Johne's Disease
in New Zealand Farmed Deer

Johne's Research Group

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Research update

Currently, there is a good deal of research being carried out on Johne's disease in sheep, cattle and deer. The expected outcome of all this work is that the disease will be more easily managed and contained, and perhaps eventually eliminated. Most of the research is being carried out by scientists at AgResearch Wallaceville and Invermay, at the Disease Research Laboratory at Otago University and at Massey University. An outline of this research was presented in Bulletin Three. In the present Bulletin, there are reports on two additional research projects; one on the transmission of Johne's disease from hinds to their calves, and one investigating the role of wildlife in the spread of Johne's disease. There is also a report from Colin Mackintosh, Tony Pearse and Jaimie Glossop on their recent visit to Australia to find out more about Johne's disease deer research there, and finally a summary of a recent paper that gives an update on Australian research on Johne's disease in sheep.

Intra-uterine transmission of Johne's disease in farmed red deer

Hanneke van Kooten*, Colin Mackintosh and Ed Koets

It has been known for a while that Johne's disease in cattle and sheep can be transmitted from an affected mother to her foetus during pregnancy.

Last October a trial was undertaken to find out whether intra-uterine transmission of infection with *M. paratuberculosis* occurs in farmed red deer in New Zealand.

With the help of veterinarian Noel Beatson and three farmers in the Timaru area, nine hinds clinically affected with Johne's disease and in the late stages of pregnancy were slaughtered, and samples were taken from these hinds and their ten foetuses (one hind had twins).

Tissue samples were cultured using the BACTEC method and fixed samples examined histologically. All nine hinds were culture-positive, and eight of them carried infected foetuses. Lesions characteristic of Johne's disease were present in tissues from all hinds. Histologically, acid

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Other publications produced by the JRG include:

- **JRG Information Leaflet**
  "Johne's disease in farmed deer". Dr C G Mackintosh, Invermay AgResearch (August 2002)
- **JRG Bulletin One**
  "Johne's disease in New Zealand farmed deer. What does this mean for you and your farm in 2004?"
- **JRG Bulletin Two**
  "Detained carcasses: Johne's disease lymph node lesions in slaughtered deer and their implications"
- **JRG Bulletin Three**
  "Update of current research on Johne's disease in deer"
- **JRG Bulletin Four**
  "How to manage Johne's Disease"

The Johne's Research Group will shortly be supplying a folder in which to keep this current Bulletin and those listed above, and it will be supplying a companion reference document called "A Glossary of Technical Terms Relating to the Diagnostic Tests for Tuberculosis and Johne's Disease in Deer".

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fast organisms were seen in six hinds, but none were seen in foetal tissues.

These results show that there is a considerable risk of transmission of Johne's disease from clinically affected hinds to their foetuses in late pregnancy. It would therefore be unwise for farmers to delay the slaughter of clinically affected hinds in order to keep the fawns.

- **Hanneke van Kooten** is a veterinary student from Holland who has been working at Invermay with Dr Colin Mackintosh for the last 6 months. Her supervisor is Dr Ed Koets from Utrecht University.

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Is Johne's disease common in wildlife on infected farms?

Jackie Whitford and Graham Nugent, Landcare Research, Lincoln.

Johne's disease has been present in cattle and sheep in New Zealand for many years but it has only recently emerged as a widespread and major threat to farmed deer.

Overseas, it has been found in a wide range of wild animal species. For bovine tuberculosis, a closely related disease, the involvement of possums as a wildlife host that is capable of independently sustaining the disease, has made eradication far more difficult than in countries where wild animals are not important hosts. An obvious and important question is therefore whether wild animals play any role in spreading or maintaining Johne's disease in New Zealand.

As a first step to answer this question, Jackie Whitford, Jamie Glossop (Massey University), Geoff de Lisle (AgResearch) and Graham Nugent have started a survey programme covering (initially) three deer farms with a recent history of clinical Johne's disease. The aim of these three surveys is simply to find out whether or not wild animals are infected and, if so, to provide an indication of which species are most commonly infected. At this early stage of the investigation, no attempt is being made to assess whether the wild animals play any important role in passing on infection to other animals, or are unimportant 'dead-end' hosts. That will be the next step should high levels of infection be found.

