THURINGIAN ANIMAL DISEASE FUND

Animal Health Service

The probability of freedom from paratuberculosis – A tool to identify non-suspect herds.

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Goal

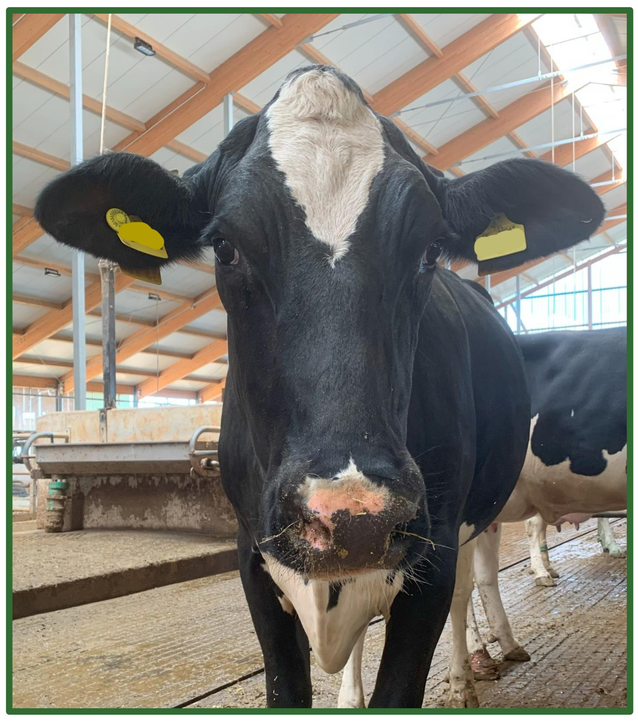
- Monitoring and identification of herds certified as not suspected of being infected with *Mycobacterium avium* ssp. *paratuberculosis* (**MAP**)
- Identification of non-suspect herds without time-consuming individual animal testing
- Quantifying the risk of introduction due to animal traffic

Method

- Calculation of the probability of freedom from the disease ($\mathbf{P_{Free}}$) via:
  - intra- and/or inter-herd prevalence
  - sensitivity of the diagnostic methods used
  - Probability of introduction

Findings

- Evaluated with the conventional methods for certifying herds as non-suspect of MAP, $\mathbf{P_{Free}}$ reaches 99%
- $\mathbf{P_{Free}}$ increases with increased sensitivity or test repetitions
- $\mathbf{P_{Free}}$ decreases with increased animal traffic



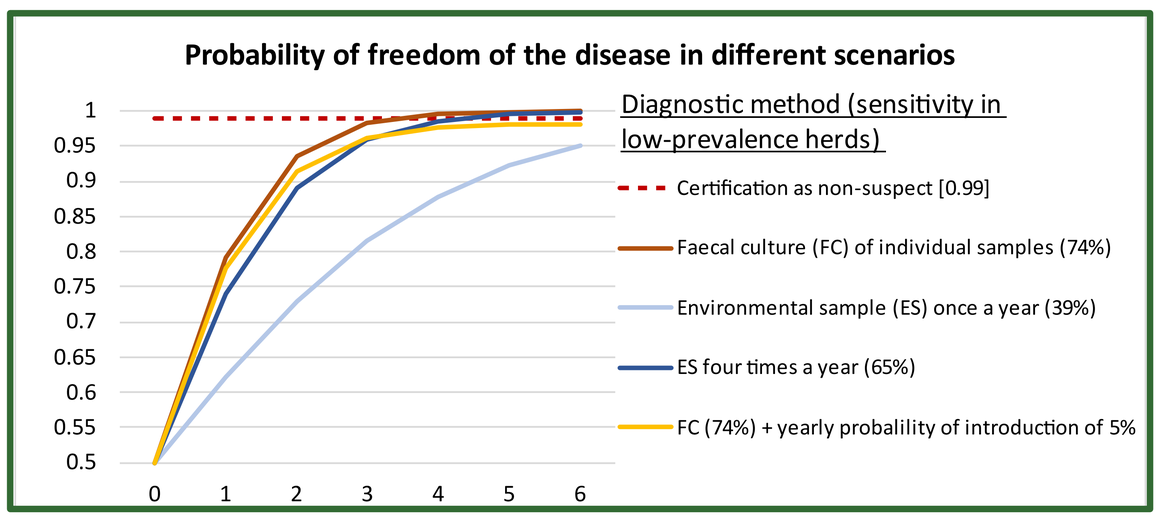
Source: A. Klassen

$$Probability\ of\ Freedom\ (\boldsymbol{P_{Free}}) = \frac{1 - Probability\ of\ Infection\ (\boldsymbol{P_{Inf}})}{1 - P_{Inf} \times Test\ Sensitivity}$$

$$P_{Inf} = Probability\ of\ Introduction\ (\boldsymbol{P_{Intro}}) + (1 - P_{Free,previous}) - (P_{Intro} \times (1 - P_{Free,previous}))$$

Introduction

The control of paratuberculosis at farm level is lengthy and, depending on the diagnostic method, also cost-intensive. The voluntary Thuringian Paratuberculosis Control Programme (**TPCP**) provides cattle farmers a pathway to eliminate the infectious agent *Mycobacterium avium* ssp. *paratuberculosis* (**MAP**) from the herd and certify the herd as non-suspect of having paratuberculosis if no MAP had been detected for at least three years. For this purpose, an annual faecal culture testing of all adult cattle was necessary. Since 2023, monitoring of certified herds relies on sufficiently high probability of freedom from paratuberculosis ($\mathbf{P_{Free}}$) as determined by various diagnostic approaches including analysing pooled samples for MAP and MAP antibodies. An essential element of this monitoring concept is the control of animal traffic into the herd.



Yearly development of the probability of freedom from the disease using different diagnostic methods (brown: individual faecal samples; light blue: environmental samples once a year; dark blue: environmental samples 4 times a year) and assuming an annual probability of introduction of 5% (yellow).

Methodology

In 2022, 148 farms in Thuringia were enrolled in the TPCP. At the end of this year, 63 (42.6%) farms were certified as “non-suspect”, and a further 11 farms were in the certification phase to achieve this status. Taking into account the limited sensitivity of the faecal culture test and assuming a closed herd, at least from the start of the certification phase, a necessary $\mathbf{P_{Free}}$ of ≥ 99% was calculated. Annual testing is required to maintain the status and the probability of introduction through animal movements is considered, as imprudent purchasing of animals is the main cause of MAP introduction.

Results + Conclusion

During the first year of applying this approach, we observed that

1. the higher the sensitivity or the more repetitions of the diagnostic test at herd level, the higher the $\mathbf{P_{Free}}$
2. the higher the risk of introduction via purchase, the lower the $\mathbf{P_{Free}}$.

Monitoring of MAP non-suspect cattle herds using $\mathbf{P_{Free}}$ provides a sufficient level of confidence and enables farmers and program managers to apply different monitoring approaches. It also allows the identification of non-suspect herds and the comparability of diagnostic methods used.

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