

PRRS Update: Recent Trends

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This topic will unfold as a series of questions and answers covering several recent trends and activities relating to PRRS. The answers will be short and snappy while still getting the point across.

▪ **Do Mutations and Recombinations of the PRRS Virus Occur?**

Not only do mutations of the PRRS virus (PRRSV) occur but they occur at a fairly high frequency (Lager & Mengeling, 1999 & 2000). The PRRSV is an RNA virus. One characteristic of RNA viruses is that they have low fidelity and therefore are subject to mutations. There are conserved and variable sequences in the PRRSV genome. The variable sequences are the areas that lend themselves to mutational changes. Recombinations, however, are an entirely different matter. Recombinations of the PRRSV have been created in the laboratory by co-infecting two different PRRSV isolates into a single cell and allowing both of them to grow in a continuous cell line (Faaberg et al., 1999). The two isolates then formed recombinant PRRSVs. Although putative evidence has been presented, but not proven, of this happening naturally, chances of occurrence in the field seem remote at best. What is much more likely to happen in the field is that two different PRRSV isolates might invade the same pig. This has been done experimentally and the result is that one isolate overpowers the other and becomes the dominant PRRSV isolate and continues as the sole isolate to replicate in the animal. The other isolate dies out.

Take Home Message

Mutations of the PRRSV are relatively frequent. Recombinations in the field are rare to unlikely.

- **PRRS Strains: How many different PRRS strains are we dealing with?**

Hundreds, perhaps thousands of PRRS viruses (PRRSVs) have been isolated around the world over the last decade. Most of these isolates have some genetic sequence differences one from the other. Antigenic and virulence differences also exist among PRRSV isolates. To date, however, there is no consensus on whether these are different strains or just different isolates. The European (*Lelystad*) and North American (*VR-2332*) prototype viruses are so vastly different from each other that there is widespread agreement that they are two entirely different strains. Since 1996, a new cluster of isolates has arisen in the USA that might qualify as possibly a third distinct strain (Murtaugh, M., personal communication, 2000). So, if we use the “genetic difference” criterion, we would have hundreds, possibly thousands of different PRRSV strains. Using the “vastly different” characterization we would have 2 or possibly 3 strains. Most people, however, generally use the terms “isolate” and “strain” interchangeably at this time.

Take Home Message

There are two distinct strains of the PRRSV recognized worldwide, the North American and the European strains. There are large numbers of isolates that are genetically different from each other, but there is no consensus at this time whether these are all different strains or just different isolates of the same strain.

- **What is the Interaction between PRRSV and *Mhyo*?**

Dr. Eileen Thacker and coworkers, in an ongoing series of studies at Iowa State University, have shown that *Mycoplasma hyopneumoniae* (*Mhyo*) prolongs and worsens the pneumonia caused by PRRSV in growing pigs when these two agents infect the pig simultaneously or within days of each other (Thacker et al., 1999a,b). Field observations over the last several years had noted that pigs infected with PRRSV in the nursery followed by *Mhyo* in the finisher developed a more severe pneumonia than if they had been infected with *Mhyo* alone. The conclusion from these field observations was that PRRSV impaired or compromised the immune system of the pig, allowing *Mhyo* pneumonia to be more severe. This current research is showing that the opposite is more likely the case, it might be *Mhyo* that causes PRRS pneumonia to be worse. The mechanism of how this happens is unknown. Possible suggestions include:

- The ability of *Mhyo* to recruit extra macrophages into the lung.

- Activation of T-cells and their production of pro-inflammatory cytokines (eg. TNF) by *Mhyo* (Thacker et al., 1999a,b).

Macrophages are the prime target cell for PRRSV infection and by having more macrophages available, the damage by the PRRSV can be sustained for a longer period. On the other hand TNF promotes and prolongs the inflammatory response. *Mhyo* induces the production of TNF- α by activating T-cells.

Take Home Message

Infection with PRRSV and *Mycoplasma hyopneumoniae* at the same time produces more severe pneumonia than infection with either agent alone.

■ **Aerosol Transmission Anyone?**

Many of you have been following the debate in the *Pigletter* over the last year on whether or not aerosol transmission of PRRSV is real or just a myth (Desrosiers, 2000). We do know that PRRSV spreads best from herd to herd by movement of pigs. Second best is via semen. However, there is a large block of PRRSV outbreaks that cannot be explained by either of these two methods of transmission. That leaves us with this question of whether or not aerosol transmission is a reality. Research efforts have been unable to get the PRRSV to move more than 2-3 m across a room much less travel the 3-4 km that field and epidemiological experiences would indicate. The bottom line here is that whether aerosol or not, there is definite indirect or area spread of PRRSV that allows it to evade our best biosecurity measures and enter swine herds (Lager & Mengeling, 1999 & 2000).

