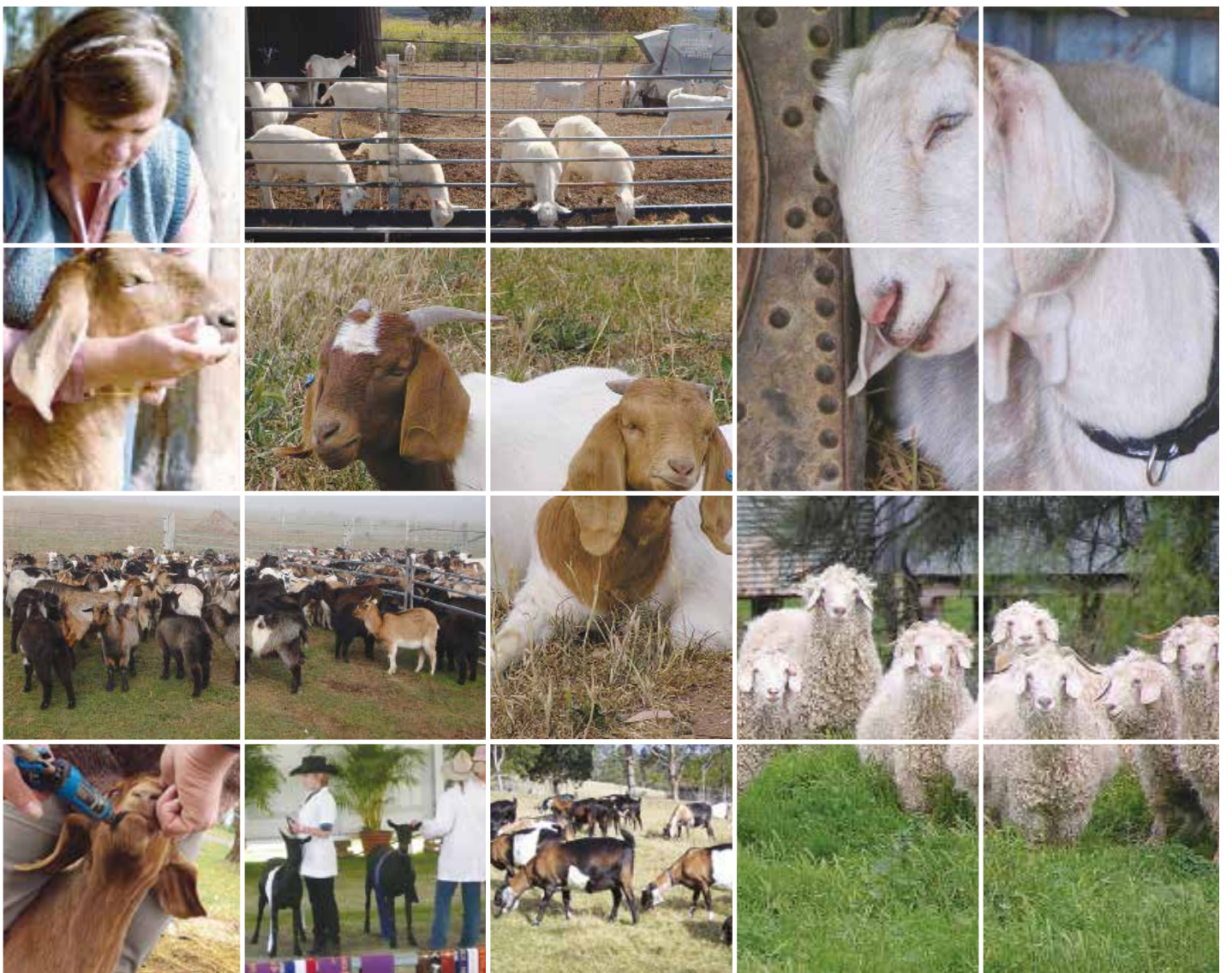




# WORM CONTROL PROGRAM

## Australian smallholders

*A regional worm control program for goats from WormBoss*





## **WORMBOSS WORM CONTROL PROGRAM**

### **Australian smallholders**

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**Acknowledgement:** This document is based on the sheep WormBoss regional program with changes supported by the Goat Industry Council of Australia and funded by Meat and Livestock Australia through the project 'Expansion of WormBoss Website to Include Goats B.GOA.0120'.

**Published:** October 2016

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**Cover photos supplied by:** Karen Kennedy, Amahle Boer Goat Stud; Dr Sandra Baxendell, Goat Veterinary Consultancies—goatvetoz; Berwyn Young; Melissa O'Garr, Hunnybee Farms & Pet Photography; Trevor Waterston & Shelly Gatt, Valley View & Bichance Dairy Goat Studs; Sandy & John Green, Killara-Ram Anglo Nubian Dairy Goat Stud.

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## Program summary

This WormBoss worm control program has been developed for smallholders who do not have the infrastructure to be able to practice grazing management to create low worm-risk paddocks and are able to assess each goat individually and then treat individuals as required. Further information on a broader range of worm control options can be obtained from the relevant regional worm control program.

A summary of the worm control components for smallholders is below (see further chapters for details).

### 1. Avoid worms

- Provide adequate browse where possible.
- Where worm control relies heavily on frequent drenching (even after implementing the control options in this program) then consider feedlotting of goats. Feeders and waterers should be designed so there is no faecal contamination.

### 2. Breed and feed for goats that are resistant and resilient to worms

- Purchase bucks with better than average worm egg count Estimated Breeding Values (WEC EBVs) in KIDPLAN by choosing the more negative values but also ensure the bucks meet your needs for other traits.
- Maintain good nutrition to enhance the goat's immunity to worms.

### 3. Assess goats for signs of worms at recommended times

- Body condition score each month.
- FAMACHA<sup>®</sup> score (in areas where there is a barber's pole worm risk).
  - ♦ weekly in the higher risk period of the year for your location.
  - ♦ monthly in the low worm-risk times.
- Scouring each week.
  - ♦ weekly in the higher risk period of the year for your location.
  - ♦ monthly in the low worm-risk times.

### 4. Drench<sup>2</sup> strategically at recommended times

- *Quarantine drench* all introduced goats with an effective short-acting drench that provides (for meat goats) four drench groups including one from either of the most recently available products or (for dairy goats) fenbendazole and abamectin which are registered for use where milk is for human consumption.
- Breeding does pre-kidding (as they temporarily lose their immunity).
- Kids at weaning.
- Drench individual goats showing obvious signs of worm-related illness.

### 5. Manage drench resistance

- Conduct DrenchTests every 2–3 years. Use DrenchChecks between DrenchTests or if there are not enough goats in your herd to conduct a DrenchTest.
- Avoid unnecessary drenching by restricting treatment to recommended times or in response to WormTest results.
- Use effective drenches and multi-active<sup>3</sup> combinations where possible. Note: multi-active combination and other drenches are not registered for use in goats. In some states and territories they can only be used with an off-label prescription from your veterinarian.
- In general, use short-acting treatments with long-acting products reserved for specific purposes or high worm-risk times and with an off-label prescription from your veterinarian.
- Calibrate your drench guns, dose to the heaviest goat and follow the label or your veterinarian's instructions.

<sup>1</sup>This drench must be tested and shown to be effective on your property

<sup>2</sup>Drench refers to anthelmintics regardless of route of administration

<sup>3</sup>Drench groups are the chemical family to which an 'active' belongs. An 'active' is the chemical in a drench responsible for killing worms. Some drenches contain more than one active and are called 'multi-active' or 'combination' drenches. See Appendix D: [Drench groups and actives](#).

## Introduction

This is an up-to-date, integrated regional worm control program for goat smallholders across Australia.

