NATIONAL ANIMAL IDENTIFICATION IN THE BEEF INDUSTRY

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Animal identification (ID) has been a management tool in the livestock industry for centuries. Initially, when producers thought about ID, a brand or an ear notch was used to remind ourselves and our neighbors who an animal belonged to. In Biblical times, the patriarchs would determine who owned an animal by the color or striping in the animal's skin. After this point, progress on animal ID seemed to slip into neutral for the next 4,000 years (Bright, 2005). Presently in the U.S., animal identification using brands and plastic ear tags is a standard procedure for 98% of U.S. producers ranching in the western states compared to less than 50% of producers in the southeastern states (APHIS, 1997). Animal identification has become an issue of great debate in recent years because of disease trace back, loss of export markets, and domestic consumer demand for age and source verified beef. Loss of export markets has received much attention and prevented the export of approximately 60,000 head-equivalents of cattle/week (Cattle-Fax). It has been estimated that over 1.8 billion pounds of beef were purchased by Wal-Mart and McDonald's Corporations; proponents of animal identification and product traceability.

The United States as a whole has lagged behind the rest of developed nations with regards to animal identification. Other countries and regions (Great Britain, Canada, Australia, South America; Table 1) have implemented animal identification and tracking systems in response to the threat of, or actual outbreaks of disease such as foot and mouth. As individual animal identification and animal movement tracking becomes the norm around the world, the United States must make difficult decisions in order to retain, and in some cases regain, its market share of foreign beef markets.

Chris Lamb (Smith; Feedstuffs, August 15, 2005) the marketing director of the British Meat & Livestock Commission described the position of the U.K. government with regard to animal tracking. In 2001, FMD-infected livestock were shipped throughout the U.K. and onto the European continent before officials knew there was an incident. Because reporting and response times were

slow, the disease spread fast, and there were more than 2,000 outbreaks in the U.K., resulting in a number of adverse consequences, such as: 1) six million animals, mostly sheep, were culled, with newspaper reports referring to the country as "the killing fields"; 2) the British economy took an £8 billion loss, and 3) meat production in the U.K. decreased by 20%, and meat consumption and exports decreased. Although consumption has recovered, production has not, and the country is now importing more meat -- meat self-sufficiency has dropped from 79% in 2000 to 67% in 2004. The lesson learned from this experience was that vigilance and preparedness are the best defense.

Table 1. Mandatory vs. voluntary traceability in global beef supply chains

Country or region	Mandatory or voluntary program
EU and Japan:	Mandatory, farm-of-origin to retail, all beef.
Australia and Brazil:	Mandatory only for exported beef, but plans for general and mandatory traceability.
Canada:	Mandatory for animals moving away from farm-of-origin.
Argentina:	Mandatory only for exported beef and for domestic beef produced in regions where animal diseases still persist.
USA:	Voluntary at present; mandatory in 2009?

Souza-Monteiro & Caswell (2004; http://www.umass.edu/resec/workingpapers.htm)

Bill Mies, VP of eMerge said (Mies, 2005) that in order to stop the spread of FMD in the U.S., it would require the National Guard blocking highways to stop the movement of all animals and animal-handling transportation including trucks and cattle trailers. Auction markets and all meat packers would be closed. California has estimated that the loss to the states economy due to an infectious disease would be in excess of nine billion dollars.

Recently, Department of Homeland Security Agriculture and Food officer Tom McGinn described (Smith, 2005) how rapidly FMD can spread. He reported that an outbreak at just five premises could spread to 40 states within 30 days, and that outbreak, if a stop-movement order is not issued until day eight, would require the destruction of 23.6 million hoofed livestock. McGinn urged producers to get individual animal identification in place because it is essential for controlling and eradicating disease. McGinn also showed how farmers in South America have put animal identification in place for llamas by using differently colored ribbons. "We've got to get the job done," he said. "If farmers in the Andes Mountains can do it, so can we." Table 2 lists four questions that would be answered with a national animal ID program.

Traceability of a food consists of development of an information trail that follows the food product's physical trail.

Table 2. Questions that could be answered with a national animal ID program

1. Where did this animal come from (state, county, ranch)?
2. Who owned it (cow calf producer, stocker operator, feedlot and packer)?
3. What other animals (wild and domestic) did it come in contact with?
4. What ingredients were in the animal's ration?

What are additional Animal Identification Drivers?

