Cleaning Ease and Animal Welfare Implications of Trailer Design

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SUMMARY

The aim of this initial study was to develop an inventory list of trailers commonly used for the transportation of market hogs in Canada. Hog transport companies in Saskatchewan, Manitoba and Ontario were visited in order to document various trailer features specifically those influencing ease of cleaning and animal handling characteristics. Each trailer design was ranked according to cleaning ease, animal handling and welfare characteristics. In addition to a trailer inventory, a questionnaire was developed and transport companies were interviewed to gain further insight into trailer design and usage.

INTRODUCTION

The transport of market hogs occurs daily in Canada and around the world. As Canada and North America watched the spread of PEDv in the United States in the summer and winter of 2014, it became increasingly apparent that even when good on-farm biosecurity procedures are in place, there may be serious gaps in biosecurity, particularly related to transportation. Transport of pigs is a major vector for disease transmission, and work is now underway to reduce this risk by developing better processes to clean, sanitize and sample trucks and trailers. Problems have been identified related to the limited number of transport units, down time, and wash capacity of truck wash facilities. In addition, current trailer designs and the use of manual labour for cleaning have inherent problems for cleaning ease, consistency and cost.

MATERIALS AND METHODS

Multiple livestock trailer dealers and wash bays across Canada were interviewed by phone or location visit using a questionnaire, and information on trailers and photographs were collected.

From January to July, 2016, livestock transport companies and wash bays in Ontario, Manitoba and Saskatchewan were visited to characterize the make and design of trailers used for market hog transportation. The trailers were assessed based on cleaning ease and animal handling considerations. In addition, a survey questionnaire was used to inquire about the ease of cleaning and animal handling characteristics of trailers as well as cleaning protocols and preferences of truckers for trailer models and features.

RESULTS AND DISCUSSION

Trailer makes and designs

Trailers used by the Canadian swine industry for transporting market hogs are comprised mainly by manufacturers which include Wilson, Barrett, Merritt and Eby, all are based in the USA. However, one transporter, Luckheart Transport in Ontario, has recently begun importing Pezzaioli trailers from Italy. In western Canada, the majority of trailers used for market hog transport are dual purpose cattle and hog trailers with a tandem or triaxle spread.

The most commonly used trailer design is a double deck potbelly trailer with a belly rail installed between the pot and top deck. Removable flooring is inserted in the middle deck in order to convert the trailer from a double to triple deck design (two decks for transporting cattle, three decks for pigs). Inside these trailers, there are generally five ramps including: 1. access to the potbelly, 2. a pull out ramp to the top deck, 3. ramp to the lower level of the nose ,4. ramp to the upper level of the nose which is also used as a compartment barrier and 5. a ramp to the doghouse which is also used as a compartment barrier.

Other commonly used trailer designs include straight deck trailers for transporting market hogs and quad deck trailers which are used exclusively for transporting isowean piglets. In Ontario, Luckhart Transport Inc is working to introduce the Pezzaioli trailer which features flat hydraulic floors, no ramps or step-ups, active ventilation (fans), misters and heated drinkers (nipple drinkers for pigs and bowl drinkers for cattle). The Pezzaioli trailers are designed specifically to meet EU transport regulations which require the provision of food and water on all transports longer than 8 hours.

Trailer characteristics related to cleaning ease

Various aspects of livestock trailers impact the overall cleaning ease of trailers due to subtle changes in trailer design. Key factors that influence the ease of manual cleaning include:

i. Floor plan. Straight decks are simpler to clean than pot trailers which have multiple ramps and floor surfaces.
ii. Flooring type and pattern. Removable decking increases the flexibility of trailer use, but must be completely removed for proper cleaning. Smooth floors are easier to clean, but texture (eg checker plate) and cleats provide animals with more secure footing.
iii. Support beams. Some beams are encased, whereas others are open I-beams which collect dirt on side ledges.
iv. Deck height. Low ceilings make cleaning difficult, as cleaners need to bend over to access the compartment.
v. Design of fixtures. Sealed lights and tubing, angled gating, conveniently placed and easy to clean gate latches reduce buildup of organic matter and facilitate cleaning.
vi. Access doors and drains. Placement of doors and drains that are well placed and easily flushed.