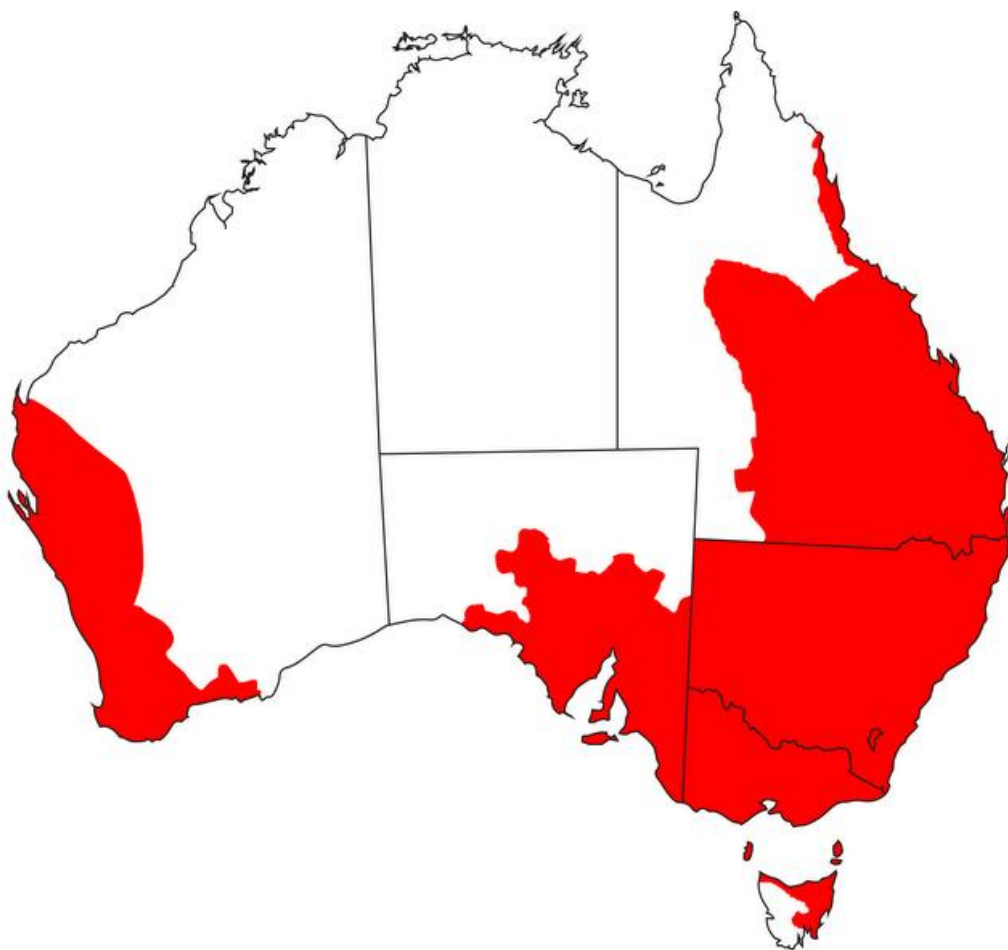
The program aims to improve the profitability and welfare of your goats through:

- fewer deaths and illness from worms
- fewer drenches, particularly long-acting drenches
- improved productivity
- prolonged life of drenches

### Where does the Australian smallholders program apply?

The Smallholder worm control program is applicable across Australia for smallholders who do not have the infrastructure to be able to practice grazing management to create low worm-risk paddocks and are able to assess each goat individually and then treat individuals as required. Further information on a broader range of worm control options can be obtained from the relevant [regional](#) worm control program.

This map covers all of the other WormBoss regions for goats.



**Figure 1. The Australian smallholder program covers all regions of Australia where goats are run.**

### Individual versus mob approach to worm treatment

Smallholders (those with a small number of goats) may find it practical to regularly assess each goat individually and then treat individuals as required.

Treating only those animals that warrant treatment is a good option to help slow the development of drench resistance on your property as drench resistance is a significant problem for most goat owners in the moderate to higher rainfall areas.

In any group of goats, the level of worm infection can vary considerably among animals. Most of the time, only a small proportion of any group will have a higher worm burden. Therefore, when individuals can be assessed regularly, there is the opportunity to treat only those animals that need treatment.

The larger the mob the less practical is individual assessment and treatment. In this case, worm egg counts (WEC) should be the basis of mob treatment decisions and readers are referred to the relevant regional worm control program.

Smallholders should also consider conducting worm egg counts because these remain the most appropriate means for assessing worm infection. If a laboratory service is used, the price per animal is typically about \$2.50–\$4 for a worm egg count. But there may be a minimum number of tests (e.g. 10) required. A larval culture may also be useful at times to identify the types of worms and most laboratories charge separately for this extra service.

If you choose to assess individuals as the basis for worm control you must assess them regularly, as often as weekly during periods of high worm-risk. Failure to do so, especially, where barber's pole worm is a risk, can result in illness and death.

## What worms are covered in this program?

### Roundworms

The most important roundworms in this region vary across Australia. The list below uses Sydney as the latitude to separate northern and southern areas:

#### Northern areas (generally north of Sydney)

The most important roundworms in this region:

- Barber's pole worm [Haemonchus contortus](#)
- Scour worms
  - ♦ Black scour worm [Trichostrongylus colubriformis](#)
  - ♦ Brown stomach worm [Teladorsagia circumcincta](#) (NSW)

Less important or only occasionally seen worms:

- Large bowel worm [Oesophagostomum venulosum](#) (NSW)

#### Southern areas (generally south of Sydney)

The most important roundworms in this region:

- Barber's pole worm [Haemonchus contortus](#)
- Scour worms
  - ♦ Black scour worm [Trichostrongylus colubriformis](#) and [T. vitrinus](#)
  - ♦ Brown stomach worm [Teladorsagia circumcincta](#)
  - ♦ Thin-necked intestinal worm [Nematodirus species](#) (in young goats)

Less important or only occasionally seen worms:

- Small intestinal worm [Cooperia species](#)

### Liver fluke

[Liver fluke \(\*Fasciola hepatica\*\)](#) is an internal parasite that occurs throughout this region where there are colonies of the intermediate host snail (*Austropeplea (Lymnaea) tomentosa* in temperate and *Pseudosuccinia (Lymnaea) columella* in warmer areas). It can affect goats severely, sometimes causing deaths. The life cycle differs from the simple life cycle of roundworms, so control strategies are different. Liver fluke should be considered if there are cases of anaemia or bottle jaw in goats that are not associated with barber's pole worm.

This program relates to roundworms. To control liver fluke, see Appendix A. [Liver fluke control](#).

### Other worms

Gastro-intestinal parasites of minor importance, such as stomach fluke and tapeworm, are not covered.

## Avoiding worms

### Which goats are most susceptible to worms?

- Weaners in the months after weaning until 18 months of age, when they develop a higher level of worm immunity. Bucks remain as susceptible as young goats.
- Late pregnant and lactating does are highly susceptible to worms as their worm immunity is reduced in late pregnancy and through early lactation.
- Adult or not lactating (dry) goats remain susceptible to worms as their immunity develops more slowly than it does in sheep, and is often incomplete.
- Rangeland goats moving into higher rainfall areas are highly susceptible to worms as they have little experience of worm infection and hence their immunity is poorly developed.

### Grazing management

Managing and spelling pastures at the right times and for the necessary length of time is a proven method to reduce the level of contamination on paddocks.

**However, moving goats between pastures each few weeks will do little to reduce the worm-risk, especially in high-risk barber's pole worm areas.**

Grazing management methods are not presented here because few smallholders are in a position to apply these options effectively.

More information on grazing management to avoid worms can be found:

- In the regional program relevant to your location
- On the [grazing management](#) page

### Feedlotting of goats

[Feedlotting](#) is a highly effective means of avoiding worms. Goats are separated from pasture that contains the infective stage of worms.

