Evaluation of a JD bulk milk ELISA as a herd screening tool in NZ dairy herds

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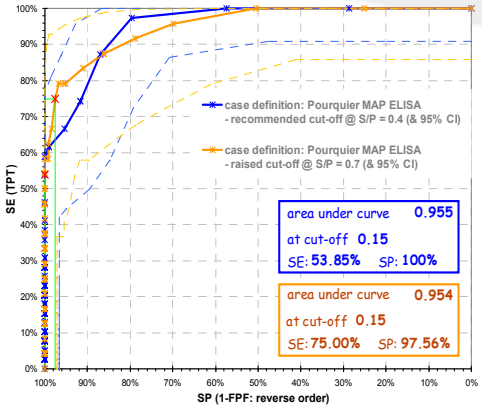
Introduction

A genomic study for the Johne's Disease Research Consortium demands efficient identification of at least 2000 New Zealand Holstein-Friesian or Jersey dairy cows with advanced MAP infection. We therefore need tools to identify and target herds with higher Johne's disease risks for individual cow screening by ELISA on herd-test milk samples.

Bulk milk ELISA tests are simple to administer using dairy company vat samples and enable the screening of thousands of herds at minimal costs. However given the low sensitivity of MAP ELISAs and expected low sero-positivity of MAP infected herds in New Zealand, the use of bulk milk tests present a special challenge for herd level Johne's disease screening.

Pooled milk

An evaluation of commercial ELISA kits to test their potential as pool tests for 10 herd-test milk samples demonstrated comparable performance using individual milk samples but pool test performance varied widely. The MAP indirect screening ELISA from Pourquier performed surprisingly well as a pool test as the ROC curve below shows. The test was able to detect more than 50% of pools containing a single serological reactor cow while maintaining pool test specificity at 100%. For detecting moderate – strong reactors (ELISA SP>0.7), test sensitivity was 75%.



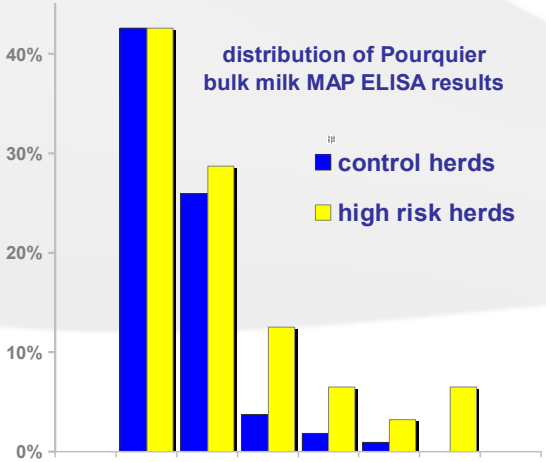
ROC analysis of pooled milk MAP ELISA ;
positive case definition = pool with ELISA reactor cow at stated cut-offs

Methods

Based on the pool test data and indicators in the literature, we decided to investigate the performance of the 'Pourquier Paratuberculosis ELISA screening kit' as a vat test, we sampled the milk vats of 154 dairy herds (case herds) which had recorded culling of Johne's disease cows over several years on the LIC National Dairy Cow Database. Another 278 randomly selected herds from across New Zealand served as controls.

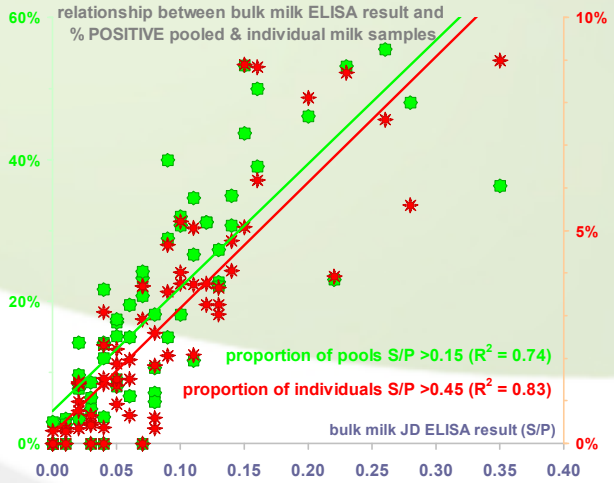
Subsequently, sixty-four herds of above herds were randomly selected after stratification according to the vat test result for screening by 10-sample pooling of herd-test milks (targeting cows over 2 years old) with individual confirmation testing.

Results



Proportion of control vs JD-risk herds categorised by vat ELISA results (SP ratios)

Differences between the distribution of vat test results in control herds versus JD-culling case herds (herds routinely recording Johne's cases) are clearly seen in above graph – with a highly significant right shift (p=0.000). The vat ELISA test result (SP ratio) was greater than 0.1 amongst 14% of the case herds compared with only 1.4% of control herds.



Correlation between vat ELISA and individual cow screening (using 10 sample pooling)

Similarly vat test results were highly correlated to the within-herd sero-prevalence results (R^2 = 0.83). A comparison of low (SP ≤ 0.05), mid (>0.05 – 0.10) and 'high' (SP > 0.10) revealed significant differences (p<0.01) in mean within-herd sero-prevalence ranging from 0,7 to 2.0 and 5.3% respectively.

Conclusion

The results of this preliminary investigation are consistent with the findings of van Weering *et al* (2007) and Duthie *et al* (www.biobest.co.uk/forms/johnes_paper1.pdf 2005).

They clearly demonstrate that the Pourquier MAP ELISA vat test is a useful research tool under New Zealand dairy conditions. The vat test will complement clinical history to help identify and prioritise herds with higher Johne's disease risks for the genomic study.

Reference

van Weering, van Schaik, van der Meulen, Waal, Franken and van Maanen **2007** Veterinary Microbiology **125**:49–58

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