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WORM CONTROL PROGRAM

Pastoral

A regional worm control program from WormBoss

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WORMBOSS WORM CONTROL PROGRAM

Pastoral

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Acknowledgement: This program was developed by the Sheep CRC, which wishes to acknowledge the contribution of the parasitologists, veterinary officers, extension officers, consultants and organizations that developed the original programs from which the WormBoss programs have been drawn, including:

- NSW Department of Primary Industries (and FarWestWorm)
- Qld Department of Agriculture, Forestry and Fisheries (and WormBuster)
- Livestock Health and Pest Authorities, NSW (formerly Rural Lands/Pastures Protection Boards)
- The Mackinnon Project (University of Melbourne School of Veterinary Science)
- Department of Primary Industries Victoria
- South Australian Research and Development Institute
- CSIRO Division of Animal Health
- Australian Wool Innovation
- Meat and Livestock Australia

Published: June 2012
Updated: November 2015

Disclaimer: Each regional 'WormBoss worm control program' has been developed from local research results and experience proven to be relevant and successful for most farms in the region. ParaBoss acknowledges that this is not the only method of worm control in the region and more refined programs can be developed in consultation with your worm management adviser/veterinarian using information and knowledge specific to your property and sheep.

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Program summary

The WormBoss worm control program for the pastoral region has five components that are effective when used in combination. Their effectiveness is reduced when not used in an integrated way.

A summary of the components is below, (see further chapters for details).

1. Respond to unusual grazing conditions (caused by dry times, drought, floods, fire)

- Move sheep from areas where they have congregated as soon as possible and *WormTest* the mob.

2. Breed and feed for worm-resistant sheep

- Consider including the trait of worm resistance when choosing rams.
- Maintain sheep above fat or condition score 2 at all times.

3. *WormTest* at recommended times or situations

- Sheep that are showing signs that suggest a worm infection.
- Prior to weaning lambs (or at 4–6 months old if a set weaning does not occur).
- Before mustering for management events (shearing, crutching etc.).
- 6 weeks after rain that has resulted in a green pick of annual grasses and herbage.
- 4–6 weeks after sheep have been congregating on small areas.
- Each 2–3 months for sheep grazing along bore drains (especially where leakages occur) or irrigation channels with little other paddock feed.

4. Drench[1] only at recommended times

- Drench all introduced sheep with a combination of no less than 4 unrelated drench groups with at least one of these being the newest drench actives: monepantel (Zolvix®) or derquantel (with abamectin—Startect®)[2].
- At other times, use the *Drench Decision Guide* on page 6 to make drenching decisions.

5. Manage drench resistance

- Avoid unnecessary drenching.
- Conduct *DrenchCheck-Day10s* after using a drench.
- Use effective drenches and multi-active[2] combinations where possible.
- Use short-acting treatments. Reserve long-acting products for specific purposes or high worm-risk times.
- Rotate among all effective drench groups[2] for each mob (and each paddock where possible).
- Calibrate your drench guns, dose to the heaviest sheep and follow label instructions.

[1] *Drench refers to anthelmintics regardless of route of administration*
[2] *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 2: Drench groups and actives.*

This is an up-to-date, integrated regional worm control program for sheep in the pastoral regions of Australia. It particularly builds upon earlier programs including joint ventures by state departments of primary industries, district veterinarians from the Livestock Health and Pest Authorities NSW, CSIRO, and universities.

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

- fewer deaths and illness from worms
- fewer drenches
- improved productivity
- prolonged life of drenches

For more information go to the WormBoss web site: www.wormboss.com.au

Where is the Pastoral region?

This region covers the areas across Australia where sheep are run under low rainfall conditions. In central and southern areas, this is generally less than 400 mm annual rainfall, but may be much higher in the northern summer rainfall areas during a very wet season.

In these areas some sheep usually have some worms, but the hot and/or dry conditions keep them at very low numbers and sheep generally tolerate these without the need for drenching. However, under wetter or more crowded conditions worm burdens can become severe, resulting in illness and deaths.

