

# Assessment of the validity of on-farm tests to diagnose uterine infection in dairy cows

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## Introduction

Dairy cows commonly experience uterine bacterial infections post-calving, which can lead to reproductive tract inflammation. While diagnosing uterine infection requires bacteriological culture, on-farm identification of inflammation is quicker. Moreover, antimicrobial treatment has shown positive impacts on reproductive performance of cows identified with inflammation of the reproductive tract. In the face of antimicrobial resistance concerns, however, the diagnostic of uterine infection might become essential. In this prospective cross-sectional study, our aim was to assess the diagnostic validity of various tests for identifying uterine infection (UI) in dairy cows, and to evaluate their utility under different scenarios.

## Materials and methods

From July 2020 to April 2023, we sampled cows between 29 and 43 (DIM) in 7 dairy herds. We evaluated 6 diagnostic methods: laboratory bacteriological culture, Petrifilm®, Tri-Plate, luminometry, purulent vaginal discharge (PVD), and esterase. The vaginal discharge was assessed using a Metrichick™, and uterine samples, for the bacteriological (laboratory, Petrifilm, and Tri-Plate) and esterase test, were collected using uterine cytobrushes. Test results were dichotomized using thresholds of  $\geq 3$  (mucopurulent discharge) for PVD,  $\geq 2$  (moderate amount of leukocytes or more) for esterase,  $\geq 100$  CFU/mL for the laboratory culture, and of  $\geq 1$  CFU on at least one of the medium for Tri-Plate. For Petrifilm and luminometry, multiple thresholds were tested (Petrifilm: 100 to 350 CFU/mL; luminometry: 50 to 300 relative light units). We estimated sensitivity and specificity of each test using Bayesian latent class models. Additionally, we devised 10 scenarios reflecting real-world farm conditions, exploring the predictive values (PVs) and misclassification cost terms (MCT) at different UI prevalences (0.20, 0.40, and 0.60) and for different false-negative to false-positive ratios.

## Results

A total of 326 uterine samples were analyzed. Among the tests, laboratory culture demonstrated the highest sensitivity (0.87; 95% BCI = 0.77-0.97) and specificity (0.71; 95% BCI = 0.58-0.86), while PVD exhibited the lowest sensitivity (0.05; 95% BCI = 0.01-0.10). Notably, PVD showed consistently low PVs, and high MCT across all scenarios, indicating its inadequacy for UI identification. Laboratory culture consistently exhibited high PVs, and low MCT, suggesting its reliability in most situations. Esterase and on-farm bacteriological tests (Petrifilm and Tri-Plate) did not yield comparable results. Interestingly, luminometry showed potential, particularly when considering scenarios where the consequences of treating a healthy cow outweighed those of leaving a cow with UI untreated.

## Significance

Our findings underscore the limitations of current on-farm diagnostic tools (PVD and esterase) in accurately identifying cows with UI. While laboratory culture emerges as the most valid test, its practical implementation on dairy farms may pose challenges. The luminometry showed promise, but would require further research to optimize its utility for judicious UI treatment.

