SWINE HEALTH INFORMATION CENTER
FINAL RESEARCH GRANT REPORT FORMAT

Project Title and Project identification number
Description of biosecurity aspects of herds with low or high PRRS incidence and comparison within and between production systems (SHIC #16-273)

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Industry Summary:

Porcine reproductive and respiratory syndrome (PRRS) compromises the health of millions of pigs and costs the industry $664 million annually. Thus, swine producers adopt biosecurity measures with intent to decrease the frequency of PRRS outbreaks. There is a critical need to better understand the effects of biosecurity aspects on frequency of PRRS outbreaks in breeding herds.

Therefore, the objective of this study was to describe key differences in the biosecurity aspects of breeding herds with relative low PRRS incidence, compared to those with relatively high PRRS incidence.

This study included herds from 14 production systems in the US. Within each production system herd selection was completed by ranking production system's herds based on the number of PRRS outbreaks since 2013 and then randomly selecting 3 farms from the 25th and 75th percentiles. The farms from 25th percentile were defined as 'low incidence', and farms in the 75th percentile defined as 'high incidence'. The biosecurity aspects of each breeding herd were assessed using a 346 questions biosecurity survey that contained multiple choice and short answer questions about herd demographics, swine density, PRRS outbreak history, frequency of risk events, and biosecurity practices related to swine transport, people movement, carcass disposal, supply deliveries, and other risk events. Statistical methods were used to determine which biosecurity aspects were significantly different between the low and high PRRS incidence farms.

Fourteen herd sets (84 herds) were enrolled in the study representing 13 states. The average herd size was 3,453 breeding females (range: 543-7,200) for the low PRRS incidence group and 4,099 breeding females (range: 1,000-10,852) for the high PRRS incidence group. Four general areas of biosecurity separated the low and high PRRS incidence farms: (1) monthly event frequency, (2) downtime requirements, (3) swine density, and (4) operational connections to other swine sites.

Rendering was the most significant difference between the groups: 64.3% of high PRRS incidence herds used rendering compared to 31% of low PRRS incidence herds. Mean monthly rendering frequency was 12.7 for high PRRS incidence herds and 5.7 for low PRRS incidence herds. High PRRS incidence farms had a higher monthly frequency of visits from visitors (range: 1-24) than low PRRS incidence farms (range: 0.5-8). Low PRRS incidence farms had significantly longer downtime requirements for visitors and manure removal personnel than high PRRS incidence farms. High PRRS incidence farms were located in areas with significantly higher densities of wean-to-finish swine. Interestingly, a higher number of boars and finishing pigs within a 3-mile radius were significantly associated with a low PRRS incidence. This may be accounted for, in part, by the higher level of biosecurity practiced at boar studs. Operational connections to other swine sites were also important as several operational connection related variables were associated with high PRRS incidence.

These observations will enable the swine industry to more effectively allocate resources to specific aspects of biosecurity which may help reduce the animal welfare and economic impacts of PRRS in the future. Our group will continue to develop biosecurity scores that correlate (help to explain) the frequency of outbreaks. In a nutshell, this study demonstrated the importance of number of events on the biosecurity risk. In other words, we encourage producers to evaluate possibility of reducing the number of pig animal movements (e.g. reducing number of weaning events per month), and number of people entry in the farm (e.g. reducing number of re-entry events).

Also, there was a significant variation in number of PRRS outbreaks in breeding herds. The risk of PRRS exposure can be measured using 'biosecurity scores' derived from questionnaires. Benchmarking the scores, and simple outcomes such as number of pig movements, and number of people entry/re-entry per 1,000 sows may be a great tool for managers and producers to identify opportunities to reduce the vulnerability of their swine operations.

Keywords:
swine, preventive veterinary medicine, biosecurity, prevention, infectious diseases, epidemiology.

