Mycoplasma hyopneumoniae: Lateral transmission and gilt exposure methods

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Introduction

Mycoplasma hyopneumoniae is the causative agent of Enzootic Pneumonia,[1,2] a highly prevalent clinical condition that influences the production outcome of swine operations.[3] *Mycoplasma hyopneumoniae* is a pathogen that has been in the swine industry for a long time and continues to be a significant problem for the swine industry. The major effects are in the grow finish phase of production with effects of: decreased average daily gain, increased mortality and lower percent marketed pigs to the primary market, poorer feed conversion and increase medication cost of treatment in feed, water and injectables.

These costs are significant when using actual production numbers from records accumulated from 2007-2015, and plugged into an economic model the resulting cost was $4.99 per pig.[4] As well as other data reported from other farm systems at $2.85.[5]

Research data suggests that disease status in the sow farm have an important effect on downstream flows.[6] One of the biggest challenges is proper acclimatization of the gilts going into the sow herd to control the level of shedding to piglets in litter and subsequent disease problems. Reducing the amount shedding is important to reduce the amount of downstream disease in the pigs.[6] Historically this was not a problem because most of the replacement gilts were born in positive herds or raised internally in the herd and were infected early in life with plenty of time to reduce shedding by the time of farrowing. Today most all of the replacement gilts are *Mycoplasma. hyopneumoniae* negative requiring that they get acclimatized once they get to the sow farm. One of the challenges is getting the gilts infected. Work has been done with seeder gilts to expose negative gilts which took (6 infected): (4 negative) gilts to get this done in 30 days.[7] Allowing these gilts, the necessary time following infection to reduce shedding at farrowing.[8] This is critical weather you want to stabilize a positive sow farm to reduce the impact of clinical disease in the finishing phase or if you want to do a herd closure for elimination protocol.

Mycoplasma hyopneumoniae elimination programs have been overall highly successful with a fair number of herds doing this.[9] Herds that look at doing elimination are primarily herds that are struggling to get gilts exposed on a consistent basis and herds that are doing a filter project as well as farms that are just tired of dealing with clinical problems of *Mycoplasma hyopneumoniae*. One of the first questions is will I really be able to get all the benefits since my pigs are predominantly grown in pig dense areas, won't my pigs just get re-infected in the area anyway?

Objectives of gilt exposure

- The main objective is to reduce the numbers of *Mycoplasma hyopneumoniae* shed to piglets and subsequent disease problems in the finishing phase.
  - This is accomplished is by getting the gilts to be colonized and stop shedding by the time they farrow their first litter.
- Establish the day zero for elimination of *Mycoplasma hyopneumoniae* program.

Methods of exposure

The first step is to identify gilts that are *Mycoplasma hyopneumoniae* positive to use to infect the negative incoming gilts at an early enough age to allow them to not be shedding by the time of farrowing. These negative gilts would ideally be infected by 84 days of age. Figure 1 demonstrates the time needed to reduce shedding in farrowing gilts and their piglets.

There are several methods of exposing these negative gilts.

- Using seeder animals has been done for a long time by the industry and works well if the right animals are used and there is plenty of time. Depending on the age of replacement gilts this may be difficult. To achieve a shorter time such as 30 days the work shows that a large number 6:4 of seeders is needed to be 100% successful.[7] One of the challenges with this system if the infection dies out in the seeders it can be difficult to get restarted resulting in problems in finishing population and it may take some time to get the herd stability reestablished costing a lot in performance during the process.
- Intra tracheal inoculation has been done in research work and challenge models. This can be done using a lung homogenate inoculum from positive animals from the farm to avoid cross contamination of other Mycoplasmas or disease.[10,11] This method although effective is very labor intense and more dangerous to staff due to restraint methods that have to be used.
- Aerosol inoculation has been done for other diseases and by other species for vaccination so is a possibility. This can be done using the same lung homogenate inoculum from positive animals from the farm. This method has the advantage of less labor and animals don't have to be restrained to get this job done. There are some technical steps required including: having a smaller air space to work with animals, shutting down ventilation for 30 minutes and watching barn temperatures to get post exposure time as long as possible as well.[12]

Figure 1: Gilt *Mycoplasma hyopneumoniae* exposure timeline

For the intratracheal and aerosol inoculations will need a source of inoculum. The best is from the herd itself since there is no possibility of introducing a different pathogen to the farm. This can be done by identifying animals with clinical signs and testing with either tracheal swabs or laryngeal swabs to be sure animals are positive for *M hyopneumoniae* by PCR. Some systems are treating the potential donor animals with Excede to reduce other potential pathogens from being introduced with the inoculum. Once positive animals are identified they can be humanely euthanized to harvest the lungs and the tissue can be put into a (Ninja) blender with equal volumes of Friis media to make a lung homogenate. Once this is completed then can filter (panty hose has worked the best) the homogenate to be diluted with additional Friis media and used for exposure by either method.