Leann Saunders from IMI Global, Inc. (Saunders, 2004) suggested that the drivers for a national identification and traceability program have included: 1) protecting our nation's livestock herds -- preparedness for disease and bioterrorism; 2) promoting consumer confidence -- to assure export-market access and to deliver on brand promises; and 3) adding value as a benefit of supply-chain management -- improving ability to capture and evaluate critical information that will improve profitability. Smith and Saunders (2005) believe that traceability is a truly daunting task because the world has over four billion livestock animals.

There are also additional reasons to consider animal ID and especially traceability. Packers, feeders, producers and buyers anxious to access premiums in the export and domestic markets are requesting animals that have source and age verification to meet the demands and requirements of these markets. Recently, congressional representatives sent a letter to the Secretary of USDA suggesting that "….private animal ID systems will speed the process of implementing a national ID program, enhance U.S. markets and add value to U.S. livestock."(CattleNetwork.com, July 21, 2005). The beef cattle and industry will likely continue to evolve around the animal identification issue as they respond to markets, animal health concerns, agroterrorism and other issues. Table 3 summarizes additional drivers for animal traceability.

The lack of a national, verifiable animal traceability program may continue to cause problems in regaining full access to foreign markets. Several foreign speakers at the 2005 International Livestock Congress in Houston, TX said that one of the drivers that caused their countries to embrace animal identification was the fear of disease (FMD or BSE) and its' effects on the national economy. Table 4 (Cattle-Fax, April, 2005) shows which country saw their export markets decline the most due concerns over BSE.

Table 3. Additional reasons for identification, traceability and verification across the entire complex of the livestock and meat industries (Smith and Saunders, ILC, 2005)

- Surveillance, control and eradication of foreign animal diseases
- Biosecurity protection of the national livestock population
- Compliance with requirements of our international customers
- Compliance with Country of Origin Labeling requirements
- Ascertain origin and ownership to deter theft and misrepresentation
- Facilitate value-added and value-based marketing
- Isolate food safety problems

Table 4 . Major beef exporting countries global market share

Country	2003	2004
Brazil	18.5	23.8
Australia	19.9	21.1
New Zealand	9.1	9.7
Argentina	6.0	8.8
Canada	6.0	8.8
Uruguay	5.0	6.5
United States	18.0	3.2

D. Lenz. 2005. Cattle-fax. http://www.cattle-fax.com/members/special/files/special050422.pdf

National Animal Identification System

The introduction of the National Animal Identification System (NAIS) was the first coordinated step for livestock traceability to safeguard animal health. The NAIS is the cooperative State-Federal-Industry program administered by USDA's Animal and Plant Health Inspection Service (APHIS) for the purpose of tracking all animal movements from the birth premise to the slaughter plant. The main objective of this program is to develop and implement a comprehensive national animal tracking system which will enable State and Federal animal health officials to identify both domestic and foreign animal diseases on a real-time basis and to track all exposed and infected animals within 48 hours of an initial positive diagnosis. Another purpose of the NAIS is to enable State and Federal animal

health officials to promptly ascertain animal health status for the purpose of issuing both intrastate and interstate animal health movement certificates (http://animalid.aphis.usda.gov/nais/about/pdf/NAIS_Draft_Program_Standards_42505.pdf).

Animal identification in the United States varies by species and region of the country. While a national animal identification program was already being quietly discussed and slowly developed, the 2001 terrorist attacks and the 2003 BSE case in WA hastened the implementation of NAIS.

A recently released draft strategic plan lays out USDA's timeline for the implementation of this system with all elements mandatory by 2009. The elements of NAIS include:

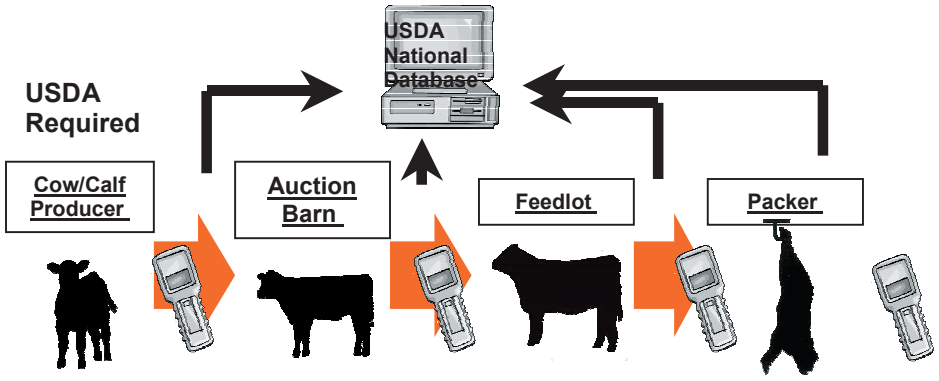
Step 1. Premises Registration. The first step of the process is to identify all locations where livestock reside or are commingled with a nationally unique seven (7) digit alphanumeric code. As of July 27, 2005, 91,082 premises were registered across the country. The draft timeline aims to have 25% of all premises in the country registered by April 2006. As of July 27, 2005, all states, five tribes and two territories were registering premises. (http://animalid.aphis.usda.gov/nais/about/premises_summary.shtml).

