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WHITE PAPER ON

TRACEABILITY IN THE U.S. GRAIN AND PLANT PROTEIN FEED INGREDIENT INDUSTRIES

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BACKGROUND

The EU General Food Law Regulation EC No 178/2002 will introduce a broad non-prescriptive traceability requirement that includes all food and feed business operators in the European Union. The new legislation (EC No 178/2002) establishes a legal framework for tracing raw materials from production to final consumption.

Traceability, defined in the European Commission (EC) regulation No 178/2002,

> "means the ability to trace and follow a food, feed, food-producing animal or substance intended to be or expected to be incorporated into a food or feed, through all stages of production, processing and distribution."

The regulation further specifies under Article 18,

> "Food and feed business operators shall be able to identify any person from whom they have been supplied with a food, a feed, a food-producing animal, or any substance intended to be, or expected to be, incorporated into a food or feed. To this end, such operators shall have in place systems and procedures which allow for this information to be made available to the competent authorities on demand."

To retain their comparative advantage in the global market and address domestic food safety and quality issues, the U.S. grain producers and handlers are implementing methods to produce, handle, and market trait specific grains, including documentation systems that trace raw materials back to the farm. Traceability and documentation are considered core competencies for grain operations (GEAPS 2002). These efforts concomitantly address some of the traceability issues contained in the European Union regulation EC No 178/2002.

U.S. GRAIN INFRASTRUCTURE

The United States' on-farm grain storage capacity totaled 11.175 billion bushels (285 million mt) while the nation's off-farm storage totaled 8.419 billion bushel (214 million mt), based on estimates by the National Agricultural Statistics Services (NASS) (2002). Iowa leads all states in on-farm storage capacity with 1.6 billion bushels (41 million mt), followed by Illinois, Minnesota, Nebraska, and North Dakota. These five states account for 53 percent of the U.S. on-farm grain storage capacity, while the leading states with off-farm storage include Illinois (29.2 million mt), Iowa (26.8 million mt), and Kansas (20.2 million mt).

Grain destined for export passes through country elevators, inland sub-terminals, and export terminals where it is loaded onto vessels, ranging in capacity from 20,000 mt to 50,000 mt (Figure 1). The number of commercially licensed grain handling facilities in major grain producing states and terminal exports is presented in Table 1.

