

Industry and individual farm perspectives of deer JD

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Johne's disease (JD) is clearly an emerging disease of deer industries a North America, New Zealand, Australia and the UK. The global occurrence of JD in other species suggests it is also likely to become a concern to developing deer industries in other countries. The clinical occurrence and diagnosis of this disease has been discussed elsewhere. This presentation will focus on the issues faced by the individual farmer and the deer industry and will propose a number of options. Areas for research necessary to underpin industry and on-farm JD management programmes will be proposed.

The individual farmer

The individual farmer will view JD in relation to the risk to his or her herd. It can be seen from two perspectives:

Not a serious issue?

Farmers whose herds already have JD and who have not experienced outbreaks of this disease in young deer might consider JD to be of minimal concern. Some farmers will adopt a pragmatic approach and live with the disease.

Alternatively, some farmers may be unaware of this disease and its potential impact on their farming system. However, with increasing awareness of this condition a growing number of farmers are becoming wary.

A serious issue!

JD is a real or potentially serious issue in the following circumstances:

- If JD does not currently exist on the farm, and the farmer wants to keep it that way;
- If JD does not exist on a deer component of a larger sheep and/or cattle farm, which has the infection in those stock classes;
- If the farming enterprise relies on purchase of weaners from a number of sources for venison finishing. This is important since the highest loss rates have been in this class of animal and under those circumstances;
- If the farm is a stud selling high-value animals or genetic material. In New Zealand declaration of Johne's disease is now beginning to affect stud deer sales. It is becoming more imminent that stud deer farmers will be asked by wary buyers to provide an assurance of the Johne's disease status of their property. Potentially, because the risk of transmission in semen and with embryos is very small, the market may dictate that a reputable studs with Johne's disease may be able to sell only genetic material rather than live deer;
- If a commercial deer farm is genetically recorded as part of a breeding and selection programme, the effective value of individual animals increases and therefore the risk of loss of genetic potential through disease such as JD increases;
- If highest profitability is the goal of the property, risk of clinical and/or sub-clinical losses will limit the ability to achieve that goal;

There is a concern for the future marketability of venison if the herd prevalence of JD increases. This is because of its association, albeit inconclusive at present, with Crohn's disease. Food safety, either real or perceived, is one of the major risks to the marketplace. While it is unlikely that JD would transmit via venison, this has not been proven not to be the case. The consumer may be less convinced by lack of evidence rather than evidence that confirms lack of risk. Furthermore, while one tends to focus on the consumer of the product as being "the market", in reality it is frequently the big chain retailers who determine

acceptability of product in the marketplace. To differentiate product from that of competitors, a large retail chain could decide that they only wish to source venison from proven JD-free herds or countries, thus giving a competitive advantage over their rival retailers. If the link with Crohn's disease was confirmed, this could become a significant issue;

There is always a risk that those in the venison supply chain may talk the price of venison down if there is a perceived or real risk of disease transmission;

While there is no indication that JD has transmitted with velvet antler, this product is unique in that the first step in the processing chain is at the farm, in a deer yard environment, which in most circumstances would not meet the requirements for hygienic food handling. Contamination of the velvet from faecal material or dust containing mycobacteria is an inevitability. The organism may survive the processing procedure, depending on which method is used, eg. freeze-drying vs. heat.

Keeping a herd JD-free

Many farmers whose herds currently demonstrate no evidence of Johne's disease are becoming concerned to keep their current "JD-free" status. Increasingly questions are being asked of veterinarians as to how the JD status of live animals can be verified. The following options are proposed:

JD-free herd of origin for deer purchases- At present, without a validated herd screen test, this can be based only on clinical evidence of absence of disease, coupled with the integrity of the seller's declaration. Definition of status on these criteria alone is unlikely to be robust since the complete history of the herd of origin would require knowledge of sources of stock coming onto that property over a prolonged period, whether sheep or cattle had been grazed on the deer farm.