Step 2. Animal Identification. The next step in implementing the system will be to assign official individual or group identification numbers to the livestock. While poultry and swine will likely use group identification, it is widely believed that the cattle industry will adopt individual identification utilizing a radio frequency electronic identification tag to facilitate speed of commerce movement and identification capture through auction barns, feedlots and packing plants. USDA is currently in the process of establishing the animal identification number allocator in order to issue official tag numbers to tag manufacturers. The process is expected to be completed by fall, 2005.

Step 3. Animal Movement Recordkeeping. Perhaps the most difficult step that will require the most technology, coordination, and retrofitting, will be the recording of animal movements from one premises to another. For adequate trace back of animal diseases, a complete picture of the animal's lifespan is needed, including all locations, or premises, and all other animals with which it has been in contact. NAIS will ask all premises to record the date, premises number, animal number and an event code for all animals entering the premises. Figure 1 describes how the proposed system would work if Radio Frequency Identification Devices (RFID) were adapted:

Figure 1. Proposed capture of traceability information using RFID from the ranch to the packing plant and recording this information in the USDA National Database

(http://www.iowabeefcenter.org/content/USAIPSystem(tutorial)_files/frame.htm



Again, data from each RFID scan will be sent to the USDA's national database. Information kept by USDA includes the animal ID number, previous premise number, current premise number, and dates and times of transfer.

Challenges for Western Producers to Comply with National ID

Russell Tronstad, Extension Agricultural Economist from the University of AZ raised several concerns that the NAIS needs to consider before a mandatory ID program is implemented (http://www.lmic.info/memberspublic/pubframes.html). Concerns described included: 1) a pasture in the West may be very vast with hundreds of cattle contained inside the boundary fence, the cattle may be owned by hundreds of individuals, particularly on tribal lands. For example, one tribal herd in AZ has a normal carrying capacity of about 3,500 head with over 1,000 individual owners; 2) to complicate matters, 15 to 20 individuals could have a stake in the calf sales of a given cow, and any one of these individuals or someone else can replace a cow in the name(s) of the individual(s) if the cow dies or is sold. Tracking this kind of ownership and replacement will require cooperation from both the parties who own a "slot in the herd," and the presently unidentified individual(s) who may purchase a cow in their name(s); 3) grazing associations exist in the West where multiple ranchers pool their cattle together for summer grazing. This

practice reduces fencing and caretaking costs, but increases the intermingling and disease exposure compared to cattle moved from one pasture to the next; 4) branding and brand inspection is currently required for many states, and some have advocated that brands and brand inspections be used to trace animals. Several shortcomings and problems exist with utilizing brands as a replacement for animal identification. First, not all states require branding so in some states, cattle can move from the cow/calf operation to the feedlot and to slaughter without ever receiving a brand or having any type of individual animal identification. Secondly, brand inspections are usually done for groups of animals rather than individual animals. If a cow tests positive for BSE at slaughter, how could one readily identify where the other cows are that were commingled with the BSE cow at different brand inspections? and 5) lastly, brands are only unique for each state. Theoretically, two calves could have the same brand at the feedlot and be from two different states. Table 5 summarizes MT rancher's opinions from 2003 and 2005 toward a national animal ID program. Montana is one of the western states, which have brand laws and (or) departments of livestock inspection.

Table 5. Opinion of MT ranchers toward a national animal ID program

	August 2003	July 2005
Do you believe that a national animal ID program should be implemented?		
Yes	55%	81%
No	17%	17%
Don't know	28%	2%
Should a national ID program be voluntary or mandatory?		
Voluntary	29%	28%
Mandatory	32%	53%

* Results by MT ranchers responding to a survey by Duffey et al. (2004) or to an informal nonscientific survey by Paterson (2005).

Who supports national animal ID?

