PIG TRANSPORT SYSTEMS - A REVIEW

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SUMMARY

The Pig Research and Development Corporation (PRDC) assisted with the funding of a review of the literature on pig transport systems from within Australia and internationally. The literature has been reviewed to help facilitate the adoption of research and new technologies pertaining to the transportation of pigs, and to identify areas requiring further research.

Transport affects animal welfare, meat quality and yield. For example, the level of animal stress and the incidence of pork quality defects such as pale, soft and exudative (PSE) and dark, firm and dry meat (DFD), are influenced by transport. Pig mortality rates during transit, condemnations and weight loss, are also affected by transport.

This review identified a number of approaches that would improve animal welfare and meat quality during transport. They included improved scheduling, better management of pre- and post-transport handling, improved loading and unloading ramps, and reduced reliance upon electric prodders.

Keywords: pigs, transport, welfare, quality, yield

INTRODUCTION

Transport is an essential component of pig meat production. The transportation of pigs from farm to farm, saleyards or meat processing facilities can affect their welfare, meat quality and meat yield through the imposition of stress. Pigs become stressed because they are deprived of feed and water and are in an unfamiliar environment (Shorthose 1987); this increases the incidence of stress-related pork quality defects, such as pale, soft and exudative (PSE) and dark, firm and dry (DFD) pork. It has been estimated that PSE pork costs the Australian pig industry A$20 to 27 million annually because of drip loss, cured loss and downgrading (Paton 1992; Whan 1993; Eldridge 1994; Taylor 1996).

Meat yield is also affected by the transportation process, because of losses in carcass weight as a result of dehydration and catabolism (Lambooy 1983; Shorthose 1987; Tarrant 1989). Losses also occur as a result of bruising, injuries and deaths (van Putten 1982; Shorthose 1987; Warriss and Brown 1994).

The factors that influence animal welfare, meat quality and yield can be categorised as pre-transport, transport design, transport process and post-transport.

RESULTS

Pre-transport

Feeding pigs too soon before transport can increase mortality rates and PSE (Nielsen 1982; Shorthose 1987). However, withholding feed for too long stresses them and increases weight loss (Kelley *et al*. 1980; Nielsen 1982; Houpt *et al.* 1983; Lambooy 1983; Shorthose 1987). The consensus would be to withhold feed 16 to 18 hours before slaughter.

Scheduling. Nielsen (1982) suggested that abattoirs provide producers with specific arrival and slaughter times, so that the producers know when to withhold feed from the pigs. Producers should provide transport operators with the precise number of pigs to be transported so that recommended stocking densities are achieved (Nielsen 1982; Eldridge 1995).

Reducing loading time. Delays in loading pigs for transport increases animal stress (Nielsen 1982). The use of holding pens positioned next to the loading area can help to reduce loading time. These are effective so long as pigs are not mixed with pigs from other pens and have access to water.

Pre-transport handling. Pigs can become stressed when being handled, adversely affecting their meat

quality. Hemsworth and Barnett (1987) and Broom (1996) recommended regular handling of pigs when they are young, making them much easier to handle when older. Pig handling is also improved when stock persons are selected who have the will and aptitude to handle them carefully (Nielsen 1982; Hemsworth and Barnett 1987). Pigs become less stressed when they are moved in small groups rather than in large groups or individually (van Putten 1982; Grandin 1989).

Prodding devices. Electric prodders exerted the same level of stress on pigs as descending a loading ramp, with successive applications of a prodder worsening the situation (van Putten and Elshof 1982). Pigs can be moved quietly from their pens into a truck by using a wooden blocking board, which reduces the level of stress.

On-farm facilities. Poorly designed or maintained on-farm facilities can present hazards to moving pigs, causing them to be stressed before they are loaded onto the truck. Pigs will move easier on stable, non-slip floors, in races with solid walls and no protrusions, and with doors that open outwards and do not protrude the doorway (van Putten 1982; Grandin 1991).

Loading and the loading ramp. Stress associated with moving, loading and unloading pigs, was greater than the stress levels incurred by short transportation (Stephens and Rader 1982). Very steep loading ramps contribute to injuries (Warriss *et al.* 1991) and may cause rectal prolapse in pigs (Guise and Penny 1989). Recommended maximum angles for loading ramps range from 15° to 27° (van Putten 1982; Tarrant 1989; Grandin 1990; Warriss *et al*. 1991). Van Putten (1982) found a positive linear relationship between the angle of the loading ramp and the heart rate of the pigs. Pigs can baulk and become stressed if there are gaps in the walls or floor of the loading ramp.

Transport design

Stock-crates. Stock-crates should be easy to clean effectively, and be maintained in good repair with no projections which could potentially injure animals (Eldridge 1990; Grandin 1991; Broom 1996). Stock-crate floors should have a non-slip surface and be comfortable to lie on (Nielsen 1982; Grandin 1991; Broom 1996).

Air-ride suspension allows for a smoother ride for the pigs, reducing stress and injuries (Grandin, pers. comm. 1997; Lapworth, pers. comm. 1997).

Internal ramps are usually too steep and cause problems, especially when pigs fall off them (Eldridge 1990). It is highly recommended that they are not used to load or unload pigs. Unfortunately, unloading ramps at many processing facilities are not capable of reaching the top deck of triple deck trucks and the internal loading ramp must be used.

Roof covering and shade. Nielsen (1982) and Shorthose (1987) recommended that transport vehicles have a covered deck to prevent sunburn.

Ventilation. Shorthose (1987) recommended that trucks were designed so as to allow alterations in their microclimates (increased airflow in summer and reduced airflow in winter). Grandin (pers. comm. 1997) maintains that trucks should have forced ventilation systems.

