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# Research into Johne's disease and Leptospirosis

## - Report 2 -

[Latest results from this work and other studies for Johne's disease can be found at the JDRC website www.jdrc.co.nz]

## Farm health and production Survey

In the period between the end of year 2008 and first half of 2009, paratuberculosis (Johne's disease JD) and leptospirosis were surveyed by mail questionnaire to 7,998 farmers, all clients of 28 veterinary practices in seven selected regions of New Zealand. A total of 1,940 questionnaires were returned – a response rate of 24.3%. As reported before, the regions of Manawatu-Wanganui, Canterbury, Hawkes Bay and Southland returned most of the questionnaires, hence were best represented in the survey. The vet-practice response rates varied from 11% to 47%.

Figure 1 shows that, according to the New Zealand statistics database AGRIBASE, the species composition of survey farms was similar to the composition of all farms in the survey regions. Sheep&beef farms were slightly over- and beef farms slightly under-represented.

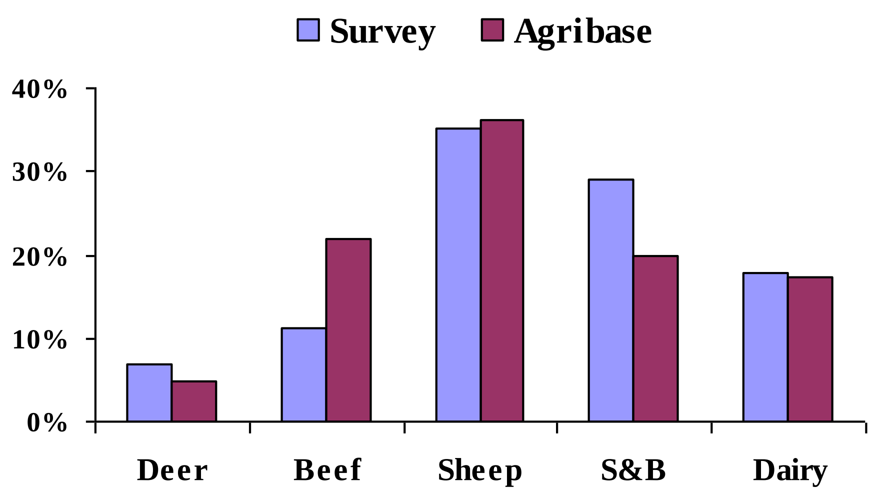


**Figure 1**. Comparison of the frequencies of farms with different species in the survey versus New Zealand farm statistics (Agribase) of the same regions

## Paratuberculosis (Johne's disease JD)

Clinical JD was defined as at least one case of JD in the last three years that was suspected by the farmer or confirmed by veterinary and/or laboratory diagnosis. The 3-yr-prevalence of clinical JD in beef cattle, sheep, deer and dairy cattle in the selected regions and overall is shown in Table 1.

**Table 1.** Number and regional distribution of confirmed and suspected cases of Paratuberculosis in herds, based on farmer response (N = 1,940 farms; **average rates**; **high rates**; **low rates**; no % shown for small samples)