The three deer farms targeted for survey include two farms near Geraldine in South Canterbury and another near Wanaka. One of the Geraldine farms was surveyed late last year, the other is being surveyed now, and the Wanaka farm will be surveyed in April. In the first survey, post-mortem examinations were carried out on seven cats, 17 hedgehogs, 52 hares, 42 rabbits, 64 possums, two ferrets, one stoat and four black backed gulls. Only one (a hare) of these 189 animals had a visible lesion in its mesenteric (gut) lymph nodes that was suggestive of Johne's disease. However, the mesenteric nodes of each animal are being submitted to AgResearch laboratory at Wallaceville for bacterial culture, as a more sensitive test for Johne's disease. Of the 130 cultures currently underway, one (a hedgehog) has been confirmed as Johne's disease, and ten others have grown mycobacteria that are definitely not bovine tuberculosis.

Further work is underway to find out if these ten are also Johne's disease. If so, this would indicate a quite high prevalence in some species. So far, three of the cats, two of the hedgehogs, three of the hares and two of the rabbits have some form of mycobacterial infection. Assuming that these do all turn out to be Johne's disease, the high proportion of cats and hedgehogs infected would fit with overseas data showing high levels of infection in scavengers. The team is currently on tenterhooks awaiting the final diagnoses from these cultures, and will report the results in a future newsletter.

If wildlife species are shown to be involved in the transmission of Johne's disease back to farm animals, then further research will be needed to investigate the significance of this so that the benefits of wildlife control in reducing the impact of Johne's disease can be assessed.

However, it is important to remember that the relatively high prevalence of Johne's disease in some wildlife could easily be spillover from the infected deer, and thus of no consequence in the persistence and spread of the disease.

Summary of the results of on-going Australian research on Johne's disease in sheep

A good deal of research has been and is being carried out in Australia on Johne's disease in sheep as part of their National Ovine Johne's Disease Control and Evaluation Programme. Last year, an overview of this research was published, called "Ovine Johne's Disease R&D Update.December 2004", produced by Meat and Livestock Australia.

Here we present some excerpts from this publication that could be of interest to deer farmers in New Zealand. While these results are based on research on sheep in Australia and can't necessarily be applied directly to farmed deer in New Zealand, they may still be useful to help guide management decisions by NZ deer farmers.

Controlling ovine Johne's disease within flocks

- Spelling pastures for 6 weeks reduces pasture contamination with ovine Johne's disease bacteria by 90% in most climates. A small number of bacteria may survive for over a year in shaded areas.
- Lambs are susceptible to infection before and after weaning. Infected ewes and contaminated lambing and weaning pastures are major factors in the transmission of ovine Johne's disease. Low risk lambing and weaning paddocks should be prepared to reduce disease transmission within a flock. If low risk pastures are scarce they should be reserved for weaners rather than lambing ewes. Short joining periods and early weaning are recommended to reduce exposure of lambs to infected ewes and pastures.
- Ewes showing signs of ovine Johne's disease can infect their lambs before birth or via milk. Direct transmission is rare in ewes that do not have obvious signs of disease. Ewes should be culled promptly at the first sign of ovine Johne's disease infection. Removing lambs from ewes at birth will not eliminate lamb infection, but will reduce the risk (high value animals).

Eradication of ovine Johne's disease from infected farms

- Eradication by de-stocking, decontamination and restocking has a low probability of success.
- Eradication is not possible or cost-effective unless great care is taken to source uninfected replacement sheep.
- Eradication is difficult when surrounding farms are infected.
- De-stocking for 15 months, over two summers, is usually sufficient for the ovine Johne's disease infection to die off on the pasture.

