Herd Profiling as a strategy for the diagnosis of PRRS virus infections.

Michael L. Snyder

ABSTRACT

The frequent use of PRRS vaccines in the United States swine industry has added difficulty to the differentiation of serology and other diseases caused by porcine reproductive and respiratory syndrome (PRRS). A considerable effort has been made to develop a strategy for using the IDEXX PRRS ELISA as a quantitative tool to assess herd status over time. Software, XCEL, has been developed to assist the user in analyzing, analyzing, reporting, and graphing individual herd sampling times and comparing the results to previous tests.

Diagnostically significant findings were determined by testing samples from vaccinated and non-vaccinated populations using two commercial tests: NOD/Li Laboratories and Schering-Plough Animal Health (SPAHI).

Examples of herd profiling strategies are reported here showing the benefits of the XCEL software. The significance of proper sampling techniques is described showing the importance of decision making.

The strategies described here are being successfully used in small, medium, and large pig production units around the world.

INTRODUCTION

The advances in our understanding of the virology of PRRS have increased the awareness of the disease and its effects on the morbidity and mortality of the affected animals. The ability to properly control the disease is currently limited due to the lack of effective vaccines and the development of a diagnostic test.

The ability of the PRRS virus to be transmitted through air is a major concern for dairy farmers. The risk of infection is significantly increased when infected material is inhaled. The risk is further increased when infected material is inhaled for extended periods, leading to a chronic infection. The ability to properly control the disease is limited due to the lack of effective vaccines and the development of a diagnostic test.

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MATERIALS AND METHODS

The IDEXX Laboratories Temporal Study: Five (5) Duroc pigs approximately 60 pounds were exposed to an Iowa isolate of the PRRS virus (1998) via the intra-tracheal route.

1. IDEXX Laboratories, Inc., ONE IDEXX Drive, Westbrook, Maine 04092

using approximately 1 x 10^9 fluorescent antibody units (FAU). Serum was obtained from samples obtained during period endocytosis day (PHED) 14, and then weekly through PHED 208. Serum was stored at -20°C until tested.

NOD/Li Vaccine Animal Trials: Four (4) primary studies were conducted and evaluated using the IDEXX PRRS ELISA: A sero-epidemiology study and a heterologous challenge (Lysated Strain of PRRS Virus), and a Mature Pig Study using a homologous challenge (Vaccine strain strain, 1992).

Group 1: Ten (10) pigs were vaccinated 14 days prior to challenge (V1/4C).

Group 2: Ten (10) pigs were vaccinated 7 days prior to challenge (V7/4C).

Group 3: Ten (10) pigs were vaccinated 7 days prior to challenge (V7/4C).

Group 4: Five (5) pigs were unvaccinated and challenged which were used as the unvaccinated control group.

Mature Pig Study: Heterologous Challenge Study: Fourteen (14) pigs were separated into three groups:

Group 1: Seven (7) pigs were administered vaccine on PHED 0 and challenged on PHED 111.

Group 2: Seven (7) pigs were vaccinated on PHED 111.

Group 3: Seven (7) pigs were vaccinated on PHED 111.

Mature Pig Study: Homologous Challenge Study: A similar study was conducted using the Lysated strain challenge, except that the Lysated PRRS (US) 3717 parent strain was used to challenge the swine, again on PHED 111.

SPAHI Vaccine Animal Trials: Two complex studies were conducted and evaluated using the IDEXX PRRS ELISA: Vaccination using PrimePac followed by homologous strain challenge, and a second study followed by heterologous strain challenge.

PrimePac Vaccination with Homologous Challenge: Three (3) groups were established. Serum samples for virology and serology were collected at the time of vaccination and at monthly intervals during the trial. Pigs were challenged at approximately 85 days of gestation using approximately 6.5 log10 TCID50/ml using the NOD/Li strain of the PRRS virus.

Group A: Each pig was inoculated with 2 ml of virus intramuscularly and subsequently challenged as previously described.

Group B: Each pig in the control group was allowed to co-mingle with pigs of Group A and were challenged in the same manner.

Group C: Pigs in this group served as challenge controls and were maintained separately with pigs of Group A and were challenged in the same manner.

PrimePac Vaccination with Heterologous Challenge: Two (2) Groups of pigs were established. Serum samples for virology and serology were collected at time of vaccination and at monthly intervals until the time of challenge. Pigs were challenged at approximately 75 days of gestation using approximately 5.4 log10 TCID50/ml using the Lysated strain of the PRRS virus.

Group A: Each pig was inoculated with 2 ml of virus intramuscularly and subsequently challenged as previously described.