| REGION | Herd status | Beef cattle | Sheep | Deer | Dairy cattle |
|---|---|---|---|---|---|
| **Manawatu-Wanganui** | No. of herds/flocks | 299 | 300 | 35 | 206 |
| | No. of Confirmed/suspected herds/flocks | 12 | 52 | 13 | 43 |
| | Herd/flock prevalence | **4%** | **17%** | **37%** | **21%** |
| **Canterbury** | No. of herds/flocks | 261 | 255 | 121 | 131 |
| | No. of Confirmed/suspected herds/flocks | 11 | 41 | 48 | 38 |
| | Herd/flock prevalence | **4%** | **16%** | **40%** | **29%** |
| **Hawkes Bay** | No. of herds/flocks | 171 | 163 | 25 | 28 |
| | No. of Confirmed/suspected herds/flocks | 8 | 38 | 7 | 3 |
| | Herd/flock prevalence | **5%** | **23%** | **28%** | **11%** |
| **Southland** | No. of herds/flocks | 56 | 140 | 22 | 61 |
| | No. of Confirmed/suspected herds/flocks | 1 | 20 | 8 | 15 |
| | Herd/flock prevalence | **2%** | **14%** | **36%** | **25%** |
| **Waikato** | No. of herds/flocks | 69 | 59 | 7 | 90 |
| | No. of Confirmed/suspected herds/flocks | 3 | 7 | 0 | 14 |
| | Herd/flock prevalence | **4%** | **12%** | | **16%** |
| **Wairarapa** | No. of herds/flocks | 64 | 61 | 8 | 43 |
| | No. of Confirmed/suspected herds/flocks | 5 | 16 | 0 | 8 |
| | Herd/flock prevalence | **8%** | **26%** | 0% | **19%** |
| **Otago** | No. of herds/flocks | 61 | 82 | 10 | 40 |
| | No. of Confirmed/suspected herds/flocks | 2 | 16 | 3 | 8 |
| | Herd/flock prevalence | **3%** | **20%** | **30%** | **20%** |
| **Marlborough** | No. of herds/flocks | 28 | 27 | 2 | - |
| | No. of Confirmed/suspected herds/flocks | 1 | 8 | 0 | - |
| | Herd/flock prevalence | **4%** | **30%** | | - |
| **East Coast** | No. of herds/flocks | 22 | 21 | 4 | - |
| | No. of Confirmed/suspected herds/flocks | 0 | 4 | 0 | - |
| | Herd/flock prevalence | **0%** | **19%** | | - |
| **Overall** | No. of herds/flocks | 1031 | 1108 | 234 | 599 |
| | No. of Confirmed/suspected herds/flocks | 43 | 202 | 79 | 129 |
| | Herd/flock prevalence | **4%** | **18%** | **34%** | **22%** |

The highest proportions of JD affected herds/flocks were in deer and dairy cattle followed by sheep and beef cattle. In line with earlier reports, highest JD rates in deer were reported from the South Island. However, the 3-year prevalence of deer in Manawatu-Wanganui was similar to that in the South Island, and overall was more variable in North Island than in South Island regions.

Clinical JD in sheep was most commonly observed in Hawkes Bay, Wairarapa and Marlborough, and lowest in Waikato.

Canterbury (29%) presented the highest 3-year prevalence for dairy cattle followed by Southland (25%), whereas Hawkes Bay farmers reported a lower prevalence in dairy cattle than the overall average.

In beef cattle, clinical JD was more prevalent in Wairarapa, and less in Southland, than in the other surveyed regions. However, 46% of the beef cattle farms studied were finishing herds having none (or few) adult breeding animals. Since clinical JD tends to be observed more often in adult cattle than in young growers, the lower prevalence in beef cattle might have been due to low age rather than a lower overall occurrence in beef cattle.

***Evidence for transmission of Mycobacterium avium paratuberculosis (MAP) between co-grazing ruminant species***

Sheep, beef cattle and deer are often ‘co-grazed’, either simultaneously or consecutively on the same pasture block, a specific feature of livestock farming in New Zealand as opposed to most other countries. Little is known about the transmission of pathogens such as MAP and leptospires (and not a lot about enteric parasites) between species. We therefore asked farmers about pasture allocation to the different ruminant species on farm.

The criteria for MAP transmission between species was the rate of observed clinical JD in a species mob if other species were present and in contact (sharing pasture), compared to single species farms. In contact meant that there had to be direct physical contact by simultaneous grazing (co-grazing) or indirect contact (alternately) by successive grazing of the same pasture block, assuming that the following species is on risk of contamination from the previous one.

Figure 2 summarises the most important findings from the analysis of survey data.

