

Survival of swine pathogens in compost formed from preprocessed carcasses – Summary

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Key Points:

- Composting of preprocessed carcasses effectively eliminated infective PRRSV/PED under cold weather conditions
- Compost biomass type (carbon source) may affect the short-term virus survival
- Environmental viral contamination (aerosolization and groundwater) from carcass preprocessing and windrow composting appears minimal under the conditions of the study
- Compost reached temperatures that can adequately deactivate ASF

Introduction

A diagnosis of a Foreign Animal Disease (FAD) like African Swine Fever (ASF) in the US would invoke a “stamping out policy.” This policy means all confirmed and exposed swine would need to be depopulated to prevent the spread of the outbreak. These depopulation events will require an approved carcass disposal method that can reliably eliminate a viable virus for disease control and prevent transmission. Little literature is available on pathogen survival even for domestic diseases like PRRSV and PEDV in compost. The airborne transmission capabilities of PRRSV and the environmental survivability of PEDV make these pathogens of immediate domestic concern in mass carcass disposal situations. Preprocessing (grinding) of carcasses is documented to require less land, less carbon source, faster tissue degradation, and, therefore, more applicable to mass disposal events than traditional full carcass composting. This study analyzed the potential risk of environmental contamination of grinding carcasses and the composts’ ability to eliminate viable swine pathogens under cold weather conditions (Minnesota winter).

Methods

This study was performed under cold (Minnesota winter in February) conditions. Pigs challenged with PRRSV and PEDV before euthanasia were used as surrogates for pathogen detection in compost windrows. Windrows were formed with preprocessed carcasses combined with 3 different carbon sources (each carbon source forming their own compost windrow): cornstalks, woodchips, and a 50/50 combination. During the grinding process (750hp horizontal grinder used), air samples were collected downwind for PRRSV, PEDV, and pig DNA PCR testing. Compost samples were collected daily for 5 days and then weekly for PRRSV and PEDV PCR testing. Water wells were placed under each compost windrow to test groundwater for the presence of PRRSV and PEDV. Compost temperatures were monitored daily for 5 days and then weekly. A swine bioassay was performed with positive PRRSV and PEDV compost samples on pigs naive for those pathogens.

Results

All air samples tested negative for PRRSV and PEDV by PCR during the grinding process and compost windrow formation. Pig DNA was detected in an air sample at 50 and 100yards from the grinder but not at 150yards. One groundwater sample was weakly positive for PEDV by PCR at 5 weeks after windrow formation. All 3 compost carbon sources reached temperatures adequate for virial pathogen elimination. Compost piles all tested negative for PRRSV and PEDV beginning weeks 3 and 4 post-formation. Woodchip compost had the most PCR positive samples for PRRSV and PEDV days 1-5. Woodchips tested PEDV positive by PCR 2 weeks after windrow formation. Swine bioassay showed that compost made of woodchips remained infectious for PEDV out to 4 days after pile formation, but not at 2 weeks. Cornstalks and the 50/50 combination windrows did not appear infectious on bioassay results for PEDV. Although some compost samples were PRRSV positive on PCR, no PRRSV infection was observed in the bioassay pigs, regardless of compost carbon source.

Discussion

Composting preprocessed carcasses did effectively eliminate infectious viral pathogens in all 3 carbon sources. Compost carbon source appears to affect viral pathogens’ short-term survival, where woodchips appeared to better harbor viral nucleic acid than cornstalks within the first 5 days. The risk of environmental contamination (air and groundwater) under the conditions of the study appears minimal. Even under cold weather conditions, all three compost biomass types reached temperatures that should adequately kill ASF (>131°F for 3 consecutive days; 140°F for 15-20minutes).

Time post windrow formation	High (°F)	Low (°F)	Total Rainfall (in)	Total Snowfall (in)	Woodchips		Cornstalks		Combination	
					Temp 1 (°F)	Temp 2 (°F)	Temp 1 (°F)	Temp 2 (°F)	Temp 1 (°F)	Temp 2 (°F)
					Day 0	23	13	0.02	0.2	46
Day 1	30	20	0	0	60	60	80	115	54	58
Day 2	44	26	0	0	152	150	86	150	132	110
Day 3	45	26	0	0	168	166	146	154	156	160
Day 4	38	26	0	0	158	158	146	148	140	140
Day 5	44	26	0	0	165	162	144	144	132	152
Week 2	50	17	0.18	0.8	45	45	132	134	100	140
Week 3	44	12	0.6	0.3	100	50	82	58	52	120
Week 4	51	12	0.3	0.2	52	50	78	54	48	48
Week 5	60	20	2.23	0.3	90	84	66	94	60	68

Bold = >140°F for 15-20min for ASFV **Green** = EPA Class A virus elimination capacity 131°F for 3 consecutive days

Table 1: Weather conditions and temperature readings of compost by biomass type

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