Final Report

Identification of Cattle and Beef Through Production and Marketing Channels

for

USDA-AMS Federal-State Marketing Improvement Program
Project OCR 566169/160-100162

to

Mr. Bryce Malone, Assistant Commissioner
Office of Marketing
Louisiana Department of Agriculture and Forestry
Baton Rouge, LA

by

K.W. McMillin and R.P. Del Vecchio
Principle Investigators
C.A. Perret, Graduate Research Assistant
Department of Animal Science
Louisiana State University Agricultural Center
Baton Rouge, LA 70803-4210

September, 2002

Identification of Cattle and Beef Through Production and Marketing Channels

Executive Summary

Traceability of cattle through live animal production, meat processing, and product distribution stages may be important for providing information on food safety or prohibited substance concerns, country of origin labeling for beef, and improvements in genetic and environmental practices to improve economic efficiencies and product traits. This study used cattle from commercial and university sources to demonstrate the effectiveness of electronic identification devices (EID) in identifying individual cattle and their subsequent primal beef cuts from calf production to processor distribution center and to identify specific places in the beef marketing system for potential identity loss or identity data transfer difficulties.

Three groups of cattle totaling 677 head were tagged with EID devices and followed through feedlot and carcass evaluation channels. Individual cattle could be traced from farm or ranch of origin to the carcass fabrication line using EID technologies with minimal difficulties and existing technology, but it was learned that feedlots and packing plants do not routinely use EID methods for cattle identification. Most of the carcass data was received with an identifying EID number, indicating that the EID number accompanied the individual carcass to the point of quality and yield grading in most processing plants. The transfer of information from the carcass to individual primal and retail cuts does not occur at the present time and is a difficult step in the traceability process. Meat processing plants routinely label boxes of primal and retail cuts that allow tracing back to a daily production lot or group. Identification of individual cattle through production and beef processing and distribution is feasible with several commercial systems, but there appear to be insufficient economic incentives for development and investment in more efficient and effective data handling and identification transfer systems for the cattle industry.

Introduction

Recently there has been much emphasis placed on food safety, with the President's Initiative and the USDA plan for farm-to-table HACCP (Hazard Analysis Critical Control Point) programs being examples of the importance of food safety to the livestock industry. Traceability is the basis of any modern food safety control system to integrate animal health and food hygiene components. The primary goal of an animal traceback system is to provide information on the source of infection or prohibited additives so that preventive and control measures can be applied to avoid introduction of the contaminant (Caporale and others, 2001). Traceability systems are recordkeeping systems and are used in practice primarily to identify foods with different attributes. An identity preservation system is more stringent than a simpler segregation system because the source and nature of the product must be identified, requiring documentation as to the traceability (Golan and others, 2002). An integrated production chain control system should be able to identify and document with accuracy all materials and ingredients, production processes, personnel involved and final products. Mandatory livestock identification provides a means to address and solve problems with drug or chemical residues and the source of animals (Augsburg, 1990).

A reminder was sent in February, 2002, to all veterinarian and inspection program personnel of the importance of ensuring that all animal identification remained associated with the carcass until postmortem examination had been completed (Derfler, 2002). Establishments are required under 9 CFR 310.2 to maintain the identity of the carcass which contains severed parts and to remove and present to FSIS personnel identifying devices such as ear tags, backtags, implants and to identify them with the rest of the carcass at post-mortem examination. This documentation is important to allow animal traceback to prevent the spread of a foreign animal disease although larger plants may maintain records of where the animals were purchased, not of the animal producers (Derfler, 2002).

The USDA Agricultural Marketing Service (AMS) has requested comments, information and data as to how best to structure and implement the two year voluntary country-of-origin labeling (COOL) mandated by the 2002 Farm Bill for implementation in 2004. The new law specifies that beef, pork and lamb may be not labeled as having a U.S. country-of-origin, unless it is born, raised, fed, slaughtered and processed in the United States. The statute specifies an audit verification system providing for certification of origin, mandatory identification and considers existing certification programs, but specifically prohibit a new mandatory livestock ID program. The law suggested that verification and audit could be based on one or more of five existing voluntary verification programs. Problems with development of voluntary country-of-origin labeling include preciseness as to which voluntary verification program should be used as a model, details as to use of the model program, guidelines on tracking and auditing procedures for meeting the statute requirements, and clarification of labeling of mixed U.S. and foreign red meat (Kernellu, 2002).

Identification of individual animals has been practiced in various forms for many years. Hot or cryogenic branding permanently identifies an animal, but there is hide damage and it is difficult to provide permanent identification of an individual animal in a small, but readable space. Eartags are commonly used to identify individual cattle, but there are several problems with this system. Eartags can be lost during animal movement or handling, which prevents permanent identification of the animal. Traditionally, only a limited amount of numerals is placed on tags, meaning that there can be duplications within a herd after a period of years or among cattle from many herds in any year. Many of the beef breed associations require ear tattooing with a number that is unique for an individual animal. Those familiar with verifying the number with a specific animal realize the limitations of this system for market animals, including the large numbers of animals to be tattooed, lack of number integrity if improperly done, lack of readability with old or fading ink, and size if tattoos are not used at an early age of the animal. The USDA has implemented identification programs for animals with specific diseases, such as brucellosis, tuberculosis, pseudorabies, scabies, and paratuberculosis to identify them in the marketplace. Current national systems of individual animal identification are the USDA Alphanumeric National Uniform Eartagging and Backtagging Systems, which have a two digit numeric state code followed by three alpha characters for ear tags and two alpha characters for back tags with ending in four numeric characters. Tags are issued in sequence, with disposition administration by state and federal agencies (APHIS, 2002).

