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Production Assistants
Steven Claas
Michael Klatt

Layout and CD-ROM
David Brown

Logo Design
Ruth Cronje, and Jan Swanson;
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Alternative filters for boars

Darwin L. Reicks, DVM
Swine Vet Center, St. Peter, MN

Introduction

The goal of all boar studs is to be PRRS negative, either through initial stocking or some type of eradication program. The industry has demanded that boar studs be negative due to the potential of spreading PRRS virus through the semen to downstream farms. Thus the percentage of boar studs that are PRRS negative, in relation to other types of the production pyramid, is much higher than in any other segment of the industry.

One question is whether boar studs are more vulnerable than other farms. For most boar studs, all of the biosecurity research of the past five years has been implemented. However, some still have been vulnerable to PRRS breaks. In several cases, no other explanation could be determined other than aerosol infection from neighboring herds. Thus, air filtration is the next logical step, aside from relocation, to protect the boar stud population and the downstream production system from PRRS virus introduction. I have worked with 9 studs over the last 13 months that have installed the 95% DOP (dioctylphthalate) HEPA-media filters.

How does it work?

The true HEPA filters are normally rated at 99.99% efficient down to 0.3 micron particle size.[1] This means that when they are new, they will filter 99.99% of particulate that is 0.3 micron in diameter. The efficiency percentage increases for larger particles and decreases for smaller particles. As the filter becomes "used" it actually becomes more efficient, as trapped particles help to filter an even higher percentage of small particles.

For the primary agents of concern with aerosol spread in swine, the diameter of each is as follows:

- Swine Influenza Virus – 80-120 nm (.080 - .120 micron)[2]
- PRRSV – 50-65 nm (.050 - .065 micron)[3]
- PCV2 – 17-22 nm (.0017 - .0022 micron)[4]
- Mycoplasma – 0.3 – 0.9 micron[4]

As you can see, SIV, PRRSV, and PCV2 should be able to get through the HEPA filters. However, it is what they are carried on which is important, as bioaerosols are generally 0.4 – 0.7 micron. The 95% DOP filters are 95% efficient for particulate that is 0.3 micron.[1]

Air filtration options

Positive pressure HEPA filtration with air conditioning

The ideal filtration system involves a positive pressure ventilation system where air is pushed into the building along with air conditioning. With this system, low ventilation rates can be maintained year round (<20 cfm/boar). With less air coming into the building, there is less risk of PRRS virus coming in with the air. In addition, the air is pushed through a HEPA filter, which rated to filter 99.99% of particulate down to 0.3 micron. Cost of this system is in the range of $1000-$1200 per boar space. This system has been utilized in France and Quebec in several facilities, and currently has a perfect record. No farm has been infected to date that has put in this system.

Positive pressure HEPA filtration without air conditioning

This system also uses positive pressure ventilation and hepafiltration, however, a traditional cool cell is used rather than air-conditioning. For some locations, the availability of three-phase electrical service is a limiting factor to put in air conditioning, so this is the only feasible option in those cases. The cost of this type of system is $300-$600 per boar space.

Negative pressure 95% DOP with air conditioning

Our clinic services several boar studs that have gone with the 95% DOP filtration system in conjunction with air conditioning. For the larger boar studs, the availability of three-phase electric near to the site is a necessity to handle the large power demands, so only sites lucky enough to have access have been able to do this, other than small studs. With this system, air can be introduced through the ceiling inlets and the filter. Then, air conditioners and air handlers recirculate and air condition the air within the room. In many cases, we can go to a very low (5-10 cfm/boar) ventilation rate, which conserves energy. We also service studs where all the air coming into the barn comes through the air conditioner and through the 95%

DOP filter. These systems are less efficient because outside air is cooled rather than the inside air cooled within the barn, but also can work quite well. The cost of filtration for this type of system is less than $30 per boar. The air conditioning has generally cost an additional $300-$400 per boar plus increases electrical bills and maintenance in the summer.

Negative pressure 95% DOP without air conditioning

There are two versions of what has been utilized here. The better version is farms where all air goes up through the ceiling and down through ceiling inlets. In those cases, 100% of the air can go through the filters. The cost for this system with installation is generally around $100 per boar. For facilities where air goes directly into the barn through the cool cell rather than through ceiling inlets, we have been filtering air just when the cool cell curtain is closed. For this past year, most of the facilities of this type were able to have all the air filtered between early October and late May. An option for these facilities is to put a bank of filters in front of the cool cell, but concern about plugging from yard debris, dandelions, fall harvest, and cottonseed trees has caused hesitation of this implementation. The cost of this system is normally less than $30 per boar.

Pros and cons

The true HEPA filtration offers more security and a proven track record as well as research results[5]. The obvious downside is cost, to the point that relocation of the stud becomes a realistic alternative. For the facilities that have installed the true HEPA filter without air conditioning, there still is the issue of cost., although only half of the full HEPA-system with air conditioning and would have much lower ongoing costs and maintenance.

The 95% DOP filter contains HEPA-media which is integrated into the filter material. Dr. Scott Dee's research showed good results with this filter, with 2 pigs becoming infected out of 76, compared to 0 out of 76 with the full HEPA system and 42/50 with no filtration.[6] The cost and ease of installation are an advantage with this system. Most of the studs that have installed this system have done so for less than $30 per boar space (for those who can only filter fall, winter, and spring) or around $100 per boar space (for those where all air can go through the ceiling inlets year round).

Some of the challenges with the 95% DOP system have been as follows:

- How can you get everything sealed up? Because the system relies on negative pressure, there is always the challenge of minimizing air entry into the building other than through the filter.
- Being exposed in the summer. For those who have air come in directly through cool cells. One thought was that the survivability of PRRS virus during warm weather would be less so there would be less risk during warm weather and less need for filtration. One of these facilities did become infected during warm weather when air wasn't being forced through the ceiling inlet filters. However, this break was not due to area spread, as infected animals had been delivered to the on-site isolation.
- All doors have to be secured. We have implemented a rule that no external doors can be opened. Deads are taken out through isolation or a hallway where doors to the barn can be closed. Culls are taken out in a similar fashion. Entering animals also go through a double door system to minimize any air re-routing around the cool cell.
- Back-drafting through inactive fans is a challenge as fan louvers can stick open and don't provide a great seal when closed. We have put fan covers inside and outside during the winter and try to delay opening up fans as long as possible. Also, it is important that fans are working and should be checked at least once per week.

Summary

Air filtration appears to be the last hurdle for keeping farms PRRS negative in hog dense areas. With the high costs of transportation and the continued desire to use fresh semen, air filtration could be an alternative to relocation of studs to remote areas.

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