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The philosophy of drenching sheep in Western Australia

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Sheep of all classes are drenched more or less regularly throughout the agricultural areas of Western Australia.

Much of the drench is wasted because it is used in the wrong circumstances. This situation is probably a result of poor understanding of drenching.

This article discusses the philosophy of drenching and attempts to relate this to the epidemiology of parasitism as it is currently understood.

Drenches are formulations of drugs which contain anthelmintics as their major active ingredients. Strictly speaking “drench” means a formulation for administration by mouth, but colloquial use often includes injectable formulations of anthelmintics as drenches. In this article, the term “drench” is used to describe any anthelmintic formulation regardless of route of administration.

In terms of activity, two basic types of drench are marketed today. These are termed “broad spectrum drenches” which have activity against most of the roundworm species which infect sheep, and “narrow spectrum drenches” which are only active against particular worms. Some of the commonly used broad spectrum and narrow spectrum drenches are listed in Table 1. They are not listed in any particular order.

The broad spectrum drenches kill most of the immature and adult gastro-intestinal worms in sheep. Some have particular advantages such as the ability to kill worm eggs present in the sheep’s gastro-intestinal tract at the time of treatment; ease of administration; particularly high activity against certain worm species; activity against lungworms; and very low toxicity. However, except in special circumstances, they can all be considered equally effective against gastro-intestinal roundworms when used in the field.

The slight differences in activity of drenches found during laboratory
testing are probably of little significance in practice, where a range of dose rates is used and quite often the recommended dose is not reached or is exceeded. To gain the most from drenches, it is imperative that dose rates be adhered to to avoid underdosing.

The dose for any given group of sheep is best based on the body weight of the heaviest of the mob and not the average weight. This ensures that all receive not less than the minimum recommended dose. Obviously the mob should be reasonably even so that the lightest sheep is not grossly over-dosed.

It must be remembered that all that drenches do is to remove the majority of gastro-intestinal roundworms (and lungworms and tape-worms for some drenches) from sheep. Drenches are occasionally falsely claimed to have other advantages. For example—

- They do not improve appetite, growth rates or general health of their own accord. These changes only occur as the result of removal of worms.
- They do not prevent reinfection with worms. They have no long-lasting anthelmintic effect.
- They do not resolve the damage done by worms. The sheep does this after the worms are removed, and it may take some time.
- They are not the answer to malnutrition or bad management.
- They do not directly affect fertility.
- A drench which can be given by injection is no more effective than the same drug given orally.
- Sheep do not become resistant to drenches. Worms may do so.

Why drench sheep?
Drenches can be used for three quite different purposes.

1. Tactical drenching
Sheep can be drenched with the purpose of salvaging them from a situation in which they are likely to die or suffer severely from worms. This is probably the most common use of drenching in W.A.—sheep are allowed to get wormy in the hope that they will not, and are then drenched.

This “wait and see” policy is based on the assumption that worm disease does not always occur. Unfortunately, once it does, pastures are heavily contaminated with worm larvae and the sheep may be rapidly reinfected after treatment. This necessitates further drenching, or a management system which allows for the provision of worm-free pastures on which sheep can graze after they are drenched.

This approach, sometimes called tactical drenching, is undoubtedly the best approach in dry areas where worms are rarely a problem.

2. Strategic drenching
Sheep can be drenched at approximately the same time each year in order to pre-empt the occurrence of worm disease which is thought to be imminent. It is assumed from past experience that worm disease will occur and so the sheep at risk are drenched just before dangerous worm burdens are reached.

This approach suffers from the same drawbacks as the first one. Also, drenches may be given too early or too late.

3. Preventive drenching
Sheep can be drenched at critical times with the aim of preventing the carry-over of worms from one season to the next. Drenching stops the contamination of pasture with worm eggs, so preventing the build-up of large populations of infective larvae on pastures. Consequently, the sheep never pick up many worms.

This approach is probably the best use of drenching because worm disease is prevented rather than cured. It could be called “preventive” drenching.

The last approach is practical in most sheep raising areas of Western Australia because of the regular summer drought. The reliable summer drought and preventive summer drenching together are a valuable weapon for the control of worms. This is apparent when the epidemiology of worm disease is considered.

The epidemiology of sheep worms in Western Australia
Epidemiology means the whole combination of inter-acting factors which can precipitate disease.

