RESEARCH ABSTRACT

SWINE HEALTH

Title: Mitigation of PRRS transmission with UV light treatment of barn inlet air: proof-of-concept – **NPB #18-160**

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Scientific Abstract:
Porcine reproductive and respiratory syndrome (PRRS) is an infectious swine disease that causes significant economic loss to swine producers every year. PRRSV aerosols are an important route of transmission. Proper treatment of infectious air could potentially mitigate the spread of the disease from one barn to another. This project involved designing, building, and testing a lab-scale apparatus for mitigating aerosolized PRRSV with UV light treatment. UV lights of three wavelengths, blacklight (365 nm) UV-A (both fluorescent and LED-based lamps), "excimer" UV-C (222 nm), which was proven to be almost innocuous to mammalian skin while being germicidal, and conventional germicidal UV-C (254 nm) were tested for their ability to inactivate airborne PRRSV. The airborne PRRS virus was irradiated in fast-moving air with short treatment times (<2 s). Treated PRRSV aerosols samples were collected and titrated using standard virological techniques, and the results of the experiment were expressed as 50% tissue culture infective dose per milliliter ($TCID_{50}$/mL) using the Spearman-Karber method. The results showed that UV-C (254 nm) and UV-C excimer (222 nm) could effectively inactivate the aerosolized PRRS virus. The UV inactivation model was developed based on experimental data to estimate UV doses. A UV dose needed for 2-log (99%) & 3-log (99.9%) aerosolized PRRS virus reduction was 0.0872 & 0.0958 mJ/cm^2, respectively, for UV-C (254 nm). This finding is also important because the value for the 3-log (99.9%) PRRS virus reduction was over 12x lower than the one and only previously reported 3-log (99.9%) PRRS virus reduction by 1.21 mJ/cm^2 (Cutler et al., 2012). The practical significance is that the UV-C (254 nm) doses (and therefore the UV treatment cost) might be lower than previously estimated. The UV-C (222 nm, excimer) dose needed for 2-log (99%) and 3-log (99.9%) aerosolized PRRS virus reduction was 0.0429 and 0.0489 mJ/cm^2, respectively. This finding is important because the 222 nm 'excimer' UV doses were more than 50% lower than the conventional 254 nm for the same level of PRRS virus kill. However, the cost of 222-nm excimer lamps is still economically prohibitive to consider them for the scaling-up trials. The UV-A (365 nm, both fluorescent and LED) could not reduce virus load for tested doses up to 4.11 mJ/cm^2. Pilot-scale or farm-scale testing of UV-C treatment of aerosolized PRRS large volumes of air simulating barn ventilation rates are recommended based on the high effectiveness of PRRS inactivation and reasonable cost estimates comparable to HEPA filtration.