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PRRS eradication: Test and removal

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Introduction

Dear Colleagues,
The topic of PRRS eradication is one of the most exciting and volatile subjects in the swine industry today. Clearly, it is time for a comprehensive forum in which to discuss various methods that are currently being tested throughout the world. We feel the 2000 Leman Conference is the perfect setting for such an event, and we want to provide "real-world" examples of 3 different eradication strategies:

1.) Test & Removal

2.) Producing negative pigs from positive sows

3.) The Danish National Program.

The goal of this session will be to summarize principles, results, strengths and weaknesses of the 3 methods. We will not attempt to conclude whether one protocol is superior to the others, but rather we will focus on describing each method in sufficient detail, so that participants can become familiar with the advantages and disadvantages of all 3 methods. Following the 3 presentations, we will have a 30-minute discussion period. This period will be very important, for it is our goal to have a critical scientific discussion of the methods, particularly the failures and limitations of each one.

Prior to this event, specific ground rules were established.

A. All speakers must follow certain guidelines during preparation of their presentations and proceedings:

1. Each speaker will have 20 minutes in which to discuss their data.

2. The presentation should be focused on applied research, and results should consist of a dataset of farms, not just a few individual cases.

3. Participants should support the principles of their methodologies with published scientific data at all times.

B. All speakers must address 4 specific points during their presentation and in their proceedings:

1. Define the scientific principles of the methodology; referencing published papers at all times.

2. Describe the protocol, providing a description of the established endpoint measures of success. In other words, what are the qualifications that a herd must fulfill in order to considered truly negative?

3. Summarize the results. What is the percent of success versus failure? What are characteristics of successful farms versus those that experience failure?

4. Evaluate the known strengths and weaknesses of the method.

The goal is to create a standardized approach to the lecture and the proceedings, so members of the audience will be able to compare and contrast the 3 methods quickly and easily. We look forward to your interaction, and hope to receive feedback regarding this format. Again, thank for coming and welcome to the Conference!

Sincerely,

—Scott Dee

Define the scientific principles of the methodology

Test and removal (T&R) is a proven method for the elimination of swine pathogens[1,2]

App and ADV have been successfully eliminated from infected farms using this method.

PRRSV persists in adult breeding swine[3]

PRRSV was isolated from 1/60 adult breeding swine (1.7%).

The site of isolation was the lateral retropharyngeal lymph node.

Persistent PRRSV is infectious and virulent[3]

Intranasal inoculation of PRRSV-naïve sows at 95 days of gestation using the lymph node isolate resulted in transplacental transmission of virus and infection of fetuses.

Fetal condition at 14 days post-infection ranged from mummification to infected fetuses that were both grossly and microscopically normal.

PRRSV can be transmitted vertically and horizontally from dam to offspring4,5,6

PRRSV can infect fetuses during mid- to late-gestation, and can be shed in saliva, milk, and colostrum under experimental conditions.

Field studies have demonstrated the infection of offspring at days 1, 2, and 16 of lactation.

Tonsil biopsy is not an accurate ante-mortem test for the detection of PRRSV-positive breeding swine7

Tonsil tissue was successfully obtained only 50% (21/42 sows) of the time following verification by histopathology.

All tonsil samples collected at necropsy from 42 sows were PRRSV negative, therefore tonsil is not a representative site of PRRSV persistence in adult swine.

The use of tonsil biopsy in adult swine results in injury to the animal and requires more time and labor than jugular venipuncture.

Management of the gilt pool controls the spread of PRRSV in the breeding herd8,9

Introduction of naïve or actively infected gilts exacerbates PRRSV transmission.

Closure of the breeding herd in combination with the use of an off-site gilt developer significantly reduces PRRSV-seroprevalence of both populations.

Successful elimination of PRRSV is possible by T&R10,11

T&R, in combination with partial depopulation of post-weaning pig facilities, has resulted in elimination of PRRSV from commercial seedstock operations.

This status has been verified over a 24 month period.

A low PRRSV seroprevalence (<15%) is required to minimize production loss.

Describe the protocol

Gilt management

A 12-month process consisting of three specific 4-month intervals focused on reducing the PRRSV seroprevalence in the breeding herd prior to T&R (**Figure 1**).

Months 1–4

Introduction of replacement gilts delayed for 4 months.

Offsite gilt developer houses 2- to 4-month-old replacement gilts.

Replacement rate reduced to 15%.

Months 5–8

Developed gilts added to herd over 4 month period.

Replacement rate increased to 65%.