Scientific Abstract:

Porcine reproductive and respiratory syndrome (PRRS) compromises the health of millions of pigs and costs the industry $664 million annually. Thus, swine producers adopt biosecurity measures with intent to decrease the frequency of PRRS outbreaks. There is a critical need to better understand the effects of biosecurity aspects on frequency of PRRS outbreaks in breeding herds. Therefore, the objective of this study was to describe key differences in the biosecurity aspects of breeding herds with relative low PRRS incidence, compared to those with relatively high PRRS incidence. A herd set was defined as 3 breeding herds within the 25th percentile of PRRS outbreaks (low PRRS incidence) and 3 breeding herds above the 75th percentile (high PRRS incidence) within a production system. Herd selection was completed by ranking each production system's herds based on the number of PRRS outbreaks since 2013 and then randomly selecting 3 farms from both the 25th and 75th. The biosecurity aspects of each breeding herd were assessed using a 346 question biosecurity survey that contained multiple choice and short answer questions about herd demographics, swine density, PRRS outbreak history, frequency of risk events, and biosecurity practices related to swine transport, people movement, carcass disposal, supply deliveries, and other risk events. A conditional logistic regression model with Lasso penalty was applied to the data using the *clogitL1* R package to determine which biosecurity aspects were significantly different between the low and high PRRS incidence farms. Fourteen herd sets (84 herds) were enrolled in the study representing 13 states. Mean herd size was 3453 breeding females (range: 543-7200) for the low PRRS incidence group and 4099 breeding females (range: 1000-10852) for the high PRRS incidence group. Four general areas of biosecurity separated the low and high PRRS incidence farms: (1) monthly event frequency, (2) downtime requirements, (3) swine density, and (4) operational connections to other swine sites. Rendering was the most significant difference between the groups: 64.3% of high PRRS incidence herds used rendering compared to 31% of low PRRS incidence herds. Mean monthly rendering frequency was 12.7 for high PRRS incidence herds and 5.7 for low PRRS incidence herds. High PRRS incidence farms had a higher monthly frequency of visits from visitors (range: 1-24) than low PRRS incidence farms (range: 0.5-8). Low PRRS incidence farms had significantly longer downtime requirements for visitors and manure removal personnel than high PRRS incidence farms. High PRRS incidence farms were located in areas with significantly higher densities of wean-to-finish swine. Interestingly, a higher number of boars and finishing pigs within a 3-mile radius were significantly associated with a low PRRS incidence. This may be accounted for, in part, by the higher level of biosecurity practiced at boar studs. Operational connections to other swine sites were also important as several operational connection related variables were associated with high PRRS incidence. These observations will enable the swine industry to more effectively allocate resources to specific aspects of biosecurity which may help reduce the animal welfare and economic impacts of PRRS in the future.

Introduction:

Porcine reproductive and respiratory syndrome (PRRS) compromises the health of millions of pigs and costs the industry $664 million annually. To avoid the economic and animal welfare implications of a PRRS outbreak, swine producers adopt biosecurity measures targeted at decreasing the frequency of PRRS outbreaks. There is a critical need to better understand the effects of biosecurity aspects on frequency of PRRS outbreaks in breeding herds.

Objectives:

The objective of this study is to describe key differences in the biosecurity aspects of breeding herds with low PRRS incidence, compared to those with high PRRS incidence.

Materials & Methods:

Swine production systems in the US were invited to enroll a breeding herd set that met the following criteria: (1) weekly PRRSV status since 2013 was available; (2) willingness to complete a biosecurity survey; and (3) breed-to-wean premises. A herd set was defined as 3 breeding herds within the 25th percentile of PRRS outbreaks (low PRRS incidence) and 3 breeding herds above the 75th percentile (high PRRS incidence) within a production system. Herd selection was completed by ranking each production system's herds based on the number of PRRS outbreaks since 2013 and then randomly selecting 3 farms from both the 25th and 75th percentiles using the RAND function in Microsoft Excel. The biosecurity aspects of each breeding herd were assessed using a 346 question biosecurity survey that contained multiple choice and short answer questions about herd demographics, swine density, PRRS outbreak history, frequency of risk events, and biosecurity practices related to swine transport, people movement, carcass disposal, supply deliveries, and other risk events. A conditional logistic regression model with Lasso penalty was applied to the data using the *clogitL1* R package to determine which biosecurity aspects were significantly different between the low and high PRRS incidence farms.