Deer and sheep: Deer sharing pasture with JD-negative[1] sheep appeared to protect deer indicated by a 3-fold lower risk JD clinical manifestation in deer compared to deer-only farms. However, when JD was suspected or confirmed in sheep mobs, the risk of clinical JD in deer increased 7 times compared with deer only farms. And vice versa – JD-negative deer was associated with a 5-times lower risk of JD in sheep, whereas JD was 6-times more frequently reported from sheep in the presence of JD-positive deer as compared to sheep-only farms.

Deer and beef cattle:, No significant associations were found between these two species, perhaps due to relatively few farms grazing deer and beef cattle. At this stage of the research, an association between these two species and JD clinical manifestation can not be ruled out.

Sheep and beef cattle: Similar to deer and sheep, clinical JD was 8-10-fold more often reported in beef cattle when co-grazing sheep were also affected by clinical JD and half as often when co-grazing sheep were JD-negative. Vice-versa, the same relationships existed for JD in sheep with/-out contact with beef cattle.

The bottom line: It appears that JD in one species increased the risk of clinical JD in another. However, possible reporting bias could not be ruled out at this stage.

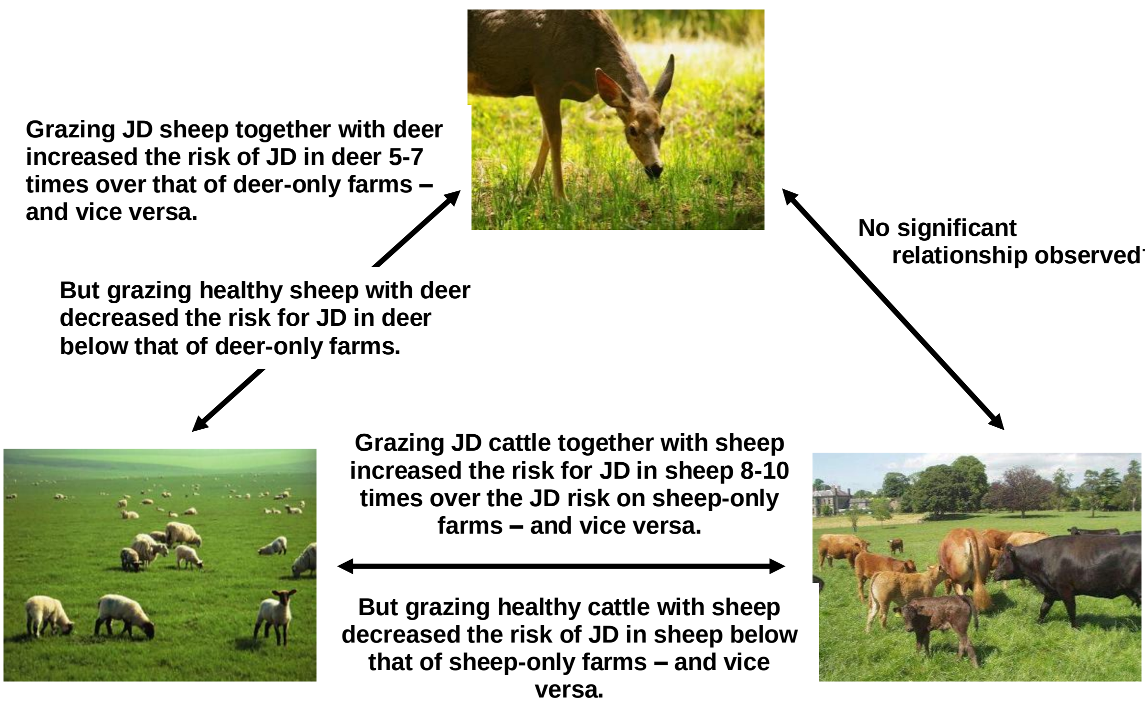


Figure 2: Transmission between species:
Observed clinical Johne's disease (JD) on single versus farms co-grazing two species

[1] No clinical cases reported in the last three years.

