

## Cost-effectiveness of further research into OJD and soil type/pH

There has been long-standing interest in Australia on whether the pH of soil has any impact on establishment or course of ovine Johne's disease under Australian conditions. Despite a number of meetings to discuss the matter and the lack of a body of scientific evidence, interest within some industry groups has not waned. The matter has also been considered by the Johne's disease Research Advisory Group on a number of occasions and this document sets out the rationale for the decisions reached by the Research Advisory Group members.

Key issues that have been considered in these deliberations include:

1. This specific type of investigation is quite high-risk in that it is unlikely to provide conclusive results:
  - The mycobacterial requirement for iron, which is made more bioavailable in a low pH environment, applies in an *in vitro* bacterial culture situation or in an infected animal. It does not apply in the environment, where free-living mycobacteria are in a dormant state, so that there is no requirement for an external source of iron (a key part of the hypothesised mechanism of action).
  - Because of the inherent complexity of the trial design it would be necessary to focus on a single (or very small number) of potential factors (e.g. just soil pH)
  - a statistical association does not necessarily mean the hypothesised factor is causal
  - Because any likely relationship is complex there is a significant risk that focussing on a single factor such as soil pH might fail to detect true underlying relationships (assuming they exist). For example, acid soils are common throughout the New England area and there have been ample opportunities for introduction of OJD, yet OJD is still not known to occur in the area, suggesting that any relationship may not be as simple as acid soils.
  - Adding additional factors (e.g. soil type) might reduce risk but would add exponentially to complexity and cost
  - Previous research has failed to detect any specific relationship between soil pH (within the range of the study) and OJD, although parent soil type was found to have some effect on OJD prevalence
  - If there is a relationship between OJD and soil pH, it is quite possible (likely, given the failure to detect any association in the study above) that quite large changes in pH will be required to have any impact on the disease – i.e. it is acid v. alkaline, rather than very acid v. moderately acid and this has been shown in agronomic trials to be difficult to achieve and not cost effective under normal Australian farming conditions. (see for example <http://www.dpi.vic.gov.au/agriculture/farming-management/business-management/ems-in-victorian-agriculture/environmental-monitoring-tools/soil-acidity>)
  - The incidental geographical correlation of higher OJD clinical prevalence with the occurrence of low pH soils in Victoria cannot be taken as proof of causation without substantially more in-depth analysis of the data. For instance, the higher prevalence of OJD also happens to coincide with higher sheep numbers, soil which is non-arable and, hence, more suited to animal production, etc. A project to further investigate this is currently under consideration by AWI.

2. What will be the benefit/outcome of the research for producers?

- There are currently a number of very good (agronomic/production) reasons for producers to lime soils and reduce soil pH, yet uptake is limited. Will identification of a relationship with OJD increase this uptake?
- If the relationship is acid v. alkaline, rather than just degrees of acidity, it is not feasible for farmers to manipulate their soil pH to the extent necessary to have any impact on OJD in their flock
- Further, if the relationship requires alkaline soils for protection, there are only relatively small areas of Australia where such soils occur (e.g. parts of north-west Victoria and south east SA)

3. Research of this nature is complicated, time consuming and expensive:

- Trials need to involve multiple farms with a variety of soil types and/or pHs, or a complex of paddocks sufficient to run hundreds of sheep in a replicated design with different soil treatments on each paddock and to control for the many confounders that could influence the outcome (e.g. age, breed, management factors, including densities, grazing systems, other enterprises, buying and selling practices)
- Sample sizes (both sheep/farm and farms/paddocks) need to be large to provide sufficient power to detect moderate effects and provide confidence that any effect observed is genuine
- Trial duration needs to be sufficient to allow differences to become apparent, probably of the order of 3-5 years or more
- Because of the scale, duration and complexity of design the research is likely to be costly (most likely >\$1 million)

4. Competing research priorities

- Given the above comments, it is difficult to justify a program of complex, costly and high-risk research which may not provide any real benefit to the producers who ultimately provide the funding.
- There is a limited research budget and MLA and the RAG have chosen to invest in other areas that are expected to have better prospects of delivering useful outcomes for all producers, through improved diagnosis and a better and safer vaccine.

**Johne's Disease Research Advisory Group**

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