Semen – there have been no published studies in deer to establish whether *M. paratuberculosis* will survive in deer semen. However, *M. paratuberculosis* has been cultured from fresh semen from clinically affected bulls. Infections of the testes are probably uncommon in stags and transmission via semen is probably very rare. However, semen should not be collected from deer with clinical JD.

It is not known whether or not the infection would become established by insemination of a hind with infected semen. In cattle, recovery of *M. ptb* from the reproductive tract of artificially inoculated cows has been reported in the absence of development of clinical disease.

Embryos - fresh embryos may contain a small risk of transmission of *M. ptb* but it is likely to be very low. Frozen embryos are likely to present an even lower risk.

Farmer risk aversiveness

Based on these criteria the farmer needs to decide how risk averse they are to the introduction of JD. One example of risk aversiveness was where a farmer subjected a stag shot from a safari park, to a series of tests before using it in an AI programme. The semen was collected from the reproductive tract of the animal immediately after it was killed and a blood sample was collected for gel immunodiffusion, ELISA and complement fixation tests. Faeces were smeared for a ZN stain. The faeces were cultured, gross pathology was observed, a histological section of ileocaecal valve examined, and the semen was both cultured and subjected to a PCR test. It was agreed that if all of those test criteria were negative the risk of transmission of JD from that semen was very minor.

The "industry"

In NZ, Johne's disease in deer is regarded as a problem for the deer industry and not a problem owned by MAF on behalf of society as a whole. Thus, the industry is generally required to fund research and develop programmes to control or eradicate JD in deer if so

desired. This contrasts with the situation in Australia where the National Johne's Disease programme that is setting out to eradicate JD from sheep, cattle and deer. During surveillance, a number of JD-infected deer herds have been found. However, that scheme is on technical "thin ice" when it comes to deer herd screening since no test has been validated for that purpose.

Another issue that industries face with "industry ownership" is that decision makers are often those directly affected or who may have voting constituents who are directly affected by the disease. These people may have a conflict of interest.

Further, deer industries worldwide are small and their ability to generate revenue is limited compared with the funding required to operate national disease control programmes and to fund the research which is necessary to underpin such programmes.

Deer industries may have the following options:

Option 1. Do nothing

This may be the appropriate option if the herd prevalence of infection is already high, since current technology is insufficient to allow eradication of the disease.

If the herd prevalence of the disease is low as is currently believed in New Zealand, the "do nothing" option could result in:

- spread of the infection with a resultant increase in herd prevalence, and therefore this would result in:
- a higher incidence of clinical disease threatening the economic viability of individual farms
- potentially putting future markets at risk by association with a suspected related human disorder (Crohn's disease)
- farmers whose herds are currently not affected are at risk of introducing infection forcing a policy of closing their herds if they are risk-averse.

Option 2. Eradication

- This option may be targeted at the individual animal and herd levels.
- *Individual animals:* currently a test and slaughter programme within a herd is not a feasible option. Firstly, no tests or combination of tests are adequate to detect infected animals reliably at a satisfactory sensitivity. Secondly, survival of the organism in the environment means that infection of uninfected deer is inevitable. This is in contrast with eradication of *M. bovis*, which has a shorter survival time in the environment and for which there is an adequate series of tests and management methods to eliminate the disease in most situations.
- *Herd:* The infected herd can be depopulated, thereby removing the infection from the farm. However, unless there is a guarantee that replacement animals come from JD-free herds, this may be an exercise in futility. Furthermore, a considerable time-period is required to reduce the risk of reinfection via soil. This is applied in the Australian sheep industry scheme. This is politically, personally and economically difficult, even with state funding.