The WormBoss Pastoral region includes these sheep production areas:

- Queensland: north and west of Mitchell, and west of the Great Dividing Range to Hughenden, then west to Julia Creek, then south including Longreach and Charleville, and just including Windorah, Eromanga and Thargomindah in the south-west.
- New South Wales: west of the following towns Goodooga, Nyngan, Lake Cargelligo, Griffith and Finley.
- Victoria: north and west of an approximate line from Swan Hill across to Kaniva.
- South Australia: north of Goyder's line to the dingo fence.

In some districts within the areas described above (as well as the low rainfall areas of Western Australia, east of the cereal zone), sheep rarely or never need treatment for worms. Low stocking rates help to reduce the worm problem, but these districts also tend to have one or a combination of the following that limits the completion of the worm's life cycle for much of the time: very seasonal rainfall, extreme heat, high evaporation rates, low humidity, and sparse pastures.

If you are new to these areas, see how much drench your local stock and station agent carries and talk to neighbours and veterinarians to find whether worm problems arise locally and adjust this program accordingly. Also, *WormTest* regularly while you build your experience in worm management. In the years with above average rainfall, many sheep have died in these areas from worms when local folklore says sheep do not get worms.

The regional boundaries are approximations only due to the seasonal variability, mostly associated with rainfall in this region.

A map of the region is shown on the next page.

What worms are covered in this program?

Roundworms

The most important roundworms in this region vary according to latitude and rainfall patterns.

In southern areas or when there is winter rainfall:

- Scour worms
  - Black scour worm — *Trichostrongylus* species
  - Small brown stomach worm — *Teladorsagia* (*Ostertagia*) *circumcincta*

In northern areas or when there is summer rainfall:

- Barber's pole worm — *Haemonchus contortus*
- Black scour worm — *Trichostrongylus* species
- Nodule worm — *Oesophagostomum columbianum*

Also important in both the north and south, but mainly for young sheep

- Thin-necked intestinal worm — *Nematodirus* species

Liver fluke

In this region liver fluke only occurs in imported sheep, except perhaps on irrigated pastures. When sheep are brought here from areas with liver fluke, include a triclabendazole drench (which is effective against all stages of liver fluke) with quarantine treatments for roundworms.

Other gastro-intestinal parasites

Gastro-intestinal parasites of minor (stomach fluke and tapeworm) or occasional (coccidia) importance are not covered in thus program.

Figure 1. The WormBoss Pastoral region.

Grazing management

In this region, grazing management is not routinely used as a preventative strategy to reduce exposure of sheep to worms as pasture contamination with worm larvae is usually low and the extensive nature of properties makes it almost impossible. However, under certain conditions, much higher levels of worm contamination on the pasture can occur, resulting in sheep being affected by worms.

These conditions are

- higher than normal rainfall, especially in successive seasons and years
- flooding causing ground to be waterlogged (resulting in worm eggs hatching despite no rainfall)
- flooding or fires causing sheep to congregate on smaller areas
- tall grass and strong winds causing sheep to congregate in corners of paddocks
- preferential grazing of green pick along the wet areas of bore drains or irrigation channels when there is little other feed in the paddock

When these conditions occur

- *WormTest* sheep (see 'When to *WormTest* and when to drench', page 6)
- move sheep from areas where they have congregated as soon as possible

Breeding and feeding for worm-resistant sheep

Breeding for resistance

Genetic selection can be used to increase a sheep's resistance to worms and can result in fewer drenches being required each year. The best way to increase the genetic resistance of your flock to worms is to use rams with better than average worm resistance.

However, in this region, breeding for worm resistance is seldom warranted. The times when drenching is required will usually be in response to rainfall resulting in infections that even the more resistant sheep in the mob cannot withstand, or in weaners that have not yet developed immunity.