Currently representatives from the dairy, cattle, sheep, and swine industries have developed preliminary implementation plans. All other livestock, including goats, cervids, equine, aquaculture, poultry, llamas, and bison are becoming engaged in the plan. Some features of the plan are common to all species, while others are species specific. A complete list of NAIS participants and other plan information can be found at http://www.usaip.info.

Government and industry continue to work through confidentiality, liability, and cost issues that concern producers. The National Cattlemen's Beef Association has stepped forward with a consortium of service providers to provide a private industry database option for the data collected for NAIS. The estimated completion date for this proposed database is January 2006, compared with USDA's goal of January 2009.

National Animal Identification System Pilot Projects

USDA provided funding for pilot projects across the country to give state animal health officials the opportunity to start implementing the system and to evaluate the impact of NAIS on the state's livestock industry. USDA funded 29 projects for states and tribes. The first years funding was focused on registering premises and tracking livestock while the second year of funding will be aimed at establishing a premises registration process in each state and registering as many premises as possible.

The Montana pilot project focused on recording animal movements and traceability back to the original premise (Table 5). Premise registration of approximately 12,000 cattle ranches is a second year priority. The Montana project has also evaluated the impact of traceability on auction markets, comparison of the different companies RFID tags, retention rates of these tags and readability after several years of use. In Kansas, their pilot project is designing and evaluating technology for recording radio frequency identification tags with readers mounted on livestock trucks. The Northwest Pilot Project is developing, implementing and testing multiple processes that will allow the tracing of individual livestock through multiple industry segments, across state and national borders, from the herd of origin to processing. The Tri-National Livestock Identification Project involves three contiguous Western states (Arizona, Colorado, and New Mexico), three sovereign Native American nations (the Navajo Nation, the Hopi Tribe, and the Ute Mountain Ute Tribe), and two Mexican states (Chihuahua and Sonora, Mexico) that will use their existing brand inspection infrastructure to assist in carrying out livestock movement recordings.

Table 6. Tracking of cattle movement for the MT Pilot Project

Project	Management Description	Next Phase (Backgrounding/ Stocker, Auction Barn)	Feedlot Phase
1	300 calves born, raised and weaned on MT ranch. Shipped directly from ranch to feedlot		Finished in feedlot in NE
2	500 calves born, raised and weaned on ranch in MT	Calves shipped to OK to graze wheat pastures	Finished in feedlot in NE
3	550 calves born on ranch in ID, moved to MT returned to ID for summer grazing	Calves sold to a feedlot which takes delivery at ranch and transports directly to feedlot	Calves finished in a feedlot in KS
4	220 weaned calves born on three different ranches	Calves marketed though an auction market	
5	200 calves born on MT ranch, moved to USFS summer grazing permit, calves will be sorted in fall		Finished in NE feedlot
6	92 suckling MT calves	Sold to producer in UT	Finished in Midwest feedlot
7	5000 cows. Evaluation of different RFID ear tags; scanners, readability failure rates and tag retention rates	Five cooperator ranches. Cows have been tagged for as long as three years.	

Market Driven Animal Identification (Source and Age Verification)

When animal identification was brought to the forefront with the discovery of BSE in the U.S., beef customers and markets looked for ways to stabilize and boost consumer confidence by utilizing the system and technology proposed by NAIS. Although not widely used in 2004, auction markets and video

auctions are now providing producers with the option to sell livestock as source and age verified to customers such as Wal-Mart, McDonald's, and potential export markets. The Beef Export Verification (BEV) plan for Japan will require processes for validating the source and age (less than 21 months) on all cattle and beef products.

Ishmael (2005) quoted Steve Hunt the CEO of U.S. Premium Beef as saying "We believe producers who can trace cattle back to their origin and provide age verification will obtain more value relative to the market." Recently, USPB was paying producers an additional $10/head for age and source verification. Many producers have sold cattle in Superior's VASE program, Northern Video's VESA program, Joplin Regional Stockyards and 101 Livestock Auction. These value added sales are realizing additional income for cattle producers that can age and source-verify their cattle.

Can we use the technology to make better cattle?

Dovetailing the market driven identification programs are the value added programs that utilize identification to capture and analyze data used by the producer, feeder, and/or packer to improve the genetics of the cow herd, the carcass value of fed cattle and the beef purchased by the consumer. Branded programs such as Certified Angus Beef (CAB) are moving to electronic identification to track and verify the specifications for their product. Others, like the Montana Beef Network, are using identification to provide data to producers to use as a benchmark to compare their herd's performance and carcass traits to industry goals. Value added programs will likely provide an added benefit to a mandatory national animal identification because the technology can be the same.

