

## SWINE HEALTH

**Title:** Using Direct Virus Exposure in Conjunction with Modified Herd Closure for a PRRS Eradication Program – NPB #04-200

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### **Abstract:**

PRRS virus eradication can be done by a number of procedures. The use of direct virus exposure to ensure that all animals in the herd have been exposed to the PRRS virus can be used to aide herd closure and allow for a known date to start the closure. In this study herds were closed for a minimum of 200 days. PRRS virus eradication was successful in all the herds in this trial using direct virus exposure and herd closure.

All herds also were able to introduce negative naive gilts into the herds after the closure period and remain negative to the original herd virus. Three of the herds broke with a new virus as defined as greater than 5% difference in ORF 5 gene sequencing.

Direct virus exposure and herd closure were able to generate negative pigs from these positive sows. These herds continued to generate negative pigs through the nursery phase during the trial period.

This is a cost effective means of virus eradication from the herd. This is a tool that can be used get the value and performance from a PRRS negative production system in an economical way. The cost that is associated with this method is the cost of additional housing space during the closure period.

Even with good biosecurity methods virus can reenter herds. Using this method of eradication will allow for a rapid return to negative pig flow at an economical cost.

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## **Introduction:**

There are many procedures that have been used for PRRS eradication<sup>1,2,3</sup>. Herd closure has been documented as a reliable means of herd stabilization and virus eradication<sup>2,3,4,5</sup>. The challenge has been to correctly identify when the last pigs have been exposed to virus. Data from previous work done with herd closures suggests that the herd needs to be closed for at least 200 days from the date of last infection/exposure before allowing PRRS negative animals back into the population. The challenge has been to know when the last animals were truly infected/exposed in the herd so you can start counting. Direct virus exposure using the herd's isolate of the PRRS virus to the herd infects/exposes all the animals at a given point in time, therefore eliminating the question of when the last animal in the herd was exposed. One of the advantages of direct virus exposure is it accelerates the return to more normal performance by ensuring that all animals are exposed in the herd and no subpopulations are left to break at a later date. By the use of direct virus exposure and herd closure together it has been able to generate negative pigs to flow downstream into the production system. With this information we can select a point in time to begin herd closure and calculate the days to make sure that there has been at least 200 days of time. The practice of direct virus exposure coupled with herd closure, are successful tools to eradicate PRRS from a herd.

The ability to eradicate PRRS from the herd without having loss of weekly production by erosion of sow inventory or having to do an off site breeding project or depopulation / repopulation can greatly reduce the cost of a herd closure and eradication program. The use of direct virus exposure can enhance the likelihood of success of the herd closure and more easily develop a time line for the herd closure and reduce the cost of eradication. One of the requirements to follow this type of approach is to be able to hold gilts for an extended period at least 6-8 months of time. This allows time for these animals to be exposed to the herd virus at the same time that the sow herd is exposed using direct virus delivery. The goal is to be able to continue to bring animals in over time and consistently meet breeding and pig flow production targets. By doing this it results in no changes to the herds' normal production flow. This includes the number of sows bred per week, sows farrowed per week, pigs weaned per week and parity distribution.

## **PROJECT OBJECTIVES**

1. To generate negative pigs into a negative pig flow from positive herds.
2. To eradicate PRRS from the herd cost effectively.
3. To be able to bring negative (naive) replacement animals back into the herd and roll the herd over time to PRRS negative status.
4. Reduce the impact on production in a PRRS eradication program.

## **Materials and Methods:**

1. Identify 10 sow farms that have been infected with field PRRS virus and that have used direct virus exposure along with a modified herd closure plan and want to participate in the eradication program.
  - a. Modified herd closure
    - i. Have a facility that will hold a minimum of 6-8 months worth of replacement gilts
      1. Best if staged in size at the beginning.
    - ii. Expose all gilts to PRRS virus using serum from the farm for direct virus exposure.
    - iii. Continue to flow replacements into the herd at the normal pace.
    - iv. Make sure no other introductions to the herd for 200 days minimum from the last exposure of either the sow herd or replacement gilts.
2. Farms that have the ability to inventory 6-8 months worth of gilts in a facility that can be exposed to PRRS at the same time with the same virus that the sow herd is exposed.
  - a. Continue to flow production through the unit as normal flow would dictate.
  - b. Continue to bring the gilts that have already been exposed with direct virus exposure in the herd on a regular basis.

