PRE-SLAUGHTER TREATMENT AND TRANSPORTATION RESEARCH IN THE UNITED STATES

TEMPLE GRANDIN
Grandin Livestock Handling Systems Inc., 1401 Silver St., Urbana, Illinois, 61801, USA

INTRODUCTION

The United States is a huge country, double the area of the EC countries of western Europe. A total of 38 million cattle, 80 million pigs and 5 million sheep are slaughtered annually (USDA 1986). Due to the large land mass and the lack of a modulating effect from the ocean the climate has extremes of 46°C deserts and -15°C snow storms. The U.S. is also diverse culturally with many people of Mexican descent in the south and people of European descent in the north. The country consists of 50 semi-independent states which are free to make their own laws, provided these laws do not conflict with the Constitution or national (Federal) legislation which is passed by the Senate and the House of Representatives.

Truck transportation of livestock is virtually unregulated by either state or federal law. There are no laws governing truck design, space required for each animal or maximum allowable transit time between rest stops. Each state has general anti-cruelty laws which are often poorly enforced. Anti-cruelty laws apply to gross abuse such as starving or beating an animal.

The Humane Slaughter Act of 1958 and the amended Humane Slaughter Act passed in 1978 covers handling, lairage and stunning at the slaughter plant. It does not cover transport to the plant. According to this law, livestock must be stunned prior to hoisting or bleeding. The approved stunning methods are captive bolt, CO_2 gas and electricity. However, ritual slaughter is completely exempt from the Humane Slaughter Act. Since ritual slaughter is exempt, some plants shackle and hoist fully conscious live animals by one one back foot prior to Kosher or Moslem slaughter. Most ritual slaughterers of large beef cattle have voluntarily installed upright restraint devices. With the exception of one plant, all ritually slaughtered calves and sheep are hoisted while fully conscious prior to the throat cut. Many of these plants refuse to install more humane restraint devices until they are forced to by legislation.

Livestock Marketing

The United States has a nation-wide meat grading service provided by the USDA (United States Dept. of Agriculture). Use of the grading service is voluntary. All plants are inspected by the USDA for sanitation and protection of public health. Approximately 50% of the feedlot fattened cattle are graded with USDA grades which are uniformly applied in all states. A very small percentage of pigs are USDA graded. The majority of pigs and about half the fattened cattle are graded with each slaughter company's own "in house" grading system. "In house" grading systems often vary greatly from company to company.

The lack of nation-wide uniform grading for all livestock has resulted in a mixture of livestock selling methods. Roughly half of the livestock sold for slaughter in the U.S. is sold by live weight instead of carcass weight. Many producers prefer live weight selling because a scale reads with the same weight at different slaughter companies. There are strict Federal laws under the Packers and Stockyards Act which govern the operation of livestock scales. These laws protect the producer. Many producers prefer to sell live weight because it is difficult to compare price bids from different companies when each company has a different carcass grading system. The National Pork Producers Council is working with the meat industry to implement a voluntary national pork carcass grading system. Progress is being

made slowly.

Livestock Identification

There is no national livestock identification system. Some states have good statewide identification programs. About 40% of the livestock slaughtered in the U.S. cannot be traced from the slaughter plant back to the original farm or ranch of origin. Trace back to the large fattening operations is easy, but trace back to the original small farm where the animal was born is often impossible. Slaughter companies, livestock producers and Federal officials are making progress to create a national identification system for pigs.

No Incentive to Reduce Losses

The lack of mandatory national grading and identification has retarded improvements in pork quality and reduction of losses. The pork industry has more problems than the beef industry. "In house" grading of pork is more variable from company to company than "in house" grading of beef. The American system is working well for promoting the production of quality beef. Most "in house" beef grading systems are based on the USDA grading methods, and a much higher percentage of beef is USDA graded.

Compared to Europe, Canada and Australia, the U.S. conducts very little research on pre-slaughter factors and pork quality, bruise prevention, stunning methods and transport. Live weight selling encourages pork producers to produce fast growing pigs which gain weight rapidly. There is little incentive to produce low levels of PSE and reduce losses. The pork producer has no incentive to reduce PSE when he is paid for the pigs based on live weight. U.S. pork producers are capable of breeding and raising high quality pigs. Changing the marketing system so that quality is economically rewarded would be the quickest most efficient way to improve pork quality, and motivate producers to implement the latest research findings.

U.S. Research

In years past, the U.S. was a wor innovator of stunning equipment. C stunning, pneumatic captive bolt a the V conveyor restrainer were o originally developed by priva industry. The referenced review wi be limited to the last fifteen yea of U.S. research relevant to th seminar. Due to budget reduction transportation research is at standstill. USDA laboratories th were actively researching transport tion ten years ago are now clos down. Retiring transportation scie tists have not been replaced. Some their research which is relevant pre-slaughter handling is in Ma and Jesse (1980), Stermer et a (1981). They used radio transmitte to measure the heartrate of calv and pigs subjected to various han ling procedures. Rough handling a electric prods greatly increas heartrate. There was a flurry of U. stunning research in the middle the 70's by Althen et al. (197 Marple et al. (1977) and Overstre et al. (1975). This basic resear determined some of the effects stunning on meat quality.

