Evaluation of positive pressure filtration to reduce aerosol transmission of PRRSV during an experimental challenge of farm access points

Hunter Baldry; Katie Wedel, DVM; Nathan Schaefer, DVM; Pete Thomas, DVM

Key Points:

- Dilute vaccine aerosolization combined with novel environmental sampling techniques allowed for testing of PRRSV aerosol entry into PPF farm access points.
- Under the experimental conditions of this study, positive pressure air speeds > 1.85 m/s resulted in no aerosol transmission.
- Ensuring adequate positive pressure air speed through steps taken to increase access point pressure can further reduce the risk of aerosol PRRSV transmission on PPF farms.

Introduction:

Aerosol transmission of Porcine Reproductive and Respiratory Syndrome virus (PRRSV) is an important risk factor for breeding herds located in pig-dense regions. Some systems are investing in positive pressure filtered (PPF) farms to reduce the risk of aerosol PRRSv transmission via retrograde air movement, but no research exists on the positive pressure air speed required to withstand aerosol PRRSv entry. The objectives of this study were to: 1) provide proof of concept to challenge a PPF farm with aerosol PRRSV, 2) assess the risk of aerosol PRRSV transmission via retrograde air movement, and 3) provide best practices to prevent aerosol PRRSV entry.

Materials and Methods:

To simulate an aerosol PRRSv challenge, modified live virus vaccine (Ingelvac PRRS® MLV) was diluted to high and low concentrations (Ct x̄: 23, 29) using phosphate buffered saline and dispersed through a cold mist fogger. Environmental samples were collected before and after fogging using Swiffer® sweeper cloths saturated in neutralization broth and swabbed over either a 1.8 x 0.6 meter board covered in plastic, or a pair of clean Tyvek coveralls. A 5 mL sample of diluted MLV was collected for positive control. All samples were tested by PCR at the BIVI Health Management Center in Ames, IA. Trial 1: Testing was completed at distances of 0, 1.5, 3, 7.6, 13.7, and 19.8 meters from the fogger in a parking lot using the coverall method. Based on these results, the 1.5 meter distance and 20 s fog time was chosen for on-farm challenge. Trial 2: Testing was completed at a 4,200 head PP filtered sow farm located in a pig-dense region of Iowa. Four farm access points were challenged using the board method: wean chute, mortality load out, gilt/cull chute and supply room. Attic pressure and inlet openings were recorded and altered to vary the pressure at each access point.

Results:

The results from Trial 1 and 2 are summarized in Tables 1 and 2, respectively. All samples collected when positive pressure air speeds were > 1.85 m/s were PCR negative. Average positive pressure air speed ranged from 0.17 to 4.39 m/s (x̄: 1.68 m/s). All samples taken before fogging were PCR negative, while 10/37 samples were positive after fogging.

Table 1: Trial 1 Results

Distance (m)	Fog time (s)	Flow rate	Vaccine concentration	PCR positives
0	10	High	High	**3**/3
1.5	10	High	High	**3**/3
3	10	High	High	**3**/3
7.6	10	High	High	**3**/3
7.6	20	High	High	**1**/1
13.7	20	High	High	**1**/1
19.8	20	High	High	0/1
0	20	Low	Low	**3**/3
1.5	20	Low	Low	**3**/3
3	20	Low	Low	0/3
7.6	20	Low	Low	0/3

Table 2: Trial 2 Results

Air speed (m/s)	Minimum	Maximum	Average
Negative Samples	0.54	4.39	2.56
Positive Samples	0.18	1.06	0.45

Discussion:

Higher positive pressure air speeds were more protective against retrograde aerosol movement. These data suggest that steps taken to increase positive pressure air speeds may reduce the risk of PRRS transmission on PPF farms. The potential still exists for aerosol PRRSV to enter PPF through open access points, so steps to reduce this risk include: minimizing the time doors are open and limiting doorway opening size; opening inlets in the access point and checking pressure prior to opening outside doors; wearing disposable coveralls and cleaning and disinfecting the area after outside doors have been opened. In this study, access points with low positive pressure and low air speeds had the greatest risk, so veterinarians must work with producers to identify these areas. Finally, winter represents a high risk time period for aerosol PRRSV transmission due to the seasonality of the virus and the lower attic pressure settings which result in lower positive pressure air speeds.