Genetic resistance to Tb in deer

"Stags for sale. Liveweight etc, Velvet weight etc, Certified Highly Resistant to Tuberculosis."

Such an advertisement may sound far-fetched today, but selling certified Tb resistant deer may well be a viable proposition in the future.

The ultimate long term goal in Tb control is to rid the country of Tb in wild and feral animals such as possums, ferrets, cats, deer and pig, thereby preventing the reintroduction of Tb on farms. While good progress is being made towards this goal, there are many farms where we cannot prevent exposure of livestock to feral vectors and in these areas a practical short to medium-term solution for Tb control in livestock is to increase their resistance to Tb.

Vaccination and selection for resistance are possible ways to achieve this. Dr Colin Mackintosh of AgResearch Invermay and Dr Frank Griffin of the Deer Research Laboratory at Otago University are collaborating in a research programme to investigate these alternatives. The research is helping to obtain a much better understanding of the mechanisms of protection against Tb. The prospects for some real practical progress are positive. This issue of *Stagline Update* deals with selection for resistance. Vaccination will be looked at in upcoming issues.

Disease is the result of an interaction between the host, the infectious agent and the environment. One of the most important host factors is their genetic make-up. Virtually all animal populations will show a range of susceptibility or resistance to natural diseases. This is true for Tb in deer. Even in severe outbreaks it is rare to see more than 50 percent of the animals affected in a herd, even when animals are often related to each other. In groups of animals with wide genetic diversity the range of disease severity is likely to be even greater.

The immune system is very complex and this range has evolved to enable animals to respond to many infectious agents. However, when a disease is endemic or constantly present in a population, there is steady selection pressure in favour of resistant animals and against highly susceptible animals. In the case of Tb, however, deer populations have not been exposed to this agent for very long, either in the wild or on farms. Therefore there has been little selection pressure for resistance.

The researchers conducted a Tb challenge study last year whereby 40 stags of diverse genetic origin were challenged with a small standard dose of Tb organisms. Their immune status was monitored for four months using the Deer Research Lab's Blood Test for Tb (BTB). They were then slaughtered. They found a wide range of disease outcomes ranging from five deer with no visible lesions (NVL) and culture negative, to eight with multiple lesions indicative of early spreading Tb. The rest formed a graded series in between. Preliminary laboratory tests indicated that the white blood cells of the seriously affected animals were less able to contain Tb infection than those from the NVL animals.

These results suggest that there is an underlying genetic basis to the range of susceptibility seen and the next stage of the study is to investigate this. Semen was collected from all the stags prior to Tb challenge and stored in liquid nitrogen. The three most 'resistant' (R) stags and three most 'susceptible' (S) stags were selected on the basis of the challenge study, and their semen was used to inseminate 220 hinds under contract on a commercial farm. A 50 percent conception rate was achieved and 90 calves were weaned. All have been parentage tested by *GenomNZ*.

The R and S offspring were taken to an experimental Tb farm at Milton. Blood samples from these weaners are presently being tested in order to ascertain which components might enable prediction of the response of the different animals to Tb. Shortly, the 90 deer will be challenged with Tb and their disease status determined four months later at slaughter. The response will then be compared to results of the Tb challenge of the sires. In the longer term, it is hoped tests will be developed which can be used in commercial herds to select deer on the basis of their resistance or susceptibility to Tb. It is envisaged that farmers in high risk endemic areas will be able to screen their hinds and cull out the highly susceptible hinds and select their stags for maximum Tb resistance. This could be an important consideration for prospective buyers from Tb endemic areas. It may not be too long before we see an advertisement for Tb resistant deer!

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