BEHAVIOURAL CONSIDERATION IN ANIMAL TRANSPORT DESIGN

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Taken from: Welfare of Pigs during Transport
http://www.grandin.com/welfare.pigs.during.transport.html

The purpose of this paper is to review the most important scientific information on pig welfare during transport and to provide practical information. This paper is divided into five sections of 1) equipment for loading and unloading trucks, 2) handling methods, 3) conditions on the truck, 4) fitness of the animal for transport and 5) incentives to reduce losses.

LOADING AND UNLOADING EQUIPMENT

Non-slip flooring is essential on loading ramps and alley floors. A good finish is to print the pattern of expanded metal into wet concrete. Ideally the ramp angle should not exceed 20 degrees for a non-adjustable ramp and 25 degrees for an adjustable ramp (Grandin, 1987). A pig's heart rate will increase as the angle of a loading ramp increases (Van Patten and Elshof, 1978). Mayes (1978) studied a pig's stride width and found that cleats on ramps must be spaced to fit the normal walking stride of an animal. For 250 lb. (120 kg) market weight pigs, the cleats should be on 8 in. (20 cm) centers. Use 1-inch x 1-inch cleats. Missing cleats must be immediately replaced to prevent leg injuries. Stairsteps work well on concrete ramps. For market weight pigs, they should have a 2 ½ inch (6.5 cm) rise and a 10 inch (25 cm) long tread (Grandin, 1987).

The author has observed that small piglets can get dew claw injuries when they go down a ramp designed for market weight pigs. The animals slip and damage their dewclaws. To prevent injuries to young piglets, small closely spaced cleats are required. In segregated early weaning facilities ramps with small closely spaced cleats must be provided unless the loading and unloading docks are level with the truck. Further information on the design of loading ramps can be found in Grandin (1987, 1990, 2000 and National Pork Board, 2001). Good maintenance of equipment is essential to prevent accidents that can injure either pigs or people.

Pig movement through alleys and chutes can be greatly affected by air movement, shadows and lighting. Pigs have a tendency to move from a darker area towards a brighter area, but they will not approach blinding light. (Grandin, 1982; Van Putten and Elshof, 1978). Adding a lamp or moving a lamp will often facilitate animal movement (Grandin, 1996). Pigs will balk at air blowing in their faces. Pig movement out of the finishing barn can often be improved by opening the curtains to let in daylight and to equalize the air pressure. At night, lights are effective for attracting pigs into trucks or trailers. Pigs will often move up a ramp more easily if they are moved to outside of the building before they encounter the ramp.

HANDLING METHODS

Quiet handling by well-trained people is essential. Handlers should be trained to use behavioral principles of handling such as flight zone and point of balance (Grandin, 1987).Flags, plastic paddles or panels should be used as the primary driving aids. Frequent use of electric prods is detrimental to pig welfare because shocking increases body temperature, heartrate and the incidence of stressor non-ambulatory pigs (Benjamin et al., 2001 and Brundige et al., 1998). Electric prods must not be used as the primary driving aids. When pigs are loaded out of either a segregated weaning facility or a finishing barn it is best to move small groups directly from the home pens to the truck. For finishing pigs it is recommended to move 3 to 6 pigs at a time. For smaller pigs, larger numbers may be moved. Pigs should be moved without piling up. Handling of market weight pigs will be easier if the alley in a finishing building is 36 inches (92 cm) wide. This allows two pigs to walk down the alley side by side.

Both genetics and previous experience will affect the ease of handling of pigs. Piglets that have never walked on concrete may balk and be difficult to move. Moving the animals will be easier if they are given an opportunity to explore the new floor surface prior to being driven over it.

Pigs from certain lean genetic lines may be more excitable and difficult to drive (Grandin, 1997). Shea-Moore (1998) found that high lean pigs were more fearful and explored an open arena less. When they were mixed they had significantly more fights (Buss and Shea-Moore, 1999). More time was required to move lean line pigs down an alley compared to a fatter line of pigs. Observations and work with producers by the author has shown that excitability can be reduced and the pigs will be easier to drive if the producers walk through the pens every day (Grandin 2000). This is especially important for pigs from excitable genetic lines. Grandin (1987) found that walking in the pens or allowing pigs to walk in the aisles produced calmer, less excitable animals. The producer should walk through both grower and finishing pens to teach the pigs to quietly get up and flow around him. Pigs differentiate between a person in the aisle and a person in their pens. British researchers have reported that pigs from certain farms are more difficult to drive (Hunter et al., 1994). Geverink et al. (1998) reports that pigs which have been walked in the aisles during finishing will be easier to drive. Moving the pigs out of the finishing pens a month prior to slaughter also improved their willingness to move (Abbott et al., 1997).

CONDITIONS ON THE TRUCK

Overloading of trucks is a major cause of increased stress and death losses. Severe overloading of trucks results in clear evidence of physical stress (Warriss et al., 1998).