Moreover, a scoring system developed to help describing the overall vulnerability of individual farms based on biosecurity aspects. The scoring system was correlated with the frequency of PRRS outbreaks to understand the value of the biosecurity score on correctly assessing the overall risk of PRRS introduction based on the score.

Results:

Fourteen herd sets (84 herds) were enrolled in the study representing 13 states. The mean herd size was 3453 breeding females (range: 543-7200) for the low PRRS incidence group and 4099 breeding females (range: 1000-10852) for the high PRRS incidence group.

Four general areas of biosecurity separated the low and high PRRS incidence farms: (1) monthly event frequency, (2) downtime requirements, (3) swine density, and (4) operational connections to other swine sites.

Rendering was the most significant difference between the groups: 64.3% of high PRRS incidence herds used rendering compared to 31% of low PRRS incidence herds. Mean monthly rendering frequency was 12.7 for high PRRS incidence herds and 5.7 for low PRRS incidence herds. High PRRS incidence farms had a higher monthly frequency of visits from visitors (range: 1-24) than low PRRS incidence farms (range: 0.5-8). Low PRRS incidence farms had significantly longer downtime requirements for visitors and manure removal personnel than high PRRS incidence farms.

High PRRS incidence farms were located in areas with significantly higher densities of wean-to-finish swine. Interestingly, a higher number of boars and finishing pigs within a 3-mile radius were significantly associated with a low PRRS incidence. This may be accounted for, in part, by the higher level of biosecurity practiced at boar studs. Operational connections to other swine sites were also important as several operational connection related variables were associated with high PRRS incidence.

Overall, herds belonging to the relatively low PRRS incidence group had a lower biosecurity score, compared to herds of the high PRRS incidence group (figure 1).

