meat NEW ZEALAND

R&D brief

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Project funded by meat NEW ZEALAND from 1991 to 1994

Contractor: AgResearch

Breeding sheep with resistance to nematode infection

- Some lambs have low faecal egg counts even when they are grazing contaminated pastures.
- How can farmers use this trait to increase the profitability of their flock?

Breeding for resistance - an alternative method to control parasites

One option to combat production losses caused by internal parasites is to improve the genetics of the flock, through selecting animals that show natural host resistance to internal parasites.

Host resistance is the ability of a sheep to successfully resist the establishment of roundworm infection and interrupt the life cycle. Resistance is estimated using faecal egg counts (FEC). Lower values indicate greater resistance.

Benefits of breeding for resistance?

Parasite resistant animals deposit fewer eggs onto the pasture. In other words, the advantage of having a more parasite resistant flock is that pasture contamination is reduced. This has long term financial and production benefits to all the animals in the flock, not just those depositing fewer eggs. It is estimated that eggs shed onto pasture will decrease by 4% per year under a selection programme for both production and resistance traits.

Funded by Meat New Zealand

Through funding from Meat New Zealand and the Government, AgResearch conducted a New Zealand-wide study to find out more about breeding for resistance.

The project aimed -

(1) to identify strains, breeds and sires of sheep that are highly productive and have a high resistance to internal parasites.

(2) to examine the relationship between the resistance trait and production traits such as fleece weight and growth rate.

In a nut shell, the project found that it is possible to select for resistance but that most gains are made when the breeder uses a performance recording scheme and index selection. This will ensure that production levels are also increased while FEC levels decrease.

Extensive trials throughout NZ

Between 1991 and 1994, an extensive series of trials on commercial Romney, Perendale, Texel and Coopworth ram breeding flocks were undertaken in partnership with the breeders. In total, more than 28,000 lambs, descended from over 820 sires, were measured for host resistance to internal parasites and production traits.

All the lambs from AgResearch research flocks and about 20 lambs per sire from commercial stud flocks were grazed on contaminated pastures post-weaning. All lambs were drenched at weaning to create a 'level playing field'.

Tested FEC levels and genetic links

When sample FEC levels approached a threshold (800 eggs per gram [epg] on commercial farms and 1500 epg for research flocks), each lamb in the flocks was tested for FEC and liveweight. Blood samples were taken from some flocks.

It took between six to ten weeks until mean flock FEC rose to about 800-1000 eggs/gram. Animal production is affected at this level.

Sires with highly productive progeny and marked resistance to internal parasite challenge were identified. The breeding values for parasite resistance and production traits were supplied to the breeders and the breeders made active use of the animals by mating them to the most productive and parasite resistant females.

Tested sheep performance and the environmental and breed effects

The project tested related progeny grown in both Northland and Southland, so they could see the effect of location and environment on resistance. Romney, Texel, Perendale and Coopworth breeds were also compared to identify the highly productive breeds with a marked resistance to internal parasites.

Finally, productive traits including liveweight, fleece weight and fat depth were analysed to see the effect that resistance has on production.

Results

Resistance to internal parasites is heritable

Firstly, the results showed FEC levels were moderately heritable (approx. 0.20). Antibody levels to parasite antigens had higher heritabilities with values ranging from 0.22 to 0.34. There was low genetic correlation between these traits.

Not related to NZ location

Secondly, rams tested for host resistance in one environment were likely to rank well in other environments. This means that scientists and breeders can confidently make evaluations across flocks. Farmers can be assured that when they take a ram selected for resistance home, it should perform acceptably on their property.

Some breed differences

Thirdly, the project found that there are some breed differences with respect to how resistance works. In the trial the Texel x Romney lambs (average FEC of 145 epg) and the Perendale lambs were identified as having two to three fold lower egg counts than pure Romney (average FEC of 333 epg) or Coopworth flocks. However, there was also a lot of within breed variation. Using the genetic variety within a breed is recommended, instead of breed substitution.

Trend between increased resistance and lower production

Fourthly, the project showed that resistance to parasites (i.e. low FEC) appears to have a small unfavourable genetic relationship with hogget fleece weights (mean value of 0.13 averaged over the Romney and Coopworth breeds).

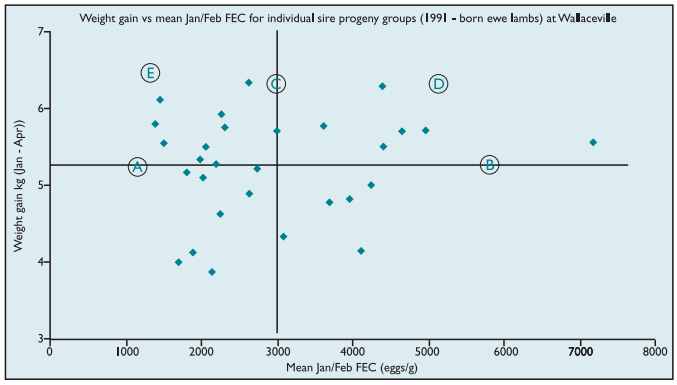
In other words, if you select for resistance fleece weights will tend to decrease. If you select for fleece weight, FEC levels will tend to rise over the flock. The correlation between FEC and liveweight was not significant. Any production gains achieved via a reduction in pasture contamination levels have to be balanced against the effect of this negative genetic relationship.

However, this should not put farmers off breeding for resistance as the magnitude of the negative relationship is low and sheep favourable in both traits can be found.

Use an Index to improve both resistance and production in your flock

Both resistance and production can be improved at the same time by using a selection index. An index is a way of combining breeding values from different traits together so that the best overall progress can be made. Since 1994, selection on the basis of both resistance and production traits has been available to commercial ram breeders through the WormFEC™ service. Currently, about 15,000 sheep are evaluated annually through WormFEC™.

This graph explains the difference between resistance, resilience, tolerance and susceptibility.



These dots are the mean of 29 sire groups of lambs, born and grazed together.

(A) Resistant sire groups are those to the left of the vertical line (i.e. low FEC).

(B) Susceptible sire groups are to the right of the vertical line (i.e. high FEC).

(C) Resilient sire groups are above the horizontal line.

(D) Tolerant sire groups are those in the top right-hand corner (i.e. high FEC but high production).

(E) The desirable sire groups are those in the top left corner as they perform yet don't have high FEC's to contaminate pastures (i.e. they are resistant and resilient).

How to **select** for host **resistance**?

- Use a performance recording system.
- Measure the animal's resistance using a FEC challenge protocol. You need at least two FEC's (from weaning through to selection at eight months) to get a true picture of an animal's status.
- Select animals that are not only resistant to roundworm infection but are also highly productive.
- Measure resistance in young male lambs because they contribute the most to genetic advancement.

Points to **remember**

- Selection for host resistance is becoming more widely practised by New Zealand ram breeders.
- A second project, funded by Meat New Zealand, is determining the economic value for resistance (see project number 94PR 120/1.1). Research also continues on finding a genetic marker for resistance.

Contacts for more information

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