

# Protection against heterologous PRRSV challenge in pregnant sows immunized with multivalent PRRS vaccine

M. Wagner and B.D. Roggow, Fairmont Veterinary Clinic, Fairmont, MN,  
H.S. Joo, College of Veterinary Medicine, University of Minnesota, St. Paul, MN

## Purpose of study

The purpose of this study was to investigate ability of protection against highly heterologous PRRSV in 90 day pregnant animals that had been acclimated as gilts with live PRRSV and subsequently immunized with a multivalent PRRSV protein vaccine. Following an intranasal challenge, clinical signs were observed daily and blood samples collect from sows and piglets. Findings of trials demonstrated partial to complete protection against challenge viruses.

## Trial Description

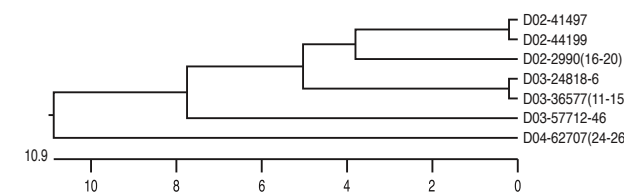
Three separate trials completed consisting of pregnant PRRS positive sows and pregnant PRRS naive gilts. Each trial utilized positive sows from one source farm and naive gilts from a second source farm. The positive sows were initially exposed to PRRSV as gilts during acclimation and also exposed to natural virus during previous clinical disease in sow population. The naive gilts had no history of virus exposure.

All PRRSV in positive source farm had been documented since start up of the farm. Farm was initially started as a naive farm. The specific farm dendogram is shown in Figure 1. Based on farm dendogram, five specific farm PRRSV clusters have been diagnosed in herd during the period of 2002 to 2004. No new virus identified in 2005. Sequence comparison demonstrates 7% or more difference based on ORF5 between farm virus clusters.

Positive sows had been recently vaccinated with a multivalent killed PRRS vaccine two months prior to challenge. All positive sows had received a minimum of two vaccinations prior to challenge.

At 90 days gestation, positive and naive animals were challenged intranasally with virus. Each challenge virus used had previously been associated with severe clinical disease in non related herds. Each challenge virus also had never been documented in positive source herd for trial animals. A dendogram that demonstrates this is shown in Figure 2. Based on dendogram information, challenge viruses used are at least 8% or more different based on ORF5 than any other viruses positive source animals have been exposed to.

FIGURE 1



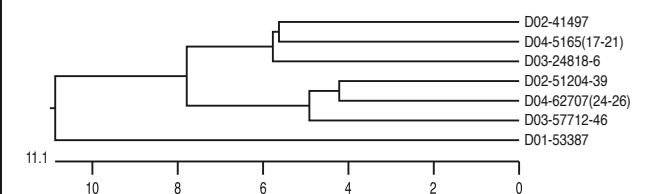
Percent Identity							
	1	2	3	4	5	6	7
1		87.6	87.2	91.9	99.8	85.7	84.4
2	11.6		99.8	90.7	87.4	82.8	81.4
3	11.8	0.2		90.4	87.1	82.6	81.1
4	8.0	7.6	7.8		91.7	84.7	83.7
5	0.2	11.8	12.0	8.1		85.6	84.6
6	14.3	16.9	17.1	15.9	14.5		89.9
7	16.4	18.7	18.9	17.7	16.2	11.0	

### PRRS Virus Challenge Strain

TRIAL	Virus RFLP	When Isolated	Range of ORF5 Difference of Challenge and Positive Source	IN Dosage
1	1-2-1	2004	11.8% - 16.5%	10 <sup>^</sup> 5.5
2	1-4-4	2002	8.4% - 14.9%	10 <sup>^</sup> 4.5
3	1-4-2	2001	12.2% - 16.5%	10 <sup>^</sup> 3.5

Challenge viruses in farms they were isolated from produced 10% abortions and 2-4 months of 8% or higher nursery mortality.

FIGURE 2



Percent Identity							
	1	2	3	4	5	6	7
1		82.8	87.6	82.8	81.4	87.7	82.4
2	17.1		85.7	91.5	92.0	84.6	83.3
3	11.6	14.7		85.7	84.4	88.6	86.2
4	16.9	9.0	14.1		89.9	84.4	84.4
5	18.7	8.4	16.2	11.0		84.2	82.4
6	11.4	15.6	11.8	15.7	16.6		85.4
7	15.8	15.5	12.2	14.6	16.8	13.6	

## Percent Identity

	1	2	3	4	5	6	7
1		87.6	87.2	91.9	99.8	85.7	84.4
2	11.6		99.8	90.7	87.4	82.8	81.4
3	11.8	0.2		90.4	87.1	82.6	81.1
4	8.0	7.6	7.8		91.7	84.7	83.7
5	0.2	11.8	12.0	8.1		85.6	84.6
6	14.3	16.9	17.1	15.9	14.5		89.9
7	16.4	18.7	18.9	17.7	16.2	11.0	

