beef+lamb new zealand

RESEARCH AND DEVELOPMENT

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R&D BRIEF 81: NATURAL FOOTROT CONTROL THROUGH BREEDING SHEEP WITH RESISTANCE

DISCOVERY OF A GENETIC MARKER

The genetic marker for natural resistance in sheep to footrot was discovered during 1997-1999. This project built on early work by farmers who conventionally bred sheep with resistance to footrot. Footrot is caused by the highly contagious bacterium Dichelobacter nodosus.

Virulent infection causes severe lameness in sheep and goats, with under-running of the hoof and inflammation. Infected animals tend to lose body weight, have less fibre growth and have reduced lambing percentages.

FOOTROT CAN CRIPPLE PRODUCTION

The estimated cost to the country can be up to $100 million in a bad year. A one-off outbreak on a farm can cost in the vicinity of $20,000. For example, one farmer had lambing percentage drop by 20%, wool production drop by 1kg per ewe and ewe death rate increase from 5 to 10%. The discovery of footrot in a flock is extremely disheartening and stressful for the farmer.

KEY FINDINGS

This project, contracted to Meat New Zealand and WoolPro, investigated the basis of natural genetic resistance to footrot in sheep. Two key tests have been developed.

Firstly, genetic markers (DNA patterns) have been found which can identify if a sheep is resistant to footrot. A blood test for resistance is currently being commercialised.

Secondly, study of the D. nodosus bacterium showed that there are more strains than first thought and that sheep can have up to 8 strains at one time. A rapid test to identify D. nodosus strains is also being commercialised, reducing the time taken to identify footrot strain from 2 weeks down to 2-3 days.

THE HISTORY OF FOOTROT RESISTANCE

In 1967 Edward & Margaret Orr (Glenbrae Corriedales) began selecting Corriedales that showed a natural resistance to footrot while under challenge. One ram in particular resisted all footrot attack over 11 years and became the basis of the Glenbrae stud.

In 1981 Dr Martin Skerman, Wallaceville Research Centre, tested the ability of the Glenbrae flock to resist footrot by comparing them to a selection of standard stud Corriedales. Trials showed that less than 10% of Glenbrae sheep under severe footrot challenge had a breakdown, while 80% of the sheep from the 5 other studs got severe footrot. The first-cross Glenbrae lambs were five times more tolerant to footrot than the other Corriedales. In 1990 Lincoln University began work to identify genetic markers for this resistance, using Glenbrae sheep as ‘a living database.

RECENT LINCOLN UNIVERSITY TRIALS

The Orrs Corriedales as well as Merino, Awassi, Borderdale, Coopworth, Poll Dorset, Texel and Finn flocks and herds of Mohair goats were involved in the recent Lincoln University project.

Between 50 to 100 progeny from several sires were put in a feedlot situation and challenged with footrot. The lambs were 8-10 months old. The Orrs developed this method to provide a high and uniform challenge, as part of their conventional breeding programme. At the end of the trial period, the progeny were scored for footrot by standard visual methods. Then the sheep s footrot status was related to its DNA results in a key group of genes that control immune response.

RESULTS

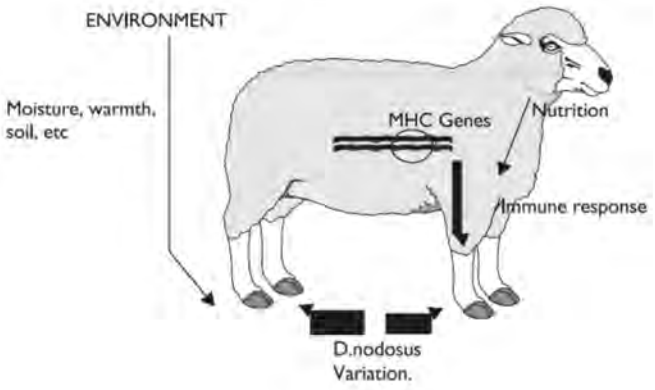

Diagram A: Environment, nutrition and genetics all affect a sheep's susceptibility to footrot

Part 1: The project successfully identified genetic markers (MHC genes) on the sheep genome that indicates whether a sheep has high, medium or low natural resistance to footrot.

A laboratory test was developed to select resistant sheep based on their genetics, without having to expose them to footrot. This should be available as a commercial blood test in 2001. The system will allow farmers to take a pin-prick blood sample from a sheep s ear and send it in for analysis.

Comparison between breeds showed that the location of the genetic marker is similar across breeds of sheep.

Part 2: A second test, to quickly identify footrot strain, was also developed.

Lincoln University student Huitong Zhou developed a rapid-DNA test that can accurately determine the strain of D. nodosus in about 2 to 3 days. In the old system samples were cultured, taking about 2 -3 weeks. If commercialised, farmers will benefit as they can post in soil, inter-digital scrapings or foot lesion material and get rapid results back as to the footrot strain present in their flock.

DNA mapping showed that there can be up to 8 different strains of D. nodosus on a single hoof. This explains, in part, the ineffectiveness of vaccines in some situations. Work continues on investigating whether the strain of footrot is related to the expression of resistance in the sheep.

HUGE BENEFITS TO FARMERS

Although the genetic marker test will be a powerful management tool for farmers, it is not a 'magic bullet solution. Farmers with the genetically-resistant flock still need to ensure the sheep have good nutrition levels so that they can maintain a high immune response.

- Faster genetic gain (speed up the shift to a more resistant flock)
- Time-saving (less time checking feet and treating)
- More profit (less chemicals, vaccines and antibiotics and higher production as sheep out producing rather than being treated)
- More market friendly (less chemicals and improved animal welfare)

It s estimated that in current NZ flocks about 2-3% of Merinos, 15% of Corriedales and 46% of other breeds e.g. Romneys, are resistant to footrot challenge. However, the degree of resistance varies within breeds as well as between breeds. The effort by studs to guarantee 'footrot-free rams and to isolate their flock from contact with the disease has meant that rams entering the commercial environment are often highly footrot-susceptible. Severe foot breakdown after contact with footrot can result.

USE OF THE GENETIC MARKER TOOL

Using the genetic marker to select sheep will help farmers get to the stage where there is a very low incidence of footrot in the flock. The sheep will need less treatment so the need for vaccines, antibiotics and constant use of zinc sulphate or Formalin is reduced or eliminated.

The heritability of footrot is quite high (about 0.3-0.4 where 1 is totally heritable). Farmers using rams selected for resistance to footrot should notice a major improvement from the birth of their first lamb crop. Over a period of up to 5 years, the entire flock could include at least first cross footrot-resistant ewes.

It is possible that 'resistance to footrot will be included as a genetic trait in the Sheep Improvement Ltd (SIL) genetic database. This means breeders can incorporate the trait into their overall selection criteria. At this stage there seems to be no negative spin-off between footrot resistance and production traits.

POINTS TO REMEMBER

- Sheep bred and selected for resistance to footrot will maintain their resistance if managed correctly.
- The potential return on investment from this research is huge.

CONTACTS FOR MORE INFORMATION

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For more information freephone Beef + Lamb New Zealand on 0800 BEEFLAMB (0800 233 352) or visit www.beeflambnz.com