Further information about breeding worm-resistant sheep can be found on the WormBoss web site: www.wormboss.com.au

Feeding for resistance

In addition to breeding, nutrition plays an important role in immunity. In this region, dry conditions are common and sheep in poor condition, especially those under 18 months old, or on poor feed or suffering from mineral deficiencies may be more vulnerable to worms. Chronic low-level worm infestations are common when pastures 'hay off' and exacerbate poor body condition.

The main problems occur when the season improves: the worms build up faster than sheep re-develop their strength and immunity, or they build to much higher levels when sheep are forced to congregate, such as along drains, or in small areas after flooding or fires. In these cases, barber's pole worm can build up explosively in susceptible sheep.

Individual sheep should not be allowed to drop below store condition (use either fat or condition score 2), even in drought. Aim for score 2.7 to 3 (forward store condition) at most times.

When to *WormTest* and when to drench

Why check worm burdens in sheep?

Checking worm burdens with a *WormTest* is essential for correct and timely drenching decisions. The result is healthy sheep, without unnecessary drenching. *WormTests* are the best basis for drenching decisions even though signs such as weight loss, a tail in the mob, pale skin and eyes, bottle-jaw and deaths may be apparent, as other diseases also show these signs. Signs occur well after production losses from worms are occurring in the mob; therefore, *WormTests* give early warning to prevent significant production losses.

Drenching based on *WormTests* is also the most cost-effective ongoing option for worm control in this region, as unnecessary drenching of large mobs is expensive in both drench and labour costs. Even in remote areas *WormTest* results should be received within a few days, so *WormTest* first if you are concerned about worms.

How are worm burdens tested?

Most *WormTests* are done through a laboratory. However, worm egg counts (but usually not larval cultures) can be done by producers if they have the equipment and skills.

What samples should be collected for *WormTests*?

Sheep do not need to be yarded for a *WormTest.* Collect fresh dung from the paddock. Obtain *WormTest* kits or sample collection details from laboratories or resellers in your area. Follow the instructions provided in the kit.

- Avoid delays in transit (when worm eggs can hatch) by collecting and posting early in the week.
- Ensure samples are kept cool, but not refrigerated, before sending. Include a frozen ice brick wrapped in newspaper with the samples when transporting in hot weather.

Which mobs and how many should have a *WormTest*?

In this region, all mobs that may need drenching should be *WormTested* separately, rather than using one mob to represent some or all other mobs. Paddock differences in this region have a significant effect on resulting worm burdens, even if the sheep are of a similar class. Also, mustering and giving an unnecessary drench is expensive.

When should *WormTests* and drenches be routinely done?

In this region drenches should not be routinely given. Always conduct a *WormTest* before drenching sheep (except when introducing sheep and in unusual cases of predicted extensive flooding, see below). Don't forget the rams.

Include a larval culture with the *WormTest* in areas or on properties with a history of barber's pole worm, or when there is higher than normal summer rainfall, or where animals show signs of anaemia (pale inside eyelids) or bottle jaw (swelling under the jaw).

Drench Decision Guide—Pastoral region

***WormTest*:**

- Sheep showing signs that suggest a worm infection
  Scour worms: dark scours (or sometimes clotted dung instead of pellets); weight loss; death.
  Barber's pole worm: anaemia (pale inside eyelids and gums); 'bottle jaw' (swelling under the jaw); lagging or collapse when mustered; death.
  Note: A *WormTest* can save an unnecessary drench if signs are from another cause, however, if severe anaemia and bottle jaw are noted, an immediate drench for barber's pole worm is usually warranted. A concurrent *WormTest* should also be carried out (take samples before drenching) to confirm the diagnosis, as similar signs may occur in this region from the blood parasite *Mycoplasma ovis* (formerly called *Eperythrozoon ovis*) and other causes.
- Prior to weaning lambs
  Lambs are the most susceptible mob on the property: if only one drench is ever needed on a property it

will be the weaning drench. If monitoring worm egg counts and productivity over a number of years shows drenching at weaning is not required on your property, only *WormTest* again at weaning if the conditions have been wetter than usual.