Economic impact of ovine Johne's disease

- Ovine Johne's disease can result in significant mortality rates and economic losses. Annual death rates between 2.1 and 17.5% of the adult flock have been identified on individual farms. Average economic loss due to ovine Johne's disease was estimated to be Aust$65.92 per hectare per year or Aust$7.68 per Dry Stock Equivalent (DSE).
- Computer simulation models have been developed to predict the spread of ovine Johne's disease within and between farms and to compare the cost-effectiveness of various control strategies. Established infection costs producers on average Aust$17,000 per year (2,000 ewe self-replacing Merino flock). Management strategies that reduce the contact of susceptible sheep with infected faeces can lower flock mortality rates.

Detecting ovine Johne's disease

- Pooled Faecal Culture (PFC) is now the main test used to screen flocks for ovine Johne's disease. Introduction of this test has saved the national programme approximately Aust$6-8 million in the cost of disease surveillance.
- Tracer lambs can be used to detect on-farm infection. They must be exposed to infected pasture for at least 6 months before infection can be detected. This procedure has proved a useful additional tool to test the success of eradication programmes.
- Abattoir monitoring of cull sheep for visible signs of ovine Johne's disease has proved to be a reliable method for detecting infected flocks in regions with a high to moderate prevalence of the disease. Abattoir monitoring is now routine in all states.

Update on JD research in Australia

Colin Mackintosh (AgResearch Invermay), **Tony Pearse** (DINZ and NZDFA) and **Jaimie Glossop** (Massey University) visited Australia earlier this year to discuss research being completed into Johne's disease. The following is a summary of those parts of their report that might be of particular interest to deer farmers in New Zealand.

All Australian researchers visited expressed a strong desire to share existing information and possibly collaborate on future research, particularly in the areas of Pooled Faecal Culture (PFC), the PARALISA blood test and potential development of Market Assurance Programmes (MAPs).

Visit to Orange, NSW

The Market Assurance Programme (MAP) in the Australian sheep industry involves an initial veterinarian's visit with risk assessment and sampling of targeted animals as confirmation of Johne's disease infection on-farm. Repeated rounds of Pooled Faecal Culture (PFC) are then completed as a cost-effective method of on-going monitoring of herd status.

Although researchers are confident about the potential of PFC to detect Johne's disease in deer, approval will be costly as validation is required in a number of state and federal testing centres. Development of blood tests such as the ELISA also depends on the development of an MAP for the deer industry.

Currently, 12 to 14 deer herds in Australia are known to be infected with Johne's disease, and a potential link between them is a common source of deer. Management practices appear to have a significant impact on the severity of clinical Johne's disease on these farms, with significantly fewer deer affected on those properties that have good nutrition and above-average management.

Visit to Elizabeth Macarthur Agricultural Institute, Camden, NSW

Researchers at EMAI principally carry out research on sheep and cattle Johne's disease, including a study of transmission between the two species. They are also developing a direct PCR on faecal samples as a potentially sensitive diagnostic test for the detection of subclinically infected animals.

Visit to Victorian Institute of Animal Science, Atwood, Melbourne

Johne's disease in Australian deer is similar to Johne's disease in New Zealand deer with sporadic adult deaths and weaner outbreaks. To date, all cases diagnosed in Australia appear to be due to the bovine strain of the bacterium, and properties that have experienced outbreaks have had some association with dairy cattle.

The results of a study to determine the sensitivity of tissue culture, histology, individual and pooled faecal culture, and the Parachek blood test (an ELISA) in deer were published in 2004. It was found that tissue culture was the most sensitive method of diagnosis at 92%, and the sensitivity of pooled faecal culture decreased as pool size increased, from 47% for individual samples to 27% for pools of 20 samples. Researchers also found that the number of Johne's disease bacteria excreted by infected deer ranges widely, with deer showing clinical signs generally excreting significantly more than subclinically infected deer.

Vaccination of deer against Johne's disease has been carried out on three severely affected properties in South Australia where other means of control were found to be impractical and where non-specific reactions to Tb skin tests were not an issue. The effectiveness of vaccination is currently being monitored on those properties.

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