Many goats in small herds or kept in backyards already receive a lot of supplementary feed. When worm control costs are taken into account, going to a zero grazing (feedlot) situation may be cost effective, especially if existing pastures can be converted to growing browse for cutting and feeding.

In situations where paddocks are heavily contaminated with worms on an ongoing basis (and in some cases, drenches are no longer very effective), feedlotting becomes the only viable option to prevent illness and death from worms.

#### Requirements for feedlotting:

- There must be absolutely no grazing in the feedlot area by spraying out the grass and replacing with gravel, pine-bark or similar or leaving as compacted dirt.
- Feeders and waterers must be designed so that there is no manure contamination of the feed by the goats' feet or manure. Waterers must also be kept clean and in good order, without leakages onto the surrounding area. Daily trough cleaning is recommended in even the smallest feedlot to prevent coccidiosis; this is a severe risk in feedlots with poor hygiene.
- Grass can sometimes grow around waterers that leak and these plants should be removed as they would have high numbers of worm larvae.
- The ration must not include cut pasture that has had goats, sheep, alpacas and ideally cattle, grazing it.

Feedlotting can also reduce the spread of Johne's disease, which occurs in some dairy goat herds.

It can also protect against dog attacks and paralysis ticks, which are also common problems in goats kept in peri-urban areas.

## Breed and feed for resistance and resilience

### Use worm-resistant bucks for breeding

Genetic selection can be used to increase the resistance of goats to worms.

To increase the genetic resistance of your herd to worms use bucks with better than average worm resistance as measured by Estimated Breeding Values (EBV) for worm egg count (WEC) in [KIDPLAN](#). Research has shown that progress will be made, but may be slower than for sheep.

Resilience is independent of worm resistance so must be selected separately by choosing better production performance such as growth, fat and eye muscle depth.

### What is the difference between resistance and resilience?

#### *Resistance to worms*

Goats that are resistant to worms have lower worm egg counts by reducing worm development and growth, and the rate of egg production of the female worms established in the gut. Reduced larval establishment and expulsion of adult worms are not often observed in goats.

#### *Resilience to worms*

Goats that are resilient to worms can grow and produce successfully, despite being infected. It is independent of worm resistance and therefore unrelated to worm egg count. When comparing two animals with similar EBVs for growth, a more resilient animal will perform better than a less resilient animal when both have high worm burdens.

#### *Drench resistance*

Drench resistance is the ability of a worm to resist the effects of a drench. Drench resistance is a genetic characteristic of the worm and differs from an animal's resilience and resistance to worms. Worms can be resistant to more than one group of drench.

#### *Scouring*

The propensity to scour has a substantial genetic component that is independent of both resistance and resilience to worms. Only fibre goats will show dags, but meat and dairy goats can display soiling of their hindquarters and under their tails, but these effects do not last long. Dag as an indication of scouring is not available as an EBV for goats.

Coccidiosis also causes scouring. It is more common in young animals, and under intensive conditions with build-up of manure and moist conditions. It often occurs after management events that cause stress (such as transport), and goats of all ages can be affected and produce scours.

### How can a buck be selected for worm resistance?

1. Choose bucks from studs that provide EBVs for worm egg counts (WEC EBV).
  - Raw WEC values alone are not reliable enough to use in selection as they do not account for environmental differences or pedigree data (which are included in WEC EBVs).
2. Ensure that selection for worm resistance is balanced with other performance traits.
  - Select better than average WEC by choosing the more negative values.
  - At the same time, select better than average EBVs for performance traits (e.g. growth) that are important to you. A compromise regarding the various traits will be required.
3. Note: when extra traits are included in a selection program, the progress that can be made with each individual trait may decrease slightly, however progress with your breeding objective can still be high.
4. Choose the WEC EBV age that corresponds to the time of most worm-challenge on your property, e.g. weaning (WWEC), post-weaning (PWEC), yearling (YWEC).

### What are Estimated Breeding Values (EBV)?

EBVs are an estimate of an animal's genetic merit rather than its visual or phenotypic merit. The effects of factors such as birth type, dam age, nutrition and management are removed to reveal an animal's genetic breeding value: what can be passed onto its progeny. EBVs are calculated and reported by Sheep Genetics, the national genetic analysis service for the sheep and goat industry. Buck breeders who are members of [KIDPLAN](#) will have WEC EBVs available for their goats if they are measuring WEC.



More detailed information on using Estimated Breeding Values to select for worm resistance—note that this article is on Australian Sheep Breeding Values, but the principles are the same for goat EBVs.

### **FAMACHA<sup>®</sup> Scores**

If you are regularly recording individual goat [FAMACHA<sup>®</sup>](#) scores as part of your barber's pole worm management, then it is possible to select for low FAMACHA scores and this is a method of selecting for resilience and resistance. Breed from animals with consistently low FAMACHA scores (i.e. deep pink to red colour of the mucous membranes of the lower inner eyelid) and these animals may require fewer drenches. Cull animals with consistently high FAMACHA scores.

### **Feed for resilience and resistance to worms**

Young growing animals in their first year, and does during late pregnancy and early lactation are most susceptible to worms and have increased requirements for protein and energy. Protein is most important for regulating the resistance of goats to infection, but both protein and energy are equally important for improving resilience to infection.

To provide an [adequate diet](#), ensure that

- Young animals and kidding does have sufficient pasture (at least 1,000 (3 cm) –1,500 (5 cm) kg green pasture dry matter per hectare; more for higher production) or browse
  - ♦ Late pregnant and lactating does have a 2.5–3.0 fold increase in nutritional requirements.
  - ♦ Does need to be in the optimum body condition (CS 3.0 or slightly better) at kidding.
  - ♦ Weaners need to be at least 40% of adult body weight going into winter.
- Pasture quality is improved by the inclusion of legumes, improving soil fertility and grazing management.
- Include browse wherever possible.
- Energy-rich supplements such as cereal grains, lupins or oilseeds or (less effectively) hays and silages, will boost nutrition.
- Goats of any age in poor body condition are very susceptible to worms.

[More information on body condition scoring.](#)

## When to check and when to drench

### What signs to assess and when

Where worm egg count is not used, there are three indicators that animals can be affected by worms; these reflect different worm types:

Sign to assess	Worms assessed
Body condition score (BCS)	scour worms and to some extent, barber's pole worm
FAMACHA <sup>®</sup> score	barber's pole worm
Scouring (faecal consistency score)	scour worms

Depending on your location, you may need to assess for either or both barber's pole worm or scour worms. See the "Which worms are covered in this region" section.

Unfortunately, unlike worm egg count, these indicators are not specific for worms and changes in them can be caused by other conditions. For this reason, worm egg counting is considered the preferred means for assessing worm infection in goats, but this program acknowledges that WormTests may not be easily conducted by smallholders.

### Body condition score

Assess monthly.

This involves assessing the amount of fat covering the short ribs and backbone in the loin area and monitoring how this is changing over time. As the animal becomes fatter, the spines of the vertebrae and the edges of the short ribs become less prominent and the muscle that lies on top of the short ribs (the backstrap) and associated fat become larger.

#### More information on how to condition score goats:

- **Assessment skills for goat meat marketing**  
<http://agriculture.vic.gov.au/agriculture/livestock/goats/marketing/assessment-skills-for-goat-meat-marketing>
- **Video: Body Condition Scores in Goats**  
<http://www.youtube.com/watch?v=a2ppHAUblYY>
- **Video: Dairy Goat Body Condition Scoring**  
<https://www.youtube.com/watch?v=FC0u1j06y5Y>

### FAMACHA<sup>®</sup> score

Assess weekly during periods of high barber's pole worm risk and monthly during periods of low risk.

