefore resistant to the drench(es) used.

### Monitoring drench programme effectiveness

Use the FEC test to determine the effectiveness of a worm control programme and/or whether a drench is needed.

Larval culture will identify which worms are present.

### Deciding whether adult sheep need drenching

Once over a year old sheep can usually resist the establishment of large worm burdens, and should not need drenching. However, this resistance drops if the sheep are stressed, for example in ewes at lambing. If you believe adult sheep do need drenching, conduct a FEC first to confirm the need.



## Health check

Worms can cause Ill-Thrift and/or scouring in stock but these signs can be caused by other things. Determine the cause of the problem before spending money on drenches.

When animals exhibit Ill Thrift or scouring discuss the problem with your veterinary adviser. A FEC may be part of the investigation.

Refer M&WNZ R&D Brief 124 Ill Thrift: Identifying the causes and measuring their effects.

## Who does faecal egg counts?

There are lots of ways of getting faecal egg counts done - ask your animal health adviser, or you could learn to do them yourself. However, as with any other technical service, the quality and value of the results is only as good as the skill and experience of the person doing the count.

## Collecting faecal samples

Collecting faecal samples is easy. Clean impervious containers such as plastic freezer bags or plastic pottles are ideal, or you may have been given a faecal sampling kit.

### Some points to note:

- ▶ Only one sample per container (approximately one heaped teaspoon).
- ▶ Faeces must be fresh when collected (still warm).
- ▶ At least ten samples are needed to give a meaningful result for a mob.
- ▶ Keep samples in a cool place. If they cannot be examined on the day they are collected, store them in a cool places e.g. fridge, not the freezer.



## Keeping records

Moving from a reliance on drenching alone for control to sustainable internal parasite control requires more record keeping and forward planning.

The photocopy/master sheets on the following pages can help with both.

Farmers may wish to consult with an animal health adviser when they start using these record sheets.

### Faecal Egg Count Summary Sheet

Use this sheet to summarise the results of faecal egg counts. How this is used will depend on the nature of the farm and the numbers of stock. All stock classes could be recorded on the one sheet, or it may be more appropriate to use a separate sheet for each age class.

### Drench Effectiveness Status Sheet

This sheet is designed to record information about the drench efficacy status of a farm. Whenever resistance to a drench family appears and if the identity of the resistant worms are known, this information can be recorded.

### Pasture Use Planning Sheet

This sheet may be easier to use if it is enlarged to A3 size. More than one sheet may be needed, depending on the size of the working blocks of land. Use pencil to fill it in so changes can be made during the year.

Identify land blocks down the left hand side of the planning sheet. Start by identifying blocks that are going to be spelled say for hay, crop and when this is going to occur. Then plan stock movements. Be sure to include all stock classes and land uses. (This sheet is modified from one produced for the New Zealand Meat Research and Development Council funded by the Parasite Action Group Project [91MT34/1.1].)

## Bibliography

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## Faecal Egg Count Summary Sheet

Date Sampled	Age/Mob	Days since last drench	Results			Comments
			Strongylate *epg mean (range)	Nematodirus *epg mean (range)	Other findings	

\* epg = eggs per gram

## Drench Effectiveness Status

Farm:

Host species:

Date:

Drench Type	BZ (White)	Levamisole (Clear)	Dual Combination	Ivermectin 1/2 dose	Ivermectin Full dose	Abamectin	Moxidectin	Other
<b>Worm Type</b>								
<i>Haemonchus</i>								
<i>Ostertagia</i>								
<i>Trichostrongylus</i>								
<i>Nematodirus</i>								
<i>Cooperia</i>								
<i>Oesophagostomum</i>								
<i>Oesophagostomum /Chabertia</i>								
Other								

Record the percent efficacy for each drench against each species where available from your FECRT results

## Pasture Use Planning Sheet

- minimise the contamination of pasture with worm eggs shed by infected stock
- minimise the exposure of susceptible stock to infective larvae

Block	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
Drafting													
FEC													
Drench													

This chart is designed to help you plan land use. Fill out in pencil so changes can be made during the year if conditions change. Make sure all species and classes of stock are included and all other types of land use (e.g. closing up pasture for hay making, winter feed) are included.