Calculating the Prevalence of *Mycoplasma iowae* in a Turkey Breeding Flock

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ABSTRACT

Mycoplasma iowae causes important production losses in turkey breeding flocks. In this study, an epidemiological approach to determining the prevalence of *Mycoplasma iowae* (Mi) within a turkey breeding flock has been developed.

Prior prevalence of Mi in the flock was estimated from previous field samples collected during a 2006 survey, and used subsequently to determine the sample size required for estimating the flock level prevalence of Mi in the prospective survey. Other variables that were considered in the calculation of sample size included economic inputs such as labour and testing costs, inter-flock and intra-flock variances and the number of epidemiological groups on the farm. It was determined that a sampling fraction of 3.01% from all epidemiological groups would be required to detect Mi infection.

The determination of the prevalence of Mi within a flock can be difficult, because transmission is erratic and it is very slow to grow in culture, sometimes taking more than 3 weeks. The recent use of a field strain validated real time PCR has improved the speed of diagnosis but it is comparatively an expensive diagnostic test when done through a commercial laboratory. Thus testing large numbers of samples is prohibitive for many companies. Using Survey Toolbox to calculate economically optimal sample sizes for estimating the prevalence of Mi, contributed to the beneficial effects of rapid diagnostic methods in flock health program focused on detection, control and elimination of disease.

KEY WORDS

Mycoplasma iowae, turkeys, eradication, surveillance

INTRODUCTION

Mycoplasmas are prokaryotic organisms that do not have cell walls but are bound by a plasma membrane composed mainly of lipids and proteins(Hafez, 2006). They are relatively small organisms and tend to be host specific with a predilection for mucosal surfaces(Kleven, 1997). *Mycoplasmas* are generally not invasive and depend on their hosts to supply their nutritional requirements (Bradbury 2003). They are the smallest known bacteria that are capable of replicating outside cells and have lost many of their non-essential genes. They are

however, highly evolved organisms and can cause significant disease, resulting in economic loss in mammalian and avian species (Bradbury 2005). Avian species are the only species known to be infected with *Mycoplasma iowae* (Kleven & Baxter-Jones 1997).

Mycoplasma iowae (Mi) is mostly a pathogen of turkeys but it can also be found in other domestic poultry species. It is able to induce a transient immune suppression that may result in a low to undetectable humoral response and it is the ability of Mi to conceal itself from the host immune system that makes Mi difficult to diagnose and control. The organism can be pathogenic and if so it primarily affects the embryo and growing poult. There can be a range of clinical presentations and these can include decreased hatchability as a result of increased embryo mortality. If the embryo survives to hatch, there is commonly stunting and leg abnormalities in the growing poult. There is significant variation in field strain isolate pathogenicity. Control of pathogenic Mi at the commercial level is primarily through sourcing Mi free stock and then the maintenance of strict biosecurity.

METHODS AND RESULTS

The objective was to design an observational study to calculate the prevalence of Mi within the Turkey flock. A cross sectional epidemiological survey was developed, using two-stage sampling, to determine the prevalence of Mi in the nucleus breeder flock. To perform the epidemiological modelling and calculation, the computer software - Survey Toolbox for Livestock Diseases© (Cameron 1999) will be used. Parameters required for the sample size determination, include the prevalence and variance estimates from the previous survey as well as estimations of the costs involved in the survey. Prior prevalence was estimated from collated results of culture surveys that were conducted in 2006.

Using the software to perform calculations for the parameters identified above, it was determined the selection process required all 75 epidemiological groups be sampled with a sampling fraction of 3.01% from each group.

DISCUSSION

Although the Survey Toolbox© program was designed primarily for use in developing countries, the application to this project was relevant, as it is active surveillance, and when working with industry, the cost restraints are as important a consideration as they would be in similar surveillance efforts in developing countries. The software calculated an optimal sample size related to a cost function, making the economic appeal of a statistically significant sampling program greater for the company.

In the development of the survey, there was a need to balance the positive aspects, opportunities and potential outcomes with the negative aspects so a SWOT analysis was performed. Economic output was considered a threat to the progress of the survey; however,

the benefits gained from the survey in conjunction with the opportunities for a number of parties involved created a favourable environment for supporting the survey.

CONCLUSION

The design of the study has taken into account the need for maximising efficiency both in terms of resources and management, as well as the economic efficiency of the survey testing procedure. Opportunities that arise as a result of the survey will also have long term benefits for future reference, especially relating to the use of new treatment methodologies and diagnostic testing procedures.

Development of a prevalence survey for Mi within the Hybrid Turkey flock, created an epidemiological monitoring tool. Strategically measuring prevalence of Mi within the flock allowed the assessment and evaluation of the effectiveness of the control programs that are implemented. It also provides a method to monitor changes in the prevalence of Mi in each flock generation as new treatment and control methods are implemented. As the prevalence of Mi is reduced over time, the goal of the epidemiological methodology will also change to demonstrating freedom from disease within the flock.

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