Transportation of Pigs in Western Canada: Temperatures Within Trucks During Winter and Summer Months

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Transportation, without any doubt, is a major stressor to pigs and is one of the most critical periods in pig handling before slaughter. It involves separation from a familiar environment, physical exertion and psychological stress during loading, an unfamiliar social environment, and a challenging environment on the vehicle. Death losses during transportation in Canada are reported to range from 0.05 to 0.17%, with an additional 0.10 to 0.20% becoming non-ambulatory. Losses are higher in the summer and vary among compartments within a truck, and are also affected by method of handling, facility design and farm of origin. Little is known about micro-environmental conditions that develop within compartments during transportation and its effect on welfare and meat quality of pigs. As part of a larger project on handling and transport of pigs, we examined the temperature conditions in trucks to determine if differences exist among compartments. The study was conducted in both summer and winter to assess the seasonal variability in temperatures.

All animals used in the study were market animals (approx. 115 kg), including both males and females, and were assembled from multiple pens. The pigs were transported from the PSC Elstow Research Farm, and involved approximately 8 hours of travel to the Maple Leaf plant in Brandon. Pigs were loaded in the evening and transported overnight to arrive at the packing plant at 6 am. Trials were conducted in both winter and summer. The range of outdoor temperatures encountered were 7.7 to 22.9°C for summer and -24.5 to -3.8°C for winter. The truck used for transportation was a three-deck dual (cattle and pigs) purpose, pot-belly trailer. Compartments in the upper deck were numbered from 1, at the front, to 4, at the back and in the middle deck it was numbered from 5, at the front, to 8, at the back. The bottom (pot-belly) was numbered from 9 at the front, to 10, at the back. Compartment 6 was not used due to load limitations. Loading density was 0.41 m^2/pig, equivalent to a k value of 0.017 m^2/kg0.667. The trailer included 5 internal ramps with slopes ranging from 22 to 30°C. Eleven loads of 195 pigs (six loads in the summer and five loads in the winter) were used in the study.

We measured the temperature and humidity within each compartment using temperature and humidity sensors (iButtons). Five iButtons per compartment were mounted 5-6 cm below the ceiling. These were positioned in the centre of the compartment, and 15 cm in from the centre of each wall of the compartment. The values of temperature and humidity were recorded at 5 minute intervals. Temperatures reported here represent the mean of all five sensors within each compartment. Temperatures were determined at the time each compartment was filled with pigs (loading), at the time the vehicle left the farm (departure), at arrival at the packing plant (arrival), and at the time of unloading of each compartment (unloading).

The average temperatures at loading, departure from the farm, at arrival at the plant, and at unloading are given in Table 1. There were significant differences between summer and winter for all time points assessed. The temperatures were highest during loading and at departure from the farm, and then cooled during transport. In the summer temperatures tended to increase while waiting to unload, but they decreased in the winter.

The temperatures within each compartment of the truck during summer and winter trials are presented in Figures 1-4. At the time of loading, during the winter, compartment 5 was considerably colder than the rest, with the pot-belly compartments intermediate. Compartment 5 is at the front of the truck and its divider is relatively solid. Warm barn air being ventilated through the truck 30 minutes prior to loading in winter does not effectively reach this compartment. The compartment is generally the first to be loaded, and is considered to be difficult to fill. The very cold temperatures that exist here in the winter

may add to the difficulty. Compartments 9 and 10 are also likely to be poorly ventilated during the warming period, but they are not loaded until the entire upper deck has been filled. By this time the heat from the pigs has warmed the trailer considerably.

By the time of departure, the compartments in the middle deck and compartment 10 were the warmest in both summer and winter. All of these compartments have pigs immediately above them, and compartments 7 and 10 have low ceilings.

Table 1. Average temperatures at the time of loading, departure from the farm, arrival at the packing plant, and unloading for summer (6 loads) and winter (5 loads) months

Season	Loading	Departure	Arrival	Unloading
Summer	20.3*	21.7*	15.0*	19.1*
Winter	11.8	12.3	1.6	-1.8

* *indicates a significant difference between summer and winter ($P < 0.05$).*

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These factors would contribute to their warming from the heat of the pigs.

By the end of the journey, temperatures in all compartments had decreased significantly. In both seasons the middle deck and the pot remained the warmest. The temperatures in the top deck fell below freezing during the winter. These decks had no pigs above them to warm the ceiling and heat loss through the roof was likely considerable.

Between arrival at the plant and unloading, approximately 30 minutes in these trials, the truck is stationary and the compartments warm up in the summer. The hottest temperatures are seen in compartments 5 and 10. Compartment 5 has relatively poor ventilation as the front of the compartment is solid. It also is immediately above the tractor drive wheels and transmission which will be dissipating heat. Compartment 10 is also poorly ventilated and has a low ceiling.

During the winter the temperature in the warmer compartments decreases during the waiting period prior to unloading. This is surprising as we could assume that heat loss would be greater while the truck was in motion. It may be that pigs begin to arouse themselves during this stationary period and this facilitates heat loss from the compartment.