- Before mustering for management events
  As sheep are mustered infrequently in this region, it is good to conduct a *WormTest* before mustering for routine activities such as shearing or crutching, rather than drenching 'just in case'.
- 6 weeks after rain that has resulted in a green pick of annual grasses and herbage
  Generally, a single fall of rain won't cause a significant increase in worms in this region. However, follow up rain sufficient to allow annual grasses to germinate and persist will also favour development of worm larvae; sometimes these can increase to a serious infection within a month or two.
- 4–6 weeks after sheep have been congregating in small areas
  When sheep are restricted to smaller areas, such as when paddocks are flooded, they are forced to re-graze areas more quickly and heavier than normal. The pasture becomes more contaminated with worm eggs and if conditions have favoured egg hatching, the sheep will have higher worm infections.
- Each 2–3 months for sheep on bore drains/irrigation channels when there is little other paddock feed
  In very dry times or drought (when worms are otherwise not expected), sheep preferentially graze green pick along drains and channels. This can lead to higher levels of worm contamination along the drains, and infection and illness in the sheep, compounded by the generally poorer condition of the sheep in these times.
- November/December and February in north-west Victoria and the western Riverina
  In years when winter and spring have been much wetter than usual check whether a first summer drench (November/December) and/or second summer drench (February) could be required. Under these conditions, consider a *WormTest* when the pasture is haying off and again in February.
- In southern Queensland, if autumn and winter were wet and the spring and summer is wet or likely to be wet, *WormTest each* 4–8 weeks (depending on the amount of rainfall) until the season dries out.

Drench with a short-acting drench if:

- This is a new mob (or rams) being introduced to the property
  Use the guidelines presented on page 9, 'How can drench-resistant worms be kept out of your property?' Sheep coming from properties with liver fluke should also be treated with triclabendazole.
- Predicted extensive flooding is expected to isolate and restrict sheep for some weeks
  Drench (without a prior *WormTest*) prior to the flood arrival. Consider a long-acting product only if sheep are likely to be isolated for more than 6 weeks and they are in a summer rainfall area and ground conditions are wet. Also consider a fly preventative treatment and then move sheep to higher paddocks.
- The mob's *WormTest* result is equal to or above the threshold figures in the table below for the class of sheep and the type of *WormTest* result.

Table 1. Threshold worm egg counts at and above which sheep should be drenched in the Pastoral region

Class of sheep	No culture or culture has less than 60% barber's pole (i.e. mostly scour worms)	Culture has more than 60% barber's pole
Ewes (dry to mid-pregnancy) or wethers	400 epg	800 epg
Ewes pre-lambing	300 epg	300 epg
Sheep under 18 months or rams	300 epg	500 epg

When choosing the drench to use, refer to the next section in this program: 'Managing drench resistance'.

For nodule worm, use a drench containing either a benzimidazole (BZ) or a macrocyclic lactone (ML) group.

The WormBoss website has a section on drenches where you can search on drench names, drench groups, or the parasite you wish to target. www.wormboss.com.au/drenches

Managing drench resistance

Summary

1. Give all introduced sheep (including rams) a quarantine drench (page 9).
2. Avoid unnecessarily drenching sheep when conditions are very dry or in droughts.
3. When a drench is used, follow the guidelines on choosing and using drenches (pages 9 and 10).
4. *DrenchTests* will rarely be feasible in this region. If a drench is warranted, consider a *DrenchCheck-Day10* to check the effectiveness of that drench (page 8).

Why manage drench resistance?

Drench resistance can occur in very dry areas and this is mainly due to:

- Importing sheep carrying drench-resistant worms from somewhere else.
- Drenching at a time when it is very dry and there are no worm larvae on the pasture to dilute the progeny of resistant worms surviving the drench.

Selection for drench resistance happens when worms in a sheep are exposed to a drench. Some worms can survive a drench group because they have genes conferring resistance to that group. This may initially be just one worm in 100,000 or even 1,000,000 worms. Some worms may be partly drench-resistant: they can survive lower (sub-lethal), but not full doses of the treatment.