Months 9–12

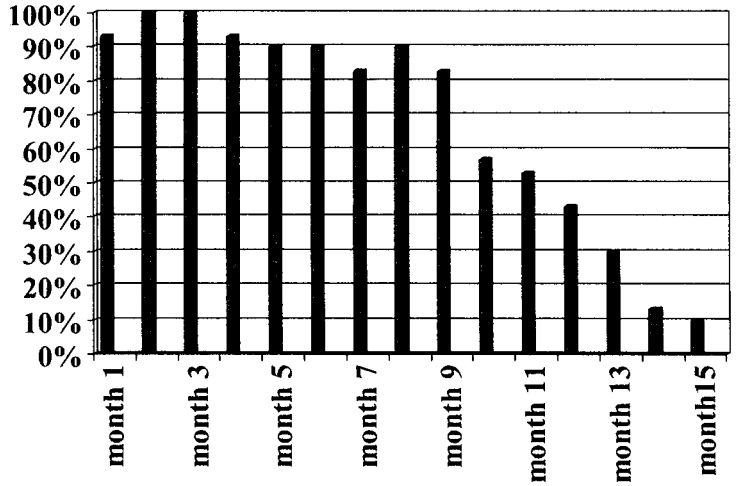
PRRSV-negative gilts added to herd until PRRSV seroprevalence is <15%.

Replacement rate maintained at 65%.

Test and removal protocol

Initiated when desired seroprevalence attained.

Figure 1: Change in PRRSV breeding herd prevalence over time following herd closure



The entire breeding herd is tested in one day.

Sera are tested by ELISA and Taqman PCR.

Animals are removed or retained based on the diagnostic protocol outlined in **Table 1**.

The breeding herd is monitored monthly by ELISA using a sample size based on a 95/5 detection sampling scheme for a 12 month period.

Endpoint measure of success

A farm must achieve 12 consecutive months of negative testing before it is considered PRRSV-negative.

Singleton ELISA reactors are re-tested by ELISA and serum PCR. If positive, the animal is removed and necropsied. Lymphoid tissues are tested by PCR, virus isolation, and immunohistochemistry for the presence of PRRSV.

Results

The results of a recently completed evaluation of T&R and a modification of the protocol entitled wean and removal (W&R) over 10 commercial seedstock farms, and the differences in the protocols are summarized in **Tables 2** and **3**[12]. The relationship between the use of a protocol and the elimination of PRRSV as compared the final status of the positive control farms was analyzed for significance by Fisher's exact test. A significant relationship (P = .0075) was detected with T&R, but not (P = 1) with W&R[12].

Potential reasons for the failure of W&R

The PRRSV seroprevalence was >15% in 3 W&R farms in contrast to 1 T&R farm.

The difference in the mean breeding herd seroprevalence of the T&R group (10%) versus the W&R group (16%) at the beginning of the study was found to be significant at a P value of .0075 by 2-sample t-test.

The protocol required >6 months before the entire breeding herd was tested.

Lack of compliance regarding the removal of ELISA-positive animals.

Recording errors at the time of testing, such as the incorrect labeling of serum tubes or improper reading of animal identification, resulted in improper animal retention or removal.

The use of replacement gilts that had been previously infected with PRRSV at 10–12 weeks of age (farms 9–10).

Table 1: T&R diagnostic protocol and course of action

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

Table 2: Differences in T&R and W&R protocols

	Test and removal	Wean and removal
Test schedule	Same day	Weekly
Test method	ELISA/PCR	ELISA only
Response	Immediate removal of animals	Weekly removal of animals

Table 3: Summary of farms in T&R or W&R study groups

Protocol	BHI	Initial Prevalence	Final Prevalence
T&R mean	769	10%	0%
T&R range	318–1095	5–11%	0%
W&R mean	669	16%	9%
W&R range	210–1295	14–25%	7–10%

Known strengths and weaknesses

Strengths

Efficacy
Appears to be very effective at eliminating PRRSV from study farms.

Results from the field support results of study.

Diagnostic protocol
Eliminates the need of multiple whole-herd tests.

Multiple tests difficult under today's conditions.

PCR enhances detection of peracute infection.

Weaknesses

Cost of diagnostics
Use of PCR raises per sample collected ($10.66/animal sampled).

Pooling of sera 3:1 reduces cost.

Requires low PRRSV seroprevalence prior to initiation
Removal of pregnant sows is detrimental to herd productivity and profitability:

- Removed sows re-located to alternative facilities.
- Pregnant gilts purchased to minimize production loss.

Labor requirements on the day of testing
Organize large groups.

Non-regulatory status allows the use of technicians, producers, and students.

Sample size of study groups
Needs to be repeated over a larger number of farms.

Industry trends
Unknown efficacy in farms with large breeding herd inventories (>2000 sows) or a history of PRRSV vaccination.

Conclusions

PRRSV elimination strategies such as test and removal are in the early phases of development and much more information and testing is necessary. It is likely that the results of future studies on this topic will result in the generation of multiple strategies, and present practitioners with a number of options, similar to the history of ADV elimination. It will then be up to the veterinarian and farm owner to determine which protocol should be applied in each specific case.

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Table 4: Summary of T&R Diagnostic Data

BHI (n=5)	% removed	ELISA + PCR +	ELISA + PCR -	ELISA – PCR +	ELISA – PCR -
769	7.2	3	51	1	713
318 – 1095	2.1-10.7	0-6	17-84	0-2	296 – 1072

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