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Sheep worms - breeding worm resistant sheep

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Introduction

Drench resistance in sheep worms is a widespread problem that is rapidly approaching a crisis point in Western Australia. Drench resistance to ivermectin in brown stomach worm was discovered for the first time in Australia in Esperance in 1991. Recently, drench resistance to the macrocyclic lactone group of products (ivermectin, abamectin and moxidectin) has also been reported in barber's pole worm and brown stomach worm in other parts of Australia and this is particularly alarming given that this group is the last remaining effective drench group on many properties**.** There is little hope of new sheep drench groups becoming available within the next few years.

Unless current sheep worm control practices change, drench resistance will continue to increase and there is a real risk of running out of effective control options**.** Because of this, for sheep farms to remain profitable and sustainable, it is vital that non-chemical control options become an important part of the worm control program.

Worm resistant sheep

The only currently available, permanent, long-term solution to help manage drench resistant worms is to breed worm resistant sheep. In terms of whole farm management, these sheep have several advantages:

- lower production losses due to worms;
- less drenching;
- lower worm contamination of paddocks;
- smaller carry-over of worms from one season to the next;
- reduced impact of drench resistance; and
- increased life span of current effective drenches.

Sheep with resistance to worms are also likely to meet the criteria associated with the increasing global consumer demand for clean and green commodity production.

Some breeders are concerned that they will reduce the potential genetic gain for other production traits if they include worm resistance in their breeding programs. Modeling studies show that including worm resistance in the breeding program results in larger gains in other production traits than selecting on the production traits alone. Research results from New Zealand have confirmed huge carry-over effects for lowered faecal worm egg count (WEC). This is mainly due to the worm contamination reducing from one generation to the next. Thus, worm resistance should be seen as an extremely important trait in any sheep breeding program where worms could be a problem.

Resistance to worms in sheep is an inherited trait that can be increased by selection. The heritability of worm resistance, as measured indirectly by individual sheep faecal WEC, is at least 25 per cent. This means that 25 per cent of the genetic superiority of an animal will be passed on to their progeny. For example, if the average faecal WEC of a flock is 400 epg (eggs per gram) and an individual has a true faecal WEC of 200, then this animal's superiority is 200 epg (400 minus 200) as they are 200 epg below the flock average. With this example, 25 per cent of the superiority will be passed on to its progeny. Thus, if such animals are mated with each other, then it can be expected that their progeny will have a superiority of 50 epg (25 per cent of 200) below average. On the other hand, if such an animal is mated to a random sample of ewes, then this genetic gain will be halved as an animal only passes on half of its genes to its progeny.

There is typically a large variation in the faecal WEC between sheep, making it relatively easy to identify the more resistant individuals within a group.

As with all genetic improvement programs, selecting within a flock can take several years to achieve noticeable improvements but an increasing number of farmers who have been selecting sheep for worm resistance for some time, have achieved good results.

Research results

Since 1988, the Western Australian Department of Agriculture, with industry support, has been selecting for worm resistance in the Rylington Merino (RM) flock. The following graph shows the genetic trend of the decline of the faecal WEC in the Rylington Merino selection line relative to that of the unselected control line.

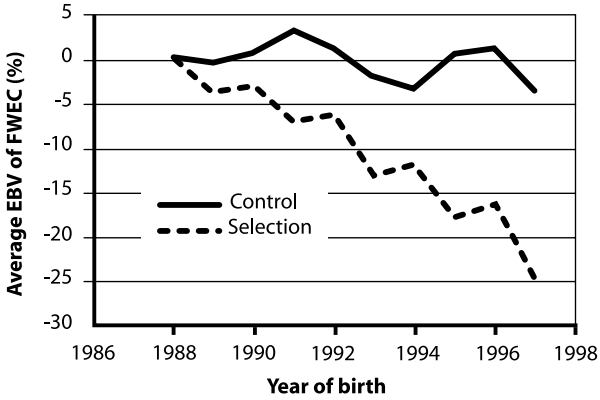

Figure 1: Genetic trend of Rylington Merino sheep selected for worm resistance compared to the unselected control group.

This graph represents a genetic gain of 2.7 per cent per year or about 10 per cent per generation for the selected line. This is very good considering that the annual genetic gain for most production traits in sheep is less than one per cent. During the main winter worm challenge period, the actual average faecal WEC output from hoggets in the two lines will vary from year to year due to non-genetic influences, with the main one being between-season rainfall variation.

The overall worm resistance of a sheep flock can be increased in two ways:

- by sourcing stock from breeders who have already been selecting for worm resistance. Contact your local veterinarian, sheep adviser or Department of Agriculture office for names of breeders who have included selection for worm resistance in their breeding objectives; and/or
- by measuring worm resistance in your own flock and selecting those animals with greater worm resistance to include in breeding programs.

How to select worm resistant sheep

Selecting for worm resistance can be incorporated into normal sheep breeding practices by comparing worm egg counts of individual sheep. The number of worm eggs in the sheep's faeces is a guide to the number of adult worms that have developed inside the sheep.

It will generally be most cost effective to concentrate on the young rams, with faecal sample collection at hogget age and/or at weaning time. Combining information from measurements taken at weaning and hogget age will increase accuracy, but one measurement will in most cases be most cost effective if pedigrees are available.