Visual identification methods are ear tags, back tags (for short retention identity), brands, tattoos, earnotching, and color patterns with photographs. Non-visual identification techniques are grouped into electronic identification (EID) and biometric groups. The EID methods include bar codes, two-dimensional symbology, radio frequency identification (RFID), and optical character recognition. The EID methods except RFID are hampered by line of sight reading and cleanliness requirements (Wiemers, 2000). There are other means for individual animal identification, including subcutaneous skin implants, ceramic boluses, deoxyribonucleic acid (DNA) genetic profiling, antibody identification, and retina scanning (Smith and others, 2000). The biometric identification methods are extremely accurate, but expensive and time consuming to conduct (Wiemers, 2000). Many of these identification techniques would have advantages over visual tags, but are too costly, too slow, or have insufficient testing for inclusion in a national identification or traceability system (Stanford and others, 2001). One study showed that 32-mm injectable responders in the armpit were more suitable at the farm than smaller sizes and subcutaneous injection in the ear or upper lip, but recovery in the abattoir required more care and longer time than smaller sizes and other locations (Conill and others, 2000). Wiemers (2000) compared animal identification devices for reading distance, ease of reading, retention, cost, ease of application, animal restraint requirement for application, tamper resistance, and ease and cost of device collection at slaughter. An example of a bovine meat traceability system was proposed using animal electronic transponders where all information regarding the animal was recorded and updated to a central database, the electronic transfer of data from transponders to electronic labels at the processing plant, and the reading of electronic labels to supply information to consumers at the retail store (Caporale and others, 2001). Gledhill (2002) reported that today's meat traceability software systems can enable producers to track meat products from the animal's birth to the supermarket display case.

The importance of traceability is especially apparent in specific global markets, such as the European Union, where American products have been removed from the marketplace because of disagreement on pesticide residues or growth promotant usage. The European Union leads most other countries in the development and mandatory implementation of traceability for livestock and meat products because of the seriousness of the food safety and animal disease crises in the past decade (Clemens and Babcock, 2002). Success in the global marketplace requires uniformity in product evaluation and consumer protection methodologies. All EU beef products, effective January 1 of 2002, must be labeled with the country of animal's birth, country/countries of feeding/fattening, reference number linking the meat to an animal or group of animals, country of slaughter and establishment number of the slaughterhouse, country/countries of cutting and approval number of cutting plant(s), and a label with the country of origin. Ground beef labels must have a traceability code, location of the slaughter member state, and member state of preparation. Japan has implemented full traceability within its domestic beef industry, with country of origin labeling required at retail meat counters. Australian producers apply a registered tail tag number identifying the ranch on all cattle leaving that ranch. A temporary tail tag moves with the animal and then with the carcass to the end of the dressing line. Carcass tickets are affixed to each side of the carcasses for sorting by lots in the coolers and fabrication according to a production schedule. Carcasses, quarters, and boxed cuts are labeled after cutting with the establishment number and a date of packing to provide tracing of carcasses and cuts to the tail tag and ranch of origin. The Australian beef industry will soon use a fully integrated electronic system that links radio frequency tags to identify cattle, the European Article Number (EAN) barcoding technology for processing and retail sectors, and an electronic messaging system to link data from different components in the system. Argentina and Canada identify primary production establishments and herds and provide tracing for carcasses and cuts to slaughter facilities and production establishments. It would be feasible for Canada to provide individual animal identification for animals leaving the production establishment and to link individual animals to carcasses and cuts (Clemens and Babcock, 2002).

The National Cattlemen's Beef Association Cattle Identification Standards Subcommittee developed electronic identification criteria based upon an International Standards Organization (ISO) electronic ID tag. Specifications developed were printing of the entire ISO number on the tag for a minimum reading range of 30 inches in an active commercial processing environment, application of the tag before the animal has left the herd of origin, and removal of EID tag only at the packing plant. It was also recommended that the tag placed in the manufacturer recommended position in left ear, that the tag be used only once, that the tag be tamper-proof/tamper-evident in design, and each producer would be responsible for cross-referencing any other identification number. There are two basic standards issued by ISO for Radio Frequency Identification Devices (RFID): ISO standard 11784 Radio Frequency ID of Animals – Code structure and ISO standard 11785 Radio Frequency ID of Animals – Technical Concept. The first standard specifies the RFID code for use with animals and the second standard deals with activation of a transponder and the transfer of stored transponder information to a transceiver.

About 62% of the cattle and calves in the U.S. are on farm or ranch operations with less than 49 head (NASS, 2002). This project was designed to target the program objectives of developing and testing new and more efficient methods of handling and distributing cattle and meat and examine improved marketing practices or systems to address the problem/impediment of individual animal traceability in the U.S. livestock and meat industries. Most of the cattle for this project were from individual farmers with small numbers of cattle and represented efforts to improve the ability of small farmers to more nearly direct market their cattle through retained ownership.

Project Objectives

1. To trace the identity of individual cattle and their subsequent primal beef cuts from a calf feedlot preconditioning period to boxes of primal cuts in the processor distribution center.
2. To identify the specific places in the marketing system for potential identity loss or difficulties in transcribing individual identity from one identification method to a subsequent identification method.

Methods and Materials

The paperwork for the project was revised and sent to the project director in the Louisiana Department of Agriculture and Forestry to reflect the funding from the USDA Agricultural Marketing Service Federal State Marketing Improvement Program. Meetings were held among the principal investigators and graduate research assistant to determine the project structure and steps necessary to initiate and complete the project. Various companies with ISO electronic identification (EID) systems were contacted to obtain information on the suitability of products for use with the project cattle. Bid specifications were developed for EID tags, readers for EID tags, and portable computers to process EID tag data. Three groups of cattle were identified as being compatible with the goals and timeframe of the project and being available for EID tagging and tracking through the slaughter and processing stages.

