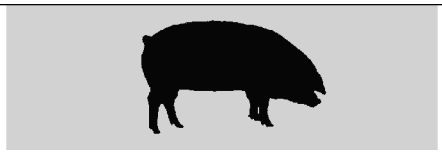
The Professional Animal Scientist 20 (2004):518–523



Case Study: Moving Devices for Finishing Pigs: Efficacy of Electric Prod, Board, Paddle, or Flag

J. J. MCGLONE[1], PAS, R. L. MCPHERSON, and D. L. ANDERSON
Pork Industry Institute, Department of Animal and Food Sciences, Texas Tech University, Lubbock 79409-2141

Abstract

A total of 320 finishing pigs (72 to 90 kg) was used in four studies to assess the efficacy of various moving devices by evaluation of pig behavior and time to complete a standardized course. The handler was behind the pigs (n = 3) with the objective of moving the pigs forward. In the first study, pig reactions to an electric prod or paddle touching their ham, neck, rear hock or back, or on their left or right side were recorded. The percentage of pigs moving forward was greatest (P<0.05) when pigs were touched on their back. Future work standardized touching pigs on their back to get them to move forward. In the second study, paddles colored blue, red, or green were found equally effective (P>0.05) at moving pigs. Studies then standardized evaluations using blue devices. In the third study, the electric prod, paddle, and board were evaluated for time to complete the course. A handler using a board required less time (P<0.05) to move pigs compared with an electric prod or paddle. Pig vocalization was similar after being touched with either the paddle or electric prod, but these devices caused more pig vocalization than the board (P<0.05). In the fourth study, the board was compared with a flag. The board and flag were statistically equal in time required to move pigs through the course. In conclusion, the board was the most efficacious moving device among those evaluated.

(Key Words: Pigs, Handling, Moving Devices.)

Introduction

Many studies have indicated the large effect that good vs. poor handling and housing systems can have on pig physiology, behavior, and pork quality (Grandin, 1993; Hill et al., 1998; Faucitano, 2001). Ease of routine moving and handling of pigs can affect the final outcome of meat quality and overall welfare of pigs (Geverink et al., 1998). Despite the need for pork producers to move large numbers of farm animals, little is published about how best to move animals based on scientific evaluations. The broad objective of this case study was to evaluate the efficacy of common moving devices for finishing pigs. Following preliminary studies, a test course was developed that was designed to be moderately challenging for pigs to complete. The specific objectives were 1) to determine the time required for pigs to complete the course and 2) to gain an understanding of pig behavioral reactions when handlers use common hand-held moving devices.

Materials and Methods

The Texas Tech University Animal Care and Use Committee approved this study prior to initiaion. All studies were conducted using terminal Newsham genetics (Colorado Springs, CO). Subject pigs (n = 320; both barrows and gilts) were, in all cases, naïve to the handling facilities and to movement in the building except for when they arrived at about 20 kg of BW.

At least 1 wk before testing, pens of pigs were established with 9 or 10 pigs per pen. Prior to that, pens might have had 11 to 14 pigs per pen. With 10 pigs per pen, the pens provided 0.74 m^2 (8 ft^2) per pig of floor space. Each pen had a three-hole feeder that provided feed ad libitum. Water was also provided ad libitum through a nipple waterer.

Pigs were selected when they were >70 kg of BW on average. Actual BW, when collected, are provided in each section, when the BW were taken as a part of the protocol of each experiment.

Pigs were moved from their home pens, in groups of three, down an aisle with a board. National Pork Board (NPPC, 1996) recommends moving pigs in small group sizes;