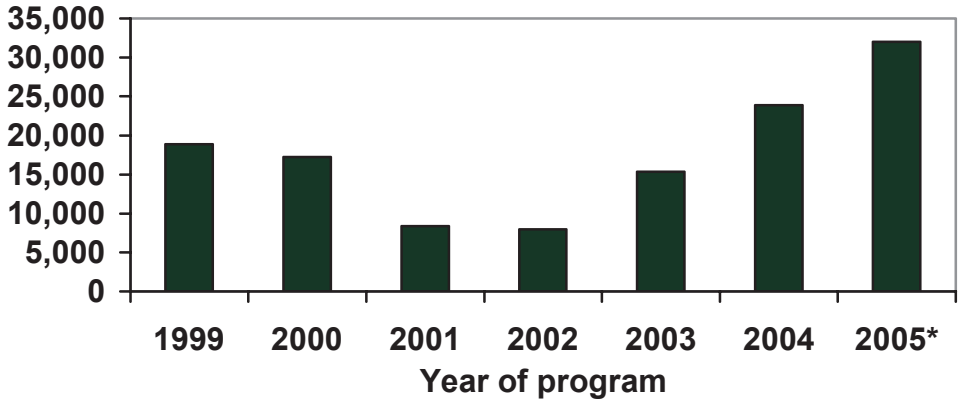
The Montana Beef Network (MBN) has three primary objectives: 1) educational programs aimed at meeting beef quality assurance standards, production and marketing goals; 2) voluntary certification of feeder calves that have met defined management protocols; and 3) information feedback from the feedlot and packing plant to the cow-calf producer showing if the feeder calves met industry requirements for quality, consistency, safety and red meat yield (mbn.montana.edu).

The cattle certification and tracking component of the project (Objectives 2 and 3) uses electronic identification (RFID) tags and secures the feedlot and carcass data on the calves certified in the program. Currently, all data are stored

by eMerge, Inc. Approximately 18,000 calves were certified during the first year and more than 32,000 during 2005 (Figure 2).

The difficulty in convincing all the various segments of the beef industry to cooperate in voluntary information exchange has often resulted in a less than desirable rate of return of carcass data for the MT producer who sold calves at weaning.. This difficulty caused some producers to drop out of the program until data recovery improved. Presently, approximately 80% of producers are receiving at least some data on their cattle. The data captured throughout the process is synthesized, summarized, and explained to the producer to provide information on how they might modify their breeding and (or) management practices to improve the quality of their product.

Figure 2. Number of cattle enrolled in the MT Beef Network from 1999-2005



*Preliminary as of August 15, 2005

During the winter of 2005, a cooperative project with Certified Angus Beef and Colorado State University (Paterson et al., 2005) was implemented to summarize carcass data for the years of 1999 through 2003. The following table (Table 7) summarizes these data. At 66.6% Choice or better, these cattle came close to the industry target of 70% Choice. These quality grades far exceed the national average, which remains in a range of approximately 52-55%. Since most of these cattle were of English breeding (mainly Angus), it would be expected that yield grade (YG) values might be slightly above the national average. The 10.1% rate of YG 4s & 5s was even higher than expected, and could result in serious grid discounts. The problem is probably due to a combination of genetics and management, so corrective change is suggested.

The average carcass weight was 784 lb with a range of 344-1160 lb with an average YG of 3.1 and a range of 0 to 6.81. While the REA was very acceptable (12.8 sq. in), the ratio of REA to carcass weight (1.64) appears to suggest the need for slightly more muscling in the calves (Table 8). The average hot carcass weight was slightly below national levels, again probably influenced by English breed genetics. However, Montana-origin carcasses are a closer fit to the demand specifications at the food-service and retail levels. The fat cover average of 0.51 inch suggested the cattle were harvested at the appropriate weight.