Worms that survive treatment produce eggs that give rise to infective larvae on a pasture. These are eaten by sheep and so the worm life cycle continues. In this way, each treatment causes an increase in the proportion of the worm population that is either partly or fully drench-resistant.

If resistance to a drench group is already present, it will likely remain, even if the drench group is not used for years. Drench resistance probably 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 sheep 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. In this region, a *DrenchCheck-Day10* is the preferred method to check individual drenches at any time. *DrenchCheck-Day10s* should be considered when any drench is given and it is the most practical and cost-effective method of testing drenches in this region.

While a *DrenchTest* or Worm Egg Count Reduction Test (WECRT) is the most accurate test for drench resistance, this test is rarely feasible in this region as infections are often not high enough and when they are, they may be unexpectedly high and need swift treatment or are in lambs at weaning, which should not be put at risk in a *DrenchTest*.

The *DrenchCheck-Day10*

This simple and inexpensive test gives an indication of drench effectiveness.

The *DrenchCheck-Day10* involves two *WormTests*: the first up to 10 days before drenching (usually at a routine *WormTest* time) and the second between 10 and 14 days after the drench.

The results from the two *WormTests* are compared to gauge the extent that worm egg counts have been reduced by the drench. Discuss the results with a worm control adviser.

For more detail see the fact sheet 'Checking for drench resistance with a *DrenchCheck-Day10*' on the WormBoss website (www.wormboss.com.au).

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

Keeping drench-resistant worms out of your property is part of sustainable worm control.

Assume that purchased sheep are carrying worms with some degree of drench resistance to one or more drench groups. See Appendix 2: Drench groups and actives.

1. 'Quarantine' drench all sheep new to the property (particularly if sheep or rams are from a higher rainfall district where drench resistance in more common).
    - Use a combination of no less than 4 unrelated drench groups with at least one of these being monepantel (Zolvix®) or derquantel (with abamectin—Startect®). This can be done using multi-active (combination) and/or single-active products concurrently—up the race with one product, then up the race again with the next.
    - Do not mix different drenches unless the label states you can, as different products may be incompatible.
2. Quarantine the sheep after treatment.
    - Hold the sheep in quarantine in yards (small mobs) or a secure paddock (larger mobs) for at least 3 days 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 of sheep, goats or alpacas for 3–4 months in cooler weather or 4–6 weeks when it is hot and dry (greater than 35°C during the day).
3. After quarantine, release the sheep if possible onto a paddock that is likely to be contaminated with worm larvae due to grazing by other sheep. This will 'dilute' (lower the proportion of) resistant worms surviving treatment with worm larvae already on your property.
4. If possible, *WormTest* the imported sheep 10–14 days after drenching for added confidence that treatment was successful.
5. Get expert advice on up-to-date recommendations for quarantine treatments. These will evolve as the drench resistance picture changes.

How can the development of drench resistance be slowed?

Choosing drenches

Integrate all 4 principles where possible:

1. *Use drenches most effective on your property*; ideally use those shown to reduce worm egg count by at least 98% as shown by a *DrenchCheck-Day10.* If drench effectiveness is unknown, conduct a *DrenchCheck-Day10* after drenching. The more effective a drench is, the fewer drench-resistant worms will remain in the sheep after treatment.
2. *Use a combination of two or more drench groups where possible*, as the chance of a worm being resistant to all group ingredients in the combination is much lower than for each individual group on its own.
3. *Use short-acting treatments where possible*, and restrict the use of persistent products for specific purposes and high worm-risk times of year. In this region, long-acting products are rarely warranted, and then only in summer rainfall areas and when sheep are likely to be inaccessible for extended periods.
4. *Rotate* among all effective drench groups each time a mob is drenched (and for each paddock where possible)*. An effective drench from a different group may kill worms that were resistant to the last treatment. These may be worms that survived treatment in the sheep or were picked up from the paddock.

