

Use of stochastic modeling to determine number of laryngeal swab sample pools and collections for detection of low *Mycoplasma hyopneumoniae* prevalence



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INTRODUCTION

There is a need for ante-mortem *Mycoplasma hyopneumoniae* (Mhp) diagnostic sampling protocols to determine if populations are negative ($\leq 1\%$ prevalence (Pr)), remain negative over time, and to detect early infection to prevent spread.

A recent study showed that increased sample size resulting from ante-mortem laryngeal swab sampling (LS) combined with pooling allowed for a higher herd detection rate by PCR while pursuing the most economical approach, in a high Pr population.

The following study was designed to determine ante-mortem LS accurate guidelines for detection of Mhp by PCR at low Pr levels.

MATERIALS AND METHODS

A stochastic sampling model was used to determine the number of pigs and the number of times to sample herds in order to detect one positive pig in a pool when the rest of the pool was negative in a Mhp low Pr and high Ct scenario.

DxSe have been described previously for a high (H = 36) Ct in 3:1 pools and 5:1 pools.

Three DxSe were run:

3:1 pools:

- 79.1% (99% lower confidence limit (LCL))
- 81.9% (95% LCL)
- 90% (mean)

5:1 pools:

- 58.5% (99% LCL)
- 61.8% (95% LCL)
- 72% (mean)

For each adjusted DxSe value, the model was run for the number of individuals sampled from a 2,500 population size (30, 60, 90, and 120) and a percent Pr (1%, 2%, 3%, 4%, and 5%).

For each pool, adjusted DxSe, N individuals and percent Pr, two values were recorded from the stochastic model:

1. Detection probability of $\geq 99\%$
2. Detection probability of $\geq 95\%$

For each detection probability, a minimum of 100 iterations were run and the highest value, indicative of the number of collections needed, was recorded.

RESULTS

Results for 99% LCL and 95% detection probability are reported in Table 1. Additional tables and interpretation training will be available on a future website.

Table 1: Number of sample collections needed at varying Mhp group prevalences by number of laryngeal swab samples collected (99% LCL, 95% detection probability, $\geq 2,500$ population size).

N Individuals	30	60	90	120
N 3:1 pools	10	20	30	40
Percent prevalence				
1%	15	8	6	4
2%	8	4	3	3
3%	6	3	2	2
4%	4	2	2	2
5%	3	2	2	2

N 5:1 pools	6	12	18	24
Percent prevalence				
1%	21	11	7	6
2%	11	5	4	3
3%	7	4	3	2
4%	5	3	2	2
5%	4	3	2	2

CONCLUSION AND DISCUSSION

These novel Mhp sampling guidelines take into account DxSe for the LS procedure and provide guidance for determining number of pigs and number of samplings required to economically detect Mhp in low prevalence scenarios.

These guidelines are actively being implemented to monitor Mhp suspected negative populations.

