The effectiveness of on-farm control programmes against wildlife-derived bovine tuberculosis in New Zealand

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Abstract

In New Zealand the Australian brushtail possum (*Trichosurus vulpecula*), introduced in the middle of the 19^{th} century, is the main wildlife reservoir for *Mycobacterium bovis* infection for farmed livestock and other wildlife species. Thus, control of tuberculosis (TB) has to involve both livestock and vector animals. Areas with endemic wildlife infection constitute 23% of New Zealand's land area. Vector control is mainly performed by large scale poisoning operations, by both aerial and on-ground baiting, conducted by official agencies, such as Regional Councils. The costs of vector control rose from NZ$18 million in 1995 to NZ$28 million in 1998/99, and finances are not available to cover all areas with endemic wildlife infection. There is a need for farmers to be involved and participate in TB control to complement the official control efforts. This thesis comprises a number of studies that looked in detail at on-farm control measures that could be applied at farm level, their efficiency and cost-effectiveness, in order to determine if and how farmers could take on-farm measures which would complement the official TB control programme.

In an initial survey of 27 Wairarapa herd managers, whose cattle herds were TB infected, 'grounded theory' was used to identify factors related to farm management and TB infection in cattle. Most farmers had knowledge or suspicion about potential high risk areas on their farm, where cattle were more likely to become infected with TB. Farms that grazed cattle in paddocks with TB hot-spot areas had a greater herd TB incidence than farms that excluded cattle from such areas, and used adjacent paddocks. Grazing management was found to be flexible, more so on beef farms than on dairy farms. These results formed the basis for designing on-farm control measures.

A subsequent intervention study used 67 Wairarapa farms. On-farm control measures were implemented for three years on 34 randomly selected 'focused control' farms. On-farm control measures included targeted vector control in spring and autumn, and adoption of grazing management in summer and winter that excluded cattle from TB hot-spots during these times. These measures were implemented by the research team during the first two years and farmers continued the control work in the third year. At the end of three years the effect of the interventions was evaluated. Focused control farms achieved more effective TB control than standard control farms. They were significantly less likely to have multiple TB animals per year, a higher proportion of focused control farms came off Movement Control, and the two-year cumulative TB incidence was reduced more on focused control farms than on standard control farms.

Part of the project was also to compare the Wairarapa project with a contemporary intervention study. The study was conducted on a national scale in four separate areas of New Zealand by a

national organisation, using 35 focused control and 70 standard control cattle/deer farms. Farmers were advised by a multi-disciplinary team on possible management changes and vector control for two years. The implementation of these measures was the responsibility of the individual farmers. Three and a half year after the start of the project the effectiveness was evaluated as part of this thesis. Focused control farms reduced the two-year cumulative TB incidence more than standard control farms. Comparison with the Wairarapa project indicated that the hands-on operational approach of the Wairarapa project had advantages over the 'advice only' approach in the national project.

All farmers involved in the two intervention studies were surveyed at the end of the intervention studies using a questionnaires, asking about farm management and TB related issues. Only the Wairarapa focused control farmers were interviewed during the project period. Only slight differences existed in these variables between focused and standard control farms in each of the projects, indicating that the allocation of farms to the two farm groups was adequate. Questions were also asked about attitudes towards TB and its control. Overall farmers rated the importance of TB eradication as very high. However, the majority of farmers were not in favour of stricter Movement Control regulations, removal of compensation or having to pay TB testing costs directly. Many farmers saw organisations, such as Government and Regional Council, as being responsible for eradicating TB and did not see any need to conduct control programmes themselves.

An economic analysis of the adoption of on-farm control measures was conducted using deterministic, stochastic and decision analysis. Under the current compensation level of 65% for TB test positive animals, the adoption of on-farm control measures generally was beneficial to dairy farms, but for beef farms only if they achieved TB free herd status. Reducing the compensation level to zero did not alter the situation significantly. The net gain in dairy farms increased, the situation in the beef breeding farms changed minimally and on beef finishing farms the adoption of control programmes became beneficial if the number of TB animals was reduced at least by two, without achieving TB free status.

The final stage of the project described in this thesis was the development and use of FarmORACLE, a whole-farm simulation model, that allows the user to combine knowledge about TB and its occurrence on farms with farm-specific grazing strategies. The model was used to compare traditional grazing strategies with alternative strategies, that excluded cattle and deer from grazing TB hot-spot paddocks during high-risk times. Four farms were described in detail. In all four farms an alternative grazing strategy was found that resulted in higher production or greater economic returns, while protecting the herd against exposure to tuberculous possums.

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