PRRS in the United States: The re-education of the swine practitioner

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It has now been approximately 3 years since the discovery of the etiology of "mystery swine disease." Since that time, the name of the syndrome has changed twice and is now known as porcine reproductive and respiratory syndrome (PRRS). There has been an accompanying explosion of new information concerning the characteristics of the virus, its epidemiology, its effect on the immune system of the pig, and methods for diagnosis and control. While PRRS has indeed been a devastating disease, it has been helpful in some respects because it has forced veterinarians to try to control a disease without using a vaccine. Until recently it has not been possible to vaccinate against PRRS virus. Now that the option is available, it is imperative that we not forget what PRRS has taught us over the last few years.

As we attend conferences and listen to producers and practitioners, we are concerned that vaccination is being viewed as a "silver bullet" that can solve all PRRS-related disease problems. Before we go too far with mass immunization programs, we need to remember the importance of solving PRRS problems by formulating plans using a combination of accurate diagnostics followed by cost-effective control strategies that emphasize management, and perhaps vaccination, implemented at the proper time in the life of the pig. It is a good idea to review how PRRS virus is maintained on a farm, how virus transmission within specific populations of pigs may increase the risk of infection or reinfection, and how the spread of virus can be monitored using currently available diagnostic tests. We hope that once these concepts are understood, our profession can implement control measures with a higher level of success.

Proper isolation of incoming breeding stock is critical to control PRRS

Over the years, perhaps no disease control strategy has been handled as poorly as isolation. A proper isolation facility is a building located on a separate site. Here incoming stock can be held for a time and tested for the presence or absence of antibodies to certain diseases. The facility also allows new stock to be properly acclimatized to the microflora of the recipient farm. In the past, isolation periods of approximately 30 days were recommended. This was based on published data on incubation periods of well-known swine viral diseases such as pseudorabies (PRV) and transmissible gastroenteritis (TGE). However, due to the prolonged period of viremia following infection with PRRS virus, and the fact that the incubation period of PRRS has still not been defined, we feel it imperative that isolation periods be lengthened to 45–60 days. New animals should be tested for both the American and the European strains of PRRS on arrival and prior to being introduced into the breeding herd. Our work at the University of Minnesota shows that the primary means of the virus entering a farm is through adding infected breeding stock. Not only will this protocol provide better protection against introducing viremic pigs into the breeding herd, it will also allow new stock another month to mature.

It is also helpful to house PRRS-negative sentinel pigs in the isolation facility. Testing of the sentinels should coincide with that of new stock and can be another aid towards detecting infection.

The replacement gilt is critical to maintaining stability in the breeding herd

As we know with parvovirus, exposure of naive gilts prior to breeding is critical to building natural immunity. Such is the case with PRRS virus.[1] Frequently we encounter recurrent reproductive problems in previously infected farms. More often than not, a parity analysis will indicate that gilts are the primary parity affected. Serologic follow-up usually reveals high titers with positive isolation of virus from gilts exhibiting signs of reproductive failure, and negative results from new replacement stock. Therefore, the need for proper exposure of naive gilts prior to breeding is essential. This procedure can begin during the isolation/acclimatization period and may involve the use of vaccine.

On the other hand, we have heard practitioners recommending the purchase of IFA-positive gilts with high titers because the high titers equal protection. This is not true! These animals may be the source of further viral introduction into the population and the predisposing factor for recurrent reproductive problems. If the source of replacement stock is infected, the ideal animal to enter

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into a PRRS-positive herd is not the pig with the high titer, it is the pig that has been previously exposed, is no longer viremic, and has demonstrated a reduction in titer. These pigs are usually protected, and while they can become reinfected, they do not display episodes of PRRS-related diseases.