*When rotating drenches the current drench would ideally exclude any groups that were used the previous time. However, in practice, ensure the current drench has at least one effective active from a drench group that was not used the previous time.

Using drenches

Follow all 4 principles where possible:

1. *Avoid unnecessary drenching*, especially
    a. Adults.
    b. During droughts or prolonged dry periods.
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 larger sheep are not under-dosed and smaller sheep are not excessively over-dosed.
4. *Follow the label instructions* to ensure correct dose and use of treatments (including complying with withholding periods).

Should long-acting treatments be used?

In this region, the only time a long-acting treatment should be considered is in the summer rainfall areas where there has been a history of barber's pole worm outbreaks and extensive flooding threatens to isolate and crowd sheep for a number of weeks.

Fortunately, producers often have some days notice of large floods, so in a situation where sheep are likely to be inaccessible for a month or more, the sheep can be treated with a long-acting product before being moved to a safer paddock. A fly preventative treatment is also warranted at the same time.

Do not use a long-acting drench more than once a year.

Appendix 1: Roundworm life cycle and larval survival

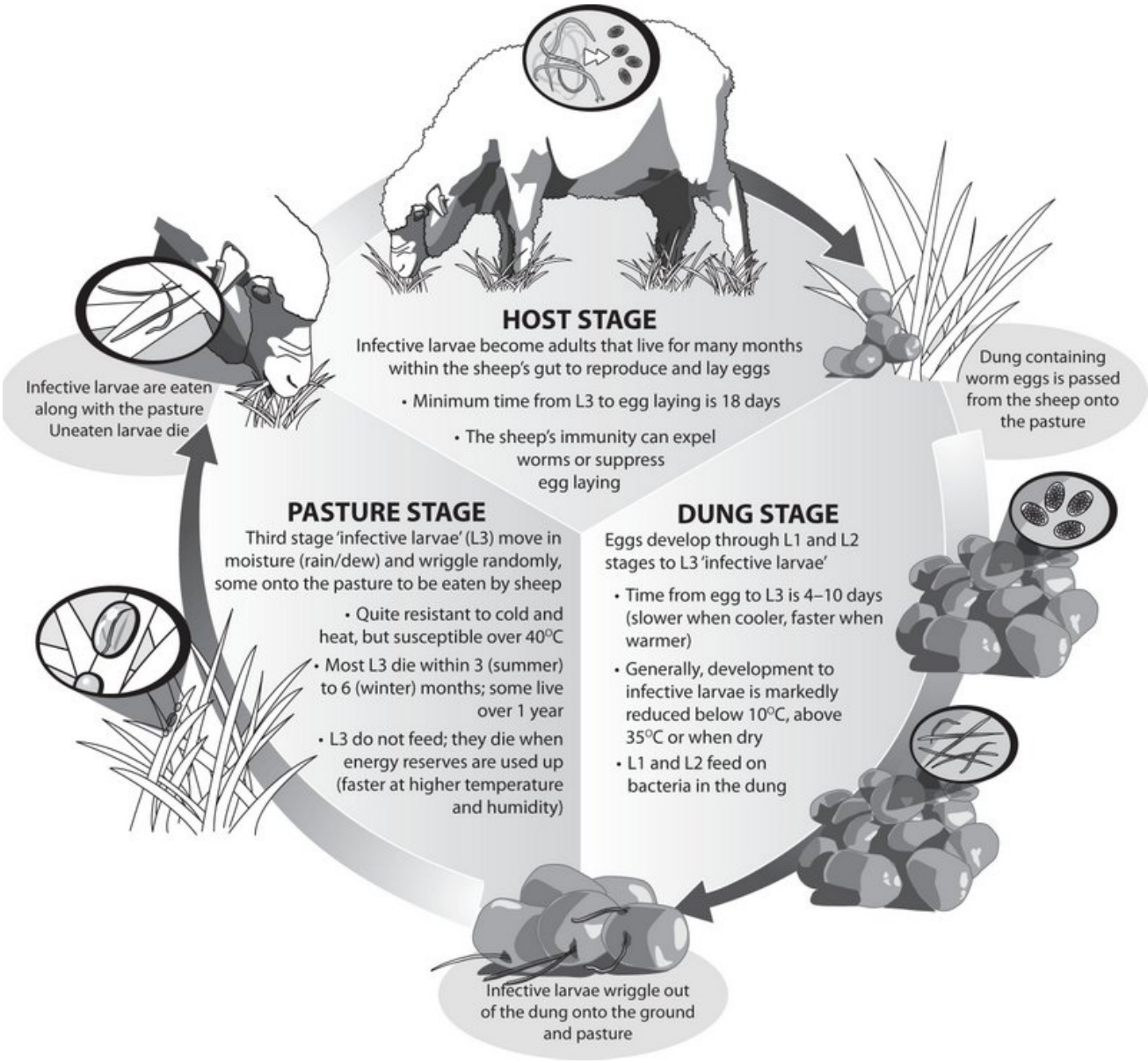

Figure 1. The life cycle of sheep roundworms

Appendix 2: Drench groups and actives

Drench groups and actives	Worms	Examples* of brand names/comments
BZ or benzimidazole group ('white')[B] albendazole fenbendazole oxfendazole	barber's pole worm, 'scour worms', adult liver fluke, nodule worm, aids control of intestinal tapeworm (*Moniezia*)	Valbazen (albendazole) WSD Fenbendazole (fenbendazole) Oxfen (oxfendazole)
LV or levamisole group ('clear')[B] levamisole	barber's pole worm, 'scour worms', nodule worm	Nilverm, Levamisole Gold
ML or macrocyclic lactone group[B] (sometimes called 'mectins') Ivermectin abamectin moxidectin	barber's pole worm, 'scour worms', nodule worm	Ivomec, Noromectin (ivermectin) Absolute, Vetmec, Paramectin (abamectin) Cydectin (moxidectin)