The following comments apply to areas where there is reliable summer drought, and consequently where Haemonchus contortus (barbers pole worm) is not important. This is the situation in most of the sheep raising area.

The life cycle of sheep worms involves two phases—the presence of worms in the sheep, and the presence of worm eggs and larvae on pasture.
The pasture is contaminated by the passage of worm eggs in sheep faeces. Sheep are infected by eating with pasture, larvae that develop from these eggs.

In 1959–60 Dr. I. Parnell, working at "Glen Lossie", Kojonup*, studied the sequential development of worm burdens in autumn-born and spring-born lambs. This he did by killing lambs each week and counting the worms in their gastro-intestinal tracts. Figure 1 shows the average worm-counts for the individual months (rather than weeks). Several important points are illustrated by this graph:

- The worm burdens of the spring-born lambs were never as high as those of the autumn-born lambs. This suggests that the spring-born lambs were not exposed to as much pasture contamination as the autumn-born lambs.

- The burdens of the autumn-born lambs steadily increased from June until November and then stabilised. They decreased in autumn. This suggests that after October-November these lambs acquired no new worms, either because they were immune or because the number of larvae on the pasture was low.

When the two findings are considered together it is apparent that there were many worm larvae on pasture until October-November. After this the spring-born lambs acquired few worms and the autumn-born lambs acquired no more worms (they were grazing the same pasture). Therefore after October-November the numbers of larvae on pasture must have dropped to low levels.

- Many immature worms were present during summer. These must have been picked up before October/November, and so cannot have developed immediately to adult worms. The fact that the number of immatures dwindled through summer and autumn, while the number of adult worms remained high, suggests that these immatures must have been developing slowly and replacing adult worms which were rejected by the sheep.

Figure 2 shows the faecal worm egg counts of the two groups of lambs. Several points are apparent:

- The worm egg counts were not highest in November when worm counts were highest. Thus the egg counts were not a reliable indicator of worm burdens.

- The highest egg counts were recorded in summer and autumn. This means that the pasture was being contaminated most by the lambs at this time.

- In May, the autumn-born lambs had egg counts similar to the spring-born lambs. This means that they were producing as much pasture contamination in May as the autumn-born lambs, despite their smaller worm burdens.

From Dr. Parnell’s work, and further knowledge gained of worms in recent years, an explanation for the pattern of development of worm burdens in sheep in W.A. can be deduced.

Pertinent recent findings are:

- Worm eggs on pasture do not all develop to infective larvae at the same rate. When temperatures are low development time is extended and may take more than a month. Eggs dropped on any one day do not necessarily develop at the same rate.

- Infective larvae on pasture do not die after a short period, particularly during winter. Eggs dropped in April may produce larvae which are present on the pasture from May to September.

- Most larvae are produced from eggs when temperatures are in the range of 14° to 22°C, and when there is adequate moisture.

Figure 3 was prepared with these points in mind.

The rainfall pattern immediately limits the hatching of eggs and development of larvae to the period between April and October (assuming an "average" year).

Furthermore, temperatures in the months outside these are generally too high for successful development
of larvae. Once infective larvae have developed from eggs, they survive through winter and then die off as temperatures rise in spring. Those that develop in spring last a much shorter time. In Figure 3 the period from April to October is therefore shown as the time for development and survival of infective larvae. Larvae which develop late in this period probably survive six to eight weeks, and so the period for survival is extended to December.

This suggests that eggs dropped in the months outside these times never develop to infective larvae. The exception is probably the last few weeks before April when dews and some rain and lower temperatures may allow some eggs to develop, or at least survive.

The pattern for the numbers of infective larvae on the pasture is illustrated in Figure 3. There is a steady increase in the numbers of larvae on the pasture until spring, then numbers fall rapidly as temperatures rise. Most larvae on pasture in winter originate from contamination with eggs deposited in autumn and early winter.

This theory explains Parnell’s findings—worm burdens building up until October/November and then stabilising. It also highlights the significance of the summer rise in worm egg-counts. It is the tail end of this rise which produces the pasture contamination for the next season.

This has been found to hold true for other winter rainfall areas in Australia, and while the finer details of timing may not be accurate, the theory is likely to be correct for most West Australian sheep-raising areas.