Animal welfare groups have funded high percentage of recent researc The Council for Livestock Protectio a consortium of national huma organizations, funded laborato research on a double rail restrain system for ritual slaughter of calv and sheep (Westervelt et al. 197 Giger et al. 1977). Further fundi from the Council enabled commerci development of the calf system (Gra din, 1987 and 1988). The system now in use in two large calf slaug ter plants.

In 1984, another organization nam Humane Information Services fund several projects. Marshal-Nimis a Rempel, 1986 found that pig bre affected handling during loadin Yorkshire pigs were the slowest to load onto a truck. Conditions by auction markets were surveyed

Grandin (1985). Some of the problem areas were handling of cripples and day old dairy calves. They also helped fund research on sight restriction as a means of reducing stress (Douglas et al. 1984). Further grants from Humane Information Services (now Humane Family Foundation) and Grandin Livestock Handling Systems Inc. are being used to develop double rail restrainer system for adult cattle.

All new developments in lairage and race systems have been funded by private industry. Lairage and race designs suitable for large North American and Australian slaughter plants are described in Grandin (1988a, 1980 and 1982). At the Society for Veterinary Ethology I described an idea to reduce stress. Three or four single file races leading in parallel to multiple stunners would avoid the stress associated with forcing pigs into single file at high production speeds. Many U.S. pig slaughter plants operate at speeds of 1000 pigs per hour. Cattle plants operate at rates of 100 to 300 cattle per hour.

The National Pork Producers council and some of the state pork producer organizations have funded limited research on PSE and handling. A project is underway to determine the national incidence of PSE. Providing pigs with small amounts of environmental stimulation during fattening will produce calmer less excitable animals (Grandin, 1989). This may help reduce stress during pre-slaughter handling. Genetics also affects handling. Some pigs are so temperamental that it is almost impossible to calmly drive them up a race. The pork industry needs to work on both environmental and genetic factors to produce calm pigs which are easy to drive and handle.

Research by Robert Kauffman from the University of Wisconsin indicated that filter paper can be used as an inexpensive pork wetness test (Kauffman et al. 1986). A short stunning to stick interval reduces bloodsplashing in pork and elimination of electric prods also reduced bloodsplash (Burson 1983, Calkins et al. 1980). During the last ten years there has been only one study on stunning method and animal welfare. Genetic factors may affect a pig's reaction to CO_2 gas (Grandin, 1988b). There are large individual differences in pig reaction to CO_2 in groups of pigs from a varied genetic background. There has been much more welfare related research in the U.S. on animal housing. Four university groups have conducted many studies on pig housing, veal stalls, and animal behavior. Research funding has come from the USDA, industry groups and animal welfare groups. Very little of this research is relevant to pre-slaughter handling or transport.

Much of my own research on handling methods, PSE, dark cutters, bruises and bloodsplash has been conducted without funding. The studies were conducted during consulting projects. One of the first reports on the detrimental effects of mixing strange cattle was made by Grandin (1978). A bruise survey indicated that cattle sold on a live weight basis had twice as many bruises compared to cattle sold on a carcass basis (Grandin, 1981). Producers selling on a carcass basis had to pay for bruises. This survey indicates the importance of financial incentives to reduce losses. Resting in the lairage and the elimination of electric prods reduced both petechial hemorrhages and PSE (Grandin, 1986). Further analysis of the data indicated that weather conditions have a significant effect on the incidence of petechial hemorrhages. Weather conditions also affect the benefits obtained from treatments known to reduce hemorrhages. On some days, a special handling procedure consisting of rest, shorter stunning time and elimination of electric prods resulted in large reductions of hemorrhages, on other days the special treatment had almost no effect (Grandin, 1988c).

A recent survey by Larry Borchert (1989) of Oscar Mayer is likely to wake up the U.S. pork industry to the PSE problem. The results were reported at the 1989 Livestock Conservation Institute meeting. Pork from seven large U.S. slaughter companies was evaluated for PSE and bloodsplash. There were large differences between slaughter plants. One slaughter plant had extremely high levels of both PSE and bloodsplash and another had very low levels.

Canadian Situation

Canada is a country which has many similarities to the U.S., but it is way ahead of the U.S. on PSE, preslaughter handling and transportation research. Canada has a national mandatory grading system for pigs. Uniform grading helps to provide incentives to produce quality. Canada has national laws which regulate the treatment of livestock during transport, and a nation-wide livestock identification system.