Watering facilities. The rate of dehydration is greatly accelerated by road transportation (Warriss *et al*. 1983; Becker *et al*. 1989). Shorthose (1987) reported that access to water during transit and lairage reduced weight losses.

Spraying facilities. Spraying pigs with water helps to settle them down and lower their body temperature (Shorthose 1987). However, most trucks are unable to fit sprinkler systems because of restrictions in tare weight and because the spray is sometimes sucked out of the truck through the ventilation system onto other vehicles with very little benefit accruing to the pigs.

Effluent retention. Grandin (1991) suggested that truck floors be leak-proof to prevent urine and manure from dripping onto the highway, and to comply with environmental regulations. The challenge is to allow adequate ventilation without the spread of effluent.

Instrumentation. Several types of instrumentation for measuring animal stress in transit have been tested in Australia. These include infra red sensors of movement, and video cameras. Temperature, heart rate and respiration rate were commonly measured in stress analysis.

Transport process

Mixing pigs and fighting. Mixing unfamiliar pigs increased fighting (Parrott and Misson 1989). Fighting increases energy consumption and, therefore, the incidence of DFD meat. Skin and meat quality were affected when pigs from different pens were mixed before transport or at lairage (Guise and Penny 1989a, 1989b).

Stocking density should be such that animals can lie down (Broom 1996; Troeger 1996). Overstocking contributes to PSE pork and increases mortality rates, whilst low stocking rates increase carcass weight losses (Nielsen 1982; Shorthose 1987; Grandin 1991). Recommended stocking density ranges from about 0.35 m^2 to 0.50 m^2 per bacon weight pig (100 to 120 kg liveweight).

Temperature, humidity and wind chill. Lambooy (1983) maintained that weather (temperature and humidity) was the most important influence on the condition of pigs during transport. Shorthose (1987) reported that pig mortality rates in transit were greatest during hot weather, unseasonal periods of warmer weather and periods of high humidity. Grandin (1991) recommended that when weather conditions were hot and humid as many pig shipments as possible should be in the early morning or at night. Broom (1996) suggested that in cold weather, adequate screens or insulation were sometimes necessary to reduce wind chill and maintain body temperature.

Inspecting animals during transport. Broom (1996) recommended that pigs be checked during the journey to ensure their welfare. Stoppages should otherwise be minimal because pigs can overheat when the vehicle is stopped (Broom 1996).

Route selection. A recent study in the United Kingdom found that pigs on a rough journey (on minor roads) were more stressed than pigs on a smooth journey (on the motorway) (Bradshaw *et al*. 1996). Pigs also vomited more, and stood and walked around more on the rough journey, possibly to alleviate the effects of travel sickness (Bradshaw *et al*. 1996).

Transport distance and times. In Australia, pigs are transported relatively long distances to slaughter (Shorthose 1987). Long transport distances and prolonged lairage times reduces carcass yield and increase ultimate pH levels (DFD) because more energy is used than during short transport and lairage times (Nielsen 1982; Warriss and Bevis 1986). The shorter the time from farm to slaughter, or from last feed to slaughter, the less likely DFD meat is to occur (Shorthose 1987). Shorthose (1987) found that, in Australia, distance travelled had the greatest effect on pig mortality rates in transit.

Cleaning the stock crate after each load of pigs helps to prevent skin blemishes and improves hygiene, reducing the spread of diseases (Grandin 1991).

Post-transport

Unloading ramps. Pigs find it difficult to descend steep loading ramps. However, Warriss *et al.* (1991) found that ramp angles up to 20° appeared to present few problems to pigs descending them. Unloading ramps should have a level dock before the ramps go down, so that the pigs have a level surface to walk on to when they exit the truck (Grandin 1991). It is important that the height of an unloading ramp matches that of the truck floor, or that the unloading ramp height is adjustable; it is equally important that there are no gaps in the floor or sides of the ramp, which can predispose pigs to breaking their legs and can cause them to baulk (Shorthose 1987).

Lairage design. Lairage areas should be quiet and protect animals from extremes of weather (Shorthose 1987). Grandin (1991) recommended that pens be long and narrow to allow more fence length per pig with a gate at each end to facilitate one-way movement of pigs. It is important that pigs have access to water at all times whilst in lairage.

Mixing pigs from different piggeries before slaughter resulted in skin blemishes and loss of meat quality (Guise and Penny 1989a; Grandin 1992). If unfamiliar pigs are mixed in transport or lairage they tend to fight which increases stress and muscle temperature, both of which contribute to PSE and DFD (Trout 1993). Kelley *et al*. (1980) indicated that the effects of mixing unfamiliar pigs in lairage could be exacerbated by fasting the pigs for over 12 hours.

Lairage times. Broom (1996) recommended that pigs be able to recuperate adequately if they have been disturbed by transport for some hours. Lairage times should be long enough to rest the pigs before slaughter to reduce stress related quality defects, but not so long that yield losses occur. Shorthose (1987), Grandin (1991), and Troeger (1996) suggested a resting time of two to four hours. Trout (1993) recommended longer resting times for pigs transported longer than five hours.

Handling from lairage to slaughter. Shorthose (1987) maintained that handling from lairage to slaughter is extremely important because animals stressed during this time do not have time to recover. Stressing pigs before slaughter and improper electrical stunning contribute to ecchymosis (blood splash). To reduce blood splash Grandin (1991) recommended minimising the use of electric prodders and not leaving pigs in the restrainer during breaks in processing procedures.

DISCUSSION

Presently, there are industry and government-funded programs aimed at introducing a national quality assurance system for transporting pigs. The objective of this review was to provide information to complement such an approach.

A complete document will be presented to the PRDC, which will be used to assist the determination of research and extension strategies. The review will be followed by a survey of current practice in Australia to identify areas of pig transportation that can be improved. Further work under the project will identify economic aspects of current and improved practices.

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