## Leptospirosis

### *Human health risk*

The survey asked whether, how often and when leptospirosis was suspected or diagnosed among farmers, farm workers or family members if they were in contact with ruminant livestock. The results (Figure 3) indicate that the rate of human leptospirosis in the past 10 years was about 90/100,000. This rate is 20 times higher than the rate of official public health reports about the risk for the general population (4.4/100,000), and similar to a previously published report[2] of notified cases among farmers during 1990-98 (92/100,000). We therefore believe that the data are fairly representative for the farming population. However, one must consider that leptospirosis is rarely confirmed by laboratory diagnosis, hence farmers may only have recalled and reported the most serious clinical episodes that were confirmed by medical and/or laboratory diagnosis, and thus officially notified. Survey data suggested that the rate of clinical leptospirosis in former years (1954 – 1999) was lower than rates of recent years (2000 – 2008), possibly due to memory bias and generation change among respondents.

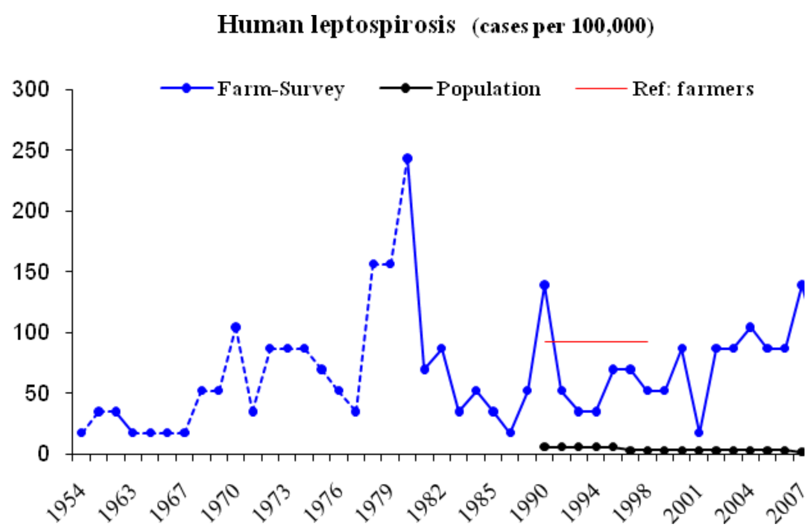


**Figure 3: Clinical leptospirosis among survey farmers (blue dotted 1954-79, blue 1980-2007) in comparison to rates of notified cases in the NZ population (black) and a report[2] about notified cases among farmers durnig 1990-98 (red).**

The incidence of human leptospirosis was lower in Southland than in any other regions. It was higher among people on large dairy or beef cattle farms (>400 head) compared to sheep or deer farms. However, the human leptospirosis incidence was 8-fold higher in farmers reporting

[2] CN Thornley, MG Baker, P Weinstei, EW MAAS, *Epidemiol. Infect*. **128**, 29±36, 2002.

that their deer were affected by leptospirosis than farmers where leptospirosis was not observed in deer. This confirms the specific public health implication of leptospirosis in deer. Vaccination of deer also appears financially attractive: a recent study by Wilson and co-workers (2009) resulted in up 6.5kg additional body weight at slaughter in yearling deer if it was established that young deer were heavily challenged from weaning onwards.

Human leptospirosis was significantly lower when ruminant livestock on-farm was vaccinated. While this finding sounds encouraging, it requires confirmation by testing humans and livestock on the same farm for true exposure (MAT antibody).

***Leptospirosis in animals***

As reported before, clinical leptospirosis was most frequently suspected or confirmed over the past three years on deer farms (5.1%), followed with a wide margin by beef cattle (2.1%), sheep (1.3%), and dairy cattle (0.8%). Due to the low number of reported clinical leptospirosis cases in the survey data, only deer herds were examined further. The breakdown of 237 deer herds suggested that leptospirosis tended to be observed more often on farms where deer were co-grazed with sheep. However, such inference is premature at this stage. Data currently collected by all 28 collaborating veterinary practices through on-farm sampling are expected to provide more accurate information, based on laboratory test confirmation of herd/flock infection status.