There is a well-established process to check for anaemia called the FAMACHA system, in which you assess the colour of the mucus membranes inside of the lower eyelid (conjunctiva) and compare it to colours on a FAMACHA card. The colour of the conjunctiva reflects the amount of red blood cells in the animal.

The FAMACHA system uses a card with 5 blocks of colour: 1 is a red, 2 is a red-pink, 3 is a pink, 4 is pink-white and 5 is white. Scores of 1–2 are recorded from healthy goats and 4–5 from goats suffering anaemia.

To check the eye colour, press gently directly onto the closed upper eyelid, pressing the eye into the socket just a little, while pulling down on the skin of the lower lid (the video listed below provides a good demonstration of how to do this). The pressure on the eye is not painful, and will help to cause the conjunctiva to bulge at the bottom. The nictitating membrane or third eyelid may also come out from the inside corner of the eye and spread across the eye, this should not be scored as it is generally paler.

The card is held close to the conjunctiva and the colours on the card are compared to the conjunctiva. The score that most closely matches the colour of the conjunctiva is chosen.

#### More information on FAMACHA score in goats:

- **Why and How To Do FAMACHA<sup>®</sup> Scoring, published by University of Rhode Island.**  
[http://web.uri.edu/sheepngoat/files/FAMACHA-Scoring\\_Final2.pdf](http://web.uri.edu/sheepngoat/files/FAMACHA-Scoring_Final2.pdf)

- Video: Why and how to do FAMACHA Scoring by Anne Zajac, Virginia-Maryland College of Veterinary Medicine, published by University of Rhode Island. <https://www.youtube.com/watch?v=I5rcuvVG56Q&feature=youtu.be>

## Scouring

Assess weekly for watery scours.

This involves assessing the [consistency of the goat's faeces](#) and monitoring whether this is changing over time. The faeces can be dry, firm pellets (score 1), through to soft, watery diarrhoea (score 3.5).

Care needs to be taken because diarrhoea (high faecal consistency scores) can result from causes other than worms. Lush, green pasture will cause the faeces to become softer or watery. [Coccidia](#), an intestinal parasite, will also cause diarrhoea, but the faeces generally also has a foul smell, may contain blood and the animal will appear hunched up due to abdominal pain.

Diarrhoea is not a reliable indicator of worm infection and not recommended as an indicator to assess worms because it can result from causes other than worms. For example, lush, green pasture will cause the faeces to become softer or watery. Coccidiosis, an intestinal parasite, will also cause diarrhoea, but the faeces generally also have a foul smell, may contain blood and the animal will appear hunched up due to abdominal pain.



**Figure 1. Watery scours indicate a drench is warranted.**

Note that if a goat with watery scours does not respond after drenching, there may be some other cause of scouring or the drench is ineffective. Such scouring can be likely soon after a change of diet to very lush green feed, if such a diet change has not occurred consult your veterinarian as it could be a sign of coccidiosis.

## When to drench

After assessing body condition score, FAMACHA and scouring as indicators of likely worm infection, use this information to decide the need for drenching in the following way.

Drench

All goats that have one of more of:

- Body Condition Score of 2 or less (poor condition)
- FAMACHA score of 4 or 5 (pale and anaemic)
- [Faecal consistency score](#) of 3.5 (watery diarrhoea)

Kids, young goats from weaning to 18 months of age, bucks or does during late pregnancy and lactation that have one of these:

- Body Condition Score of 2.5 or less (moderate to poor condition)
- FAMACHA score of 3 (moderate anaemia)

## Managing drench resistance

Never assume that a drench treatment will completely kill worms in your goats. Drench resistance is a result of worms having genes that enable them to survive treatment. It is likely that these genes were present in some worms before a drench was ever used. Drench resistance is now very common and in many cases severe for some drench groups, making testing for drench effectiveness a vital component of a worm control program.

Drench groups are the 'chemical families' of drenches and some groups contain a number of drench actives. For example the Benzimidazole group has the following actives: fenbendazole, oxfendazole, albendazole. When resistance is present for one of these actives, it is likely present for all other actives within the same group.

Selection for drench resistance happens when worms in the goat are exposed to a drench. Initially, there may be very few worms that survive the treatment (perhaps as few as 1 in 100,000) but these resistant worms lay eggs and their offspring constitute an increasing proportion of the worm population. In this way each treatment causes an increase in drench resistance because only resistant worms survive to reproduce.

Resistance may develop faster with more drenching and use of persistent products. Drench resistance is unlikely to be reversible, so not using a drench for a while will not permanently result in the worm population becoming susceptible again. While ever drenches are being used, drench resistance cannot be prevented, but the rate at which it occurs can be greatly reduced.

The first step is to know what drenches are effective on your property.

### How can the effectiveness of drenches be tested?

Each property has its own drench-resistance profile based on its own drenching history and that of properties from which the goats were sourced. The profile of neighbouring properties can be quite different.

The extent of resistance is only known by testing. Obvious worm control failures may only occur when resistance is quite advanced.

- A *DrenchTest* is the most accurate test for drench resistance.  
**However, these are rarely a practical option for smallholders.**
- A *DrenchCheck* is used to check individual drenches at any time and where a *DrenchTest* is not practical because of small herd size. This is a guide only to drench efficacy and resistance and is best used to monitor drenches between the times that full resistance tests (*DrenchTests*) are performed.

### The DrenchCheck

This simple and inexpensive test gives an indication of drench effectiveness and whether it should be properly investigated using a *DrenchTest*.

The *DrenchCheck* involves two *WormTests* with larval differentiation

- The first up to 10 days before drenching (usually at a routine *WormTest* time).
- The second at 14 days after the drench. The second *WormTest* should be based on individual samples and not the Bulk Collection Method.

The results from the two *WormTests* are compared to gauge the extent that worm egg counts (sometimes based on the larval differentiations) have been reduced by the drench. Discuss the results with a worm control advisor.

See ['Checking for drench resistance with a DrenchCheck'](#)

### How can drench-resistant worms be kept out of your property?

Keeping other people's drench-resistant worms out of your property is part of sustainable worm control.

Assume that purchased goats are carrying worms with some degree of drench resistance to one or more [drench groups](#).

1. 'Quarantine' drench all goats (including bucks) new to the property.
  - Discuss with your veterinarian which drench groups and how many can be used, their dose rates and withholding periods, including those drench groups not registered for use in goats, but which can be used with an off-label veterinarian's prescription. The quarantine treatment should ideally consist of:
    - ♦ Meat and fibre goats: four drench groups are recommended, preferably including one from the most recently available products.

- ♦ Dairy goats whose milk will be for human consumption: the number of registered drench actives is limited to two (fenbendazole and abamectin).
  - Do not mix different drenches unless the label states you can or under veterinary advice, as different products may be incompatible. Otherwise, use drench products concurrently—up the race with one product, then up the race again with the next.
2. Quarantine the goats after treatment.
    - Hold the sheep in quarantine in yards (small mobs) or a secure paddock (larger mobs) for 1–3 days (1 day if feed is green, high quality, 3 if it is dry, low quality) to allow worm eggs present at the time of drenching to pass out of the gut.
    - Provide adequate feed and water.
    - Keep this paddock free from goats, sheep or alpacas for at least 3 months in summer or 6 months in cooler months.

**When using anthelmintic products in goats, a veterinary prescription is often required because:**

- Goats require a different dose rate and withholding period than specified on most products, even for many registered goat drenches.
- Most sheep drenches are useful, but not registered for use in goats.

**While cattle drenches can be used at the label rates on goats in South Australia and sheep drenches on goats in Victoria, a veterinary prescription is still required for dose rates recommended for goats.**

## How can the development of drench resistance be slowed?

### Choosing drenches

Use all 3 principles where possible.

