Traceability – from field to fork

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Agriculture is challenged by the fact that product from many producers is routinely commingled prior to sale. This is true for any agricultural product from pineapple to pork, however it has become especially critical in the wake of livestock diseases that threaten the food supply. With this threat, comes the need to provide stability to the food supply and reassurance to the consumer. This stability and reassurance could mean traceability or identity preservation. In order to analyze traceability, the roots of the science and an overview of the red meat industry will be identified as well as the economic consequences for all players including producers, retailers and consumers.

**The logistics**

Traceability offers the potential for addressing many of the issues created with the commingling of red meat. It also offers the potential of accelerating the development of brand-name red meat products.

Colorado State University Meat Scientist Gary Smith gives five applications for traceability:

- Ascertaining ownership
- Identifying parentage
- Improving palatability
- Assuring food safety
- Determining compliance in branded programs
Another motivation for traceability has also emerged in recent months – food security. The potential for introduction of foreign diseases accelerate the need for traceability as a means for animal health authorities to identify, isolate and contain any outbreak quickly.

Tracking any product, especially animals, from birth to slaughter and back is difficult. Research at Colorado State University has shown that “maintaining individual animal identification on primal and subprimal cuts through a beef plant would be possible, but at slower fabrication speeds and much higher production costs.” Traceability, for ground beef is almost impossible at large plants, with CSU research showing that each 4-ounce, ground-beef patty contains muscle or fat from at least 55 and as many as 1,082 different animals (Maday, 2002).

On the other hand, smaller plants can maintain individual identity on meat products more easily. A Drovers, Food Systems Insider article featured one of these smaller plants, B3R Country Meats in Childress, Texas, that markets premium-branded-beef products. B3R collects 40 pieces of data on each carcass while maintaining individual identity and shares information with producers to help improve their supply chain. Thus, individual identity and traceability is possible – if but only on a small scale at present.
The emergence of traceability

The Bovine Spongiform Encephalopathy (BSE) scare in the United Kingdom is the single tipping point or major cause of the escalation of the origination of efforts to establish traceability. BSE, a disease found in cattle that may be linked to possible variant of a potentially fatal human disease, caused beef consumption to drop dramatically in the UK. Subsequently, a single case of BSE in a Canadian cow in 2003 caused the Canadian cattle industry to plummet.

These scares as well as two additional EU food crises that occurred almost simultaneously in 1996 – an outbreak involving Salmonella contamination in Danish pork and an E. coli outbreak traced to Scotland. These scares led to a lack of confidence by EU consumers and thus led to the establishment of trace back systems in Europe (Bailey, 2002). Currently, food products within the EU are differentiated by food safety and quality assurance characteristics.

The red meat industry

According to The Evolution of Identity Preservation in Red Meat Markets written by DeeVon Bailey and Dermot Hayes, market tests by the Pig Improvement Company (PIC) suggest it may be possible to link genetic development to retail marketing schemes in the U.S. Meaning, genetic development could be used to develop branded retail products. The consequence of which could have enormous implications since different genetic strains could be
developed for specific markets and retailers resulting in revolutionary changes in pork marketing channel dynamics (Bailey, 2002).

Since potentially, producers with a specific genetic line could be limited to selling in a specific market, opportunities for small and medium-sized producers could actually expand within these newly developed niche markets (Bailey, 2002). And thus, products with traceable characteristics would be a key element of this type of marketing system because of the direct link between production and final product.

**Structure of traceability systems**

So far, the U.S. food system has relatively limited traceability of food products, particularly food products. Meanwhile, several European countries have implemented animal product identification mechanisms. Dr. Brian Buhr and Dennis DiPietre conducted a study in 2001 to gain information on how European animal product supply chains have managed identity preservation back to the farm and identify the feasibility of adopting such practices in the U.S.

Five European organizations were chosen for this investigation including a poultry production system, an egg production system, a salmon production system, a veal production system and a lamb, pork and beef supply chain. The study summarized that the key advantages of these highly-technical
systems was the linking of production information together to form digital traceability. One system in particular, the Scase system, utilizes production based data terminals to capture the information created during the production process. This system integrates this data from the perspective of being able to access and upload information via the Internet (Buhr, 2003).

Within this system, the consumer needs only the bar coding which they can key into the appropriate website to determined where the animal was slaughtered, where the animal was raised and identify any medications the animal received throughout its life cycle (Buhr, 2003).

**New technology**

Individual identification is the basis for traceability and within this industry are emerging technologies that facilitate identification, data collection and tracking for individual animals. Radio frequency identification devices (RFID) was first used by the Department of Energy as part of a fish tracking system to identify fingerling salmon with microchip implants that when excited by appropriate readers emit a unique 15-character identification number (Howie, 2003).

The following are a list of emerging technologies in the beef industry:
External ear tags – There are two types of RFID eartags available from several companies. These include small electronic button rags and larger, flat eartags with large numbers for visual reference and RFID transponders embedded in the plastic. They also can include a barcode with, or in place of, the RFID device. The cost to producers is $2 to $2.50 each.

Injectable transponder – These devices, small implants injected under the skin, are widely used for identifying companion animals. The implant contains a small computer chip that uses passive RFID technology and cost $4 to $5 each.