PRRS serology is a valuable tool for assessing the spread of virus on a farm

The indirect fluorescent antibody test (IFA) for detecting antibodies to PRRS virus is an accurate, effective test if one understands how to use it properly.[2,3] Remember that detecting an antibody by any serologic test indicates that the pig has only been exposed to an antigen. It does not mean that the animal is immune. Serology must also be performed on adequate sample sizes of the entire population, over a period of time. A single bleeding can provide a quick assessment of seroprevalence, but in order to properly assess the situation, the profile needs to be repeated. To assess the PRRS status of a farm, we recommend an initial testing of ten sows, ten 4-week-old pigs, and ten 5- to 6-month-old pigs. If more information is required, a larger sample can be drawn. We usually find that bleeding ten animals from each stage is adequate; however, at times we may need to repeat our sampling and collect 30 samples from the stage in question, i.e., the breeding herd. Larger sample sizes can help detect whether there are existing subsets of naive animals within an infected population or vice versa. The ability to detect these subpopulations is critical to stabilize herd exposure. Titers are also important to assess the exposure level within the population tested. Animals with high IFA titers (1:256–1:1024) have recently been exposed to virus and may be viremic. As other tests become available, i.e., serum neutralization (SN), we may be able to use them in conjunction with the current test to better assess the immune status of the population. Unfortunately, titers from vaccination mimic those of naturally infected pigs and can make interpretation of serology confusing.

Viral shedding can be controlled in adult animals by closing the herd

Closing the breeding herd to outside replacement stock has been shown to be an effective method to prevent spread of the virus among adult swine.[4] Viremic periods are much shorter in these animals compared to nursery-aged pigs. While culling procedures and breeding-herd inventory may be briefly interrupted, the speed at which a consistent level of exposure and subsequent natural immunity can be obtained is very beneficial. Temporarily, you can select replacements from the finishing facility. To monitor shedding, you can test specific sows every 30 days for a period of 3–4 months. Animals that are no longer viremic usually demonstrate a decline in IFA titers over time. Once viral shedding is controlled in the breeding herd, you can implement pig-flow control measures. If the current vaccine becomes approved for use in sows, this may be a very valuable tool for stabilizing breeding herd immunity.

Table 1

Two patterns of serologic profiles for PRRS antibodies

Pattern 1 Stage	# tested	% Positive	Titer range
Sows	30	0%–10%	0–1:16
4-week-old piglets	10	0	0–1:16
8-week-old piglets	10	50%–100%	1:256–1:1024
5- to 6-month-old pigs	10	10%–30%	1:16–1:64

This pattern is indicative of a high likelihood of successful control following nursery depopulation.

Pattern 2 Stage	# tested	% Positive	Titer range
Sows	10	50%–100%	(unspecified)
4-week-old piglets	10	50%–100%	
8-week-old piglets	10	50%–100%	
5- to 6-month-old pigs	10	30%–50%	

This pattern is indicative of a high likelihood of reinfection following nursery depopulation.

Pig flow strategies can be useful to control PRRS

We have found that by making a calculated change in pig flow, one can interrupt the spread of virus among groups of pigs.[5] We have demonstrated the value of nursery depopulation in over 30 farms in the United States. This technology is now being used successfully in Europe and Korea. As mentioned earlier, it takes some planning, but results have been good.

Once again, serologic profiling is very helpful to determine whether it is the proper time to implement such control measures. The profile demonstrated in the first part of Table 1 describes circulation of PRRS virus during the nursery stage. Notice that sows and weaned pigs are IFA negative or have low titers. This indicates the absence of recent exposure to virus in these areas. This is in contrast to 8- to 10-week-old nursery pigs, all of which have been exposed. The second profile depicts recent exposure throughout all stages of the farm and it is likely that a high degree of viral shedding is taking place. Depopulating this nursery will more than likely fail, because weaned piglets may carry the virus into the nursery. If reinfection occurs, you may need to repeat the depopulation procedure but there appears to be little reduction in performance. Fortunately, it is inexpensive and does not require excessive labor or multi-site production.