The choice between weaner and hogget samplings depends on the level of the local worm challenge. For example, in low worm challenge environments the natural immunity of the hoggets combined with the lower challenge can often result in inadequate faecal WEC levels to allow good differentiation between animals. In many situations, though, faecal WEC testing at hogget age could reduce costs because a proportion of the flock is likely to have already been culled based on other production traits.

To do the selection, the sheep are exposed to a relatively small worm burden picked up from normal paddock grazing and each sheep's individual faecal WEC is measured. The best time to do this, in the winter rainfall regions of Western Australia, is during the green feed period.

Testing procedure

1. Checking worm egg counts before testing

Worm egg counts of the test mob should be monitored as a group before commencing testing of all the individuals for selection.

For hogget age sheep, start checking faecal WECs two weeks after the beginning of the winter rainfall season, then re-check every two to three weeks until the faecal WEC reaches an acceptable level. Monitoring can be done simply by collecting three to five fresh dung pellets from individual piles deposited by 12 to 15 sheep in the paddock.

For weaners, start faecal WEC monitoring four to six weeks before the anticipated individual sheep sampling time. Plan to do the individual sampling at or close before weaning, but it is important **NOT** to do it during the first couple of weeks after weaning as the stress of weaning can suppress the sheep's immune response and their ability to show their true genetic potential for worm resistance.

The two main purposes of monitoring are:

- To ensure an adequate worm challenge is present that will allow identification of resistant and susceptible individuals. For the non-barber's pole worm areas, this is achieved when the average faecal WEC of the mob reaches about 500 eggs per gram (epg) when typically a few animals will have a zero count and a few will be over 1000 epg.
- To ensure that the worm challenge does not increase to levels where the production and welfare of the animals are compromised.

2. Sampling individual sheep

When the target faecal WEC level has been reached, individual samples from each of the candidate animals are collected, over as short a period as possible. Before collection, the laboratory doing the faecal WECs should be notified to ensure that samples can be processed at the appropriate time. Samples must also be kept cool (refrigerated but not frozen) and sent to the laboratory within 48 hours of collection.

Once the results are evaluated, all sheep can be drenched, if necessary.

3. Co-selection against scouring and dagginess

Most cases of winter scours in grazing sheep are probably due to the effects of either immature and/or adult worms in the sheep. When scouring is due to immature worm larvae this will not be expressed as an increased faecal WEC. Therefore, it is advisable to treat scouring as a separate trait.

Scouring is a heritable trait, which implies that it can be selected against to assist in reducing dagginess. Some breeders have expressed interest in selecting sheep for reduced scouring (as well as worm resistance) on the basis of visual recording of individual dag scores (DS) or faecal consistency scores (FS) in their sheep using a five point scoring scale.

Using the information

To maximise the gain from selecting for worm resistance whilst maintaining other breeding objectives on the farm (such as lower micron, increased fleece weight), a geneticist should analyse the faecal WEC results. There are a number of service providers in the industry who can do this. Contact the authors for assistance. The geneticist will convert the raw faecal WEC data into a faecal WEC estimated breeding value (EBV) for each animal by incorporating information from an animal's relatives, and correcting for other non-genetic factors such as the age of the ewe and whether the individual was a twin or single lamb. This process increases the accuracy of each individual's estimate and will therefore improve the rate of genetic gain. The individual EBVs of fleece weight, body weight, fibre diameter, WEC, and so on are then combined into an overall selection index. This will allow maximum overall genetic gain in all of the economically important traits.

Summary

1. Ram breeders

- Ensure a controlled and adequate worm challenge.
- Select for reduced faecal WEC as well as reduced scouring at weaning and/or hogget age.
- Increase the selection response by using trait EBVs incorporated into an overall selection index.
- Allocate at least 30 per cent of total selection to faecal WEC selection and a further 20 per cent to scouring, if necessary.
- Ask for information on worm resistance where a sire was progeny tested in a sire evaluation scheme.

2. Ram buyers

- Ask for information on the average faecal WEC of the test group (to check that there was adequate selection pressure from worms when the worm resistance selection was done).
- Ask for information on a ram's deviation from the group mean rather than actual faecal WEC (this allows 'within group' comparison; such as, was the ram better than average?).
- Ask for information on worm resistance where a sire was progeny tested in a sire evaluation scheme.

3. General

- Any genetic improvement program, such as selecting on fibre diameter to reduce the average micron of a flock and selecting sheep for worm resistance will take time before major improvements are apparent.
- By including worm resistance in breeding programs now, significant progress can be made before existing drenches become totally ineffective and it is no longer profitable to run sheep because worms have become uncontrollable.
- For more specific information on selecting sheep for worm resistance, contact Johan Greeff or John Karlsson on 9821 3333, Rob Woodgate on 9892 8444, local Departmental worm control advisory staff or your local sheep breeding adviser.

Further reading

Farmnote 51/2002 *Sheep worm control in Western Australia*

Farmnote 54/2002 *Sheep worms – faecal worm egg counts*

Farmnote 55/2002 *Sheep worms – testing drench resistance and effectiveness*

Farmnote 57/2002 *Sheep worms – barber's pole worm*

Farmnote 4/2003 *Genetics for sheep breeders*

Factsheet 3/2002 *Sheep worms – quarantine drench to combat resistance*

Factsheet 4/2002 *Sheep worms – summer/ autumn worm control*

Misc Pub 26/2002 *Recommendations for breeding sheep for resistance to worms in a Mediterranean climate*

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Rylington Merino contributors

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