Table 2: Clinical leptospirosis observed during the past three years in deer herds with/without co-grazing with other species

| | # Farms | # Lepto pos farms | %-pos |
|---|---|---|---|
| Deer | 45 | 0 | 0.0% |
| Deer+sheep | 24 | 3 | 12.5% |
| Deer+beef | 35 | 1 | 2.9% |
| Deer+dairy | 6 | 0 | 0.0% |
| Deer+sheep+beef | 109 | 6 | 5.5% |
| Deer+sheep+dairy | 9 | 1 | 11.1% |
| Deer+beef+dairy | 0 | 0 | 0.0% |
| Deer+sheep+beef+dairy | 9 | 0 | 0.0% |
| Total | 237 | 11 | 4.6% |

Results about associations between JD or leptospirosis on production outcomes are not yet available and will therefore be the subject of the following report (3).

## Progress of sampling animals on farm for JD and leptospirosis

Faecal and blood sampling from a subset of up to 300 survey farms and some 11,000 animals is currently underway. Up to the second week of November, samples have been received from 183 farms and 5,700 animals. The location of farms not yet sampled, partially or completely sampled is shown in Figure 4. Farms selected for sampling were stratified by species composition to provide maximum statistical power for analysis, and therefore the most robust result. As already collected by mail survey 2008, production outcomes were again inquired from all sampled farms to obtain up to date information. We expect that, once complete, the sample of 300 farms will result in more refined information about risks, species transmission and economic consequences associated with Johne's disease and leptospirosis.

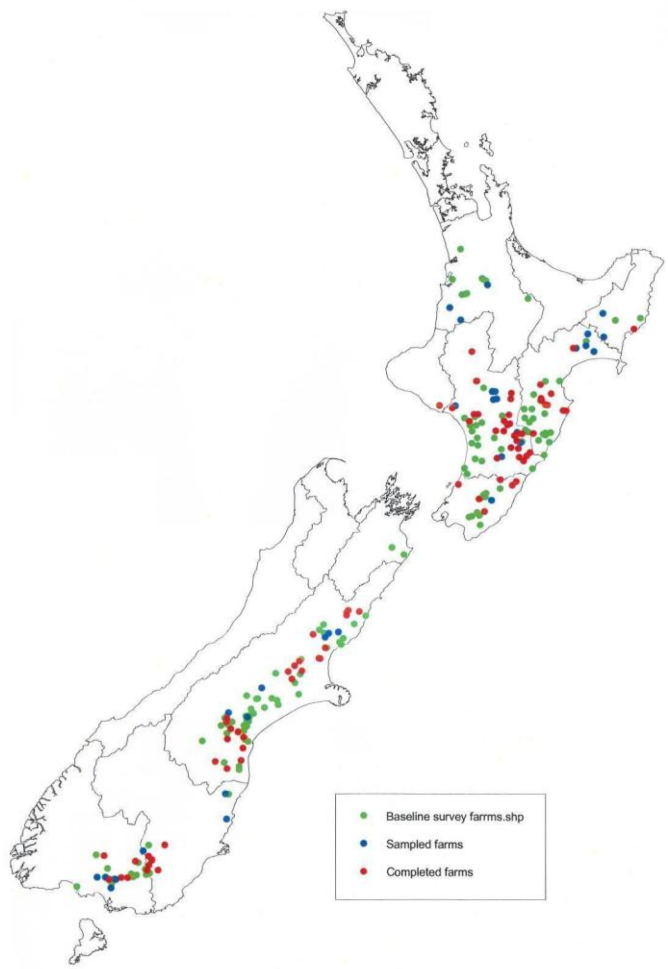


Figure 4. Location of 300 farms listed for sampling. (●) Farms not yet sampled. (●) Farms incompletely sampled. (●) Farms sampled completely, all questionnaires received.