establishment of L3 for extended periods after dosing, there are other factors to consider. MOX as a milbemycin, is more efficacious against 3-ML-resistant parasites than the avermectins (ivermectin and doramectin), so fewer ML-resistant parasites will remain in the sheep after dosing with MOX. This suggests that MOX may be preferred to avermectins, particularly when the post-dosing larval intake from pastures is low. MOX does, however, delay the re-infection of dosed sheep with some parasites after treatment and may select for AR in the 'tail' phase of its sustained activity.

Treatment with different formulations of MOX may take the place of two or more treatments of a short-acting anthelmintic when pasture infectivity is high and when sheep are susceptible to re-infection. It is not clear if one dose of MOX will select for AR more, or less, than more doses of 3-MLs.

There is no clear-cut answer as to whether MOX should be used or avoided for peri-parturient ewes. However, it is clear that a) the persistent effect of MOX should be avoided at the stage the ewe's immunity is likely to return and b) MOX should not be used exclusively (year on year) for the lambing dose c). Leaving 10% of the single bearing/fittest ewes untreated will protect the *in refugia* population.

In the case of closantel, the use of the narrow-spectrum anthelmintic to control *H. contortus* is almost always preferable to using a broad-spectrum drug, when only that species is the target for control. However, the use of closantel at times of year (e.g. autumn / winter) when the population of *Haemonchus* 'in refugia' is low is likely to be highly selective for AR.

6.7 Preserve susceptible worms on the farm (*in refugia* population).

The 'dose and move' strategy has been widely recommended in the past because it was a successful, cost-effective method of achieving good worm control. When pastures with low levels of worm eggs and larvae become available for grazing, best use is made of them by dosing sheep with anthelmintics before placing them on the field. This ensures pasture contamination remains low for an extended period providing a period of productivity uninhibited by parasite infection, without the need for repeated anthelmintic treatment.

Unfortunately, this strategy is also likely to select for AR, because any worms surviving treatment will enjoy an extended period of reproductive advantage over unselected parasites. All the time the sheep remain free of re-infection from the low contamination pasture, any surviving worms are resistant and contaminating the pastures with their eggs. Without the dilution effect of a heavily contaminated pasture the frequency of resistant genes in the free-living population can increase quickly and the cleaner the pasture, the faster the resistant-gene frequency increases.

The benefit of the low contamination pasture may persist for weeks or months but levels of contamination will build and the worms will have be a more-resistant population than was present earlier in the season. Sheep grazing this pasture will then be infected with a selected population of parasites, with a higher resistant-gene frequency than before treatment. The repetition of such events around the farm over several years will lead ultimately to a highly resistant population of parasites, despite the farmer having 'enjoyed' the benefits of good worm control in the meantime.

How, then, can the potential benefits of low contamination pastures be exploited without selecting heavily for AR? Two approaches can be used: (1) part-flock treatment and (2) delay the 'move' after the 'dose'.

6.7.1 Part-flock treatments and Targeted Selective Treatments (TSTs)

Some animals in the flock can be left untreated, allowing a pool of unselected (unexposed) parasites to produce eggs that are passed out on to the low-contamination pasture. It has been suggested that leaving about 10% of the flock untreated before such a move will be sufficient to provide a large enough dilution effect to delay the development of AR. However, this depends on the treatment given to the remainder of the flock being highly efficacious (See below).

For example, if a treatment given to 90% of a flock only reduces FEC by 90% in treated sheep, eggs from resistant worms will be passed in approximately equal numbers to eggs from unselected worms. If the anthelmintic is 99% efficacious, unselected worm eggs will outnumber selected (resistant) worm eggs by 10:1 and, if the efficacy is 99.9%, unselected worm eggs will dominate the egg counts by 100:1. The cleaner the destination field, the more important the recommendation becomes, and the more important it is that the treatment approaches 99.9% efficacy.