Belgian Blue cattle group: In February 2001, 81 Angus and Belgian Blue steers and heifers on a LSU AgCenter Animal Science Hatch project (3130) were tagged with electronic identification tags (EID, Allflex USA, Inc.). In April, 24 of the cattle (six each of Angus and Belgian Blue steers and heifers) were sent to the Iberia Research Station at Jeanerette, LA and 57 head sent to H. C. Hitch Feedlot in Guymon, OK. The steers (13 Belgian Blue and 17 Angus) and heifers (9 Belgian Blue and 18 Angus) were fed at Hitch Feedlot for 135 and 146 days, respectively, before slaughter in commercial beef processing plants, IBP for steers and National Beef Packers, Liberal, KS, for heifers. After overnight chilling, carcass data were collected by experienced carcass personnel from West Texas State University.

Project scientists visited the H.C. Hitch Feedlot on August 15, 2001 to evaluate the progress of the cattle, assist in collection of weights, and evaluate the method of electronic identification at the feedlot. The scientists also toured the IBP plant in Amarillo Texas to determine their system of identifying cattle, carcasses and cuts.

Brahman cattle group: In the fall of 2000, the LSU AgCenter Department of Animal Science purchased 2 to 12 bull calves from several Brahman breeders at weaning for Hatch project 3248. The project investigates Brahman sires or lines that contribute genetic effects for desirable carcass traits using paternal half-sib Brahman steers. The calves were back-grounded and grazed until the spring of 2001. In April, 2001, 72 Brahman steers were shipped to the King Ranch Feed Yard in Kingsville, TX. Each steer had an eartag with its individual crossbred herd identification number. When arriving at the feedlot, the steers were then eartagged with a feedlot pen number. Animal scientists on the Hatch 3248 project traveled to the King Ranch Feedlot on May 22-23, 2001 to observe the cattle and converse with feedlot personnel. Due to an insufficient number of Allflex tamper-proof electronic tags at the time of shipment, the steers were EID tagged (Allflex USA, Inc.) at the feedlot on May 22, 2001 when 100 day weights were taken. Electronic ID numbers in addition to the animal's individual identification number and feedlot pen number were recorded. The scientists toured Sam Kane Beef Processors in Corpus Christi, TX, to view the slaughter and processing operations. In August and September 2001, the 72 steers were weighed near the end of the finishing period ("check" weights) for price determination before sale of the cattle for commercial slaughter. Sam Kane Beef Processors in Corpus Christi, TX, was the successful bidder on the cattle and slaughtered the steers in three groups. Carcass data were collected by Texas A&M Extension and Education Center personnel and sent to the LSU Animal Science Department.

Calf to Carcass cattle group: On September 6 and 7, 2001, 348 of the 524 steers and heifers consigned to the Louisiana Calf to Carcass Program were tagged with electronic identification (EID) tags (Allflex USA, Inc.) upon delivery to two of the three preconditioning sites; the LSU AgCenter Idlewild Research Station in Clinton, LA (171 head) and McNeese State University in Lake Charles, LA (177 head). An additional 66 steers and heifers were delivered for preconditioning to Louisiana Tech University in Ruston, LA; these calves were tagged with EID on September 24, 2001. During the preconditioning period the cattle were vaccinated with a respiratory complex (BRD) vaccine which consisted of BVD, BRSV, IP3 plus pasturella, given an 8-Way Clostridial vaccination, treated for internal and external parasites with an endectocide, given a metaphylactic antibiotic treatment and were also tagged with visual ear tags. The visual tags were used in addition to the EID tags to safeguard individual animal identity. A booster vaccination of the BRD complex (IBR - PI3 - BVD - BRSV plus pasteurella) and the 8-Way Clostridial booster were provided three weeks after the initial vaccination. The calves were fed a medicated concentrate ration at approximately 1.0% to 1.5% of their body weight plus good quality hay and clean water available free choice. Preconditioning of the steer and heifer calves began September 6th with shipment of the calves to the feedlot occurring on October 18, 2001.

Producers who chose to precondition their cattle at home followed the preconditioning recommendation as outlined in Del Vecchio (2001). These cattle were brought to the nearest respective preconditioning/loading site on October 16, 2001 and were equipped with EID tags at that time (125 head). At this time, all cattle were weighed and given a feeder calf frame and muscle score (feeder calf grade) as well as assessed a dollar value to be used as the breakeven price when sold as finished cattle at the end of the feedlot phase. Of the 177 head of cattle preconditioned at McNeese State University 15 were held back (i.e., not sent to the feedlot) due to management decisions by the owners. For the 2001-2002 shipment there were 34 different producers from 22 parishes participating who consigned a total of 524 steers to the program.

On October 18, 2001, 524 steers and heifers consigned to the program were shipped to H. C. Hitch feedlot in Guymon, OK, one of three feedyards managed by Hitch Enterprises. All cattle had been tagged with EID tags prior to leaving Louisiana. The cattle arrived on Friday morning, October 19, 2001. Once the cattle had time to rest (approximately 1 to 2 days) they were processed (i.e., implanted with growth promoting implants, treated for internal and external parasites, weighed, sorted into like groups, and tagged for pen number identification), and then placed on feed in their respective pens. During the month of February 2002, 521 steers and heifers (3 head had died in the feedyard) were reimplanted with an additional growth promoting implants and then were placed back into their pens and continued on feed until their sale.

Producers owning cattle in the Calf to Carcass project and project scientists made a tour on April 14-17, 2002 to view industry marketing, feeding, and packing operations. Places visited were the Oklahoma City Stockyards, Gardiner Angus Ranch (Ashland, KS), Sunbelt Feeders (Hugoton, KS), Future Beef Operations (Arkansas City, KS), and the H.C. Hitch Feedlot (Guymon, OK).

Between the months of April 2002 and June 2002, 63 heifers and 453 steers that were on feed at H. C. Hitch feedlot were sold on a value-based grid system (of the original 524 head, 7 steers and 1 heifer had died during the feeding period). All six pens were sold to IBP in Finney County, KS. Carcass data were collected by an independent carcass data collection service (The Cattlemen's Carcass Data Collection Service) and USDA grading personnel at the IBP plant. The data were sent to Henry C. Hitch Feedlot and forwarded to the LSU AgCenter Department of Animal Sciences. Prior to the sale of the cattle, body weights were recorded on each animal and live animal grades were assigned (i.e., predicted quality and yield grades). The weights, called "check weights," were used to aid in determining more precisely when the cattle were ready to sell. The live animal grades were used to compare the accuracy of a live evaluation of a finished animal to the actual carcass information reported post harvest.