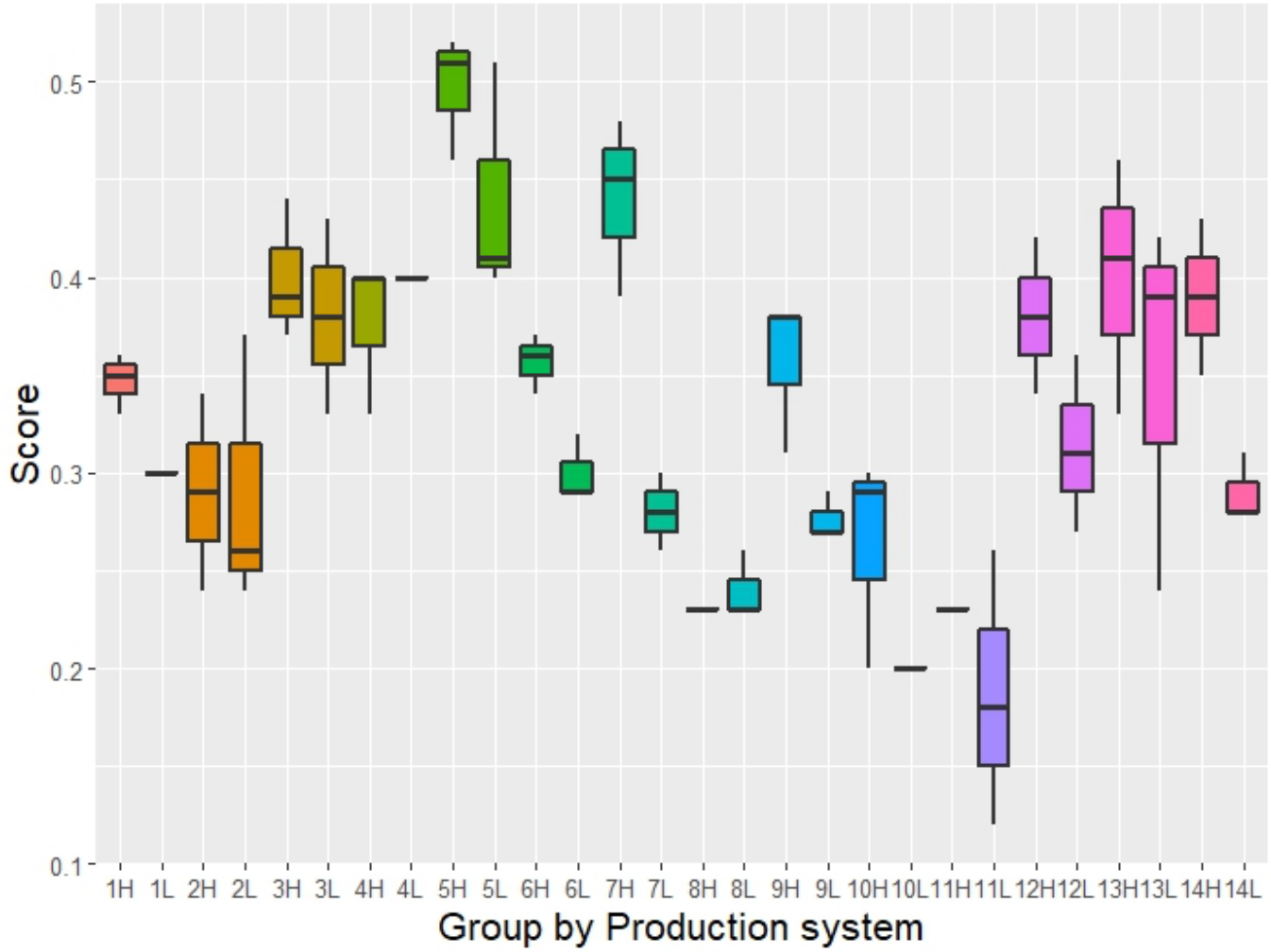

Figure 1 – Biosecurity scores for breeding herds of 14 production systems. Each production system had at least 3 herds in the 'low PRRS incidence' group (indicated as L), and at least 3 herds in the 'high PRRS incidence" group, indicated as H in the figure.

These observations will enable the swine industry to more effectively allocate resources to specific aspects of biosecurity which may help reduce the animal welfare and economic impacts of PRRS in the future.

Discussion:

Our group will continue to develop biosecurity scores that correlate (help to explain) the frequency of outbreaks.

Results from study demonstrated the increased risk of PRRS infection associated with rendering, which has motivated some participating herds to reconsider the method of carcass disposal. Also, the study demonstrated the importance of number of events on the biosecurity risk. In other words, we encourage producers to evaluate possibility of reducing the number of pig animal movements (e.g. reducing number of weaning events per month), and number of people entry in the farm (e.g. reducing number of re-entry events).

The surrounding pig density was also of significant importance. More specifically, breeding farms with more growing pig sites in the neighborhood had a greater risk of having increased PRRS outbreak frequency. This finding highlights the importance to further investigate specific causes of 'regional spread' of the virus. What is the relative importance of airborne spread, as compared to virus transmission through shared people,

equipment, manure spread, truck biosecurity practices, among other practices? Field investigations are needed to answer this question.

In conclusion, there is a significant variation in number of PRRS outbreaks in breeding herds. The risk of PRRS exposure can be measured using 'biosecurity scores' derived from questionnaires. Benchmarking the scores, and simple outcomes such as number of pig movements, and number of people entry/re-entry per 1,000 sows may be a great tool for managers and producers to identify opportunities to reduce the vulnerability of their swine operations.

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