- c. Be able to meet breeding and farrowing targets.
- 3. Identify specifics about each of the herds participating in the study and their PRRS break including sequencing information. Farms will have to have sequenced the virus to participate in the trial.
- 4. Monitor piglets to see if the farms are generating negative piglets in the system.
- 5. Reintroduce PRRS negative replacement gilts 200 days after last direct virus exposure as negative animals into the herd.
- 6. Serologically monitor the negative gilts acting as sentinels for 6 months to see if the eradication was success.
  - a. Using a 95/10 statistical sample test group.
    - i. First test before animals leave isolation
    - ii. Test monthly for the first 3 months
    - iii. Final test at 6 months post introduction of negative gilts
- 7. Statistically sample nurseries to establish their status
  - a. Using a 95/10 statistical sample
    - i. First test before replacements are entered into the herd
    - ii. Test monthly for the first 6 months post introduction of negative gilts
    - iii. Commingled nurseries will be more of a challenge because there will be other potential sources of infection for the groups. (These will be evaluated on an individual basis on the value of testing these types of nurseries).
- 8. Serology samples will be tested for:
  - a. PRRS PCR pools of 5
  - b. PRRS Elisa
    - i. Unexpected positives (false positives) will be evaluated by:
      - 1. Run 4 IFA's
        - a. European strain
        - b. US VR2332 the standard test strain
        - c. US MN Field strain
        - d. European 07 strain when applicable
      - 2. Run individual PCR's on these samples
- 9. Sequencing of viruses:
  - a. If herds do not eradicate the virus using this protocol, the viruses found in either the sow farm and or nursery will be sequenced to compare to the strain against the strain used for direct virus exposure originally.

### **Results:**

A total of 15 herds were screened for the study 5 of the herds had re-broke with a different strain of PRRS prior to starting the trial. 10 herds were successfully entered in the study and gilts were tested after introduction of negative naive gilts into the main sow herd population following the direct virus exposure, herd closure and demonstrating that the farm was generating negative pigs by testing problem piglets in farrowing (greater than 7 days of age and distributing the pigs across the rest of the rooms and chosen by visual appraisal) by PCR and having 3 negative monthly tests consecutively.

Herds and pigs were defined as negative if they were PRRS PCR negative and PRRS antibody negative to either the ELISA test or IFA tests.

As outlined in objective number 1 all herds were able to generate negative pig flow through the nursery from previously positive sow herds by using direct virus exposure and herd closure of at least 200 days. These herds generated negative flow through the time of the trial or up to the time that the herd broke with a new strain of virus.

Figure 1: PRRS PCR (Pools of 5) results from pigs at the end of nursery after introduction of negative naive gilts to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	0/6	1/6	N/A	N/A	N/A	N/A
002	0/6	0/6	0/6	0/6	0/6	0/6
003	0/6	0/6	0/6	0/6	0/6	0/6
004	0/6	0/6	0/6	0/6	0/6	0/6
005	0/6	0/6	0/6	0/6	0/6	0/6
010	0/6	0/6	0/6	0/6	0/6	0/6
012	0/6	0/6	1/6	N/A	N/A	N/A
013	0/6	0/6	0/6	0/6	0/6	0/6
014	0/6	0/6	0/6	2/6	N/A	N/A
015	0/6	0/6	0/6	0/6	0/6	0/6

Figure 2: PRRS ELISA results from pigs at the end of nursery after introduction of negative naive gilts to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	0/30	1/30	N/A	N/A	N/A	N/A
002	0/30	1/30	0/30	2/30	0/30	1/30
003	1/30	2/30	0/30	0/30	1/30	2/30
004	2/30	0/30	1/30	0/30	1/30	2/30
005	1/30	0/30	1/30	0/30	1/30	1/30
010	1/30	0/30	1/30	2/30	0/30	1/30
012	0/30	1/30	1/30	N/A	N/A	N/A
013	1/30	2/30	1/30	1/30	0/30	1/30
014	1/30	1/30	0/30	1/30	0/30	2/30
015	0/30	1/30	2/30	4/30	N/A	N/A