[1]To whom correspondence should be addressed: john.mcglone@ttu.edu

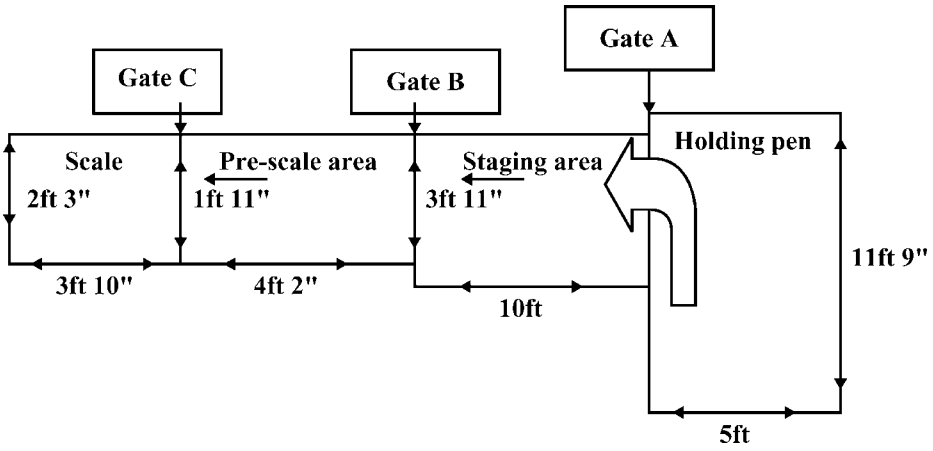


Figure 1. Course used to evaluate moving devices. Pigs were required to enter a gate between the holding pen and the staging area. Pigs then had to enter the more narrow pre-scale area before entering the scale itself. Pigs moved into the holding area in groups of three or four, depending upon the study. Pigs were moved individually from the staging area through the pre-scale area and into the scale. The time to travel the course was for individual pigs from opening Gate A through closing Gate C. Gates A and B were swinging gates with metal vertical bars. Gate C was a solid wooden guillotine gate.

thus, pigs were moved from their home pen of 10 pigs in groups of three pigs each. Pigs then made a left-hand turn into a holding pen (Figure 1). While general impressions were made during the move from the aisle to the holding pen, the actual treatments were imposed once the pigs were in the holding pen or the next areas.

After the holding pen, pigs were individually moved into the staging area. Pigs then were moved into the pre-scale area, which ended (on the left of Figure 1) with a guillotine, solid wooden door. The floors were concrete slats in the pigs' home pens and in the holding and staging areas. The aisle had a solid concrete floor. The walls, staging, and pre-scale areas were constructed of solid wood painted white. The holding area fencing was metal bars exactly as in the pigs' home pens.

In all cases, a single female handler moved the pigs using the moving devices. A observer recorded the times using a stopwatch.

Devices tested included:

- Electric prod, 1700 mA (medium power), blue in color (model LMPLUS; Hot Shot, Savage, MN), with a 42-in shaft
- Paddle (4.7- × 2.35-cm head, with a white plastic handle, 16.5-cm length, various colors, primarily blue)
- Board with no handle (11.8 × 14.2 cm, blue in color)
- Flag (11.8 × 11.8 cm, black plastic, white plastic handle, and length of 15.7 cm)

Experiment 1—Body Regions. A total of 160 pigs (avg. BW = 72.5 kg) were moved into the staging area individually. Pigs were touched once firmly on the ham, neck, rear hock, or back area with either the electric prod or the paddle. For the electric prod, the animals were first touched then shocked for 1 s. A single device was used on a single pig; thus, the data represent 80 pig experiences with each device. Immediately after each body part was touched, the observer recorded which direction the pigs moved: forward, backward, lateral, jump, or no movement. These data were collapsed into a comparison of moving forward (the desired direction) and not moving forward (ineffective device use outcome).

On another group of pigs within Experiment 1, 80 pigs were tapped with each device (electric prod or paddle) on their left or right side. The percentage of pigs moving and the pig direction were recorded. These pigs were naïve to these two movement devices, and after these two tests in the staging area, these pigs were considered experienced and were not used in other studies.

Experiment 2—Paddle Colors. A total of 45 pigs (avg. BW = 77.5 kg) were used to assess the effects of paddle color on movement of pigs through a course. Three paddle colors were evaluated in this study in random order: red, blue, and green. Pigs were moved in groups of three (15 small groups in total with 5 replications per treatment). The observer recorded which direction the pigs moved in response to use of the selected paddle color by the handler and the time for a group of three pigs to enter the scale.