A PREVENTIVE DRENCHING PROGRAMME

Emphasis has been placed on the autumn contamination of pasture with worm eggs being the main source of the sheep’s worm burdens. If this contamination could be stopped, then in theory the numbers of infective larvae on pasture should subsequently remain low, and worm burdens in sheep remain low. This has been shown to work in Victoria. The administration of two drenches in the dry period reduced overall worm burdens for the remainder of the year.

Figure 4 shows how the two summer drenches work. The bottom graph shows the worm egg output and subsequent pasture levels of infective larvae in an untreated situation. The top graph shows the effect of two drenches on the worm egg output of sheep, and the resultant reduced pasture levels of infective larvae. Several things must be borne in mind:

- The aim of the programme is to reduce the deposition of worm eggs on pasture in autumn. To do this the sheep are treated when they have low worm burdens. An immediate response to drenching may not be obvious. It is a “pay now, gain later” programme.

- The result of the drenching is to reduce the number of infective larvae on pasture during winter and spring. The programme will not work if sheep which are susceptible to worms (lambing ewes and lambs) graze a pasture in winter which had untreated sheep on it during autumn. All sheep grazing autumn pasture that is to be used as winter and spring pasture for susceptible sheep should be treated. Set stocked wethers may not need treatment, but in areas where worms are a real problem the use of the system may increase production.

- Broad spectrum drenches at optimum dose rates should be used. As no drench is fully effective in removing worms, the sheep should be treated twice, with an interval as

Counting worm eggs in sheep faeces in the Department of Agriculture’s Parasitology Laboratory
shown in Figure 4. This also allows for the removal of any worms that might have been picked up after the first drench.

- This is a minimal drenching programme for areas with reliable summer drought. Additional worm control measures, such as tactical drenching, may be needed in some years.

Pre-lambing drenches

As a rule the faecal worm egg counts of ewes increase at lambing time and remain at a high level for several months. This increase is due mainly to a change in the immune status of the ewe, which is a direct result of her hormonal state during lactation.

Non-breeding adult sheep exhibit immunity to worms in a number of ways:

- many infective larvae that are eaten with pasture are rejected before they develop to adult worms in the sheep.
- larvae that do develop to adulthood in the sheep are often stunted in growth.
- some larvae are retarded in development and remain in the larval stage for extended periods.
- the egg-laying capacity of adult female worms is limited to well below their potential.

These controls do not operate in the lactating ewe. As a result the female worms are able to increase their egg production, retarded larvae may resume development and start to lay eggs, and larvae ingested with pasture become established, develop to mature adults and start to lay eggs. The final result is that worm eggs in the ewe’s droppings increase the contamination of the lambing paddock. By the end of lambing the lambing paddock ends up heavily infested with worm eggs and larvae. It should not be grazed by lambs or weaners.

Because of the increased contamination at lambing time the lambing paddock ends up heavily infested with worm eggs and larvae. It should not be grazed by lambs or weaners.

![Figure 4 — The effect of summer drenching on pasture contamination. Top graph: Egg output of summer-drenched sheep (broken line) and pattern of availability of infective larvae on pasture. Lower graph: Egg output from undrenched sheep and pattern of availability of infective larvae on pasture](image)

**Table 1. Commonly used sheep drenches**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Common Brand Name</th>
<th>Activity</th>
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<tbody>
<tr>
<td>CAMBENDAZOLE</td>
<td>CAMBEN</td>
<td>BS, L, T</td>
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<tr>
<td>FENBENDAZOLE</td>
<td>BONLAM</td>
<td>BS, L, T</td>
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<tr>
<td>LEVAMISOLE</td>
<td>PANACUR</td>
<td>BS, L, L</td>
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<td>TELMIN</td>
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<td>EXHELM E</td>
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<td>BS</td>
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<td>BOOTS BROAD SPECTRUM</td>
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<td>MEUSMISOLE</td>
<td>WORM GUARD</td>
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<td>THIBENZOLE</td>
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<td>COPPER/ARSENIC</td>
<td>CESTAGON</td>
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<td>X-PELL</td>
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<td>FRANOCIDE</td>
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<td>MANSONIL</td>
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<tr>
<td>DI-ETHYL CARBAZAMINE</td>
<td>MSD BARBER'S POLE DRENCH</td>
<td>NS</td>
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**NOTE:** Activity — activity at usual dose rate. Some have wider activity (e.g. against lungworms) at higher dose rates.