Communications were made with major meat processing companies that slaughter cattle to determine the current means of transferring individual animal information to carcasses and learn about identification systems on boxes and packages of individual meat cuts. Sixteen genetics professors, graduate students and industry personnel, representing 11 Southern research facilities responded to a questionnaire about the use of computers and electronic identification in the livestock industry and with cattle at their facility.

Results and Discussion

Belgian Blue cattle group

No eartags were lost during transport of the cattle to either Jeanerette, LA or Guymon, OK. Animals were processed upon arrival at Hitch Feedlot and initial weights were sent back to the department animal scientists with identification by EID tag number, suggesting that the Hitch Feedlot was equipped to read EID tags. Conversations by the project scientists with Rod Schemm, manager of HC Hitch, confirmed that EID equipment is used at one of the other feedlots. The equipment consists of a handheld reader which scans the EID tag and allows the operator to input limited information such as weight, lot number, animal number, and other information. The equipment is used at the HC Hitch feedlot only when animals with EID tags are processed and was borrowed for processing and weighing of the Belgian Blue group cattle. The feedlot does not tag animals with EID tags.

IBP-Amarillo processes 6,000 head per day with a cooler capacity of 20,000 head. The animals are identified by their individual tags. The tags are removed, bagged and attached to the carcass before the hide is fully removed. The tag number is then transferred to a barcode which is attached to the carcass before going into the coolers. At that time, IBP-Amarillo was not EID equipped, although barcode readers were used by the sales department.

The carcass data that was returned to the Animal Science Department revealed that the animals were identified by their EID numbers at the two packing plants, suggesting that the plants have the ability to read EID tags or the plants used the EID number as the animals identification number. This also indicated that the EID tag was maintained in each animal's ear through the feedlot period because the EID identification was carried through to slaughter and carcass data collection.

The average carcass information for the Belgian Blue cattle group was

Breed	Hot carcass weight, lb.	Fat thickness, in.	Ribeye area, $in.^2$	Yield Grade	Prime no. (%)	Choice no. (%)	Select no. (%)	Standard no. (%)
Belgian Blue	804	0.38	14.7	2.7	0 (0)	2 (5.9)	28 (82.4)	4 (11.8)
Angus	761	0.65	12.6	3.4	1 (2.1)	21 (44.7)	25 (53.2)	0 (0)

Brahman cattle group

The scientists who visited the King Ranch Feed Yard found that at the 20,000 head capacity feedlot, animals are identified by lot numbered eartags that include the date the animals entered the feed lot. All data is recorded on paper and no other observations are recorded besides body weight. Cattle are not individually identified unless they are part of a retained ownership group and the owner wishes that the animals be individually identified. The feedlot does have plans to electronically equip their system; however, they had concerns about the number of systems available and whether the selected system would be used in the packing plants. The feedlot would be willing to cooperate with university personnel to test different equipment and identification tags at a later date. A problem noted at the King Ranch Feedlot was that the TruTest model 703 scale was not compatible with the Allflex EID tags and readers. Cattle are processed at a different scale than the scale where the final check weight is taken, so the EID system must be portable for movement from place to place or duplicate EID systems would be needed at each scale.

At the Sam Kane beef processing plant, animals are identified by a lot number and a kill order number, which is a number assigned by the packer. Paper tags are attached to the carcasses and various parts when the animals are processed and before the carcass enters the cooler. The paper tag number is then transferred to a barcode which is attached to the carcass. Typically, at this time this plant does not maintain a connection between individual live animal ID and plant carcass ID. At the present time, the plant is under an expansion phase and plans to electronically identify carcasses and automate the trolley system have been postponed until the upgrade is complete. Concerns expressed by plant personnel about an EID system include the various systems available, the possibility of new technology, and if the system is feedlot compatible. There is the possibility that carcasses will be derailed before an information transfer point, so the kill order and lot number for an individual animal may be incorrect compared with an EID database system. Unless a lot must remain together, carcasses are put into groups according to their grade. Carcasses of the same grades are then processed together. In addition, about 20% of the animals are sold on a grid pricing basis.

Other problems that were identified with incorporating an EID system into the Kane beef processing plant included differences in the identification numbers on carcass and other parts, animal derailment causing mis-numbering of individual carcasses in a given lot, the limited education of the plant workforce, lot number changes when individual eartags are removed instead of lot eartags, and a general belief by plant personnel that the current system is acceptable for identification of cattle.

Weight and gain data were reported using individual LSU AgCenter eartag identification numbers, not EID tag numbers. The average initial weight for the Brahman steers was 646.73 pounds. The steers gained an average of 3.43 pounds daily to finish at an average final weight of 1252.47 pounds and 531 days of age. The carcass information did not include EID identification numbers. Hot carcass weight averaged 763.67 pounds with an average of 0.46 inches of fat thickness and 13.31 square inches of rib eye area. The average quality grade for the pen was Select+ with 55% of the steers grading Choice and 45% grading Select.

Calf to Carcass:

The vast majority of the calves consigned were preconditioned at one of the three designated preconditioning/loading sites, i.e., LSU AgCenter Idlewild Research Station, McNeese State University and Louisiana Tech University (see Table 1). However, a few producers did choose to precondition their calves on their farms (Home). The EID tags that were placed in the ear of each calf during the preconditioning period remained intact in the ears of the cattle throughout the preconditioning period (i.e., once placed in the ear no tags were lost during preconditioning). Further, every EID tag continued to emit its signal through the preconditioning segment of the project. During preconditioning there was an average gain of 54 lbs per head with no death loss. Additional performance data for the calves during the preconditioning phase can be found in Table 2.

