

Handling Pigs for Optimum Performance on the Farm and in the Slaughter Plant

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Observations at packing plants indicate that some lines of hybrid pigs have a very nervous temperament and others are calm. Some pigs are easy to drive up chutes and others are nervous and constantly balk and back up. Certain lines of lean pigs, which contain the stress gene, tend to be more nervous and excitable than lean lines without the stress gene. Observations at large packing plants have also indicated that lines with some Duroc genetics tend to be calmer. Lines with Hampshire or Pietrain genetics tend to be more nervous. Shea-Moore (1998) found that a certain genetic line of high lean pigs were more fearful than fatter types. She also found that they balked more during driving. Some genetic lines of high lean pigs fight more than fatter pigs (Busse and Shea-Moore 1999). Some producers have moved away from lines that are extremely nervous and carry the stress gene. This also has the added benefit of improving pork quality. Pork from heavy weight pigs with the stress gene was judged by a taste panel to be tougher and drier than normal pork (Monin et al 1999).

Problems with Ultra Heavy Muscling

There are certain genetic lines of pigs that have extreme bulging hams. Some of these pigs have difficulty walking and they are prone to back breakage during electric stunning because the muscles grow so rapidly that the skeleton is immature and small. The author has observed a much higher incidence of broken legs in these pigs that occur during handling and loading. They also have double to triple the problems with damaged meat, blood splash and broken bones induced by electric stunning. In one plant, ultraheavy muscled pigs accounted for 90% of the broken backs and severely damaged loins. Problems with weak bones are further worsened if a producer fails to properly supplement the finishing diet. Providing adequate minerals enables a pig to build stronger bones. Finishing pigs at very high weights such as 300 to 350 pounds will also increase death losses, broken bones and PSE. Lines with Hampshire or Pietrain genetics tend to be more nervous. The author has also observed that pork from ultra lean pigs with bulging muscles is often tough.

Walking Pens

Practical experience has shown that lean pigs with excitable genetics will be easier to load into trucks and handle at the packing plant if the producers have walked through the pens every day during finishing. This is especially important in a wean to finish operation where the piglets remain in the same building from weaning to finishing. Only 10 to 15 seconds per pen per day is required. In facilities with large pens provide 10 to 15 seconds per 50 pigs, everyday. The principle is to train the pigs to calmly get up and flow around the person. If the person stands still as he/she trains the pigs to chew on boots instead of moving. It is important to keep moving in the pens. The person should move at the same speed as a pigs normal walking speed. The person walking the pens should also walk through the pens in a different random direction each day. The handler's goal is to teach the pigs to drive. One large pork operation with a high percentage of pigs carrying the stress gene found that walking the pens greatly reduced death losses during transport and in the plant yards.

Environmental Enrichment

Research studies on the effects of environmental enrichment have had varying results (Grandin 1987, 1989, Pedersen et al 1993). In some trials contact with people made pigs easier to handle and in others it made them harder to drive. One of the causes of negative results was spending too much time in the pens.

This caused the pigs to become too tame and refuse to drive. They wanted to follow people instead of driving. Other studies showed that allowing pigs to walk in the aisle every day made them easier to load onto a truck (Abbot et al 1997, Geverink et al 1998).

In studies where handling in the pens made pigs harder to drive, much more time was spent interacting with the pigs than the 10 to 15 seconds per day, which the author recommends. There is an optimal level of exposure for people. An animal needs to be tame enough not to panic but not to be so tame that it wants to follow people instead of driving. The secret is actually training the pigs to move calmly when the person walks through the pens. The handler must never kick or slap the pigs. This would stress the pigs. Calm handling and walking through the pens will have no effect on weight gain. To prevent any possible detrimental effect, walking the pens should be done during the entire finishing period. There may be detrimental effects if a producer attempts to walk the pens for only one week prior to slaughter.