***Experiment 3—Electric Prod, Paddle vs* Board.** The main data set was collected to compare the electric prod (blue, 1700 mA), the paddle (blue), and a board (blue). A total of 99 pigs (avg. BW = 90.4 kg) were evaluated (11 pens of 9 pigs per pen; 3 pigs per pen per device). The observers recorded the incidence of pigs turning in the handling area (an undesirable behavior), time required to complete the course, and pig vocalization.

Experiment 4—Board vs. Flag. A total of 16 pigs (avg. BW = 77.8 kg) were used to evaluate the effectiveness of an 11.8- × 11.8-cm flag compared with a board to move pigs through the course. The same model system as above was used. In this study, four pigs were moved at a time and in the test area. Flags and boards were randomly alternated when testing individual, naïve pigs in the common test area. Eight pigs were moved with the board, and eight pigs were moved by using the flag in a manner similar to how the board is used (placing the device behind the pig and encouraging it to move forward by touching it on the ham with the device and touching the pig's caudal dorsal surface with a hand).

Data Analysis. Data were analyzed using Microsoft Excel (Microsoft, Red-

TABLE 1. Percentage of pigs moving forward or in other directions when touched with either a electric prod or a plastic paddle[a].

	Moving device	
Item	Electric prod	Paddle
Forward	66.3	70.0
Back	7.5	15.0
Lateral	7.5	3.8
Jump	15.0	0.0
None	3.8	11.3
Total of non-forward movement	33.7	30.0

[a]χ^2 = 42.8; P<0.01. The total percentage of non-forward movement compared with forward movement was not significant (χ^2 = 0.31; P>0.10).

TABLE 2. Percentage of pigs moving forward when touched on different body regions[a].

	Moving device	
Item	Electric prod	Paddle
Ham	85	70
Neck	55	50
Rear leg hock	40	65
Back	85	85
Left side	25	32
Right side	35	30

[a]χ^2 = 7.6; P<0.05. The percentage of pigs moved forward when touched on either the right or left side was not significant (χ^2 = 1.15; P>0.10).

mond, WA) and SAS (SAS Institute, Cary, NC) software. A Chi-square or ANOVA was used depending on the study design. For percentage data, a simple Chi-square analysis was used. Preliminary analyses determined that the effects of gender (barrow vs. gilt) and order of testing (first, second, etc.) did not influence time through the course nor did these factors significantly interact with movement devices.

For Experiments 2 and 3, data were analyzed as a randomized complete block design with home pen as the block. Each device was observed on at least three pigs per home pen (per block). Pigs within pens experiencing the same device were considered subsamples. A collection of three pigs was the experimental unit.

In Experiment 3, one observation with a red paddle had an individual value that was 30 SD from the grand mean. This was a case of a single pig that was particularly difficult to move.

Experiment 4 used only one group of pigs, and, thus, block was not in the model. Individual pigs were the experimental units. This study had two treatments and 16 pigs in the sample.

Data were not normally distributed; the means and standard deviations were positively correlated. A log transformation was used to normalize the data effectively before ANOVA procedures were calculated.

Results and Discussion

Experiment 1—Body Regions. For both electric prod and paddle, about two-thirds of the pigs moved forward when touched on any body part (Table 1). The electric prod, but not the paddle, caused pigs to jump on occasion (15% of the time).

When touched on the hock (rear leg) with the electric prod, only 40% of the pigs moved forward. The neck was another body region that had <60% of the pigs moving forward. For both the electric prod and paddle, the highest percentage of pigs moving forward was when the pigs were touched on their back, although touching the electric prod on the ham also had a high percentage of pigs moving forward. When pigs were touched on their left or right side, only about 30% of the pigs moved forward (Table 2).

Based on this study, the preferred place for the use of an electric prod or paddle in future studies was on the back, with the ham being a secondary preferred touch site.

Experiment 2—Paddle Colors. Paddle color did not influence (P<0.10) the time required to move through the course (Figure 2). The blue paddle was used in all future work to be consistent. Because the pigs in our study were on the same farm and because they had similar experiences, the reason one pig was difficult to move cannot be determined from this study.