Table 1. Number of calves per preconditioning/loading site.

Loading/Preconditioning Site	Preconditioning No. of Head	Preconditioned at Home	Loading No. of Head
Louisiana Tech University	66	10	76
McNeese State University	163	0	163
LSU AgCenter, Idlewild Research Station	171	33	204
Home Loading	81	81	81
Total	400	124	524

Table 2. Results of the 42 day preconditioning period.

	Idlewild	McNeese	LA Tech	Total/Avg.
Number of Head	171	163	66	400
Initial wt (lbs)	524	593	563	560
Final wt (lbs)	568	629	638	612
Total Gain (lbs)	48	40	74	54
Average Daily Gain (lbs)	1.1	1.0	1.9	1.3

At the feedlot the heifers and steers were sorted into six pens. Table 3 provides average data for the six pens of cattle (5 steer pens and 1 heifer pen). Weight data collected after the cattle arrived at the feedlot (initial in weights and pen check weights) were sent by email to the LSU AgCenter Animal Sciences Department (c/o Dr. Del Vecchio). The EID numbers were recorded; however, the visual eartag number was used as the principle means of identification of the cattle for weight data recording. The EID reader equipment used at Henry C. Hitch Feedyard is principally located at one of their other feedlots (Hitch II, located in Kansas) but is sent to the sister lots as needed (Schemm, 2002). Hitch Enterprise's equipment consists of a handheld reader which scans the EID tag and allows the operator to input limited information such as weight, lot number, animal number, and other information.

The percent shrink observed for these cattle, calculated from the final weight in Louisiana and the off truck weight in Oklahoma was 3.4%. This meant the cattle shrunk 3.4% of their body weight, on average, during transportation from the preconditioning sites in Louisiana to the feedyard in Oklahoma.

The death loss of steers during the 2001-2002 feed-out year was 1.5% (8 head). This is higher than the average for the past 3 years, but still well below the average for steers sent to the feedlot through this program during the years prior to mandatory preconditioning, which was approximately 2.5%. As in previous years, most of the losses were due to enterotoxaemia and pneumonia. Cattle that died during the feedlot phase were identified using the visual tags, not the EID tags.

The percentage of cattle pulled into the sick/hospital pens (34.9%) was higher during the 2001-2002 year than in the previous three years. This is undoubtedly a consequence of the dry dusty environment at the feedlot due to the drought conditions. The overall percentage of pulls throughout the entire yard increased because of the weather conditions and dust associated with the lack of precipitation (Schemm, 2002). Therefore, this situation was not unique to the Louisiana Calf to Carcass cattle. Further, when examining the profit/loss margin of the cattle that became sick while in the feedyard versus the cattle that remained healthy throughout the period, it was revealed that the cattle which became sick had a profit/loss margin of $-54.02 per head, while the cattle remaining healthy had a profit/loss margin of $-23.15 per head. Indicating that cattle which remain healthy were 2.3 times more profitable (or in the case of this year, lost 2.3 times less money) than those that became sick.

Table 3. Average feedlot data for the six pens of steers and heifers.

Pen No.	Sex	No. of Head	Avg. Initial Wt.	Avg Pur Wt	Avg. Final Wt	Pur Wt ADG	Days on Feed	No. Died	No. Sick (%)	No. Sold Early	Total No. Sold	Cost per lb of Gain
261	S	83	683	704	1,257	3.07	175	1	25 (30)	0	82	52.18
534	S	81	592	610	1,179	2.92	180	3	28 (34)	0	78	48.59
214	S	118	592	607	1,159	2.90	183	2	43 (36)	1	116	50.71
264	S	97	507	526	1,184	3.02	214	1	36 (37)	0	96	47.39
530	S	81	512	525	1,157	2.97	213	0	28 (34)	1	81	47.22
568	H	64	562	584	1,089	2.40	203	1	25 (39)	0	63	59.22

The average number of sick pen head days was 268 for the steers and 285 for the heifers. This is higher than the past three years but still a marked reduction from the average from the years prior to preconditioning which was 346 days with fewer cattle on feed. This may also be an indication that the preconditioned cattle were able to recover faster and return to their pens sooner than in previous years.

Medical costs per head for this year averaged $6.32 for the steers and $5.99 for the heifers. This value is slightly higher than previous years; however, due to the dry, dusty, drought conditions and the higher than normal pull rate across the feedyard this amount seems reasonable. Animals that were brought into the hospital pens for treatment were identified using the visual tags, not the EID tags.

Average days on feed for the steers during the 2001-2002 feed-out year was slightly less than the average from the past 3 years (195 days versus 202 days, respectfully). One key reason for the reduction in days on feed was that the cattle were sold on the grid, which means there was more control over when the cattle were marketed. Historically, the Louisiana Calf to Carcass cattle were sold on a live weight basis. The pens of cattle for sale were placed on a show list for prospective buyers to assess and a number of weeks would routinely pass before an acceptable bid was received for the cattle. However, selling on a grid system creates a different scenario so that when the cattle are ready, they are offered to the buyer on their pricing grid. In all cases on the project, IBP purchased the cattle and the cattle left the yard the following week. Therefore, waiting weeks for a bid has been removed from the marketing process and the cattle are sold much quicker. The short time interval between sale and slaughter did not allow project scientists to travel to the Finney County plant to observe the slaughter, carcass grading, fabrication, and distribution processes there.

Average carcass data information (quality grade and yield grade) for the steers and heifers in the six pens can be found in Table 4. These data represent the quality and yield grades reported by the USDA grader in the IBP plant.

Table 4. Average carcass data by pen for the steers and heifers.