Tips for Moving and Loading Finishing Pigs

1. When loading finishing pigs, move very small groups of 5 to 6 at a time.
2. Do not store large groups of finishing pigs in an alley or holding pen. This will lead to damage caused by fighting. It is best to take each small group of pigs immediately from the finishing pen to the truck.
3. New finishing buildings should have a 3-foot (1 m) wide alley. This is wide enough to allow 2 pigs to walk down it side by side. If a building has a 2-foot (.75 m) alley, only three pigs should be moved at a time.
4. Do not overload the trucks. Overloaded trucks, especially during hot weather, are a major cause of high death losses.
5. Do not allow pigs to stand in a fully loaded truck, get moving immediately. Heat builds up rapidly in a stationary vehicle.
6. In winter, use straw for bedding. In extremely cold weather, straw provides the best insulation and helps prevent frostbite. Observations in packing plants indicate that trucks with inadequate bedding are more likely to contain frost bitten pigs.
7. When there is high heat and humidity, it is best to transport pigs very early in the morning and at night. Stocking density should be reduced.
8. Schedule trucks so that pigs can be unloaded promptly at the packing plant.
9. Minimise the use of electric prods. Electric prods should not be used in the finishing barn.
10. Calm pigs are easier to sort and separate than excited pigs. Pigs are easier to sort if the handler moves slowly and deliberately and separates the desired pigs from the group on the first attempt. Excited pigs stick together and are more difficult to separate.
11. If pigs refuse to leave the finishing building, try shutting off the ventilation or reversing it. Pigs often balk if air is blowing in their faces as they exit the building.
12. To make pigs flow more easily out the door of a finishing building, attach plywood to the last 16 feet (5 m) of pen near the door. This will prevent pigs that are being driven out of the building from seeing or touching pigs that are in pens near the door. After loading, the plywood should be removed because it will interfere with ventilation flow through the pens.

At the Packing Plant

Practical experience has shown that improving handling at the packing plant and reducing electric prod usage will improve meat quality. Approximately 10% more pork will be suitable for high quality exports to Japan when pigs are handled quietly and usage of electric prods is reduced. Below are some tips for improving handling in packing plants that will help maintain pork quality and reduce PSE.

1. Rest pigs prior to moving to the stunning chute for 2 to 4 hours. Slaughtering pigs immediately after unloading will have a detrimental effect on pork quality.
2. Use sprinklers during hot weather.

3. Staging areas that lead to the stunning chute crowd pen should be filled only half full. Fill the crowd pen only half full and DO NOT push the crowd gate tight up against the pigs. They need room to turn.
4. If pigs balk and refuse to go up the single file chute or constantly back out of the chutes, look for distractions that cause balking (Grandin 1996). Some of the things that cause balking are: air blowing in the faces of approaching pigs, shiny reflections on metal, puddles, a chain hanging in the chute, restrainer entrance too dark, seeing people up ahead and moving objects. Removing distractions and improving lighting will reduce balking. Light up the restrainer and chute entrances with lamps. Animals will not go into a dark place. The lamps must not shine directly into the faces of approaching pigs.
5. Electric prods should be eliminated in the yards and staging area. Pigs moved with electric prods had higher heart rates than pigs moved with a panel (Brundige et al 1998). In the stunning chute an electric prod may be needed on an occasional stubborn pig. Some other tool should be in the person's hand as the primary tool for moving the animals. The electric prod should only be picked up when it is needed. To reduce use it should not be constantly in the person's hands. In a survey that the author conducted for the USDA, (Grandin 1998) it was possible to greatly reduce electric prod usage. In two plants that had excessive use of electric prods 44% of the pigs were electrically prodded. After handlers were instructed to fill the crowd pen only half full and tap the pigs first, the percentage of pigs that were electrically prodded dropped to 15%. Handlers were able to keep up with the line when electric prod usage was reduced. It is important to eliminate distractions that cause balking. At another plant, it was impossible to reduce electric prodding when the sun was out due to harsh shadows. When a cloud covered the sun the pigs moved easily. To solve this problem, the roof over the crowd pen had to be extended to block high contrasts of light and dark at the stunning chute entrance. In plants where pigs are stunned in groups on the floor electric prods should be totally eliminated.
6. Monitoring of squealing levels is a simple way to monitor stress levels during handling. When pigs are quiet stress levels will be lower. Vocalisation (squealing) is highly correlated with physiological stress levels and poor pork quality. (Warriss et al 1994, White et al 1995) In a slaughter plant an easy way to measure squealing is to count the number of stun cycles where the entire handling area is quiet. As each pig is stunned; score on a yes/no basis - "room quiet" or "heard a squeal". From this you can calculate the percentage of time the room is quiet.

Conclusions

Geneticists and producers must work together to produce pigs which are easy to handle. Genetically nervous pigs, which have been raised in finishing pens where nobody has walked the pens, may be extremely difficult to handle at the plant. Quiet handling at the slaughter plant will improve pork quality and reduce PSE. The last 15 minutes in the stunning is the most critical time. Geneticists need to select pigs that have a calm temperament and strong bone. One must be careful not to over select for a single trait. There can be strange interactions of traits. When the poultry industry solved their leg problems in large breasted birds, a new weird trait emerged. Heavily muscled roosters with strong legs and lower death losses are very aggressive and sometimes kill breeder hens.