They are equally important and greatly slow the development of drench resistance.

1. Use drenches most effective on your property. Drenches that reduce worm egg count by at least 98% are preferred. The more effective a drench is the fewer drench-resistant worms will remain in the animals after treatment. If drench effectiveness is unknown, conduct a [DrenchCheck](#) after drenching.
2. Use an effective combination of two or more drench groups, either in a multi-active product or using more than one product concurrently (up the race with one and then the other) to combine different drench groups. The higher the efficacy of each drench group and the more drench groups included in the combination, the greater the benefit for slowing drench resistance. The chance of a worm being resistant to all active ingredients in a combination is much lower than for each individual active on its own. For goats, be aware of what drench groups are registered or permissible with a veterinarian's prescription.
3. Use short-acting treatments and restrict the use of persistent products for specific purposes and high worm-risk times of year. Persistent products provide a long time during which ingested resistant larvae can survive and reproduce. There is little need to use mid-length or long-acting treatments if animals are being moved to low worm-risk paddocks.

A small benefit can be gained by rotating drench groups providing you also rotationally graze stock across the property so that paddocks are exposed to sheep that have received different drenches. However, if you set-stock, drench rotation will not slow the development of drench resistance.

While not affecting resistance, it is essential to choose a drench with an appropriate [withholding period \(WHP\)](#) and [export slaughter interval \(ESI\)](#) according to the time left before the animals may go to slaughter, or their milk may be used for human consumption.

[Search for drenches](#) based on the worms or other parasites targeted, drench group or active and product name.

### Using drenches

Follow all 5 principles where possible:

1. Avoid unnecessary drenching, especially
  - during droughts or prolonged dry periods
  - immediately before or after moving goats onto very clean, low worm-risk paddocks (such as ungrazed cereal stubbles or paddocks that have been free from sheep or goats for extended periods). See points i) and ii) below for further discussion on this.
  - adult dry goats with low worm egg counts (refer to the Drench Decision Guide) or if WormTests are not practical then adult dry goats showing no clinical signs of worms based on eye mucous membrane colour (FAMACHA©) and adequate Body Condition Scores.

2. Calibrate drench guns to ensure the correct dose is delivered.
3. Calculate the dose based on the heaviest animals in the mob. Split mobs for drenching if there is a large weight range, so that heavy animals are not underdosed, and light animals are not overdosed.
4. Follow the label instructions to ensure correct dose and use of treatments.
5. After animals have been drenched, graze them initially on paddocks already contaminated with worms, not on paddocks that are being specifically prepared as low worm-risk. Eggs deposited on pasture from surviving drench-resistant worms in the animals will be diluted by eggs and larvae already on the paddock (these should be susceptible, or at least, less drench resistant).

If animals must be drenched onto low worm-risk paddocks, such as kidding, weaning or winter weaner paddocks, do both of the following:

- I. When the goats eventually leave these low worm-risk paddocks, treat them with an effective drench that is from a different group to the drench used when the goats first went onto the paddock. The aim is to remove any drench-resistant worms surviving in the sheep after the first drench.
- II. Ensure that the next time the paddock is grazed it is with a different mob of goats. This second mob should have a moderate to high worm burden and their last treatment must be different from the treatment used on the first mob that grazed the low worm-risk paddock. This will dilute drench-resistant worms already on the paddock with more susceptible worms that the second mob is carrying. Note that grazing with cattle will not dilute the proportion of drench-resistant worms, but they will decrease the total number of worm larvae on this paddock.

### Using Barbevax<sup>®</sup> vaccine for barber's pole worm

The use of [Barbevax](#) should slow the rate of development of drench resistance because fewer drenches will be used. It is unlikely that [barber's pole worm](#) will develop resistance to this vaccination.

Note: This vaccine is only recommended in districts where barber's pole worm is a high risk for some months of the year. For more details see the [Barbevax vaccination program](#).

### How can persistent treatments be used effectively?

Note: There is no research to confirm the length of protection for goats provided by persistent products. It is well reported that, in relation to sheep, goats are able to more rapidly metabolise drenches and are less fat. Both of these features will reduce the exposure of worms to drench actives and likely shorten the length of protection provided by the persistent product.

Effective persistent treatments kill immature and adult worms at the time of treatment, as well as infective larvae eaten by animals (with pasture) during the period of protection of the treatment—for sheep, about 3 months for long-acting and 1–6 weeks for mid-length treatments (depending on the particular product).

Both may increase selection for resistance to the actives in those treatments for two reasons. Firstly, worms are exposed to the active ingredient for longer. This favours surviving resistant worms, which then reproduce. Secondly, some persistent treatments have a period at the end of their protection period where the active concentration drops to a level where partly resistant worms may survive and reproduce.

The most commonly used persistent drenches contain the actives moxidectin or closantel. Some moxidectin and closantel products have a “Do Not Use” statement preventing use in animals that may be used to produce milk for human consumption.

Cattle pour-on or injectable products, or horse paste tubes should not be used on goats.

### Use primer and exit drenches with long-acting treatments

Primer drenches clear the animal of any worms that are resistant to the long-acting treatment. A primer drench is an effective short-acting drench (preferably a combination) that does not include the same group as the long-acting product. Give a primer at the same time that a long-acting product is given.

Exit drenches are used two weeks after the end of the actual protection period. By this time the persistent treatment has declined to very low levels. The exit drench kills larvae that have survived the persistent treatment and developed into breeding adult worms. Another name for the exit drench is a ‘tail-cutter’.

An exit drench (like the primer drench) is an effective short-acting treatment (preferably a combination) that is from a different group/s to the persistent product.

### Mid-length treatments need exit drenches

Resistance can develop to mid-length treatments in the same way as to long-acting treatments. While primer and exit drenches are desirable with mid-length treatments, they are rarely cost-effective because of the relatively short protection period compared to long-acting products. However, the use of an exit drench is highly recommended two weeks after the end of the protection period stated on the label.

### Check the persistence of a product

The effectiveness of the persistent product on your property will be shown by the length of the protection period actually achieved (rather than what is claimed on the product label). Where the persistent product contains an active/s available in other products as a short-acting formulation (e.g. albendazole and abamectin) or with mid-length activity (e.g. moxidectin) then a DrenchTest can simply include these drenches rather than the persistent products.

The schedule to test the length of protection provided by persistent products on your property depends on if you know the efficacy of the drench active.

Where the DrenchTest results indicate that the active/s are effective on your property (i.e. reduced worm egg count by at least 98%) then conduct a WormTest at 30, 60 and 90 days after treatment. If it is shown to be ineffective at the earlier test, then the later tests will be of no value.

If you do not have current DrenchTest results you should do a WormTest at 10, 30, 60 and 90 days after treatment. If it is shown to be ineffective at one of the earlier tests, then the later test/s will be of no value.

When you send the samples, request a larval culture if there is a positive worm egg count because

- resistance may only be present in one worm species
- if moxidectin was used, the protection period against different worm species differs
- if closantel was used, it is a narrow spectrum drench, only for barber's pole worm.

Note: Neither moxidectin nor closantel are registered for use in goats (see above for veterinary prescription).

If the treatment was fully effective, and you used a primer and exit drench, the product will probably have a similar length of effectiveness at the next use. However, it is best to check the effectiveness of long-acting products every year they are used by doing a WormTest at 30 and 60 days.

If a WormTest shows worm eggs are present before the end of the claimed protection period, drench resistance is likely. You should:

1. Immediately drench the animals with an exit drench (as described earlier), keep them in their current paddock for a further 3–4 days (while most eggs pass in the dung), then move them to another paddock. This will stop more drench-resistant worm eggs from contaminating the pasture.
2. Spell the pasture for at least 2 months to allow many of the drench resistant larvae to die. The next animals to graze this paddock should have a moderate worm burden, with their last treatment not being from the same drench group as the long-acting product. This will help to dilute the resistant-worm eggs already on the pasture.
3. Seek veterinary advice.