***Experiment 3—Electric Prod, Board vs* Paddle.** Examination of the data showed a weak relationship between pig BW and time to enter the scale (Figure 3). Although the slope differed significantly from zero (P= 0.05), the r^2 was very low (r^2 = 0.04). On average, larger pigs required slightly more time to complete the course than smaller pigs. Also illustrated was the increase in variation in moving time (Figure 3), as the pigs were larger (necessitating data transformation to normalize the data). Thus, not only did larger pigs require slightly more time to move on average than smaller pigs, but they also were more variable in their response to handling. In part, this could be due to the handler's ability to more

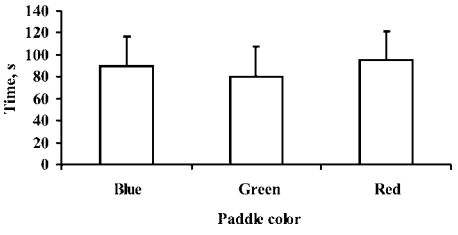


Figure 2. Effects of paddle color on time required for pigs to move out of their home pens, down an aisle, and then through a chute. Paddle color did not significantly influence time required to move through the course (n = 45 pigs).

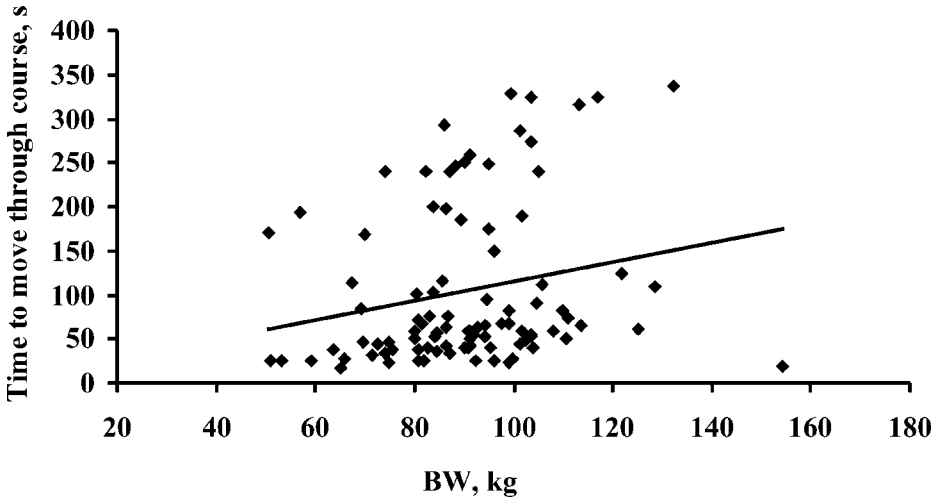


Figure 3. Relationship between BW and time to enter a scale area. Pigs required slightly longer times to enter the scale area as they became heavier. The variation in pig movement is large, and the variation increased ($y = 1.0859x + 6.5954$, $r^2 = 0.0445$, where y = time to move through the course (s), and x = BW (kg); n = 99 pigs).

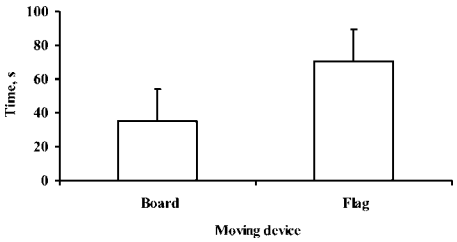


Figure 5. Time required for individual pigs to move through a course using a board or flag. Treatments did not differ statistically (P=0.28; n = 16 pigs).

easily manipulate smaller pigs and the difficulty in handling larger pigs that might not cooperate.

The movement devices had a significant effect on time to complete the course (Figure 4). The electric prod and paddle were equally effective, but less effective at moving pigs through this course than was the use of a board (Figure 4).

The observers also recorded the incidence of pigs turning in the handling area (an undesirable behavior) and vocalizing (vocalization was assumed to be a negative reaction for the pig). Pigs turned more often ($P<0.01$) with the paddle than the other devices (Table 3). The number of vocalizations was greater when the handler used the electric prod or the paddle compared with the board (Table 3).