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Methods to reduce PSE and bloodsplash

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Observations by the author at slaughter plants and farms all over the United States, Canada, Europe, and Australia indicate that producers are responsible for about 50% of the **pale, soft, and exudative (PSE)** pork on the market, and packers are responsible for the other 50%. Surveys conducted in slaughter plants in two different countries indicated that PSE levels varied over 100% between different producers.

Genetics is probably the single most important factor contributing to the prevalence of PSE pork today. Some pork-grading systems motivate producers to breed pigs that carry the stress gene. These animals have maximum lean and weight gain (Aalhus et al., 1991). Unfortunately, they also have high levels of PSE. Some of the highest levels of PSE were recorded in hybrid pigs, which had been selected for leanness and rapid growth. The breeding companies have recognised the problem and have taken steps to produce lines that will have lower levels of PSE. DNA testing methods will enable the **PSS (porcine stress syndrome)** gene to be eliminated (Sellers, 1993).

At one plant, a certain line of commercially available hybrid pigs constituted 10% of the pigs received each day. Ninety percent of the pigs that were dead on arrival or died in the yards came from these hybrids. Genetics has a large effect on death losses (Murray et al., 1998). Genetics is not the sole explanation for differences between producers. A survey conducted at a vertically integrated operation indicated that PSE levels varied 5-10 percentage points among producers who raised identical pigs in identical buildings. Handling, management, and transport also had an effect. Several surveys have shown that pigs transported a short distance will have more PSE compared to pigs transported a longer distance. Observations by the author have indicated that pigs hauled very short distances for under 30 minutes are often more stubborn and difficult to drive at the plant compared to pigs hauled longer distances (Grandin, 1993a). Pigs hauled long distances are more likely to have **DFD (dark firm dry)** meat because glycogen stores become depleted.

PSE can be reduced by fasting pigs 12 to 24 hours prior to slaughter (Warris and Bevis, 1987; Eikelenboom et al., 1990). Pigs should have access to water at all times. To reduce the possibility of carcass weight loss, a shorter fasting period of 12 hours prior to stunning and slaughter is recommended (Grandin, 1993).

Excitable pigs

There are problems with excitable pigs. The leanest animals with large muscles often have the worst excitability problems. Shea-Moore (1998) found that high lean pigs were more fearful. These pigs often have the worst meat quality problems. Pork from stress gene pigs which are grown to heavy weights is tougher and drier than pork from pigs which are stress gene free (Monin et al., 1999). Excitable pigs are very difficult to handle at the slaughter plant. This creates both meat quality and welfare problems. Handling excitable pigs at 1000 per hour in a single file race is difficult to do quietly. Some plants have installed two stunners to improve handling. Fortunately some of the vertically integrated companies have removed the stress gene from their herds. This has resulted in calmer pigs that are easier to handle. They are now breeding pigs for quality instead of quantity.

Handling of pigs can also be improved by installing a system that eliminates the single file races. The Danes have developed a CO₂ stunning system where pigs are stunned in groups. Cattle move very easily through a single file race because their natural behaviour while walking from pasture to pasture is to

move in single file. Pigs do not have the instinct to walk in single file. When pig excitability increased, problems with single file races increased. When pig excitability is reduced single file races will have fewer problems.

Many excitable pigs are animals that have been raised in confinement (Grandin, 1993). Genetics is a major factor. Observations by the author in identical pig confinement buildings and in the same slaughter plant indicated that changing genetics improved handling. Pigs with a calmer temperament were easier to handle and PSE was reduced. There is a definite need for breeding companies to select pigs for temperament. This is especially important for pigs raised in confinement.

In confinement buildings, producers must provide pigs with more environmental stimulation. Providing confinement pigs with additional environmental enrichment, such as toys and people entering the pens, produced calmer pigs that were easier to drive (Grandin, 1989; Pederen, 1993). Producers need to eliminate practices such as keeping pigs in darkened rooms. Playing a radio in the building can help get pigs accustomed to sounds. Pigs that have been finished in a pen with a radio playing at a reasonable volume are less likely to be startled by sudden noises.