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In general, straight deck trailers have been ranked as the overall easiest to clean due to presence of fewer complex floor surfaces and greater head room, while quad deck trailers are rated as the most difficult to clean. Another reason for this ranking is the increased removable decking used in quad deck trailers as compared to double deck trailers. As the amount of removable decking increases in a trailer the process of cleaning becomes more difficult and greatly increases the amount of labour required to clean the trailer. Part of the increased time spent cleaning is due to the time it takes to remove and wash individual pieces of decking.

In addition to the amount of removable decking, an increased number of ramps and enclosed spaces increase the difficulty of trailer cleaning. Trailers which feature open tubing on gates, compartment barriers and ramps are among the most difficult to clean. Open tubing within trailers can become packed with debris containing bacteria. It is difficult to clean inside the tubing, and is common practice for transport companies to weld the tubing closed to avoid it becoming filled with organic matter. Besides tubing, organic matter may also become lodged in protective light and electrical boxes, around nail heads, in hinges and any corners, and on support beams. In many designs the corners are reduced by welding extensions around ramps and in corners where debris is likely to become lodged.

Trailer characteristics related to animal handling

Stress associated with handling and transport can lead to heat stress, heart failure and high levels of stress. Particularly on hot summer days, heart failure can occur in pigs moving up ramps, or following strenuous exercise associated with mixing and handling. There are many trailer features which affect difficulty the loading and unloading of market hogs, as well as their comfort during travel and risk of injury due to trapping, pinching or impact with trailer components.

i. Ramp design. Number of ramps, ramp length, angle and surface (cleat height and spacing).
ii. Loading density.
iii. Head height. Handlers
iv. Protrusions. Sharp corners and edges, and ribbing on walls or floors can cause bruising.
v. Pen layout. Turns and distance travelled to each compartment.
vi. Flooring. Adequate ribbing to minimize slipping. Removable decks are typically smoother than permanent flooring.
vii. Gates and ramps. Crevices where feet or other body parts may be trapped. Temperature control. Hot or cold areas vary with season, ambient temperature, compartment (air flow/ventilation/boarding/bedding/contact with cold metal)
viii. Suspension and vibration. Previous research suggests that suspension in the rear of the trailer may cause greater bounce in these compartments. Pigs were more reluctant to lie, and spent more time standing in rear compartments.

One of the difficulties in ranking specific trailer models for animal handling and welfare is the ability to customize trailer design. Transporters have the option to customize trailers to their preference by pre- or post- market modifications. Two trailers from the same manufacturer and of the same design may have different features which impact animal handling within the trailer.

One of the main features which pose difficulty to hogs during loading and unloading is the number of ramps within a trailer. An increased number of ramps and angle of ramps makes loading hogs more difficult. The maximum recommended ramp angle for market hogs is 20° (Canadian Agri-Food Research Council, 2001). The design of the back ramp to the top deck either extends to the door, decreasing the severity of the slope, or leaves a few feet between the door and start of the ramp, allowing the handler loading hogs to create extra pressure which may make loading an easier process.

The number of floors in a trailer additionally decreases hog welfare at the time of transport. It requires extra time for the animals to be moved, leading to greater stress from handling and potential heat stress. By decreasing the number of floors in a trailer, it would decrease the amount to time required to load pigs and the number of ramps market hogs are required to traverse.

Additional trailer features which improve pig handling are wider doors and less loose equipment. Gate pins and hanging chains that make noise when moved are likely to startle pigs, making them more difficult to load. A feature favoured by drivers for improving animal welfare are misters installed inside of the trailers. Some trailers have misters installed in trailers which hook up to an outside water source when stopped. By utilizing misters within trailers heat stress, especially during the summer months, can be reduced upon loading, which may decrease overall death loss of hogs.

It should also be noted that animal handling and welfare issues during transport can be addressed by other means than trailer design. Handling can also be improved by measures taken on-farm, and by better training for animal handlers. Handling practices on different farms create the largest amount of variability when it comes to hogs willingness to load (likely in combination with other farm variables such as genetics, pen design and diet). Pigs from large group pen or autosort systems generally move better than those from small pen housing. Also, it is believed that handling difficulties due to ramps could be alleviated if pigs had some experience of ramps on farm, prior to shipment.