		Quality Grade, Number of Head (Percent)				
Pen Number	Total Number of Head	Prime	Choice	Select	Standard	Cutter
261	82	0 (0)	10 (12.2)	50 (61.0)	22 (26.8)	0 (0)
264	96	0 (0)	18 (18.8)	66 (68.8)	10 (10.4)	2 (2)
530	80	0 (0)	41 (51.3)	36 (45.0)	3 (3.8)	0 (0)
214	115	0 (0)	33 (28.7)	74 (64.3)	8 (7.0)	0 (0)
534	78	0 (0)	19 (24.4)	46 (59.0)	13 (16.7)	0 (0)
568	64	0 (0)	22 (34.4)	39 (60.9)	3 (4.7)	0 (0)
Total No. (%)	515	0 (0)	143 (27.8)	311 (60.4)	59 (11.5)	2 (0.39)

		Yield Grade, Number of Head (Percent)				
Pen Number	Total Number of Head	1	2	3	4	5
261	82	11 (13.4)	46 (56.1)	25 (30.5)	0 (0)	0 (0)
264	96	11 (11.5)	56 (58.3)	28 (29.2)	1 (1.0)	0 (0)
530	80	7 (8.8)	35 (43.8)	34 (42.5)	4 (5.0)	0 (0)
214	115	13 (11.3)	70 (60.9)	31 (27.0)	1 (.9)	0 (0)
534	78	9 (11.5)	39 (50.0)	28 (35.9)	2 (2.6)	0 (0)
568	64	4 (6.3)	33 (51.6)	25 (39.1)	1 (1.6)	1 (1.6)
Total No. (%)	515	55 (10.7)	279 (54.2)	171 (33.2)	9 (1.7)	1 (0.2)

With regards to the quality grade, these data show that 27.8% of the Calf to Carcass cattle graded choice, with the majority of the cattle grading select (60.4%), and the remaining cattle grading standard (11.5%) and cutter (.39%). Compared to the average of the past 3 years, these data represent a slight increase in the number of choice grade cattle (27.8% versus 21.9%), a slight decrease in the percentage select grade cattle (60.4% versus 68.7%), and a slight increase in the percent standard grade cattle (11.5% versus 9.3%). Also, this year is the first year there were cutter grade cattle (.39%), and no prime grade cattle (in the previous 3 years there was an average of .16% prime). The vast majority of the Calf to Carcass cattle (98.1%) fit into yield grades 1, 2 or 3. This is similar to results from the past 3 years where approximately 93.1% were either yield grade 1, 2, or 3. The average finish live weight for all the cattle was 1171 pounds and the average carcass weight was 754 pounds. This calculates to an average dressing percentage of 64.4%. These data were reported using the plant carcass identification number, not the EID tag number.

Analysis showed that the relationships between the live animal grades assigned to each animal prior to slaughter (i.e., predicted quality and yield grades) and the actual quality and yield grades of the carcasses as determined post-harvest were minimally correlated. Specifically, the correlation coefficient between the live animal quality grade and the actual quality grade was 0.26; while the correlation coefficient between the live animal yield grade and the actual yield grade was 0.31.

The Cattlemen's Carcass Data Collection Service, which was employed to collect detailed data on each individual carcass (i.e., ribeye area, fat thickness, marbling score and internal fat) as well as quality and yield grade, used EID as their principle means of identifying the carcasses. Therefore, the EID tag number accompanied each carcass into the cooler, but the plant assigned a number to each carcass that was different than the EID number. The Cattlemen's Carcass Data Collection Service recorded the EID number as well as the corresponding plant number for each carcass in order to link plant carcass identification with the previous live animal identification number, thereby allowing traceability of individual animals. Carcass data were reported using the EID tag for identification on all but three head, indicating a 0.58% loss rate.

Table 5 compares the price received per head by selling the cattle on the value-based grid system versus selling the cattle on a live weight basis. Calculations have been made back to the live weight of the cattle based on the grid price received. The data indicate that the cattle in general brought more money selling on the grid than if sold on a live weight basis.

Table 5. Average price by pen of the cattle sold on the grid versus being sold on a live weight basis.

Pen No.	Live Wt Price	Amount Received on the Grid Calculated to Live Wt	Difference
261	$68.00/cwt	$67.70/cwt	$-0.30/cwt
214	$63.50/cwt	$66.27/cwt	$+2.77/cwt
534	$65.00/cwt	$65.27/cwt	$+0.27/cwt
530	$65.00/cwt	$67.03/cwt	$+2.03/cwt
264	$65.00/cwt	$64.20/cwt	$-0.80/cwt
568	$67.00/cwt	$67.27/cwt	$+0.27/cwt

These data indicate that EID technology is present in the "field" segment of the cattle feeding industry. The feedyard for this group of cattle (Henry C. Hitch) and the carcass data personnel (The Cattlemen's Carcass Data Collection Service) had the capabilities to read EID tags. Other feedyards have made advances in EID technology for tracking cattle, linking electronic identification with software programs to objectively sort, manage, and market cattle based upon their physical and electronic measurements (Fee, 1995). On the tour of the Sunbelt Feeders feedlot, project scientists observed a fully automated electronic system, with a series of chutes for processing animals to record weight and height. A computer program determined the time to finish and individual animals were sorted into pens based upon the calculated finishing times via computer-operated gates. Maday (2000) gave details of these systems where electronic identification readers are linked to video imaging stations for recording animal height, length, width, and weight and ultrasonic scanners for estimates of fat thickness and muscling. The collected information is recorded or relayed directly to a computer where individual cattle are sorted into finishing lots or marketing pens based upon their weight, projected or actual performance, body dimensions, fatness, and economic projections. This allows categorization of individuals with diverse origins, sex, genetics, weight, and body conformations for marketing optimization. A computerized system minimizes the number of cattle that are discounted at the end of feedlot finishing by being over or under finished, over- or under a desirable weight, fed too long or too short when incremental gain is less than the sales price, or underfed to reach the desired quality grade (Maday, 2000). The success rate of the computer program and system with an estimated cost of $1 million mirrored the performance of human sorters. It appears, however, that the use of EID is not widespread and at this time has limited effectiveness as a means to track individual cattle through the production chain, especially through the packing plant.