Table 7. Distribution of Carcass Variables in the MBN: 1999 to 2003

Variable	Number of observations	Percentage of observations	
Year			
1999	2841	16.42	
2000	4990	28.83	
2001	1806	10.44	
2002	2479	14.32	
2003	5190	29.99	
TOTAL	17,306		
USDA yield grade			
1	460	4.33	
2	3543	33.33	
3	5554	52.24	
4	1030	9.69	10.1%---discounted
5	44	0.41	
Quality grade			
Prime +	2	0.01	
Prime	128	0.75	
Prime -	163	0.95	
Choice +	589	3.45	66.6%-- Premium
Choice	5116	29.97	
Choice -	5369	31.45	
Select +	1378	8.07	
Select	2755	16.14	
Select -	1289	7.55	
Standard +	70	0.41	
Standard	96	0.56	33.4%--discounted
Standard -	9	0.05	
Bullock	4	0.02	
No roll	91	0.53	
Dark cutter	11	0.06	
Condemned	2	0.01	

Correlation values among quality grades for all cattle showed no surprises: a slightly positive relationship with fat cover (0.274) and yield grade (0.289), but

no correlation with carcass weight (Table 9). In contrast, for the cattle classified as Premium Choice, that correlation is lower, to fat cover at 0.189 and yield grade at 0.129 (data not shown). This demonstrates one of the basic truths in feeding for the quality market. Genetic potential for marbling must be present before cattle will achieve the highest quality grades. You simply cannot "feed" quality grade into them by adding more weight and fat.

Table 8. Averages and ranges for carcass measurements for MBN cattle: 1999-2003

Variable	Mean	Range	Number of missing values
Hot carcass weight	783.5	344 to 1160	95
Marbling score	4.46	1.0 to 8.9	5483
Back fat[a]	0.51	0.10 to 1.52	3487
KPH[b]	2.17	0.39 to 4.50	7856
Rib eye area	12.82	7.40 to 18.42	3251
Calculated yield grade	3.10	0.00 to 6.81	4349
REA/100 pounds of hot carcass weight	1.64	0.91 to 3.34	3341

[a]Carcasses with back fat of less than 0.1" and one carcass with a back fat of 3.6" were deleted from the calculations.
[b]Carcasses with KPH greater than 10% were deleted from the calculations.

Based on correlation values, REA/cwt was nearly twice as important (-0.764) as fat cover (-0.314) or carcass weight (-0.47) to final YG. We have interpreted this to mean that these cattle simply do not have the muscle to be 850- to 900-lb carcasses.

Table 9. Correlation coefficients for selected carcass traits for MBN Cattle: 1999-2003

	Quality grade	Hot carcass wt	Back fat	REA	KPH	Yield grade	Marbling score	REA/ CWT
Quality grade	1.0	-0.08	-0.274	0.120	-0.060	-0.289	0.854	0.212
Carcass Wt.		1.0	0.151	0.425	0.086	0.247	0.114	-0.470
Back fat			1.0	-0.191	0.156	0.822	0.326	-0.314
Yield grade						1.0	.320	-0.764
Marbling score							1.0	-0.222

Duffey et al. (2004) surveyed BQA and Non-BQA certified ranchers to determine how the carcass data were utilized. Table 10 summarizes how the information was used. The responses suggested that the carcass summaries were used for information only (37%) or producers were using the information to change bull genetics (37%). It also appears that ranchers used the information to make cow culling selections (21%).

Table 10. Summary of how BQA and non-BQA certified producers utilized carcass data results (Duffey et al., 2004)

How do you use carcass information?	BQA certified producers	Non-BQA certified producers
Information only	36	37
To cull cows	22	19
To change bull genetics	37	38
Other	5	5

Implications

The focus of this paper has been to summarize reasons for a national animal identification and traceability program. The three reasons most commonly discussed reasons include: 1) a 48 hour trace back in case of animal disease (the USDA-NAIS program); 2) source and age verification programs driven by the market to comply with branded beef programs (e.g. Superior Livestock, Northern Video, Joplin Regional Stockyards, 101 Auction); and 3) continued improvement in cattle production traits such as carcass value and feedlot performance (e.g. Montana Beef Network).

Dr. Gary Smith from Colorado State University and LeAnn Saunders from IMI Global (Smith & Saunders, ILC 2005) proposed several goals that must be achieved in order to implement a national animal ID program. Among their recommendations were: 1) make it mandatory and speed-up the process; 2) pay for most or all of it (at every sector); 3) specify the technology (for every sector); 4) allow for confidentiality of all data; 5) specify the depth, breadth and precision required; and 6) include feed as well as livestock and meat.

It is our opinion that NAIS does not have to be either complicated or expensive if the cow/calf producer can purchase pre-scanned RFID tags and have the supplier provide the premise location and ear tag numbers to the USDA database. The expense will come once animals are moved to another premise

(auction market, feedlot, packing plant) and have to be rescanned. The challenge will be to do this rescanning quickly and not slow down commerce.

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