Trailer inspection protocols and checklists used by transporters

The SOPs and protocols for washing and disinfecting market hog trailers vary greatly between wash bays and the specific requirements of producers. Although washing and disinfecting protocols vary by location, there is some consistency between sites.

Across cleaning sites the general protocol is as follows:

1. Trucks are scraped out thoroughly prior to entry at wash bay
2. Personnel must wear sanitized boots for washing. Boots must be sanitized upon every reentry into the trailer.
3. Upon disinfecting, personnel must wear clean coveralls and sanitized boots.
4. Trailers are washed outside to inside, top to bottom, and back to front to avoid recontamination. If the trailer is frozen or especially dirty, run the hose inside trailer for approximately 20 minutes to loosen debris for cleaning ease.
5. Removable decking and winter kits (if assembled) must be removed from the trailer and washed.
6. After washing, trailer must be visibly clean with no remaining debris or it must be rewashed. Equipment within the trailer must be washed (paddles, sort boards, etc.)
7. Acceptable disinfectants include Virkon, Virocid, Synergize
8. Hoses and heads must be disinfected prior to entering the trailer
9. Trailers are disinfected in the same pattern as washing is performed (outside to inside, top to bottom, front to back). Any equipment within the trailer must be disinfected as well (paddles, sort boards, etc.)
10. No one enters the trailer once it is washed and disinfected
11. Trailer swabbing and inspection is performed at random by a 3rd party (veterinarian).

Retrofit opportunities to improve animal welfare and ease of cleaning

Retrofit opportunities will be evaluated in conjunction with engineers based on individual trailer design. Based on this report some initial factors for consideration are listed here.

Features to improve cleaning ease:

- Decrease the amount of removable decking
- Decrease the number of ramps
- Have fewer tight corners and enclosed spaces
- Avoid open ended tubing, I beams, ledges and fixtures that trap debris
- Have well placed and designed access doors and flush out openings

Features to improve animal handling and pig welfare:

- Decrease the number of ramps, and floor levels
- Reduce the amount of loose equipment (chains, pins, etc)
- Reduce sharp edges or protrusions and areas where body parts may be trapped or pinched
- Increase door width
- Decrease the slope of ramps and minimize step ups
- Handle pigs using behavioural principles (approach and retreat, use of flight zone) in a low stress manner (use prods only when needed)
- Have adequate ceiling heights during handling
- Forced ventilation in summer, and bedding/insulation in winter
- Use sprinklers at loading and unloading (temperatures ≥24°C)

Potential barriers or obstacles to automated cleaning

1. Each trailer has its own layout. There is not an industry standard for design. All trailers have different gate, floor and ramp setups.

2. Cleaning of removable floor decking, either on the trailer floor area or in storage is a problem.
3. Negotiating the different levels in the trailer and the need to open the gates, side doors and lower or move ramps would require sophisticated equipment.
4. The environment the units would need to work in is very harsh. Would the equipment stand up to these conditions, and could it become a potential source of contamination?

Certainly for initial development work, total automation is not the goal. Automated tools will be used by staff to assist them in the cleaning process. Navigating multiple floors and ramps poses a disadvantage to robotic trailer cleaning. The majority of market hog trailers contain 5 ramps, some of which include step-ups that must be navigated to access the ramp or compartment, and 3 floors, one of which is made of removable decking that must be removed from the trailer before cleaning can commence.

Outside of cleaning the floor, difficulties will extend to thoroughly cleaning gates, compartment barriers and inside hollow tubing. Equipment installed in the trailer such as gate latches and boxes enclosing electrical wires and lights require special care when cleaning to ensure all visible organic matter has been removed. In addition, when winter kits are used these must also be removed and washed resulting in some level of manual work and oversight to clean these components. However, if robotics can increase the speed and efficiency of this process it should increase biosecurity, reduce cleaning time and make the job less difficult.

CONCLUSION

Pot belly trailers remain the most commonly used trailer design in Canada. These trailers are highly versatile, have high load capacity and are relatively low weight. However, these trailers are also the most difficult to clean and have poorest animal handling characteristics. Alternative designs are available which are easier to clean and allow better ease of handling for animals, but these designs are less versatile, have reduced load capacity and/or are significantly heavier.

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