AD or amino-acetonitrile derivative group[B] monepantel	barber's pole worm, 'scour worms'	Zolvix
SI or spiroindole group[M] derquantel	barber's pole worm, 'scour worms', nodule worm	Derquantel is only found in a combination: Startect (abamectin + derquantel)[B]
OP or organophosphate group[M] naphthalophos (NAP) (OPs have lower or variable efficacy against 'scour worms' in the upper GIT and immature barber's pole worm)	barber's pole worm, 'scour worms'	Rametin (naphthalophos is commonly used in combinations)
TZ or benzimidazole group (flukicide)[N] triclabendazole	Liver fluke (all stages); not effective against round worms	Tremacide
SA or salicylanilides/phenols group[N] closantel oxyclozanide	Liver fluke (> 9 weeks and adult) and barber's pole worm Liver fluke (adults) and tapeworm	Closicare (closantel) Oxyclozanide is only found in a combination: Nilzan (levamisole + oxyclozanide)[B]
IQ or isoquinolone group[N] praziquantel	Intestinal tapeworm (*Moniezia*)	Praziquantel[N] is only available in combination with broad-spectrum drenches. First Drench[B], Genesis Tape[B]

**ParaBoss does not endorse specific brands, these are presented here as examples only.*

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. Intra-ruminal/controlled release capsules are available with BZ and/or ML actives. Abamectin is also in a pour-on formulation for both lice and worm control.

Length of protection: Varies from short-acting ('knock-down' that kills susceptible worms within the animal) to mid-length (1–4 weeks) and long-acting (approx. 3 months), which not only kill susceptible worms already in the animals, but also infective larvae that the sheep 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.

Other parasites: 'Drenches' in www.wormboss.com.au shows effectiveness of groups against other parasites of minor importance.

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The WormBoss website is the most complete and current source of information for producers, advisors and students on sheep 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 sheep need drenching now, and if so, what length of protection is required and when to check the sheep 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 sheep.

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