At any time that you are concerned that a mid-length or long-acting treatment is not providing protection, WormTest immediately and seek veterinary advice regarding drench resistance.

## Appendix A: Liver fluke control

Liver fluke (*Fasciola hepatica*) only occurs where the intermediate host (the freshwater snails: *Austropeplea (Lymnaea) tomentosa* and in warmer areas, *Pseudosuccinia (Lymnaea) columella*) are present. These snails are found where there are slow-moving creeks, swamps, springs or shallow irrigation channels and they can survive in mud when water flow temporarily stops. However, the snail is not necessarily present in all such areas.

Liver fluke may not be present on all paddocks or properties in a 'flukey' locality.

Roundworms are often specific to one type of animal, but liver fluke can infect many species including cattle, sheep, goats, alpacas and horses, as well as humans and wild animals.

### Prevention

Grazing management can help prevent liver fluke infection. Unfortunately, there is currently no effective method to breed for host resistance to liver fluke.

If liver fluke is present on a property, infection can be prevented or minimised by:

- fencing the areas that harbour the snail, to keep stock out
- conducting earthworks to deepen shallow water, or to improve drainage
- repairing broken pipes and troughs that have resulted in permanent wet areas
- avoiding grazing of snail-infested areas by the most susceptible animals (sheep, goats, alpacas and young cattle)

### Detection

Testing for liver fluke can be done using the dung samples sent for a WormTest. A fluke test, which uses a different method to that used for roundworms, must be specifically requested.

If you don't know whether your stock are infected with liver fluke, test three times a year (autumn, winter and summer) for at least two years (i.e. 6 tests).

Testing will show whether liver fluke is present and to what extent.

You can also determine which paddocks are affected by testing mobs that have only been run in a particular paddock since the last fluke-treatment.

If fluke egg counts for a particular paddock are frequently high (greater than 25–50 eggs per gram), there may be significant production losses. Reconsider your grazing strategies for the affected paddocks and see if fluke-affected areas can be fenced off.

If results at the three testing times are not always positive, then continue testing at the specified times to decide whether to drench.

If all six tests have been negative and the livers of dead or slaughter animals have not shown any signs of liver fluke, it is likely that the lymnaeid snails are not present on your property to act as a host for liver fluke. In this case, drenching for fluke will not be required (except to remove fluke from animals brought onto the property).

A blood test (antibody [ELISA] test) is also available from various laboratories, for example, the [NSW Department of Primary Industries State Veterinary Laboratory](#) at Menangle. Also, a faecal antigen test for fluke is available through [Charles Sturt University's Veterinary Diagnostic Laboratory](#).

### Response

Any positive fluke egg count is significant and indicates treatment is needed.

If testing for two years confirms that stock are infected at all test times, then ongoing testing can be stopped. In this case, three routine treatments for liver fluke should be given to stock that have been grazing the affected paddocks in:

- April–May
- August–September
- February

Some treatments for roundworms (scour worms and barber's pole worms) will control various stages of liver fluke. Check the label as some are only effective against mature fluke (see Table 1.).



The most important treatment is carried out in April–May and should be based on the flukicide, triclabendazole, which is effective against all stages of the fluke found in the stock. If treatments are also required in August–September and/or February, one or both of these treatments should be a flukicide other than triclabendazole (if this was used in April). This treatment rotation will reduce the rate of development of fluke resistant to triclabendazole.

When bringing in stock from another property, consider including a fluke treatment in the quarantine drench if their fluke status is unknown. Bear in mind that adult liver fluke can live for several years inside host animals (see Table 1).

Table A1. Fluke treatments and the age of fluke from which they are effective

Active	Age of fluke killed
Triclabendazole	All stages
Albendazole	From 12 weeks
Closantel	From 8 weeks
Closantel plus oxfendazole*	From 6 weeks
Closantel plus albendazole*	From 8 weeks
Oxyclozanide plus levamisole	From 12 weeks

Source: from Liver fluke disease in sheep and cattle, by J Boray (March 2007) NSW DPI Primefact 446

\*No commercial products with this combination are currently available.  
Note: only triclabendazole and albendazole are registered for use in goats.

**When using anthelmintic products in goats, a veterinary prescription is often required because:**

- Goats require a different dose rate and withholding period than specified on most products, even for many registered goat drenches.
- Most sheep drenches are useful, but not registered for use in goats.

While cattle drenches can be used at the label rates on goats in South Australia and sheep drenches on goats in Victoria, a veterinary prescription is still required for dose rates recommended for goats.

Table A2. Anthelmintics registered and commercially available for liver fluke control in goats.

Drench group	Brand name	Active	Company	WHP meat (days)	ESI (days)
BZ*	Alben	Albendazole (19 g/l)	Virbac	10	10
BZ*	WSD Albendazole	Albendazole (19 g/l)	WSD	10	10
BZ*	Beezed	Albendazole (19 g/l)	Landmark	10	10
BZ*	Valbazen	Albendazole (19 g/l)	Coopers	10	10
BZ*†	Flukare C	Triclabendazole (120 g/l)	Virbac	21	not set

\*MILK: DO NOT USE in lactating animals where milk or milk products may be used for human consumption.

†DO NOT USE less than 21 days before calving, lambing or kidding in cows, ewes or does where milk or milk products from treated animals may be used for human consumption.

Where TRICLABENDAZOLE is accidentally given within this period or cows, ewes or does calve, lamb or kid earlier than 21 days after treatment, milk will contain residues. This milk must not be used for human consumption, or supplied for processing for at least 21 days following treatment. Calves fed this milk should not be slaughtered for human consumption within 10 days. Lambs or kids fed this milk should not be slaughtered for human consumption within 7 days.

Some BZ drenches containing albendazole are used at slightly increased dose rates to control liver fluke. Dose rates are displayed clearly on the product label.

The following drench actives do not control liver fluke:

- moxidectin, abamectin or ivermectin
- oxfendazole and fenbendazole
- levamisole
- naphthalophos and pyraclofos
- monepantel
- derquantel
- praziquantel

## Resistance to flukicides

Resistance has developed to various flukicides. Rotate between flukicides from different chemical groups, beginning with triclabendazole for the April–May treatment.

More detailed information on liver fluke can be found at the NSW DPI web site:

<http://www.dpi.nsw.gov.au/agriculture/livestock/sheep/health>

## Appendix B: Roundworm life cycle and larval survival

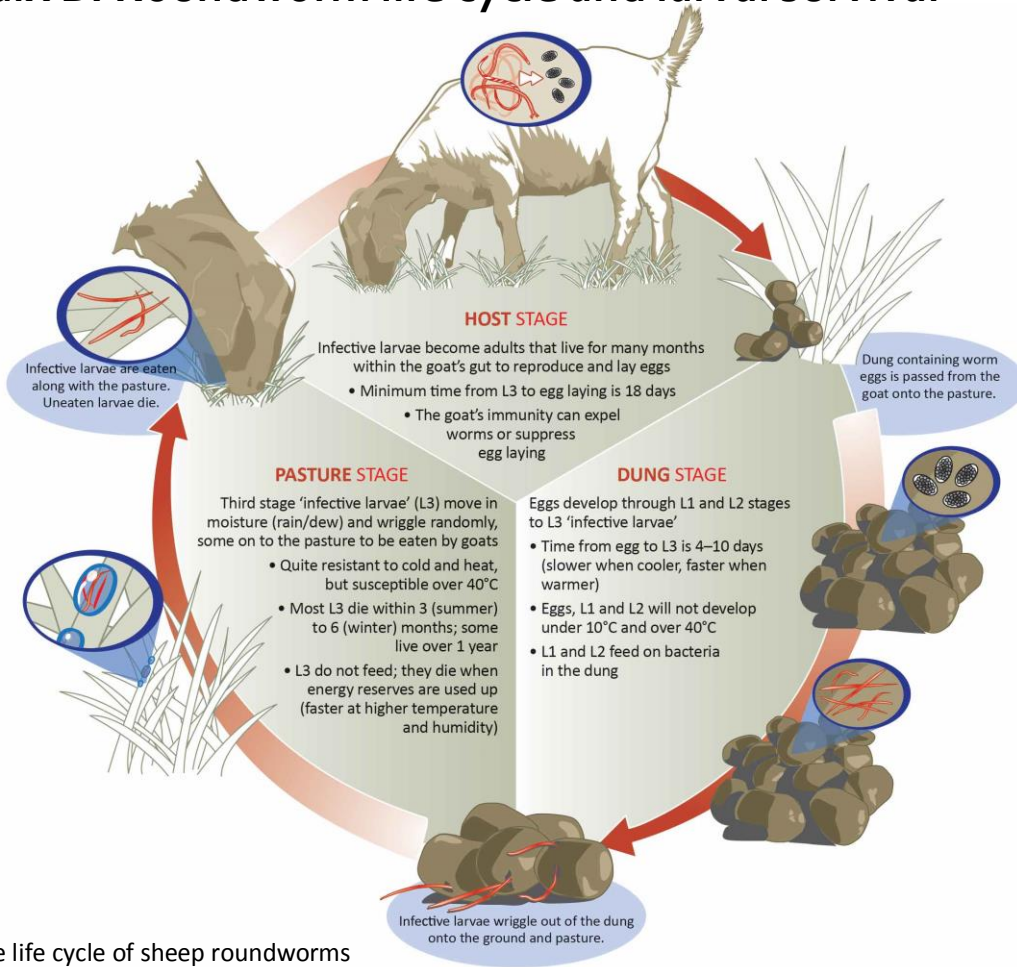
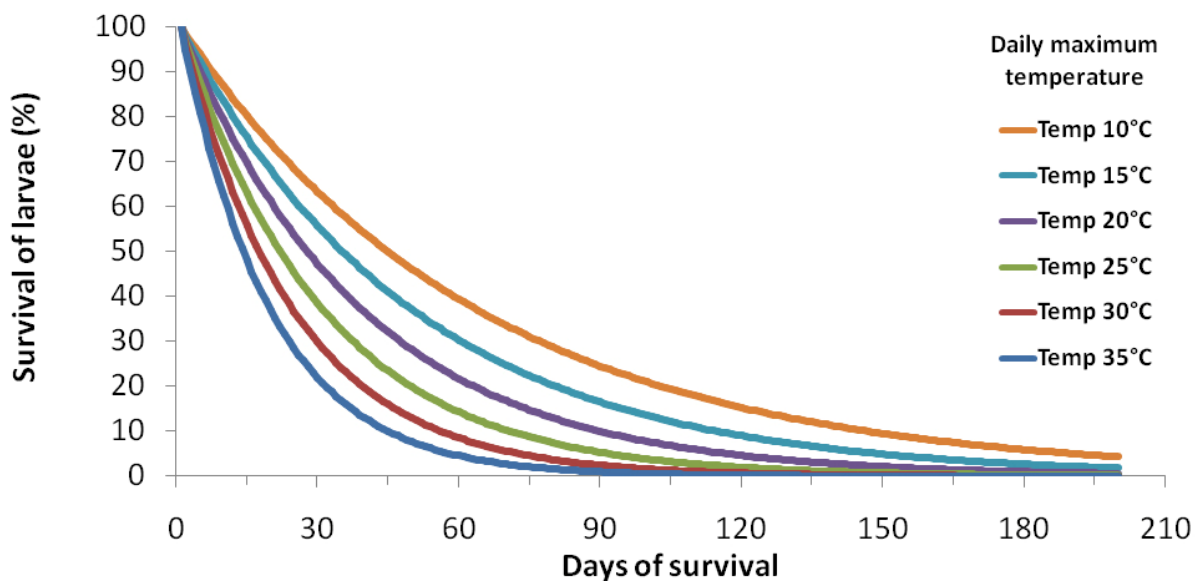


Figure B1. The life cycle of sheep roundworms

### Survival of barber's pole worm infective larvae on pasture at various daily maximum temperatures and 60% relative humidity



Source: Modeled from death rate of the L3 population in 'Simulation of pasture larval populations of *Haemonchus contortus*' by IA Barger, PR Benyon & WH Southcott. Proceedings of the Australian Society of Animal Production (1972) 9: 38

Figure B2. Survival of barber's pole worm infective larvae on pasture

## Appendix C: Factors contributing to paddock contamination with worms

**Table C1. The following table applies to brown stomach worm (*Teladorsagia circumcincta*), black scour worm (*Trichostrongylus* species) and barber's pole worm (*Haemonchus contortus*).**

Factor	Time or conditions			Effect
Minimum time before worm eggs can become infective larvae.	4–10 days			Short graze periods (less than 4 days) prevent 'auto-infection' (animals becoming infected by larvae arising from worm eggs the same mob have recently deposited onto the pasture).
Conditions required for significant numbers of worm eggs to hatch and become infective larvae.	4–10 days of: <b>Brown stomach worm</b> Temperature: daily maximum >8°C <sup>1</sup> Moisture in this time: >10–15 mm rainfall <sup>2</sup> <b>Black scour worm</b> Temperature: daily maximum >15°C for <i>T. colubriformis</i> or >12°C for <i>T. vitrinus</i> Moisture in this time: >10–15 mm rainfall <sup>3</sup> <b>Barber's pole worm</b> Temperature: daily maximum >18°C <sup>1</sup> Moisture in this time: >10–15 mm rainfall <sup>3</sup>	<b>Notes:</b> <sup>1</sup> Some hatching of worm eggs of all worm species can occur below these daily maximum levels, but this is usually at a small and insignificant rate. <sup>2</sup> Brown stomach worm eggs can develop at low rates without rainfall even in a relatively dry faecal pellet. <sup>3</sup> Development to infective larvae may occur without rainfall if soil moisture profile is high.		Unsuitable conditions prevent eggs hatching and developing into infective larvae. <b>Note:</b> The eggs of the brown stomach worm are much more tolerant of cold and dry conditions, and in general, grazing management has less effect on its control.
Maximum time worm eggs can live awaiting suitable hatching conditions.	<b>Brown stomach worm:</b> 21 days Some brown stomach worm eggs may survive for longer periods. <b>Black scour worm:</b> 16 days <b>Barber's pole worm:</b> 5 days	<b>Notes:</b> Once hatched, infective larvae of both black scour and brown stomach worm can remain in the faecal pellet until conditions are more suitable.		Prolonged periods without the right conditions (temperature/moisture) for egg development will result in the eggs dying. This lowers the worm-risk of paddocks.
The time for about 90% of the barber's pole worm infective larvae (L3s) to die (making paddocks low worm-risk).		Maximum temperature (°C)	Time for 90% larvae to die	L3 larvae do not feed. While waiting to be eaten by sheep, they wriggle randomly in drops of moisture, more so in warmer conditions. Increased activity in warm weather depletes their energy reserves faster, hastening death. In extremely hot, dry and windy conditions, the larvae dry out and die. <b>Note:</b> larvae of brown stomach worm and black scour worm can survive longer because they can remain in the faecal pellet for extended periods.
	Cold	less than 15	4 months	
	Warm	about 22	3 months	
	Hot	about 35	1.5 months	
	Very hot	more than 40	1–2 weeks	
Minimum time for infective larvae eaten by animals to mature and lay eggs (the 'pre-patent period').	Sheep: minimum of 18 days for most sheep roundworms. Goats: minimum of 14 (typically 21) days for barber's pole worm and 21 days for scour worms.			Worm larvae eaten by animals soon after an effective drench will take at least 18 days (in sheep) or 14–21 days (in goats) before they can lay eggs. During this period after administering an effective drench, animals are not re-infecting the pasture.