Group B: Each pig in the control group was allowed to co-mingle with pigs of Group A and were challenged in the same manner.

Pigs inoculated with each of the groups were used to evaluate the vaccine for the first time. The pigs were inoculated with the virus and then vaccinated.

RESULTS

The IDEXX Laboratories Temporal Study: Figure 1 illustrates the complete profile of the pigs and the group of pigs used for the study as eventually positive. Figure 2 illustrates the mean profile for 10 selected profile data. PND 0, 10, 20, 25, 30, 32, 34, each point selected to illustrate a specific event and how it would be displayed using herd profiling. During actual herd profiling, one would usually use set intervals for sampling, every 2 weeks or a confidence of 95%. Several other parameters were measured during the study of the full article studied below.

PRRS Serology: This study demonstrated that serological response to the MLV vaccine was not detected on PND 7, but was detected on PND 14. The non-vaccinated challenge group pigs showed the same results as the unvaccinated group pigs. This study demonstrated that serological response to the MLV vaccine was not detected on PND 7, but was detected on PND 14. The non-vaccinated challenge group pigs showed the same results as the unvaccinated group pigs. This study demonstrated that serological response to the MLV vaccine was not detected on PND 7, but was detected on PND 14. The non-vaccinated challenge group pigs showed the same results as the unvaccinated group pigs. This study demonstrated that serological response to the MLV vaccine was not detected on PND 7, but was detected on PND 14. The non-vaccinated challenge group pigs showed the same results as the unvaccinated group pigs. This study demonstrated that serological response to the MLV vaccine was not detected on PND 7, but was detected on PND 14. The non-vaccinated challenge group pigs showed the same results as the unvaccinated group pigs.

Mature Pig Study: The mature pig study illustrates two important points:

1. The IDEXX ELISA detects response to the two strains of PRRS used in these studies: PRRS (US) 3717 and the Lysated strain.

2. A heterologous challenge produces a higher and therefore, anamnestic response which is not observed when homologous challenge exists.


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SFAH Homologous and Heterologous Gilt/piglet Studies

Homologous Challenge Study: Vaccination induced ELISA and virus neutralizing antibodies in Group A gilts. The ELISA and VN did not detect an immune response following homologous strain challenge. Passive antibodies were detected by the ELISA and VN in pigs from the vaccinated and challenged gilt. Piglet ELISA and VN serologic results demonstrated that all groups of piglets had antibody titers in the day of age 0, which steadily decreased during the post partum sampling period.

Piglets born from Vaccinated and Challenged Gilt: Antibody decayed to baseline in a linear and predictable fashion expected of passively acquired antibodies.

Piglets born from Non-Vaccinated/Challenged Gilt: Antibody level was constant to increasing indicating a response to vertical congenital infection.

Piglets from from Control Gilt: Antibodies decayed, then increased as a response to horizontally transmitted virus.

Heterologous Challenge Study: The ELISA and VN detected an immune response in the vaccines by post challenge day (PCD) 7 and primary response in the challenge gilts by PCD 10 to 14. The ELISA and VN detected antibodies during the two week interval as the control group. Passive antibodies were detected by the ELISA and VN in pigs from the vaccinated and challenged gilts. Piglet ELISA and VN serologic results demonstrated that Group A and B piglets had antibody titers in the day of age 0 would zero which steadily decreased during the post partum sampling period. Unique serologic profiles for piglets of both groups were observed.

Piglets born from Vaccinated and Challenged Control Gilt: A high level of antibodies decayed to an antibody titer of about 150 lower than sharply increased, indicating response to infection.

Piglets born from Challenge Control Gilt: A lower level of antibodies decreased to an antibody titer of about 150 and then increased sharply. Twenty Pigs died in this group and was probably the result of congenital infection with the PRRS virus.

Herd Study (Herd 3, Midwest): A peak in deaths in P/7 ratio was noted following clinical disease at 18 weeks post placement. Ratio increases were noted in the case of these cases. A temporal association of rising HI titer to some influenza virus to accompany these ratios in PRRS ratio. It could be speculated that pigs in this group completing seroconversion to PRRS infection, were initially exposed to Mycoplasma hyopneumoniae at that time while pulmonary function was still impaired from PRRS virus infection.

DISCUSSION and CONCLUSIONS

These studies represent both experimental and production herds in character, support the usefulness of quantitative herd profiling. Without this tool, one would fail to obtain most cases and help in decision making and conclusions.

This approach appears to us to have similar application in assessing the potential role of the cattle diseases contributing to what now is globally referred to as porcine respiratory disease complex, or PRDC.