Figure 3: PRRS IFA results from pigs at the end of nursery after introduction of negative naive gilts to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	N/A	N/A	N/A	N/A	N/A	N/A
002	N/A	0/1	N/A	0/2	N/A	0/1
003	0/1	0/2	N/A	N/A	0/1	0/2
004	0/2	N/A	0/1	N/A	0/1	0/2
005	0/1	N/A	0/1	N/A	0/1	0/1
010	0/1	N/A	0/1	0/2	N/A	0/1
012	N/A	0/1	0/1	N/A	N/A	N/A
013	0/1	0/2	0/1	0/1	N/A	0/1
014	0/1	0/1	N/A	0/1	N/A	0/2
015	N/A	0/1	2/2	N/A	N/A	N/A

Figure 4: PRRS PCR (Individuals that were ELISA positive) results from pigs after introduction of negative naive gilts to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	N/A	N/A	N/A	N/A	N/A	N/A
002	N/A	0/1	N/A	0/2	N/A	0/1
003	0/1	0/2	N/A	N/A	0/1	0/2
004	0/2	N/A	0/1	N/A	0/1	0/2
005	0/1	N/A	0/1	N/A	0/1	0/1
010	0/1	N/A	0/1	0/2	N/A	0/1
012	N/A	0/1	1/1	N/A	N/A	N/A
013	0/1	0/2	0/1	0/1	N/A	0/1
014	0/1	0/1	N/A	N/A	N/A	0/2
015	N/A	0/1	2/2	0/1	N/A	N/A

Satisfying objective 2 all farms in the study successfully eradicated the resident virus from the herd using direct virus exposure and herd closure of at least 200 days. This was done in a cost effective means by renting off site finishing space to house the gilts for the herd closure period. None of the herds in this study used an off- site breeding project. All herds used gilt site to hold a least 6-8 months worth of gilts that were exposed either at the same time as the sow herd or within 4 weeks after the sow herd. Herd closure times started once the gilts were vaccinated and were all a minimum of 200 days.

Figure 5: PRRS PCR (Pools of 5) results from gilts after introduction to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	0/6	2/6	N/A	N/A	N/A	N/A
002	0/6	0/6	0/6	0/6	0/6	0/6
003	0/6	0/6	0/6	0/6	0/6	0/6
004	0/6	0/6	0/6	0/6	0/6	0/6
005	0/6	0/6	0/6	0/6	0/6	0/6
010	0/6	0/6	0/6	0/6	0/6	0/6
012	0/6	0/6	1/6	N/A	N/A	N/A
013	0/6	0/6	0/6	0/6	0/6	0/6
014	0/6	0/6	0/6	3/6	N/A	N/A
015	0/6	0/6	0/6	0/6	0/6	0/6

Figure 6: PRRS ELISA results from gilts after introduction of negative naive gilts to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	1/30	10/30	N/A	N/A	N/A	N/A
002	0/30	1/30	0/30	1/30	0/30	0/30
003	1/30	0/30	0/30	2/30	0/30	2/30
004	0/30	1/30	0/30	1/30	0/30	1/30
005	1/30	2/30	1/30	0/30	0/30	1/30
010	2/30	1/30	0/30	1/30	1/30	1/30
012	1/30	0/30	1/30	N/A	N/A	N/A
013	1/30	1/30	0/30	2/30	0/30	0/30
014	2/30	2/30	1/30	15/30	N/A	N/A
015	1/30	1/30	0/30	1/30	2/30	0/30

Figure 7: PRRS IFA results from gilts after introduction of negative naive gilts to sow herd following herd closure.