Producers should walk in the finishing pens every day to get the pigs accustomed to handling. The person should quietly walk through each pen in a different random direction each day to teach the pigs to quietly flow around them. The person should not stand in the pen and allow pigs to chew on their clothes. This trains the pigs to approach and chew instead of driving. Gevink et al (1998) reported that confinement pigs that have been driven in the aisle during finishing were easier to handle. Moving pigs out of their finishing pen one month prior to slaughter improved their willingness to move (Abbott et al., 1997)

Observations by the author have also indicated that raising finishing pigs on plastic or metal floors produces animals that are hard to drive because they do not know how to walk on concrete. Plastic or metal floors work well for young pigs, but during the final finishing phase, confinement pigs should be raised on a concrete surface. Producers must also avoid producing pigs with a high incidence of either hernias or spraddle legs. Both of these conditions have a strong genetic component.

Slaughter plant factors

After pigs arrive at the plant, handling and chilling practices will have a large effect on the incidence of PSE. I estimate that handling practices account for 10%-15% of the variation in PSE, and chilling practices account 20%-40%.

Improvements in handling practices have enabled several plants to ship 10% more pork to Japan. These handling procedures will reduce PSE:

- Schedule trucks to prevent delays during unloading. Heat builds up rapidly in a stationary truck. Do not overload trucks.
- Rest pigs for 2-4 hours prior to slaughter (Malmfors, 1982; Milligan et al., 1996). Trucks must be scheduled to allow adequate resting time.
- Shower with cool water during hot weather (Smulders et al., 1983).
- Handle gently in the stunning chute. Rough handling during the last 5 minutes prior to slaughter increases PSE, because pigs become overheated. Handlers must be taught behavioral principles of pig handling. Over-exertion and excitement shortly prior to stunning increases PSE in stress-resistant pigs that do not have the stress gene (Sayre, 1963; Barton-Gade, 1985).
- Reduce or eliminate electric prods in the stunning area. Stressful handling shortly before slaughter will damage meat quality (Warriss et al., 1990; D'Souza et al., 1998; Van der Wal, 1997).

- Reduced squealing in the stunning area will help reduce both PSE and bloodsplash. Squealing is associated with increased stress and lower meat quality (Warriss et al, 1994). The last five to ten minutes prior to stunning is most critical for reducing PSE.
- Fill the crowd (forcing) pen which leads up to the single file race only half full. Move **small** groups of pigs. In group stunning systems the staging areas that leads into the stunning areas should be filled half full. Pigs need room to turn.
- Replace electric prods with other driving aids such as flags, panels, or paddles.
- Eliminate distractions which make pigs balk and refuse to move such as air drafts blowing in their faces, sparkling reflections on the floor, shadows or small moving objects such as chains. If pigs constantly back up, the distraction that is scaring them must be removed (Grandin, 2000, 1996).

Lower temperature

Gentle handling, rest, and showering helps lower body temperature. Pigs that are overheated are more likely to have PSE or DFD meat (Garipey, 1989). Heat damages the meat, both in live pigs and shortly after slaughter, making proper chilling important. Sometimes carcasses are jammed together or there is insufficient refrigeration. Some managers make the mistake of maximizing pig numbers by overloading the cooler. They are saving a few pennies on numbers and throwing dollar bills away in carcass shrink losses. It is easier to quantify pigs per hour and person hours than shrink loss and customer dissatisfaction. The industry needs to change its mindset and eliminate the "ram and jam" mentality. To succeed in the marketplace of tomorrow, quality must come first and quantity second.

Segmented market

A segmented market causes losses to be passed from the producer to the next person in the marketing chain. A producer who sells pigs live-weight has no motivation to improve quality. Live-weight selling or a carcass marketing system that fails to reward quality are the major causes of quality problems. The producer gets the wrong economic incentives. Some grading systems reward lean, highly muscled pigs with high levels of PSE. The electronic probes currently being used by the packing plants measure fat thickness and the size of the loin, but there is no PSE measurement. This motivates the producer to select breeding stock for rapid gain, leanness, and muscle growth. These selection pressures have resulted in high levels of PSE because pigs carrying the stress gene are kept as breeding stock. The swine industry needs to use an accurate method for measuring PSE so that a PSE measurement can be added to the fat and loin eye size measurements. The producer must be financially rewarded for producing lean pigs with low levels of PSE. Changing the carcass measurement and payment system to include PSE measurement will motivate producers to reduce the incidence of the stress gene in their herds. The bottom line is that the producer has to be financially rewarded for producing quality pork instead of maximum tonnage.