The paddle was subjectively interpreted by handlers as being annoying to the pig. It is not known whether the electric shock from the electric prod is objectionable because it was painful, annoying, or both. However, because the paddle caused the same level of vocalizations as the electric prod, one could conclude that the electric prod was equally annoying and/or painful as the paddle.

Some writers have suggested that electric prods (or goads) should never be used (Grandin, 1986; Warriss, 1994) or should be used sparingly. Our results demonstrate that, for most measures, the paddle and electric prod induced similar behaviors among pigs (with the exception of jumping). Furthermore, the time required to move pigs was similar for the paddle and electric prod, and this time was greater than when pigs were moved with a board (Figure 4); thus, the board was the most time-efficient movement device.

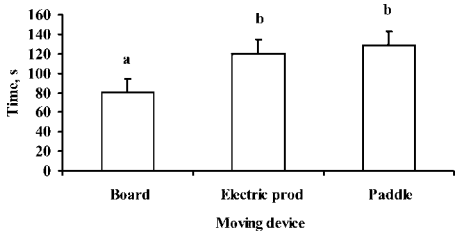


Figure 4. Comparison of time to move through a scale area for three moving devices: board, electric prod, and paddle. Bars with a different superscript (a, b) differ statistically (P>0.05; n = 99 pigs).

TABLE 3. Percentage of pigs turning or vocalizing while being handled with one of three moving devices[a].

	Pig Reaction	
Item	Turning	Vocal
Board	29.6	3.7
Electric prod	22.2	51.8
Paddle	40.7	59.2

[a] $\chi^2 = 33.4$; $P<0.01$.

Experiment 4—Board vs. Flag. The time required for pigs to be moved by board or flag was evaluated. Pigs moved as well with the flag as they did with the board (Figure 5); the two treatments did not differ ($P>0.10$).

Discussion. Pigs reacted differently to the moving devices. They seemed to view the board as a solid wall, unless they could see around the edges. If they observed an opening around the edges, they attempted to turn around and go through the opening. The flag is much the same; they seemed to view it as a solid wall unless they can see light around the edges. But another apparent pig perception of the flag was that if it was waved, they seemed to be afraid of the device, based on subjective interpretation by the observer. This reaction was not observed with the board.

The electric prod and paddle often caused the pigs to vocalize. The vocalizations were interpreted as annoyance or anger, and some pigs became aggressive in nature. Cattle were reported to vocalize when an electric prod was used (Grandin, 1997). Because pigs vocalized as much with the electric prod as they did with the

paddle, one cannot assume the vocalization may be the result of the pain of the electric shock when prodded. Rather, it was interpreted that vocalization is more of a startle reaction that is induced by being touched (not necessarily painfully touched) and startle by a foreign device. The finding that pigs moved with the use of a board rarely vocalized can only be interpreted as meaning that some pigs vocalize when handled, even if the handling is performed with minimal touching and minimal startle reaction.

Some pigs turned (22%) when the electric prod was applied and attempted to bite the device or the handler after being touched and shocked. This device-biting behavior was observed with the electric prod and the paddle but not with the other devices. The paddle was observed to be effective when a "no touch" technique was adopted. By using this device at close quarters to the pigs and rattling the device, but not making physical contact, they seemed to be less annoyed by the device than when physical contact was made. The subjective impression of the researchers was that the paddle seemed to annoy the pigs, whereas the electric prod seemed to make them angry.

Pig handlers understand that there are at least three situations under which pigs are handled and that require moving devices: wide-open spaces, a close area where the pig is near the handler, and a close area where the pig you wish to move is far away.

In the first situation, pigs are in a wide-open space (such as an aisle or a large pen). Therefore, a movement device is not absolutely needed, but handlers still prefer to have a movement device of some kind. The board can be heavy and cumbersome in this situation. The electric prod is not very useful in this situation, as it does not provide much personal protection and does not block the pig's view. The flag can be very useful in wide-open spaces because it operates as a solid wall, is light in weight, and can be used as an extension of the handler's arm. The paddle is marginally effective in wide-open spaces. It gives the handler something to hold, and it makes a noise that may get the pigs' attention.