Canadian scientist H.J. Swatland (1988) is making progress on the development of a multi-spectrum PSE grading probe. This probe will be able to detect PSE in pigs from various genetic backgrounds. The single spectrum probes currently being used cannot detect a PSE-like condition which occurs in Hampshire pigs. Andre Fortin (1988) has conducted large scale studies which indicate that resting pigs in the lairage reduces PSE. Gariepy et al. (1987) found that 73% of live pigs with a surface temperature of 32 to 35 °C shortly prior to slaughter had either PSE or DFD meat. Many Canadian projects are conducted in laboratories which are operated by government. Projects are funded by both industry and government grants. Many more valuable studies have been conducted in Canada, but it is beyond the scope of this paper to review them.

Research Implementation in the U.S.

The U.S. meat industry implements some research results very quickly and other results very slowly. The Livestock Conservation Institute a its Livestock Handling Committ serve as a forum to disseminat research results to all segments the industry.

The expanding pork export market Japan has motivated many U.S. slaug ter companies to improve pig handli methods. When they saw the Japane grader rejecting half of their loi they decided to do something. Tod major slaughter companies are placi a sustained management emphasis gentle handling and resting of pigs

New race and pen layouts have be installed in some plants. Syste which were designed by people w understood animal behavior ha worked well, but some systems ha worked poorly due to layout a design mistakes. Engineers who do n understand the "why" of a desi often make changes which cause stre and handling problems.

The U.S. industry will immediate implement research results which wi reduce costs in an obvious manne such as removing a man. Researc results that can be implemented at minimum cost are often rapidly use A good example, is improving p handling by supervising it mo closely. Numerous studies have sho that shortening the stunning to sti interval will reduce bloodsplas Over the years the U.S. industry h actually lengthened the stun to sti interval. Some companies are unwi ling to spend extra money to inste a prone sticking table. A short te accounting mentality has caused so companies to build plants as cheap as possible even though it was to t company's long term detriment. I ha observed some new very cheap p poorly constructed livestock lairag which will have high maintenan costs in the future. Some independe family owned plants are more willi to spend money on quality livesto lairage and handling facilities th the large corporate plants. Thr large companies now slaughter ov sixty percent of the fattened catt

and pigs. As the industry has become more concentrated, executives and managers with an understanding of livestock have been replaced with cost accountants.

Very few U.S. slaughter companies will voluntarily implement changes to improve animal welfare unless there is an economic benefit. Increased management emphasis on gentle handling has improved the welfare of the majority of slaughter pigs, but there is still little regard for cripples. I have observed cripples being abused in plants which had excellent handling procedures in the rest of the plant.

Most Kosher veal plants still shackle and hoist fully conscious live calves prior to slaughter. Even though restraint devices have been developed, these companies refuse to install them because they cost large amounts of money. Legislation will probably be required to force the industry to use the new devices. An added benefit of the new restraint equipment is improved employee safety.

At the present time, the U.S. meat industry has spent more time fighting with animal rights activists than working on methods to improve conditions. One reason this has occurred, is that animal rights activists in the U.S. have become extremely radical. During the last three or four years they have burned down a meat plant, livestock auction, two research laboratories and placed a bomb on the doorstep of a surgical suture factory.

Radical animal rights activists want to shut down the meat industry and they have little interest in improving conditions in an industry that they consider immoral. While writing this paper, I discovered that an animal rights activist working in a local shop had defaced one of my papers while it was being photo copied. It disturbs me greatly to be hated by some of these people. I have worked for years with responsible animal welfare groups and industry to develop and promote methods that improve welfare. The actions of extreme radicals have caused the meat industry to fight instead of making constructive changes.

The U.S. is behind western Europe and Canada on protecting the welfare of animals during transport and slaughter. As stated previously, the major problem areas are: shackling and hoisting prior to ritual slaughter, abuse of cripples, and handling of day old baby calves. Most slaughter plants do a reasonably good job of stunning. Handling has improved during the last five years.

CONCLUSION

Legislation to change the structure of the U.S. livestock marketing system would provide greater benefits for both animal welfare and meat quality than a bunch of specific animal welfare regulations on handling and transport. The present marketing system enables the producer to pass losses to the next segment of the marketing chain. A producer selling live weight has little economic incentive to reduce bruises because the slaughter plant pays for the bruises.

The Japanese export market has done more to improve the welfare and meat quality of slaughter pigs than any legislation could possibly do. The legislation of mandatory livestock identification across the U.S. would improve welfare, because losses could be traced back. A mandatory uniform grading system would motivate producers and slaughter plants to implement the latest research findings. Accurate electronic determination of PSE would promote the solution of many pig welfare problems.

Welfare legislation will probably be required in a few selected areas to stop abuses. These areas are preslaughter restraint for ritual slaughter, abuse of cripples and transport of day old baby calves at

livestock auctions and slaughter plants. There is no economic incentive to treat cripples in a humane manner.

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