In tracking the cattle on this study, it was discovered that the individual carcasses were recorded using EID numbers once the cattle reached the packing plant, but each carcass also was assigned a plant carcass identification number which was different from the EID number. Further, once carcasses exit the cooler into the breaking/fabrication room, the individual animal identity is lost and only lot number can be tracked. When discussing the inability of following the carcass through fabrication with packing house industry personnel, the general opinion was that there is no real need to keep individual carcass identity beyond the cooler through the fabrication process (Future Beef, personal communication).

Maintaining individual animal identity from the live animal EID to the plant carcass number was a major concern throughout this study. The data showed that once the animals were harvested, the EID number followed the carcass to the cooler but the packing plant also gave the carcass another number (plant carcass number). At this point the plant carcass number had to be traced back to the EID number so the identity would be maintained for collection of individual data and payment of the correct amount to each producer for each animal. The system would be more accurate and streamlined if the same number (i.e., the EID number) would be used through the harvest to the cooler and to the fabrication room without assigning another new number for identification of each carcass. None of the beef processing plants or companies surveyed had the ability or desire to identify boxes of primal or retail cuts to an individual animal. All plants had extensive coding systems for inventory control that allowed tracing of product in the supermarket back to a specific production day and lot in a specific meat plant. Traceability is obtained through records and certifications that allow a product to be traced back to its origins. Currently, as noted by Bailey and Hayes (2002), most red meat is traceable back to the processor, but not back to the farm of origin.

Further, within the limits of this study, it appears that the EID system is not used as the routine means of identifying cattle in the feedyard. Although the EID tag number was recorded for each animal during weight data collection periods, the identification number used was the visual tag when an animal became sick or died. This indicates that the feedlot personnel working collaboratively on this project do not routinely use the EID system as their main means of identifying cattle on a daily basis. Perhaps an inference can be made to this effect across all feedyards. Hitch Enterprises is one of the top cattle feeding operations in the nation and assumes a leadership role in the industry. When cattle feeding industry leaders do not appear to use the

EID tag system as their main means of identifying cattle in their own feedyard(s) under various management conditions, even when cattle are equipped with the EID tags, then it is reasonable to assume that most other feedyards do not use EID identification methods. Further, it was noted that at this time all three of the feedyards owned and operated by Hitch Enterprises do not tag the cattle they own with EID numbers.

These data also suggest that the Allflex EID tags used in this study were a reliable means of identifying cattle through the production phases incorporated in this study. Only 3 of the 516 head (0.58%) equipped with the EID tags on the Calf to Carcass segment of this study that were processed through harvest lost their EID tag either through the actual loss of the tag itself or loss of the electronic signal from the tag. This translates into a 99.42% success rate for the EID tags throughout the duration of this study. In each case the standard visual tag number was used as the means of identification.

Results from the respondents from the survey of Southern cattle research facilities indicated that they used computers to maintain animal records. Three facilities other than the LSU AgCenter receive cattle data from feedlots or processing plants as an email attachment. EID systems were not in use at facilities other than LSU AgCenter. More than half of the academic respondents thought that EID was an effective way to track animals through the various cattle sectors. Most respondents, however, were undecided about the implementation of EID being limited by the farming, feedlot and processing sectors. Fifty-six percent of the respondents concluded that the use of EID in the animal industry will not satisfy consumer concerns about food safety, while 37.5% of the respondents were undecided and 6.3% thought EID would satisfy the consumer. The use of EID cattle identification and data was not widely observed in Southern cattle research facilities.

The cattle industry has used electronic identification in some dairies and feedlots for several years. These have included neck bands and more recently electronic chips on ear tags and small implanted pellets. The World Trade Organization requires that traceability measures be scientifically justified based on a risk assessment and not be restrictive of trade between a country imposing the measure and other countries. An importing country could not have more rigorous traceability standards for imported meat than for the domestic industry.

Recent reports concerning the implementation of a standardized national animal identification system indicate that progress is slow (Ishmael, 2002). Currently, the United States does not have a mandatory national cattle identification program. The desire to have a national program which centers on disease prevention, response time to a disease outbreak situation, and ultimately disease control is supported by many producers and producer groups such as the NCBA. However, the desire to keep the sharing of production management information on a voluntary basis as well as liability concerns by producers for defects and safety hazards, such as illegal antibiotic residues or broken syringe needles left in the muscle, bring resistance to the national animal identification and traceability program (Ishmael, 2002; Maday, 2002).

There are many advantages and disadvantages of cattle identification systems. There is concern from producers that they would be held liable for contamination over which they have no control once an animal leaves the farm. However, documentation of management practices, animal health programs, inputs, and animal movement can serve as proof and protect against producer liability. Traceability would provide an opportunity to improve heard genetics, meat quality and palatability. Producers accept both the responsibility and economic incentives of raising livestock for branded programs in many of the new alliance branded beef programs. These branded programs are an effective way to development new markets for high-value, noncommodity meats (Clemens and Babcock, 2002).

In processing plants, costs could increase if line speeds were to decrease with the implementation of traceability systems. The ten largest red meat companies account for more than 90% of all steers and heifers slaughtered in the U.S. (Ward and Schroeder, 2001) while the four largest companies slaughter more than 80% of all steers and heifers (Knutson and O'Neal, 2001.) The amount of data to be collected and accessed from the 35.3 million cattle slaughtered annually would require sophisticated software and extensive computing power. The implementation of country of origin labeling will be highly dependent upon development of effective and usable systems of data acquisition and tracking of groups or lots of animals and meat from the same ranch or farm. Several companies have commercial systems that provide for tracking of animals, carcasses, and cuts through the different livestock and meat sectors and the transfer of data from one access point to another, but these are not widespread and have not been used in large processing plants.