One of the keys to this process is having a good diagnostic protocol to confirm that gilts have been properly exposed. Testing every group to be sure that this has been accomplished is key to the success of these programs whether for herd stabilization or for elimination protocols.

Objectives for lateral transmission study

- Determine the incidence rate of lateral infections in finishing phase.
- Risk factors that increased their risk of site being laterally infected with *Mycoplasma hyopneumoniae.*

Methods for determining lateral exposure

First step was to identify finishing sites that were sourced from *Mycoplasma hyopneumoniae* negative farms that were in pig dense areas. Source sow farms were tested to validate the status of the farm to be sure that it was truly negative by testing 30 sows with IDEXX ELISA and any suspects to be followed up with laryngeal swabs. Sites were run on an all in all out by site basis. A total of 50 sites were tested in summer / fall season and 50 herds that were tested in the Winter / Spring season to look for potential seasonality. A total of 100 sites were done.

Site status was determined by testing a 95/10 statistical sample of 30 head serologically using *Mycoplasma hyopneumoniae* IDEXX ELISA test. The samples were taken just prior to marketing so that maximal exposure time could be used. If S/P values were over 1.5 on IDEXX ELISA sites were considered positive if more than 3 positives below this level, then the herd was retested using 50 laryngeal swabs.

A questionnaire was filled out for each site to determine possible risk factors for sites that turned positive. Closeout information was collect from all of the sites to compare performance differences.

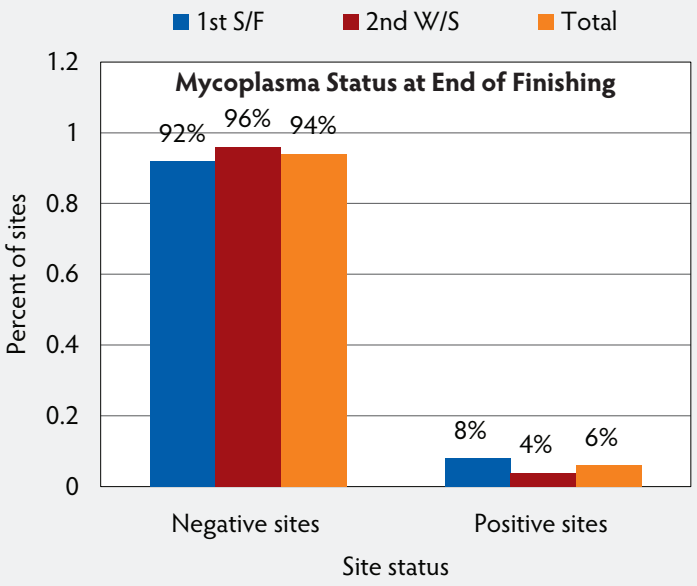
Results of lateral transmission study

100 sites were monitored across both seasonal periods from 5 different production systems with 10 sites per system per season in order to keep things as consistent as possible but not just one production system. A total of 6% of the sites were positive for Mycoplasma hyopneumoniae from lateral source introduction. All positive sites had some clinical signs when samples were collected with clinical signs of coughing. 1 site was confirmed with serology and the other 5 sites with retesting and laryngeal swabs. Figure 2 shows the results for each season and cumulative total. Because of the low number of positive sites there were no clear risk factors other than area density that could be evaluated, and due to the variance between production systems, there were no significant production parameters identified.

Discussion

The goal of intentional *Mycoplasma hyopneumoniae* exposure is to establish exposure, infection and clearance of the organism before the gilts farrow. This can be useful in both a herd stabilization plan that is being used to make pigs with a relatively low load of *Mycoplasma hyopneumoniae* at the time of weaning or to establish time zero for an *Mycoplasma hyopneumoniae* elimination programs. It will depend on the herd and the long-term control

Figure 2: Results of lateral transmission study by season and total



strategy. Certainly not all herds will follow the same plan but to reduce the economic impact of *Mycoplasma hyopneumoniae*. However, regardless of the plan for stability they will first need to stabilize the herd and controlled exposure (intratracheal or aerosol) are the most reliable ways to get this done. No matter what the protocol for acclimatization, a good diagnostic plan is needing to follow every group of gilts that enters the herd to make sure that this is successfully completed. One of the big challenges is there is just not a lot of time to get this done. One of the challenges is that there needs to be a way to get this done repeatability. With nearly all replacement gilts coming from negative herds this is more of a challenge than it was historically when replacement gilts were positive and has resulted in *Mycoplasma hyopneumoniae* surfacing as a clinical problem again.

Lateral transmission of *Mycoplasma hyopneumoniae* occurs in negative pigs placed in high pig density regions. It just doesn't happen very often, only 6% of the time there was not much of a difference in seasonal affect, but more were identified in summer / fall season tested. If a system is having difficulty with *Mycoplasma hyopneumoniae* control, it is likely due to the instability of the sow farm and not getting good gilt exposure rather than sites becoming infected downstream. This should no longer be a hurdle to over come for farms looking at elimination as a possibility and the numbers generated here can be used in modeling the impact of lateral transmission in the partial budgets for these types of projects.

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