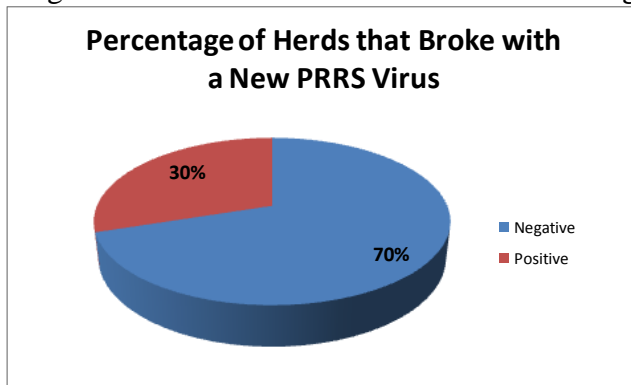
Site Number	1	2	3	4	5	6
001	0/1	N/A	N/A	N/A	N/A	N/A
002	N/A	0/1	N/A	0/1	N/A	N/A
003	0/1	N/A	N/A	0/2	N/A	0/2
004	N/A	0/1	N/A	0/1	N/A	0/1
005	0/1	0/2	0/1	N/A	N/A	0/1
010	0/2	0/1	N/A	0/1	0/1	0/1
012	0/1	N/A	0/1	N/A	N/A	N/A
013	0/1	0/1	N/A	0/2	N/A	N/A
014	0/2	0/2	0/1	N/A	N/A	N/A
015	0/1	0/1	N/A	0/1	0/2	N/A

Figure 8: PRRS PCR (Individuals that were ELISA positive) results from gilts after introduction of negative naive gilts to sow herd following herd closure.

Site Number	1	2	3	4	5	6
001	0/1	N/A	N/A	N/A	N/A	N/A
002	N/A	0/1	N/A	0/1	N/A	N/A
003	0/1	N/A	N/A	0/2	N/A	0/2
004	N/A	1/30	N/A	0/1	N/A	0/1
005	0/1	0/2	0/1	N/A	N/A	0/1
010	0/2	0/1	N/A	0/1	0/1	0/1
012	0/1	N/A	0/1	N/A	N/A	N/A
013	0/1	0/1	N/A	0/2	N/A	N/A
014	0/2	0/2	0/1	N/A	N/A	N/A
015	0/1	0/1	N/A	0/1	0/2	N/A

Bringing negative naive gilts in to the herds following the herd closures satisfied objective number 3. This helps to document that the virus has been eradicated from the herd since these negative sentinel animals can be introduced to the herd and remain negative for at least 6 months.

Figure 9: Percentage of herds that broke with a new virus during the trial.



Three of the ten herds (30%) broke back before the trial completion and were positive to a new strain being at least 5% different in the genetic sequence of Open Reading Frame 5. It is unfortunate these herds broke with a new field strain. This is the frustration of the pork industry that herds continue to break with new and different viruses to the herd.

These farms were able to maintain their normal gilt replacement schedule during the eradication process. Using this method they were able to maintain proper parity distributions before and after the eradication procedures. This satisfies the last objective of the study of having a cost effective PRRS virus eradication strategy.

### **Discussion:**

This study documents the success of using direct virus exposure along with herd closure of at least 200 days as a successful means to eradicate PRRS virus from an infected herd. This can be a very cost effective method with little to no impact on the production flow from the site. The most significant cost is paying the housing cost of holding the gilt population for 6-8 months worth of gilts. Using \$0.10 per day for finishing space and the need for approximately 1.2 finishing spaces per gilt to allow for proper square footage, results in a cost of \$24 per gilts cost for the project. Transporting gilts back to the herd is an additional cost of \$5-10 per gilt.

Eradication of the virus was possible since negative naive gilts were able to be brought back into the herd following the closure. They remained negative through the trial or until a new virus was introduced to the sow herd.

Negative piglets were generated and remained negative through the nursery phase from positive sow's herds. These flows remained negative until a new virus was introduced to the farm or the end of the study.

PRRS continues to be a frustration for the swine industry because even though there are multiple methods to eradicate the virus from herds new introductions continue to be a reality. Even with good biosecurity measures in place the virus still can infect herds. Fortunately the virus can be eradicated using these methods at a relative low cost.

### ***Lay Interpretation:***

PRRS virus can be eradicated using direct virus exposure and herd closure of at least 200 days.

- This can be done in a cost effective manner with the only additional cost is renting a site to hold gilts for the direct virus exposure and the cost of transportation to get the gilts back to the farm.
- There is no need to have any loss of production with this method of virus eradication.
- It is possible to bring negative naive gilts into these herds and they will remain negative for at least 6 months. Piglets from these farms will be negative as well.

Unfortunately herds can become reinfected with a new strain following the eradication. However these same viruses may have entered the herd even if they were still positive and more than likely made a more difficult situation to manage having multiple viruses in the herd at the same time.

**References:**

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