# Breeding Sheep Resistant to Internal Parasites

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It is estimated that approximately 30% of New Zealand's sheep meat and wool production is dependent on the use of anthelmintics. In economic terms $1200 million worth of sheep exports are supported by the use approximately $80 million of anthelmintic. Alternative methods of controlling internal parasites are needed, because of the widespread anthelmintic resistance by the parasites concerned (greater than 65% of farms have a species resistant to at least one chemical action family) and the costs of the chemical control.

One method is to breed sheep resistant to the internal parasites themselves. Based on research work undertaken by AgResearch over the past 2 decades, sheep breeders can now include this trait in their selection criteria.

Using the results from experimental work and a demand by sheep breeders, the WormFEC Service commenced in late 1994. WormFEC provides sheep breeders with the tools and advice required so they can select sheep resistant to internal parasites in their own breeding flocks. The service is provided in association with Sheep Improvement Limited or SIL as it is commonly known.

Commercial farmers wishing to obtain rams showing enhanced resistance to internal parasites only need ask for WormFEC tested rams from their breeders. The latest across flock and breed WormFEC ram rankings are also available via www.silace.co.nz. The WormFEC symbol is shown in figure 1.

**The selection objective recommended by the WormFEC Service is "high producing animals which are also resistant to internal parasite establishment".**

The aim of breeding sheep resistant to internal parasites is to reduce susceptibility to infection and thereby reduce pasture contamination. Available information suggests that both susceptible and resistant stock benefit from a reduced intake of internal parasite larvae. Pasture contamination and subsequent larval challenge levels can be reduced by grazing more resistant animals. Hence, production benefits from breeding sheep resistant to internal parasites are indirect and benefit the whole flock rather than the individual.


**Figure 1.** The WormFEC symbol that sheep breeders evaluating rams for their resistance to internal parasites display on advertising

Research has shown that young lambs are initially very susceptible to infection with internal parasites, but by about 12 months of age they have developed a degree of immunity. In the adult ewe resistance levels are high, but immunity is depressed during the late pregnancy and early lactation period, causing a peri-parturient rise in faecal egg count (FEC).

The rate of development of resistance and the level achieved in the adult are under genetic control and it is therefore possible to breed for more resistant animals. This variation in the development of immunity is shown graphically in figure 2. Animals more resistant as lambs are also more resistant at older ages and females have a smaller peri-parturient rise.

Resistance to internal parasites can be measured in a variety of ways, but faecal egg counts, after a known challenge of infective larvae is the most

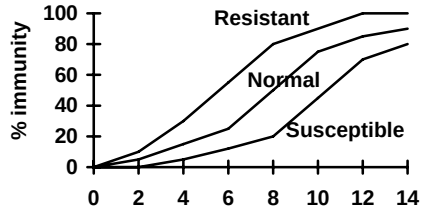


**Figure 2:** Schematic diagram showing the difference between a resistant, normal and susceptible lamb in the development of immunity to roundworm infection

commonly used method (figure 3). The lambs are drenched at weaning, exposed to a pasture larval challenge for 6 to 8 weeks, and then faecal sampled (FEC1). This is followed by another drench with another sample taken after a further 6 to 8 weeks (FEC2). Two samples are taken to provide a more accurate estimate of an individual's genetic level of resistance. However, any combination is possible, and collecting 2 samples several days apart at the end of the summer challenge is currently the most popular option (FEC1a, FEC1b).

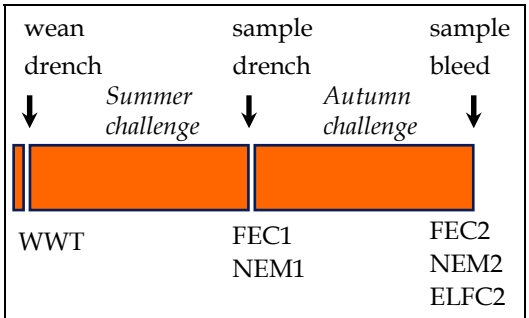


**Figure 3:** WormFEC challenge protocol with SIL measurements that can be recorded (see text)

**Animals with lower faecal egg counts are considered more resistant and those with higher egg counts are less resistant.**

Alternatively, animal resistance can be determined by measuring its parasite antibody level (ELFC2) at 7 to 9 months of age. Blood samples are collected and sent for laboratory analysis. This method reduces the work and cost to the breeder, but the genetic progress in reducing FEC will be slower.

WormFEC resistance breeding values are calculated using the latest breeding methods via SIL. No matter what resistance measurements have been collected, they are combined together and expressed as a breeding value for lamb FEC. For example a FEC1 BV% of minus 20 means that an animal has a breeding value for FEC as a lamb 20% below the average of the flock during the summer. Notice that **negative breeding values** indicate **more resistant** animals as they will have lower faecal egg counts.

Currently, commercial breeders using WormFEC select on the basis of an economically based SIL Dual Purpose WormFEC index which combines the economic benefits of parasite resistance and the other production traits. In the selection lists breeding values for the relevant traits are tabulated for each animal. These are then combined into a variety of sub-indices, several detailing their economic breeding merit for various production traits and one **DPF** (dual purpose FEC) the expected economic breeding merit for host resistance to internal parasites. The sum of these is the overall economic merit. The use of sub-indices allows the breeder to quickly identify which components are contributing to the total merit of an individual.

Calculations using this Dual Purpose WormFEC index selecting for highly productive and resistant animals, suggests that 10 years of selection will reduce lamb FEC by 40% relative to unselected animals given a similar parasite challenge and adult ewe FEC will also be reduced by a similar amount. In a flock the reduction will be greater because the reduced number of parasite eggs shed by the resistant animals will also lower the number of infective parasite larvae available on the pasture. The reduction in pasture larval challenge will result in better lamb and wool production, alternatively drenching frequency could be reduced resulting in savings of chemical and labour. More than 50 stud flocks spread throughout New Zealand have used the WormFEC service, a large proportion continuously since 1994.

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