When pigs are in close proximity to the handler, less than an arm's length away, the board is the preferred device. The board provides protection from injury and gives the illusion of a solid wall to the pig. Also, the handler can use the board as limited leverage to move pigs. The other devices provided no leverage to move pigs in a close area.

Close areas where the pigs are far from the handler are common when a line of pigs is in a chute, alley, or a race. The handlers may have devices in their hand, but the pig that is causing a delay is far ahead. In this case, the handler wants to use the device to move a pig that is far from their position. The board is not useful for this task. The paddle and the electric prod are the preferred devices for this task, although they may not be effective. More than one-fourth of the pigs attempted to turn when touched with the paddle or electric prod. If the pigs are far away, and not in a tight space, the flag may be used as a moving device; however, in a tight space with the pigs more than an arm's length away, the flag is not useful.

The general impression of the researchers was that the tool they most wanted to have in their hand in close spaces was the board. The board provided protection to the handler from the pig that may step on, bump into, or otherwise potentially injure the handler. When pigs were an arm's length away and in an open area, the handler preferred the flag. But when the pigs were an arm's length away and jammed or stopped in line, the handler preferred the paddle or the electric prod, even if these devices were less than effective.

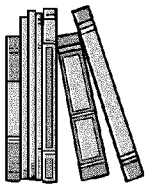
It is our subjective interpretation that the electric prod has the greatest potential for abuse among the moving devices evaluated, in part because of improper handler training. It is recommended that properly trained handlers have judicious use of the electric prod. However, this study observed that the electric prod was not needed, in that other devices were equally effective at moving pigs forward. In the interest of the welfare of the pig, it is suggested by this case study that the electric prod should not be used as a moving device because 1) equally effective alternatives are available and 2) the electric prod has the greatest potential of being used by nontrained or improperly trained handlers, which may lead to unnecessary pain being inflicted on the pigs.

Implications

These studies clearly indicate that moving devices can be objectively evaluated for efficiency. When standing behind pigs, touching them on their back and hams are the most effective sites to touch pigs when the objective is to move pigs forward. The sorting board was a more effective moving device than a paddle or electric prod; however, the paddle and electric prod were equally effective at moving pigs forward. The flag was also as effective as a sort board at moving pigs forward and should be further evaluated as a hand-held device to move pigs. On the whole, electric prods are not needed on farms, as boards induce fewer behavioral problems and the use of the board can reduce the time required to move pigs. Future research needs to evaluate moving devices and moving techniques to improve welfare and safety for animals and handlers.

Acknowledgments

The researchers thank Stanley Harris and the rest of the farm staff for their assistance in this study.



Literature Cited

Faucitano, L. 2001. Causes of skin damage to pig carcasses. Can. J. Anim. Sci. 81:39.

Geverink, N. A., A. Kappers, J. A. van de Burgwal, E. Lambooij, H. J. Blokhuid, and V. M. Wiegant. 1998. Effects of regular moving and handling on the behavioral and physiological responses of pigs to preslaughter treatment and consequences for subsequent meat quality. J. Anim. Sci. 76:2080.

Grandin, T. 1986. Observation, handling, weighing and moving of pigs. Paper presented at the CIGR seminar on Pig Housing and Small Bird Species, Rennes, France. Sep. 8–11, 1986.

Grandin, T. 1993. Livestock Handling and Transport. CAB International, Wallingford, UK.

Grandin, T. 1997. The feasibility of using vocalization scoring as an indicator of poor welfare during cattle slaughter. Appl. Anim. Behav. Sci. 56:121.

Hill, J. D., J. J. McGlone, S. D. Fullwood, and M. F. Miller. 1998. Environmental enrichment influences on pig behavior, performance and meat quality. Appl. Anim. Behav. Sci. 57:51.

NPPC. 1996. Swine Care Handbook. National Pork Board, Des Moines, IA.

Warriss, P. D. 1994. Antemortem handling of pigs. In Progress in Pig Science. D. J. A. Cole, J. Wiseman and M. A. Varley (Eds.). p 425. Nottingham University Press, Loughborough, Leicestershire, England.