## Percent Identity

	1	2	3	4	5	6	7
1		82.8	87.6	82.8	81.4	87.7	82.4
2	17.1		85.7	91.5	92.0	84.6	83.3
3	11.6	14.7		85.7	84.4	88.6	86.2
4	16.9	9.0	14.1		89.9	84.4	84.4
5	18.7	8.4	16.2	11.0		84.2	82.4
6	11.4	15.6	11.8	15.7	16.6		85.4
7	15.8	15.5	12.2	14.6	16.8	13.6	

## Results of Clinical Observations

Rectal Temperatures				Abortions						Piglet Status					
ID	Day 5 PI	Day 9 PI	When Aborted or Farrowed	ID	Day 8 PI	Day 9 PI	Day 10 PI	Day 11 PI	Day 12 PI	ID	Normal	Weakborn	Stillborns	Decomposed	Aborted
Trial 1; 1-2-1v; 2147 V	98.8	100.0	102.0	Trial 1; 1-2-1v; 2147 V						Trial 1; 1-2-1v; 2147 V	4	0	0	0	0
Trial 1; 1-2-1v; 6689 V	99.6	100.3	101.2	Trial 1; 1-2-1v; 6689 V						Trial 1; 1-2-1v; 6689 V	12	0	0	0	0
Trial 1; 1-2-1v; 5414 V	100.3	101.3	105.9	Trial 1; 1-2-1v; 5414 V		Aborted				Trial 1; 1-2-1v; 5414 V	0	0	0	0	13
Trial 1; 1-2-1v; 9837 V	103.5	101.8	101.6	Trial 1; 1-2-1v; 9837 V						Trial 1; 1-2-1v; 9837 V	2	0	1	3	0
Trial 1; 1-2-1v; 2219 C	101.2	101.2	103.0	Trial 1; 1-2-1v; 2219 C				Aborted		Trial 1; 1-2-1v; 2219 C	0	0	0	0	3
Trial 1; 1-2-1v; 2003 C	102.0	102.0	102.8	Trial 1; 1-2-1v; 2003 C				Aborted		Trial 1; 1-2-1v; 2003 C	0	0	0	0	18
Trial 1; 1-2-1v; 2248 C	101.6	102.3	103.2	Trial 1; 1-2-1v; 2248 C	Aborted					Trial 1; 1-2-1v; 2248 C	0	0	0	0	9
Trial 1; 1-2-1v; 2944 C	100.0	102.2	104.8	Trial 1; 1-2-1v; 2944 C	Aborted					Trial 1; 1-2-1v; 2944 C	0	0	0	0	10
Trial 2; 1-4-4v; 10130 V	101.1	101.7	101.7	Trial 2; 1-4-4v; 10130 V						Trial 2; 1-4-4v; 10130 V	11	0	0	0	0
Trial 2; 1-4-4v; 10214 V	100.4	101.2	102.1	Trial 2; 1-4-4v; 10214 V						Trial 2; 1-4-4v; 10214 V	8	0	0	0	0
Trial 2; 1-4-4v; 10210 V	100.5	101.5	101.0	Trial 2; 1-4-4v; 10210 V						Trial 2; 1-4-4v; 10210 V	7	0	0	0	0
Trial 2; 1-4-4v; 2866 C	101.3	101.3	102.1	Trial 2; 1-4-4v; 2866 C				Aborted		Trial 2; 1-4-4v; 2866 C	0	0	0	0	9
Trial 2; 1-4-4v; 3251 C	100.6	103.7	103.0	Trial 2; 1-4-4v; 3251 C			Aborted			Trial 2; 1-4-4v; 3251 C	0	0	0	0	8
Trial 2; 1-4-4v; 2264 C	100.6	102.5	102.0	Trial 2; 1-4-4v; 2264 C					Aborted	Trial 2; 1-4-4v; 2264 C	Sow died. Did not farrow				
Trial 3; 1-4-2v; 53533 V	101.1	102.0	102.5	Trial 3; 1-4-2v; 53533 V						Trial 3; 1-4-2v; 53533 V	13	0	1	0	0
Trial 3; 1-4-2v; 53806 V	101.0	103.0	101.6	Trial 3; 1-4-2v; 53806 V						Trial 3; 1-4-2v; 53806 V	Sow did not farrow. Not in pig				
Trial 3; 1-4-2v; 52090 V	100.0	103.0	102.0	Trial 3; 1-4-2v; 52090 V						Trial 3; 1-4-2v; 52090 V	10	0	2	0	0
Trial 3; 1-4-2v; 5738 V	100.8	101.6	102.0	Trial 3; 1-4-2v; 5738 V						Trial 3; 1-4-2v; 5738 V	7	0	2	0	0
Trial 3; 1-4-2v; 9680 C	100.0	100.2	103.2	Trial 3; 1-4-2v; 9680 C						Trial 3; 1-4-2v; 9680 C	7	2	1	1	0
Trial 3; 1-4-2v; 9800 C	100.1	101.5	104.3	Trial 3; 1-4-2v; 9800 C						Trial 3; 1-4-2v; 9800 C	5	5	0	2	0
Trial 3; 1-4-2v; 1193 C	100.0	104.0	103.5	Trial 3; 1-4-2v; 1193 C						Trial 3; 1-4-2v; 1193 C	0	11	0	0	0