Bloodsplash

Bloodsplash is damage to the meat caused by either small pinpoint haemorrhages or large blood clots in the meat. It is a severe cosmetic defect that affects the appearance of the meat. Haemorrhage problems are mainly caused by problems inside the plant, but nutritional factors such as low levels of selenium and vitamin E may possibly contribute to it by weakening capillary walls. Lean pigs often have more problems with bloodsplash.

These procedures have effectively reduced bloodsplash in many plants that use electric stunning:

- For electric stunning, use an amperage power supply where the amperage remains constant and voltage varies with pig resistance. Old-fashioned voltage-regulated stunners allow amperage spikes that damage the meat. Some plants have built their own electronic constant amperage power supplies. These units can lower bloodsplash over 100%. To ensure good animal welfare, a

minimum of 1.25 amps must be used to reliably induce a grand mal seizure and produce instantaneous unconsciousness (Hoenderken, 1983). For large market pigs, a minimum of 300 volts should be used and slightly lower voltages can be used for lighter market pigs (Hoenderken, 1983; Gregory, 1988). Some plants have attempted to reduce bloodsplash by reducing amperage to 0.5 amps. This must never be permitted because scientific research has shown that low amperages or frequencies over 800 Hz fail to induce instantaneous unconsciousness.

- Bleeding a pig within 10 seconds after stunning will reduce bloodsplash. Prone sticking systems accomplish this, but older, hanging sticking systems sometimes have intervals of over 30 seconds. Quick bleeding also improves animal welfare because it reduces the possibility of an animal reviving (Hoenderken, 1983; Blackmore and Newhook, 1981).
- The operator must be careful to avoid double stunning and causing the pig to contract more than once (Grandin, 1985/86). Double stunning can be caused by allowing the stunning applicator to slide during the stun or turning on the electricity before the applicator is pressed firmly against the pig. The pig should not squeal when the stunner is applied.
- Worn cords and switches should be replaced. Slight disruptions in electrical continuity will cause bloodsplash. Wet cords can also cause problems.
- Reduce electric prod usage. In a research trial, elimination of electric prods reduced bloodsplash (Calkins et al., 1980).
- CO₂ stunning will reduce bloodsplash (Velarde et al., 1999). The disadvantage is that it is expensive to operate and it requires well-trained maintenance technicians.

Other Factors

Both PSE and bloodsplash will fluctuate with weather changes. Observations by the author indicate that PSE levels may double during the first 4 hot days of spring. Bloodsplash tends to worsen when temperatures fluctuate. It is very important to take weather into account when new methods for reducing PSE or bloodsplash are being tested. In one study, the amount of bloodsplash reduction benefit provided by new handling and stunning procedures greatly fluctuated, depending on the weather (Grandin, 1988). On some days, it provided great reductions in bloodsplash and on other days, almost no reduction. The procedures must be tested over a period of weeks to eliminate confounding effects of weather.

Bloodsplash can be reduced by the use of CO₂ stunning (Velarde et al., 1999). Recent observations in a plant equipped with both state-of-the-art CO₂ and constant amperage electrical stunning equipment indicated that PSE and bloodsplash levels were almost identical. CO₂ definitely reduces bloodsplash compared to old-fashioned voltage regulated electrical stunning equipment. New CO₂ stunning systems could provide handling advantages by eliminating the need to line pigs up in single-file chutes. However, there have been concerns about humaneness (Hoenderken, 1983). Some genetic lines of pigs react very well to CO₂ and others may possibly be stressed. The Yorkshire breed reacts very well (Forslid, 1987), but stress-susceptible pigs may possibly be conscious during the initial excitation phase (Troeger and Waltersdorf, 1991). Therefore, CO₂ may be an excellent method in a vertically integrated system where pig genetics could be controlled, but animal welfare may be poor for certain genetic types of pigs.

Conclusions

The biggest problem facing some segments of the industry is the emphasis on quantity rather than quality. Producers need to be provided with a marketing system that provides economic incentives to improve pork quality rather than just grow heavier pigs. In the 90's the "mind set" of a large segment of the United States pork industry was commodity based. The entire mind set of the industry needs to change from commodity-based to consumer-based. When this occurs, new procedures will be developed quickly. Fortunately, the industry has become more quality oriented and this has resulted in improvements in pig

handling and changes in genetics. Until this happens, nobody will be motivated to invest the time or the money to change systems.

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