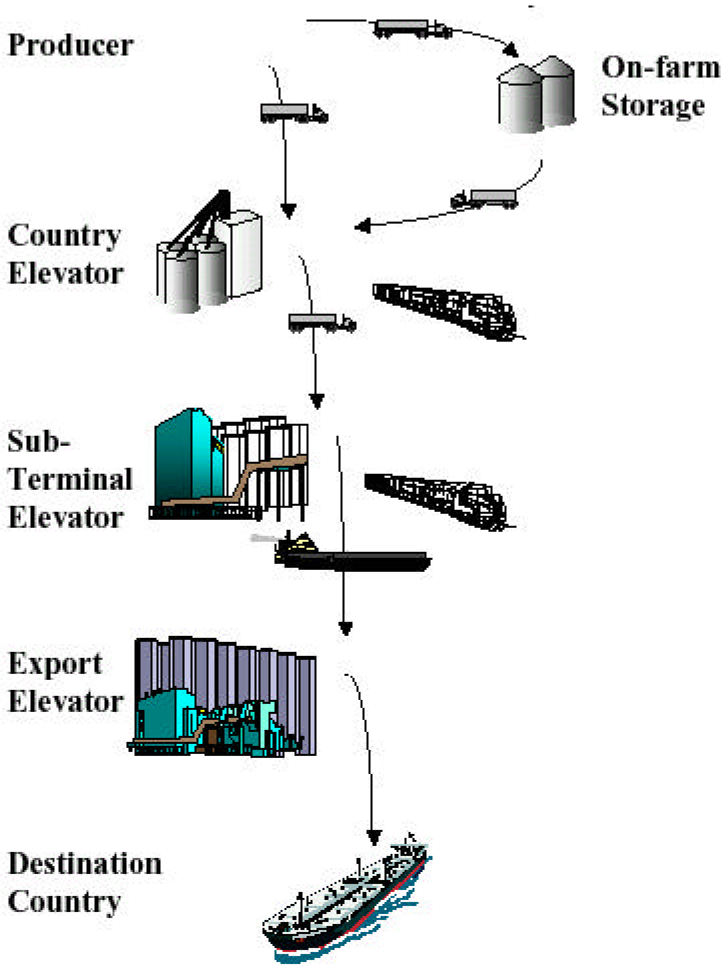

Figure 1. Movement of cereals and oilseeds for export in the U.S.
Source: http://www.vegrains.org/documents/em_chapter2.pdf

Country elevators serve as first collection points of grain during harvest and receive grain from farm storage after harvest. These structures consist of a main elevator and may include an annex, large steel storage bins, or both. The main elevator contains a driveway that runs through the center or side of the structure; in the driveway are one or several pits with steel grates upon which the grain is dumped. Grain receiving equipment in the main elevator includes a bucket elevator(s) (also referred to as a leg), distributor, spouting, lateral conveyors (e.g. screw or drag conveyors), and storage bins. The annex is a large storage structure comprised of many bins and is located adjacent to the elevator. It consists of belt or drag conveyors on the top (gallery) and bottom (tunnel) of the storage structure. Grain receipt at these facilities involves weighing and sampling the truck, recording the producer and identifying grain ownership (often requiring a field specific label), evaluating the grain quality, recording this information on the scale ticket and electronically, and directing the truck driver to a designated drive if the facility has multiple drives.

Table 1. Number of grain handling facilities by state and export location.

Location	Number of Elevators by Storage Capacity	
	<1 million bu (<25,500 mt)	≥1 million bu (≥25,500 mt)
Illinois	534	357
Iowa	373	293
Kansas	656	160
Minnesota	134	100
Nebraska	339	204
Gulf Terminal	-	12
Atlantic Terminal	-	4
Pacific Northwest	-	9
Great Lakes	-	18

Small country elevators are typically comprised of a main elevator with one leg, two pits, and no annex (Figure 2) while larger facilities include multiple legs and drives (Figure 3). In Iowa and Nebraska, the peak number of trucks per hour on the peak day during corn and soybean harvest was approximately 50 trucks/h (Table 2).

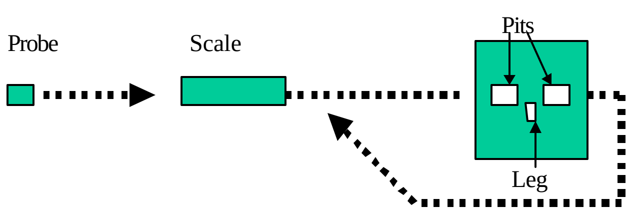

Figure 2. Small country elevator with probe ahead of the scale, one leg, and two pits.

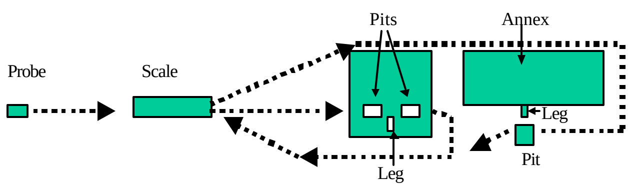

Figure 3. Large country elevator with probe ahead of the scale, two drives, two legs, and three pits.

The total time required to collect and evaluate a sample for grading factors varies between elevators, with numbers ranging from less than 1 minute to over 3 minutes (Table 3). The length of time required to assess the grain quality, in most cases, prohibited delaying the truck on the scale until test results were known (Herrman et al.

2001). Placing the sampling station before the scale (as depicted in Figures 2-3) facilitates grain segregation during harvest delivery.

Table 2. Truck size (small<11 t, medium 11-20.5 t, large >20.5 t), truck number, and the number of drives, legs, pits, and receiving capacity at 75 country elevators in Nebraska and Iowa.