Wiemers (2000) estimated that 8 to 10 million beef cattle now have some information recorded on electronic databases, with 1.5 to 3 million cattle identified in detailed audit trails from birth to slaughter. As Director of the National Animal Identification Program in Veterinary Sciences, USDA-APHIS, Dr. Wiemers believes that a national livestock identification system linking private identification systems with public animal tracking systems would be more efficient, accuracy of data would be maintained, and cost of identification devices would be effective compared with the multiple identification means now being used.

Conclusions

The project showed that individual cattle can be traced from farm or ranch of origin to the carcass fabrication line using EID technologies with minimal difficulties. Feedlots and packing plants do not routinely use EID methods for cattle identification. In the present study, carcass data was received from several sources with an identifying EID number, indicating that the EID number accompanied the individual carcass to the point of quality and yield grading in the processing plant. The transfer of information from the carcass to individual primal and retail cuts does not occur at the present time and this is a difficult step in the traceability process, both philosophically and technologically. All processors that were contacted or actually observed were able to trace pallets and boxes of primal and retail cuts back to a daily production lot or group. A standardized national animal identification program could be successful if there were both short term and long term market driven economic incentives for all segments of the industry (producers, feedlot operators and packing houses) and effective avenues of recourse for liability claims and food safety concerns.

References

APHIS. 2002. Authority and responsibility for livestock or poultry diseases. USDA Animal and Plant Health Inspection Service Veterinary Services, Washington, DC.

Augsburg, J.K. 1990. The benefits of animal identification for food safety. J. Anim. Sci. 68:880-883.

Bailey, D. and D. Hayes. 2002. The evolution of identity preservation in red meat markets. Managing for Today's Cattle Market and Beyond, Western Extension Marketing Committee and Livestock Marketing Information Center, Lakewood, CO. March, 2002. 4 pp.

Caporale, V., A. Giovannini, C. Di Francesco, and P. Calistri. 2001. Importance of the traceability of animals and animal products in epidemiology. Rev. Sci. Tech. Off. Int. Epiz. 20:372-378.

Clemens, R. and B.A. Babcock. 2002. Meat traceability: Its effect on trade. Iowa Ag Review, Center for Agricultural and Rural Development, Winter, p. 8-9.

Conill, C., G. Caja, R. Nehring, and O. Ribo. 2000. Effects of injection position and transponder size on the performances of passive injectable transponders used for the electronic identification of cattle. J. Anim. Sci. 78:3001-3009.

Del Vecchio, R.P. 2001. Louisiana Calf to Carcass Guidelines. LSU AgCenter Miscellaneous Document. 6 pg.

Derfler, P. 2002. FSIS Notice on Animal Identification. Notice 5-02, 2/11/02. USDA Food Safety and Inspection Service, Washington, DC.

Fee, R. 1995. Futuristic system redefines cattle feeding. Successful Farming, Oct., pp. 38-39.

Future Beef Operations. 2002. Personal Communication.

Gledhill, J. 2002. Tracing the line. Using information technology to reduce costs while meeting industry requirements. Food Processing 63(2): 48, 50, 52, 54, 56-57.

Golan, E., B. Krissoff, and F. Kuchler. 2002. Traceability for food marketing and food safety: What's the next step? USDA Economic Research Service Agricultural Outlook, Jan-Feb, p. 21-25.

Ishmael, W. 2002. The ID puzzle. Beef, Vol. 39 (1):32.

Knutson, J. and M. O'Neal. 2001. Meat and Poultry Facts 2000. American Meat Institute, Washington, DC. p. 28.

Kernellu, K. 2002. Country-of-origin labeling. Lean Trimmings newsletter, National Meat Association, Oakland, CA, August 26, p. 1.

Maday, J. 2000. The future of feedyard processing? Drover Feedlot Management, March, pp. 1, 3, 5.

Mayday, J. 2002. The paper trail: friend or foe. Drovers, May, pg 38.

NASS. 2002. Chapter VII. Statistics of cattle, hogs and sheep. Agricultural Statistics, USDA National Agricultural Statistics Service, Washington, DC p. 13.

Schemm, R. 2002. Personal Communication. Hitch Enterprises, Guyman, Oklahoma.

Smith, G.C., K.E. Belk, J.A. Scanga, J.N. Sofos, and J.D. Tatum. 2000. Traceback, traceability and source verification in the U.S. beef industry. XXXI World Buiatrics Congress, Punta del Este, Uruguay, December.

Stanford, K., J. Stitt, J.A. Kellar, and T.A. McAllister. 2001. Traceability in cattle and small ruminants in Canada. Rev. Sci. Tech. Off. Int. Epiz. 20:510-522.

Ward, C.E. and T.C. Schroeder. 2001. Structural changes in cattle feeding and meat packing. Oklahoma State University Extension Facts WF-553. 5 pp.

Wiemers, J.F. 2000. National animal identification. A call for government and industry cooperation. National Institute for Animal Agriculture Animal Identification and Information Systems Committee, Corpus Christi, TX, March 27.

Acknowledgments

Special appreciation is extended to the following collaborators, Fort Dodge Animal Health for providing BRD vaccine (Pyramid 4 + Presponse SQ) plus internal-external parasite control (Cydectin), Cargill - Nutrena Feed Division for providing concentrate feed (Doing Fine Transition Ration), Pfizer Animal Health for providing clostridial vaccine (Ultra-Choice 8), and Elanco Animal Health for providing Micotil (Tilmicosin Phosphate). Appreciation is also extended to the Louisiana Department of Agriculture and Forestry, Hitch Enterprises, Louisiana Tech University, McNeese State University and LSU Idlewild Research Station for their invaluable cooperation and assistance on this project.

State funds for this project and final report were matched with Federal funds under the Federal-State Marketing Improvement Program for the Agricultural Marketing Service, U.S. Department of Agriculture, as provided by the Agricultural Marketing Act of 1946." The Louisiana Department of Agriculture and Forestry Office of Marketing provided project supervision on behalf of the Federal-State Marketing Improvement Program, AMS, USDA.