Rumen bolus – There are permanent and recyclable versions of this ID mechanism. The bolus, containing an RFID device, sinks to the bottom of the animal’s rumen where it remains. The price is more expensive than ear tags at $6 to $7 each.

Retinal imaging – This emerging technology already utilized in show animals could provide inexpensive, permanent identification for traceability. However, producers will need additional visual identification.
DNA fingerprinting – The technology currently is cost-prohibitive, but a blood test at birth eventually could provide permanent identification possibilities.

Emerging technologies within the swine industry has yet to come to fruition, but have been in development for several years. RFID devices specifically designed for pigs have been engineered, as well as software to download the information, however the technology has yet to come to market (Howie, 2003).

**The cost of traceability**

All of those within the food chain would like to know what it costs to implement a traceability system. According to Buhr, there are two types of costs – sunk costs of developing and implementing the system and the marginal costs of operating a traceable supply chain. Costs from one plant within the Buhr and DiPietre study provided an example of system-wide development since it was developed completely internally. Their cost estimates include changes to plant configuration, equipment, software development and development of operating protocols at the processing plant. Their estimate for complete implementation was $6.5 million. Additionally, the company estimated that it cost approximately $24 million to complete the system-wide integration of the complete traceability system (Buhr, 2003).
The study, however, did not find the traceability technology applied in U.S. scale facilities. For one plant, Buhr estimated that the maximum physical capacity of using their on-line measurement systems was approximately 400 head per hour, compared to 1,000 to 2,000 head per hour speeds in most commercial U.S. hog processing facilities. Therefore, the reduced line speed caused by traceability measures may not seem to be at a high cost, however they certainly can add up in a high-volume, low-margin industry.

**Economic feasibility**

Many producers fear traceability primarily because they view it as a cost burden. This view, however, is a perhaps a profit-limiting perspective. Traceability, accomplished correctly, is much more than just ownership traceability – it’s also the traceability of product attributes and processes through which products have undergone on each appropriately sized unit of agricultural production during the product’s journey from farm to consumer.

Buhr states “it’s absolutely critical to differentiate between traceability and product attributes.” A product attribute is some measured or observed characteristic of the unit of production at some point in the supply chain such as a genetic trait of an animal. A product process is something done to the product in the supply chain such as an antibiotic treatment.
During the past five years, eFarm, AgInfoLink Global and teams at John Deere have been working together to determine how the tracing of product attributes and processes can add value to producers and processors at all stages of the food supply chain within the U.S. The experience so far has shown that when members of the chain invest 0.5 percent of the cost of the raw product paid by the first stage processor for each unit of product, they are reaping better than two percent to five percent increased profit, based upon the revenue generated by the last agricultural producer who sells to the first food processor (Pape, 2002). In the beef cattle industry, for example, investing about $5 per head of cattle has increased profitability by somewhere between $25 per head to $75 per head. Although this information is documented in a pilot project with just over 50 studies spanning multiple owners and various number of cattle, the research does prove, although on a limited basis, that traceability does add to the bottom line of producers.

**Immeasurable benefits of traceability**

Traceability, in reality, was developed as a means to improved food safety. Within Europe, all systems with an implemented traceability system perceive they offer a safer and higher quality product to their customers (Buhr, 2003). However, none of these systems had measured the economic value of their systems. In conversations with many of these operators, captured by Buhr, it was clear that potential benefits extended beyond simply capturing customer
value. “The potential cost reduction due to improved response (both speed and accuracy) of any potential recall had direct benefits,” said Buhr.

Thus, there are benefits to traceability that can’t be calculated in the short-term. In addition to recall cost savings, data generated by Buhr indicated that traceability is perceived to improve the members’ production performance because of improved record keeping which enables benchmark production processes within the chain to improve management and decision-making (Buhr, 2003).

Another clear benefit is the ability to utilize traceability as a marketing tool. Offering consumers the ability to actually visit virtual farms where the product was raised enables firms to differentiate their products within the meat case.

On the consumer side, the benefits of traceability are even more straightforward. Traceability could potentially improve the probability that if a food safety claim should arise, the exact source of the problem will be found and proven so that receiving compensation may be improved.

Retails will be the true beneficiary of full transparency and/or validated meat characteristics in the pork meat chain evolve to a major consumer demand. Dr. Rick Sibbel of Schering-Plough Animal Health said, “As retail brands grow
and become a larger part of the value of the business, the need for more control of purchased products will be oblivious."

Through the use of traceability systems, retailers will be able to request different product specifics and then have them delivered with more coordinated information about what consumers are buying. This will allow retailers to better capture niche opportunities and give them more control of product issues that could potentially concern and effect customers.

**Conclusion**

There’s no doubt among leaders in the food industry that a full traceability system will be implemented within the U.S. However, the time frame of such is yet to be determined. In judging the implementation of such systems in Europe, one would assume that it will likely take a national food safety scare in order for a traceability system to be implemented within the U.S. However, if the U.S. were to truly learn from the food safety scares in Europe and, most recently, from a BSE scare in Canada, the industry could perhaps find the means to implement traceability in order to counter-act such devastating circumstances, before they happen.
Sources