Location	Truck Size			Drive	Leg	Pit	Receiving	Peak Truck
	% Small	% Medium	% Large	Number	Number	Number	Capacity (t)	Number (day)
Nebraska								
Average	37	38	25	2	3	3	623	166
Standard Deviation	18	11	16	1	1	1	350	70
Iowa								
Average	31	47	22	2	3	3	630	171
Standard Deviation	12	11	13	1	2	1	336	81

Table 3. Stopwatch time study results for sampling and receiving activities at elevators.

Activity	Time Used					
	Small Elevators		Medium Elevators		Large Elevators	
	Time per activity (s)[1]	Cumulative time (s)	Time per activity (s)	Cumulative time (s)	Time per activity (s)	Cumulative time (s)
Sample Collection						
Mean	42	42	36	36	42	42
SD	9		19		21	
Moisture						
Mean	72	114	66	102	38	80
SD	33		37		31	
Dockage						
Mean	23	137	33	135	33	113
SD	43		33		37	
Test Weight						
Mean	32	169	27	162	28	141
SD	48		37		40	

[1](s) = seconds

The U.S. Grains Council (1999) reports that corn transported from inland grain facilities to export facilities by carrier were 6% truck, 26% rail, and 68% by barge during 1990 to 1995. Capital investment in constructing or upgrading inland terminals has occurred during the past several years to capture new economic efficiencies associated with rail rates. Several mergers between the Burlington Northern and Santa Fe and between the Union Pacific and Southern Pacific railroad companies have accelerated this trend (Figure 4). Vessels used to transport feed grains and ingredients to export customers range in capacity from 20,000 mt to 50,000 mt.

PLANT PROTEIN FEED INGREDIENT INDUSTRY

The 1997 Economic Census (www.census.gov/epcd/ec97/us/US000_31.HTM) reports 93 soybean processing facilities that manufactured $14.5 billion in product annually. Soybeans processed into oil and soybean meal (SBM) undergo one of two systems: solvent extraction or mechanical extraction using extruders and expellers. The scale of these two processes varies, with the solvent extraction plants typically crushing 1,000 to

3,000 mt per day compared to the mechanical technique where 150 to 200 mt of soybeans are pressed in a day.

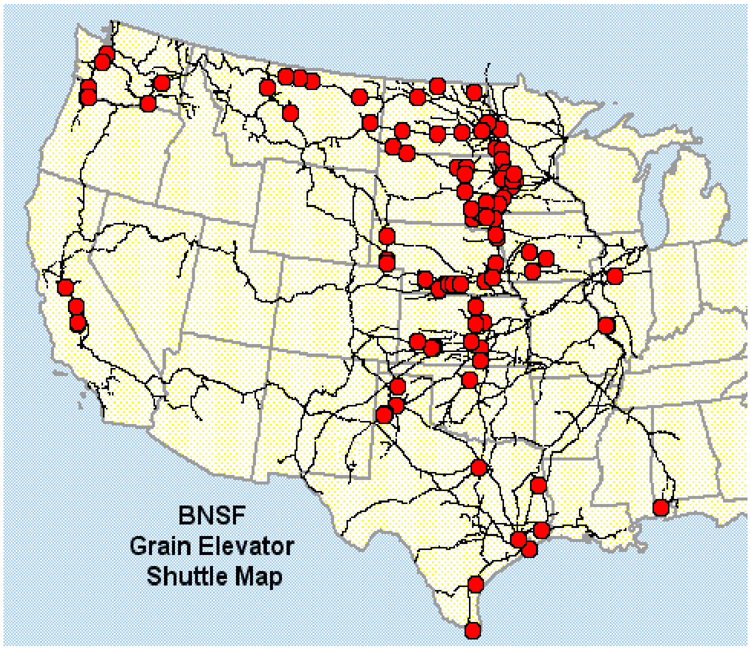

Figure 4. Map of inland terminals in the Burlington Northern Santa Fe railroad.
Source: http://www.bnsf.com/business/agcom/elevator/shuttle/shuttle.html

Solvent extraction processing of soybeans accounts for approximately 35 million mt of SBM annually (http://www.nopa.org/Stats.html). The process of preparing the soybeans for extraction begins with cleaning, followed by drying to 10% moisture content to assist dehulling (Figure 5). Soybeans then undergo cracking and dehulling through corregated rolls to produce 4-6 fragments that are conditioned to 11% moisture and 65-70°C, then they are flaked with smooth rolls. The solvent extraction process removes oil from the soy flakes by an organic acid in the "Rotocel" resulting in an oil/solvent mixture called a miscella. Oil is removed from the miscella through steam stripping with a two-stage stripping evaporator and stripping column. The organic acid, hexane, is removed from the de-fatted flakes in the desolventizer-toaster; then the meal is dried and cooled.