There needs to be a differentiation between a short trip of 2 to 3 hours and a longer trip. Guise et al. (1998) reported that market weight pigs remain standing when a trip is under 3 hours and they lie down for longer trips. The space requirements shown in Table 1 are recommended for short trips during cool weather. Barton et al. (1998) found that for short

trips of under 3 hours during moderate weather, additional space provided no benefits. On longer trips, more space will be required so that all of the pigs will have space to lie down without being on top of each other. During hot weather when the Livestock Weather Safety Index is in the Danger or Emergency Zone load 15 to 20% fewer pigs. For long trips, space allowances recommended by the EC Working Group (1992) should be used. EC space allowances provide approximately 15% more space.

Table 1: Recommended transport space requirements for pigs

Average Weight	Number of hogs per running foot of truck floor (92 inch truck width)	Short trips under 3 hours (during cool weather) Space per pig
50 lbs. (23kg)	5.0	1.53 ft^2 (0.14 m^2)
100 lbs. (45 kg)	3.3	2.32 ft^2 (0.21 m^2)
150 lbs. (68 kg)	2.06	2.95 ft^2 (0.27 m^2)
200 lbs. (90 kg)	2.2	3.50 ft^2 (0.32 m^2)
250 lbs. (113 kg)	1.8	4.26 ft^2 (0.40 m^2)
300 lbs. (136 kg)	1.6	4.79 ft^2 (0.44 m^2)
350 lbs. (158 kg)	1.4	5.48 ft^2 (0.51 m^2)
400 lbs. (181 kg)	1.2	6.39 ft^2 (0.59 m^2)

Note: For longer trips, increase the space 15 to 20% depending on temperature. On long trips, pigs should have sufficient room to lie down without being on top of each other.

Research has shown that pigs can suffer from motion sickness (Bradshaw et al., 1996). It is probably due to low frequency vibration (Randall, 1992). Feed withdrawal prior to transport will help prevent motion sickness and vomiting during transport. Feed withdrawal 16 to 24 hours prior to stunning will also help prevent carcass contamination and may help reduce PSE (Eikelboom et al., 1990; Warriss, 1993). Longer fasts would definitely be detrimental to welfare. Pigs must be provided with water up until loading and immediately after unloading.

To keep pigs warm in the winter and to prevent frostbite, deep bedding with either straw or shavings is required when the temperature is below 32 degrees F (0 degrees C). When the temperature drops to 10 degrees F, straw is recommended for extra warmth. On aluminum sided trailers, at least half of the ventilation holes should be blocked during winter. During extreme cold, the trailer may have to be lined with wood to prevent the pigs from contacting cold metal.

During the summer when the temperature is over 60 degrees F (16 degrees C), wet shavings or sand should be used. Straw bedding is too hot. At 80 degrees F pigs should be sprinkled with water immediately after loading. Heat builds up rapidly in a stationary vehicle. If a truck

has to stand when the temperature is over 80 degrees F (27 degrees C), the pigs should be wetted. Research on heat stress has shown that death losses increase as temperatures increase (Knowles and Warriss, 2000, Livestock Conservation Institute, 1981). Truck drivers should drive carefully and avoid sudden stops and rapid acceleration.

FITNESS OF THE PIG FOR TRANSPORT

One of the most important factors which determines if a pig is fit for transport is the condition of the pig that is loaded onto the truck. Sows should be marketed when they are still fit for travel. The National Pork Board advises that sows and pigs that are unable to walk should be euthanized on the farm. Stressor pigs which have temporarily become non-ambulatory must be allowed to recover before they are put on a truck. A combination of genetic selection for leaner pigs and poor management has resulted in increased sow mortality (Koketsu, 2000). Producers need to select sound animals with good feet and legs. The author has observed that some sows are lame due to poor leg conformation. Lame animals are more likely to go down and become nonambulatory.

The presence of the stress gene will increase death losses during transport. Murray and Johnson (1998) found that 9.2% of the pigs that were homozygous positive for the stress gene died during transport. Death loss percentages were 0.27% in heterozygous stress gene carriers and 0.05% in pigs that were stress gene free. Fortunately many producers are now selecting pigs that are stress gene free to improve meat quality. A survey of pigs arriving dead on arrival at the slaughter plant indicated that deads decreased from 0.27% to 0.1% when the stress gene was removed (Holtcamp, 2000). Growth promotants (such as repartitioning agents) must be used with great care to prevent an increase in downer non-ambulatory pigs.

INCENTIVES TO REDUCE LOSSES

People manage the things that they measure. Handling and stunning greatly improved at packing plans when procedures were monitored and measured (Grandin, 1998, 2000). At one plant, death losses were greatly reduced when truck drivers received rewards for low death losses. Financial incentives can be very effective to help prevent losses of pigs during transport and handling. Holding people accountable for losses is a great motivator to prevent losses. Bruises were greatly reduced when people were held financially accountable for them (Grandin, 1981).

CONCLUSION

To maintain an adequate level of animal welfare during transport requires having a fit animal that is carefully managed and handled.

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