## Appendix D: Drench groups and actives

**Table D1. Drench groups and actives**

Drench groups and actives	Worms	Brand names (actives)
BZ or benzimidazole group ('white') <sup>B</sup> albendazole fenbendazole oxfendazole	barber's pole worm, 'scour worms', adult liver fluke, nodule worm, aids control of intestinal tapeworm ( <i>Moniezia</i> )	Alben, Valbazen, WSD Albendazole (albendazole) Beezed, Fenbender 25, Panacur 25, (fenbendazole) Beezed LV, Oxfen LV (oxfendazole)
LV or levamisole group ('clear') <sup>B</sup> morantel levamisole	barber's pole worm, 'scour worms', nodule worm	Oralject (morantel citrate) None registered (levamisole)
ML or macrocyclic lactone group <sup>B</sup> (sometimes called 'mectins') ivermectin abamectin moxidectin	barber's pole worm, 'scour worms', nodule worm	None registered (ivermectin) Caprimec (abamectin) None registered (moxidectin)
AD or amino-acetonitrile derivative group <sup>B</sup> monepantel	barber's pole worm, 'scour worms'	None registered
SI or spiroindole group <sup>M</sup> derquantel	barber's pole worm, 'scour worms', nodule worm	None registered
OP or organophosphate group <sup>M</sup> naphthalophos (NAP)	barber's pole worm, 'scour worms'	None registered (OPs have lower or variable efficacy against 'scour worms' in the upper GIT and immature barber's pole worm)
TZ or benzimidazole group (flukicide) <sup>N</sup> triclabendazole	Liver fluke (all stages); not effective against round worms	Flukare C
SA or salicylanilides/phenols group <sup>N</sup> closantel	Liver fluke (> 9 weeks and adult) and barber's pole worm	None registered
IQ or isoquinolone group <sup>N</sup> praziquantel	Intestinal tapeworm ( <i>Moniezia</i> )	None registered

\*These are all of the commercial anthelmintics registered and commercially available for goats at August 2016. In most states of Australia, sheep drenches can be used in goats with an off-label veterinary prescription.

Breadth of activity across different worm species: B—Broad-spectrum; M—Mid-spectrum; N—Narrow-spectrum

Actives: An 'active' is the chemical in a drench responsible for killing worms. Some drenches have more than one active and are called 'multi-active' or 'combination' drenches.

Combination or multi-active treatments: Proprietary treatments containing more than one active. Formulated to be compatible as a mixture. Note: Do not mix your own drenches unless the labels state that you can.

Product formulation: All single actives are available as oral drenches. Moxidectin is also available in injectable products. Moxidectin is not registered for use in goats and an off-label prescription is required from your veterinarian. Pour-on products should not be used in goats for worm control.

Length of protection: Varies from short-acting ('knock-down' that kills susceptible worms within the animal) to mid-length (1–6 weeks) and long-acting (approx. 3 months), which not only kill susceptible worms already in the animals, but also infective larvae that the goats eat during the protection period.

'Scour worms': Mainly black scour worm and (small) brown stomach worm, but also others.

Label: Check product labels for full details. Follow the label or veterinarian's instructions.

Using sheep drenches in goats: Veterinarians can prescribe sheep drenches for goats, but must provide written details of withholding periods and dose rates.

Other parasites: '[Drenches](#)' shows effectiveness of groups against other parasites of minor importance.





## Legal use of drench products

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There are strict regulations about veterinary medicines in Australia. However, veterinarians can prescribe the “off label” use of some worm drenches not registered for goats.

A veterinary prescription is required for use of most drenches for goats because

- Goats require a different dose rate and withholding period to that on the label (even on products registered for goats).
- Many drenches are not registered for use in goats.

It is particularly important that goats whose meat or milk is intended for human consumption are not treated with chemicals that could result in excess chemical residue levels in those meat or milk products.

Whilst most meat goats are run in the rangelands where drenches are infrequently used, it is the larger number of goat owners running smaller numbers of goats in the moderate to high rainfall areas that are likely to put the goat export market at risk through their misuse of drenches.

### **State legislation**

#### **Victoria**

Victorians can use products sold “over the counter” in retail stores for major species (e.g. cattle and sheep) “off label” in minor species (e.g. goats and alpacas). Under this use, the Victorian authorities specify that this should not cause chemical residues in goat products to exceed Maximum Residue Limits and that the product must not be used at a higher dose rate than stated on the label. Therefore, to use the product at a different dose rate requires a veterinary prescription.

#### **South Australia**

South Australian legislation considers goats a ‘minor trade species’ and certain cattle products can be used on them, but cattle pour-on products should not be used on goats. Use at a dose rate different from the label requires a veterinary prescription.

#### **New South Wales, Queensland, Tasmania, Western Australia, Northern Territory, Australian Capital Territory**

In all states and territories other than Victoria and South Australia, veterinary medicines, including worm drenches, must be used strictly according to the label or according to a veterinary prescription.

Prescriptions must be in writing and must include details of the product name, the dose and the withholding period. Note: your veterinarian cannot override a “Do Not Use” statement on the label, e.g. Do Not Use in goats whose milk may be used for human consumption.

Veterinarians can only issue these prescriptions if there is a true client–veterinarian relationship and the veterinarian is familiar with your farm and your farm management practices. This normally requires a visit within the last 6–12 months.

If you participate in the on-farm food safety program: the Livestock Production Assurance (LPA) program, administered by Meat & Livestock Australia, you may be audited and will need to show copies of veterinary prescriptions for any worm drenches that have been used that are not registered for use in goats or have been used at a different dose rate from that on the label.

#### **Sharing drench**

Unless you are a registered veterinarian, it is illegal to take smaller amounts of product from the original package and repackage them in other bottles or containers.

# wormboss

The WormBoss web site is the most complete and current source of information for producers, advisors and students on goat worms, drenches and worm control in Australia.

On the site you will find information and tools:

## Regional worm control plans

A step-by-step guide to controlling worms practically, effectively and profitably on your property all year round.

## Regional Drench Decision Guides

A tool to help you decide whether your goats need drenching now, and if so, what length of protection is required and when to check the goats again.

## Drenches

Lists all of the drench groups and combinations as well as actives and brand names.

## Tests and tools

'How to' guides are provided on WormTests, DrenchTests and more.

## Worms

Describes the important worm species, their lifecycle and how they affect goats.

## Subscription

Subscribe to the ParaBoss monthly e-newsletter to keep up to date on your regional worm situation and new information.

## Legal use of drenches in goats

Control of worms in goats may require the use of drenches and with few drenches registered for goats, sheep drenches may be indicated.

When using drenches not registered for goats or any drenches at different dose rates than stated on the label, a veterinary prescription is generally required.

Legislation varies between states and territories, so advice should be sought from your relevant government department or your veterinarian.

It is critical that all goat producers use drenches responsibly, not only so they are both safe and effective, but importantly to prevent goat products entering the market with residues from drenches over the Maximum Residue Limits (MRL), as this would damage the goat industry's reputation and could result in an export market being closed. Responsible use will also help to slow the development of drench resistance.

Producers in the Livestock Production Assurance scheme need to keep their veterinarian's prescriptions for drenches in case they are audited.

See inside the back cover for more information.



[www.wormboss.com.au](http://www.wormboss.com.au)