The pattern of temperatures in each compartment during the first 90 minutes of travel is shown for warmest summer and coolest winter days in Figures 5 and 6. Within 30 minutes of travel, if not sooner, the pattern of temperatures seen at the time of arrival at the packing plant has become evident. The compartments in the upper deck and compartment 8 (rear, middle deck) are the coolest. All the compartments cool somewhat, although this amounts to less than 5ºC in the summer, and as much as 20ºC in the winter. During the coolest day of travel, temperatures in the 'cool' compartments averaged -10ºC, with that in compartment 3 going below -15ºC.

During all of the trips temperatures within compartments cooled, then increased slightly and fell again. The reasons for these shifts in temperature of a degree or more are unclear. It may relate to road conditions that favour increased speed or require slowing down, or to shifts in wind speed or direction. The pattern for the warm, summer day approximately 70 minutes into the trip suggests that this shifting may be greater in the upper deck than elsewhere. It may be that this period represents a time of behavioural adjustment of the pigs, from standing to resting or vice versa. Transport lengths of more than 90 minutes have been shown to improve meat quality in pigs, and the reason for this is believed to be recovery from the stress of handling at loading.

The Bottom Line

The temperature conditions pigs are exposed to during transport vary considerably between seasons and among compartments within a vehicle. It may be possible to better standardize these temperature variations by changing ventilation and insulation values in each section/ compartment of the trailer. The results found in this study will provide direction for important studies in the future.

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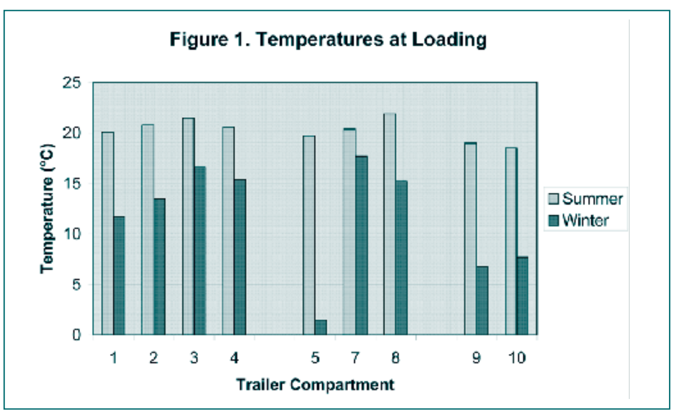

Figure 1. Temperatures at Loading

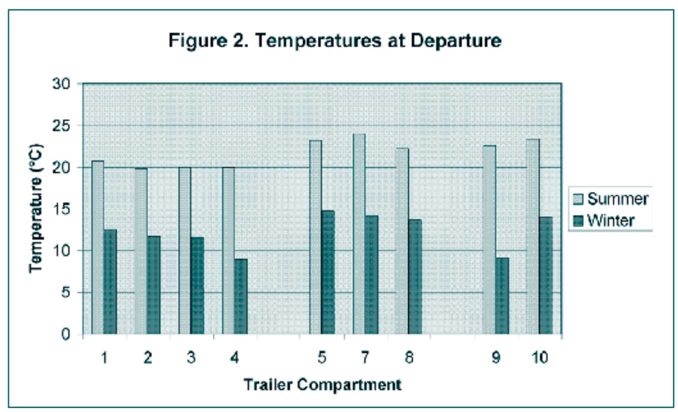

Figure 2. Temperatures at Departure

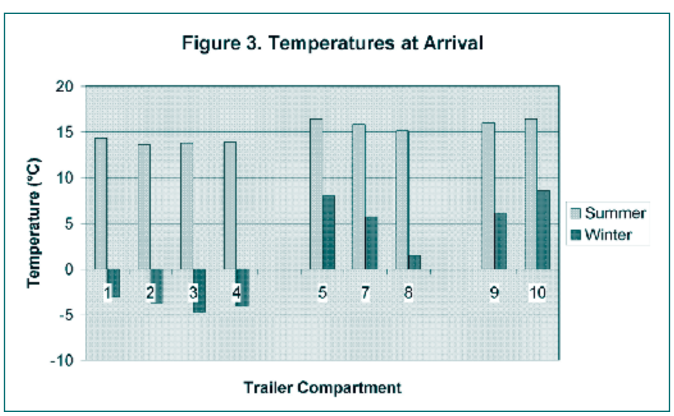

Figure 3. Temperatures at Arrival

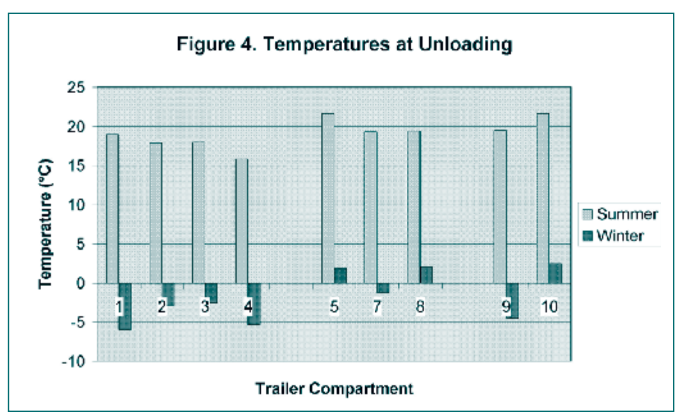

Figure 4. Temperatures at Unloading