Take Home Message

Area spread of PRRSV is a reality. At this time aerosol seems the most plausible explanation for these non-swine sources of PRRSV spread.

■ **PRRSV Elimination Strategies: How are they done?**

Strategies for the elimination/ eradication of PRRSV from individual herds are being increasingly attempted over the last 1-2 years. So far these strategies have been applied mainly to seedstock production herds. The current strategies fall into two camps, which I call:

- The Scott Dee Test and Removal (T&R) method (Dee et al., 2000) and
- The PIC pigflow change and sow herd rollover method (Torremorell and Baker, 2000).

Scott Dee - Test & Removal (T&R)

Prior to starting T&R, the sow herd is closed for at least 4 months with no gilt introductions during this time. An offsite developer is used to grow out 2- to 4-month old gilts. The entire breeding herd is tested in one day. T&R starts when the prevalence of seropositives in the sow herd is $\leq 15\%$. The T&R method is combined with nursery (and grow-finish) depopulation if the unit does not use an offsite production system. PRRS Elisa and PCR tests are used and all positive sows are removed as outlined in Table 1. Serological monitoring of the sow herd and pigs continues to confirm ongoing PRRS-negative status of the herd.

Table 1. Test and Removal diagnostic protocol and course of action

ELISA	PCR	Status	Action
+	+	Infected	Remove
+	-	Infected/ Exposed?	Remove
-	+	Infected	Remove
-	-	Non-infected	Retain

PIC - Pigflow Change and Sow Herd Rollover

A suitable herd for rollover eradication is one that is PRRS-positive, stable and is acclimatizing gilts so they enter the breeding herd as exposed, immune animals (Torremorell and Baker, 2000). The sow herd is closed to introductions ≥ 6 months. Diagnostics are used to identify the exact pattern of virus circulation within the herd. Gilts are then introduced from a PRRS-negative source. The PRRS-negative gilts are introduced only after confirmation that no PRRSV is circulating anywhere in the herd. The PRRS-negative gilts are for both the rollover of the breeding herd and to act as sentinels. These negative replacements go directly into the sow herd or, if offsite gilt breeding is used, they go into the farrowing room when they are ready to farrow. PRRS-positive sows are removed from the breeding herd by attrition. Attrition can be by T&R, accelerated culling or just normal attrition. The eradication is considered complete when the last known previously PRRSV-infected animal has been removed from the herd. In the meantime, herd monitoring is maintained by a combination of clinical observation and diagnostic testing.

Whole herd vaccination then T&R

You will note that the above eradication procedures both share the common feature that the eradication is attempted only after the entire breeding herd is immune. Because vaccination could accomplish this very rapidly, Reid Philips and Scott Dee have used a variation to the above themes by using PRRS vaccine to attain uniform cross-herd immunity and considerably accelerate the time it takes to start the T&R procedure (Philips et al., 2000).

■ Can PRRS-Negative Pigs be Produced from PRRS-Positive Sow Herds?

At this time commercial herds, especially in pig dense areas, are more likely to aim for production of PRRS-negative pigs from stable, PRRS-positive, sow herds. Andrijana Rajic reported on studies she did as a graduate student with Dr. Cate Dewey at the Ontario Veterinary College where she tested successive groups of pigs co-mingled from up to 10 sow herds (Rajic et al., 1999 & 2000). Herds were serologically stable and pigs were iso-weaned and co-mingled into an offsite nursery based on whether the sow herds were vaccinated or non-vaccinated. In a series of three studies she found that the pigs lost their maternal PRRS titres in the offsite nursery by about 4 weeks of age. However, there was a distinct difference between pigs co-mingled from vaccinated sow herds vs. those co-mingled from non-vaccinated sow herds. Pigs from the vaccinated sow herds remained PRRS-negative to the end of their nursery stay and beyond, whereas those from the non-vaccinated herds were all PRRS-positive by the end of their nursery stay. Further investigation showed that some of the pigs from the non-vaccinated herds entered the nursery carrying the PRRSV. A survey of several large commercial vaccinated stable sow herds across Canada has confirmed that many of these herds are producing PRRS-negative pigs (Sanford, 2000).

■ Closing Remarks

PRRS continues to present us with more questions than answers. However, we continue to make progress and answer questions as they arise. In this article I've gone over a few of the current questions on PRRS and tried to provide the answers as best as we know them today.

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