The success of this technology may be limited to herds with large breeding herd inventories (i.e., >1000 sows) unless we develop a better way to assess the immune status of the breeding herd. It appears to be difficult to stabilize these populations just by closing the herd. "Subsets" of naive animals may exist and infection of these groups has resulted in the spread of the virus within specific herds. Once again, this may be a place where effective vaccination programs can help.

The future

The information reviewed in this paper is well known to all of us, it just took a new disease to reestablish its importance. So, with what we know, how can we use it? Obviously, there are a lot of PRRS problems still to be solved. But what about the possibility of a new disease? Surely something new will happen over the next 5–10 years to keep our jobs interesting! We have heard a well-respected pathologist from England describing a syndrome he is encountering in his country. This problem involves a new strain of influenza virus, unlike any we have encountered in the United States.[6] A similar situation exists in Quebec with proliferative and necrotizing pneumonia. We have also debated the significance of porcine respiratory coronavirus (PRCV). What about co-infection with multiple viruses?[7] We all know that if placed under enough pressure from the immune system, viruses will undergo antigenic drift or shift. This results in viruses with antigenic variations foreign to previously well-adapted immune systems. Therefore, we must be aware of the potential for new diseases to affect pigs at all times. Let's examine a hypothetical situation involving the occurrence of irregular levels of mortality (>5%) in postweaning pigs. Respiratory signs are evident. Anorexia and fever (105–106°F) are present in the breeding herd. What do we do? Well, let's use what PRRS taught us!

- Conduct a proper diagnostic workup, including fixed and fresh tissue and a serological profile as previously described. Test for both strains of PRRS, as well as PRV, TGE, PRCV, and different strains of influenza. Identify certain animals with an ear tag for resampling in the future.
- Close the breeding herd to build a stable immune population.
- Assess the feasibility of vaccination, if available.
- Prevent introduction of new replacement stock from the offsite isolation facility until all testing is complete. Test the new stock for exposure to the previously described pathogens. If a diagnosis is obtained from the samples collected in step #1 and incoming stock are negative, proper acclimatization steps need to be taken. If specific vaccines are available, they may be indicated here. If new stock are highly positive, it may be important to extend the isolation period along with serological monitoring for changes in titers to prevent introducing viremic animals.
- Use serologic profiling to attempt to understand the pattern of viral movement on the affected farm. Is it spreading or is it localized to a specific stage of the farm? Can calculated changes in pig flow assist in interrupting the spread of the virus?

There are many proven strategies to control PRRS that may be applicable to other viral infections as well. It is important for the swine practitioner to implement such strategies in combination with a properly timed vaccination program. When used together, these strategies provide effective disease control with minimal investment.

Suggested reading

1. Dee SA, Joo HS. Clinical investigation of recurrent reproductive failure associated with PRRS virus infection in a swine herd. *JAVMA*. 1994; (in press).

2. Dee SA, Joo HS. Prevention of the spread of PRRS virus in endemically infected swine farms using Nursery Depopulation. *Vet Rec*. 1994; 135: 6–9.

3. Dee SA, Joo HS, Pijoan C. Control of PRRS virus transmission: Handling infected seedstock. *Comp Cont Ed*. 1994; 16: 927–933.

4. Dee SA, Joo HS, Pijoan C. Controlling the spread of PRRS virus in the breeding herd through management of the gilt pool. *Swine Health & Production*. 1995; 3(2):16–21.

5. Dee SA, Joo HS. PRRS Eradication: The Science of Nursery Depopulation. *Proc. Allen D Leman Swine Conference for Veterinarians*. St. Paul, MN, September, 1994: 219–224.

6. Done SH, Brown IH. Pathogenesis of Swine Influenza. *Proc. Allen D Leman Swine Conference for Veterinarians*. St. Paul, MN, September, 1994: 154–158.

7. Carlton J. PRRS and Pig pneumonia. *Swine Practitioner*. 1993: 4-7.