If the herd prevalence of the disease is high there is little point in a herd depopulation option since most herds for replacement would be infected. Depopulation of large numbers of herds would result in an over-supply of venison and therefore a fall in the price, thereby further seriously affecting the economics of the deer industry

Option 3. Control: A market assurance programme

- The aim of a market assurance programme (MAP) is to reduce the rate of spread of the disease, therefore reducing the increased rate of increase in herd prevalence. This can be implemented to put the disease into a “holding pattern” pending future technology for diagnosis and/or control and/or eradication, eg. individual animal tests and/or validated vaccination.
- A market assurance programme would have validity only if the herd prevalence of JD is low. Thus the first step is accurately estimate the herd prevalence. Speculation in New Zealand has chosen less than 20% as a realistic starting point for a MAP.

Market assurance programmes:

- establish a risk category for the farm based on a range of herd screening tests. The Australian sheep scheme has the following categories: “monitored negative 1-3”, “Check tested”, “Tested to MAP standard”, “Nil assurance”, “Suspect”, “Under surveillance” and “Infected”;
- allow the buyer to choose the risk category when sourcing animals;
- identify the herd status for the owner to manage, eg. if there is a high animal prevalence *versus* a low animal prevalence, or if there is a prevalence in difference classes of stock shown by a screen test, then management practices can be put into place;

Implementation

- Once the herd prevalence of the disease is established, and it is decided a MAP could be effective, the following proposal, put by the New Zealand Veterinary Association Deer Branch to the New Zealand deer industry, could be implemented:
- A voluntary programme would be the most feasible
- Herd screening tests would be applied sequentially to establish the risk status of the herd
- There would be a central register of infected herds. This register would be independent of the deer industry. One proposal is that it be managed by a central diagnostic laboratory contracted to perform herd screen testing
- Farmers would have the option to either declare or not declare their herd status
- There would be education throughout the industry to encourage a “Buyer Beware” approach, meaning that purchasers of stock would request a declaration of herd status from potential sellers.

Advantages of a MAP

- It would decrease the rate of spread of JD throughout the national herd
- It would allow farmers to select deer from low risk farms
- It would buy time for research and introduction of new technologies to control and/or eradicate the disease
- It is a voluntary programme
- It is non-bureaucratic and therefore at minimal cost.
- Data would evolve to enable the industry to have a better idea on the herd prevalence of infection. This could have beneficial effects in the market place.

- If in the future product needed to be differentiated from JD-free herds for various market niches, it could be done as part of a quality assurance programme

Disadvantages of MAPs

- Tests are yet to be validated for this purpose
- Infected herds are exposed to the financial implications
- The programme will not, in itself, result in eradication of the disease. It can only limit the spread on infection
- Costs are borne by the individual farmer

What knowledge is now needed

The following would significantly aid deer industries in grappling with the problem of Johne's disease:

- Development and validation of cost-effective herd screening tests;
- Development and validation of individual live animal tests that are cost-effective;
- Investigation of the risk of carcass and velvet antler contamination with *M. paratuberculosis* to provide information for consumer food safety concerns;
- Understanding of the epidemiology and risk factors associated with disease outbreaks and disease spread so farmers can implement better management strategies to minimise the risk of clinical and sub-clinical losses associated with JD;
- Development of a vaccine. This appears to be the most appropriate method for management of JD within the deer industry. There are a number of technological advances in vaccine developments, including sub-unit vaccines, which may show promise. However, any vaccine must have minimal cross-reactivity with the Tb tests and not interfere with Tb control and eradication programme;
- The industry needs an awareness campaign to provide farmers with a better understanding of this disease and the difficulties that it currently poses.

Conclusion

Johne's disease was predicted more than twenty years ago to be a potentially emerging disease for the deer industry in New Zealand, particularly after publications from the UK describing severe outbreaks of this disease in young deer. It is of significance that many deer industries throughout the world are now grappling with this problem. There is a considerable opportunity for industries to amalgamate their knowledge, their research needs, their funding and intellectual wisdom.

This disease currently is not having a huge impact on the deer industry in relative terms, but because of the rapid recent escalation in clinical diagnoses it is clear that the disease is spreading, and could severely affect the industry in future. Currently, a number of options exist for the individual farmer and deer industries. For both parties, there is no better time to implement a management programme than while the herd prevalence of the disease is low.