## Results of Serological Testing

PRRS PCR Status of Sows Day 4 Post Inoculation		PRRS PCR Status in Piglets at Birth or Abortion			
ID	Result	ID	Total Pigs	Pools Made	Pool Results
Trial 1; 1-2-1v; 2147 V	Negative	Trial 1; 1-2-1v; 2147 V	4 pigs	1	1 of 1 Negative
Trial 1; 1-2-1v; 6689 V	Negative	Trial 1; 1-2-1v; 6689 V	12 pigs	3	3 of 3 Negative
Trial 1; 1-2-1v; 5414 V	Negative	Trial 1; 1-2-1v; 5414 V	13 pigs	3	3 of 3 Negative
Trial 1; 1-2-1v; 9837 V	Positive	Trial 1; 1-2-1v; 9837 V	6 pigs	2	2 of 2 Positive
Trial 1; 1-2-1v; 2219 C	Positive	Trial 1; 1-2-1v; 2219 C	3 pigs	1	1 of 1 Positive
Trial 1; 1-2-1v; 2003 C	Positive	Trial 1; 1-2-1v; 2003 C	18 pigs	4	4 of 4 Positive
Trial 1; 1-2-1v; 2248 C	Positive	Trial 1; 1-2-1v; 2248 C	9 pigs	2	2 of 2 Positive
Trial 1; 1-2-1v; 2944 C	Positive	Trial 1; 1-2-1v; 2944 C	10 pigs	2	2 of 2 Positive
Trial 2; 1-4-4v; 10130 V	Negative	Trial 2; 1-4-4v; 10130 V	11 pigs	3	3 of 3 Negative
Trial 2; 1-4-4v; 10214 V	Negative	Trial 2; 1-4-4v; 10214 V	8 pigs	2	2 of 2 Negative
Trial 2; 1-4-4v; 10210 V	Negative	Trial 2; 1-4-4v; 10210 V	7 pigs	2	2 of 2 Negative
Trial 2; 1-4-4v; 2866 C	Positive	Trial 2; 1-4-4v; 2866 C	9 pigs	2	2 of 2 Positive
Trial 2; 1-4-4v; 3251 C	Negative	Trial 2; 1-4-4v; 3251 C	8 pigs	2	2 of 2 Negative
Trial 2; 1-4-4v; 2264 C	Positive	Trial 2; 1-4-4v; 2264 C	Sow did not farrow. Sow died		
Trial 3; 1-4-2v; 53533 V	Negative	Trial 3; 1-4-2v; 53533 V	14 pigs	4	4 of 4 Negative
Trial 3; 1-4-2v; 53806 V	Negative	Trial 3; 1-4-2v; 53806 V	Did not farrow. Sow not in pig		
Trial 3; 1-4-2v; 52090 V	Negative	Trial 3; 1-4-2v; 52090 V	12	4	4 of 4 Negative
Trial 3; 1-4-2v; 5738 V	Negative	Trial 3; 1-4-2v; 5738 V	9 pigs	3	3 of 3 Negative
Trial 3; 1-4-2v; 9680 C	Positive	Trial 3; 1-4-2v; 9680 C	11 pigs	6	3 of 6 Positive
Trial 3; 1-4-2v; 9800 C	Positive	Trial 3; 1-4-2v; 9800 C	12 pigs	5	4 of 5 Positive
Trial 3; 1-4-2v; 1193 C	Positive	Trial 3; 1-4-2v; 1193 C	11 pigs	3	3 of 3 Positive

## Summary of results

- Baseline sow rectal temperatures at time of inoculation for all groups ranged from 98F - 100F. Majority of sows exhibited some degree of fever.
- Abortions were 100% for controls in Trial 1 and 2. Trial 3 controls farrowed weak born piglets. Only one vaccinated animal aborted. At time of abortion rectal temperature was 105.9 and PRRS PCR positive. Prior to this, animal tested PRRS PCR negative.
- Visually appearance of live piglets from vaccinated sows was normal. Those from control animals were weak born or aborted.
- Viremia for 11 vaccinated sows confirmed 10 of 11 PRRS PCR negative at Day 4 post PRRSV inoculation. The positive animal was a parity 0. Viremia for 10 control animals confirmed 1 of 10 PRRS PCR negative at Day 4 post PRRSV inoculation.
- PRRSV detection for 96 piglets born from vaccinated sows pooled into 27 sets confirmed 25 of 27 pools PRRS PCR negative at day of birth. Virus detection for 91 piglets born from control animals pooled into 27 sets confirmed 2 of 27 pools PRRS PCR negative at day of birth/abortion. Positive pools from vaccinated group was from parity 0 litter. Of the 5 pigs born, only two were alive. One tested PRRS PCR positive and the other PRRS PCR negative.

## Conclusion

All trials demonstrated challenge viruses to be highly virulent to naive animals. Results from vaccinated/positive animals demonstrates complete or partial protection. All live pigs at weaning were co-mingled and tested PRRS PCR and PRRS ELISA negative at 30 days post weaning.