An evaluation of the Thermo-Assisted Drying and Decontamination (T.A.D.D.) system for the elimination of porcine reproductive and respiratory syndrome virus from contaminated livestock transport vehicles

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Introduction

Livestock transport vehicles have long been considered a high-risk route for the introduction of swine pathogens to susceptible populations. Recent work using a scale model of a weaned pig transport vehicle indicated that exposing naïve pigs to PRRSV-contaminated interiors vehicle resulted in consistent reproduction of transmission and infection of PRRSV. This work further demonstrated the an overnight (8 hour) drying period after washing consistently eliminated PRRSV from the interior of the model and prevented infection of sentinels. Unfortunately, these prolonged periods of downtime for transport in commercial systems is cost-prohibitive. Therefore, means to reduce the time necessary for complete drying and virus elimination are needed. The purpose of this report is to provide a summary of an attempt to validate a new method for achieving a dry, PRRSV-free trailer in a reduced period of time entitled Thermo-Assisted Drying and Decontamination (T.A.D.D). The principle of T.A.D.D. is to raise the interior of trailers to 160 ^{0} F for 30 minutes, in order to promote drying and degradation of virus.

Materials and Methods

The study was conducted using the scale model trailer developed by Dee. This model is constructed at a 1:150 scale of an actual weaned pig transport vehicle. Animal density, materials and design use in the model were consistent with those found in actual trailers. To initiate the study, trailer interiors were artificially contaminated with a concentration of 5 x10^{5} $TCID_{50}$ of PRRSV strain MN 30-100 using a hand-held aerosol sprayer. After contamination, trailers were washed using 70^{0} F water, at 3000 psi for 72 seconds. After washing, trailers were treated with 1 of 4 treatments: a) T.A.D.D., b) forced air (no heat), c) overnight (8 hr) drying and d) no treatment post-wash. During the application of T.A.D.D., forced air and wash only treatments, swabs were collected from the trailer interiors at 0, 10, 20 and 30 minutes post-treatment. Swabs were collected for the overnight group after a drying period of 8 hours. Swabs were tested for the presence of PRRSV RNA by PCR. A total of 10 replications were conducted per treatment. As a

measure of the presence of infectious PRRSV post-treatment, sentinel pigs were housed in treated trailers for 2 hours post-treatment, removed and tested for evidence of PRRSV infection by PCR and ELISA at 7 and 14 days post-exposure. Finally, supernatants from swabs were pooled according to treatment and injected IM into naïve pigs (bioassay) and recipient pigs were tested as described for evidence of PRRSV infection.

Results

All trailers were PCR positive immediately after washing, prior to treatment (pt). At 10 minutes pt, 7/10 swabs were positive from the T.A.D.D. trailers; however, all swabs collected at 20 and 30 minutes post treatment were PCR-negative. In contrast, 9/19, 6/10 and 6/10 swabs collected at 10, 20, and 30 minutes from trailers treated with forced air (no heat) were positive. All swabs (10/10) collected from trailers treated with washing only were PCR positive and all swabs collected at 8 hours of drying were PCR negative. All tests for the presence of infectious PRRSV were negative for trailers treated with T.A.D.D. and overnight drying. In contrast, infectious PRRSV was detected in sentinel pigs and bioassay pigs in the forced air treatment group and the wash only treatment group. Results are summarized in table 1.

Air speeds recorded during the T.A.D.D. treatment averaged 7.5 m/sec (15 mph) while velocities recorded from the forced air (no heat) treatment averaged 17.5 m/sec
(36 mph). Finally, environmental temperature and relative humidity averaged 46^0 F and 79% throughout the study period.

Conclusions

Under the conditions of this study, the efficacy of the T.A.D.D. system was equal to that of the overnight drying treatment, and it required a shorter period of time to complete its objective. Future studies to evaluate the efficacy of T.A.D.D. in full size trailers are underway. Further studies will also be conducted to evaluate the efficacy of T.A.D.D to decontaminate trailers from other swine pathogens and microorganisms of food safety concerns.

Table 1. Summary of the PCR results from the different treatments.

Treatments	0 min	10 min	20 min	30 min	8 hrs	Bioassay	Sentinels
TADD	10/10 pos	7/10 pos	0/10 pos	0/10 pos	NA	neg	0/3 pos
Forced air – no heat	10/10 pos	9/10 pos	6/10 pos	6/10 pos	NA	pos	2/3 pos
Wash only	10/10 pos	10/10 pos	10/10 pos	10/10 pos	NA	pos	3/3 pos
Overnight drying	10/10 pos	NA	NA	NA	0/10 pos	neg	0/3 pos