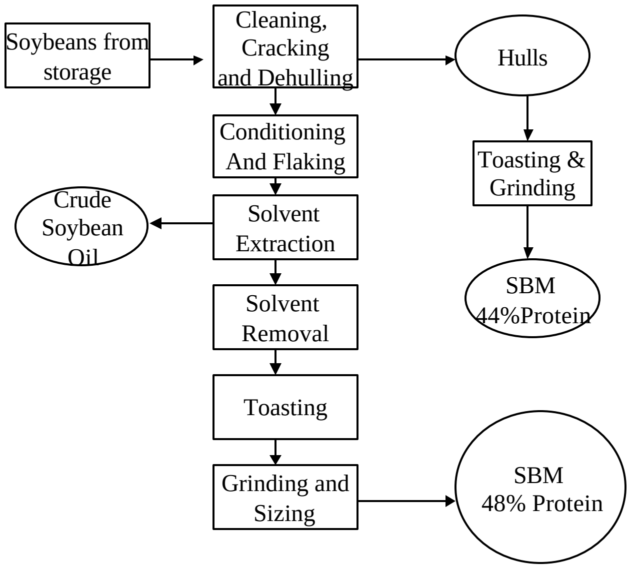

Figure 5. Process flow for crushing soybeans using solvent extraction.

Corn used for food and industrial purposes approaches 2 billion bushels (51 million mt) each year. The majority of this corn is subject to wet milling (76%), while 12.4% is used for dry-milled alcohol production, and 10.9% is used for dry milling and massa production. The 1997 Economic Census reports 58 corn wet milling facilities that manufactured $8.4 billion in product annually.

The corn processed in wet milling is typically separated into 5 components that include starch, germ, gluten, fiber, and steep liquor. The germ, gluten, fiber, and steep liquor are all used for feed. The rapidly expanding ethanol production in the U.S. will boost corn consumption and production of co-products. Many of the new ethanol plants utilize a dry milling process that yields distillers grain co-products.

FEED GRAIN AND PLANT PROTEIN MARKET STRUCTURE

The U.S. standard (commodity) grain business, characterized by handling and merchandising high grain volumes at low profit margins, remains the predominant system for merchandising cereals and oilseeds in the U.S. First promulgated in 1916, the Grain Standards Act (Public Law No. 190) provides the legal framework that facilitates grain trade through the establishment of uniform grading procedures and standards. Arbitrage opportunities exist during years where low quality grain can be purchased at a discount and blended to meet minimum or maximum grade and contract specifications.

Identity-preserved (IP) marketing focuses on preserving a specific trait typically found in a single variety or multiple varieties through the process of production, sorting, and maintaining that variety by name (or trait) with the intent of increasing the value of the product through the point of sale (Herrman et al. 1996). Segregation refers to a process by which crops are kept separate to avoid commingling during harvest, delivery, handling, storage, and transport to the end-user. Currently, there are no official definitions for these terms or practices in the U.S and the terms IP and segregation are often used interchangeably.

The demand by customers for process verification has lead to the implementation of auditable certification processes. Certification is an attempt to ensure genetic purity, consistency, and end-use performance with less reliance on costly testing procedures at every control point. In response to this emerging trend, the Grain Inspection, Packers, and Stockyards Administration (GIPSA) of the USDA will offer a Process Verification Program that conforms to ISO 9001 requirements and will provide a "USDA Certification" label to enhance buyers' confidence in the product that they receive. "The program will provide process verification services for grains, rice, pulses and products derived from these products. It will be designed for both export and domestic shipments. The process verification designation verifies the process and not the final product. The full range of processes could be verified from seed purchase to final product on grocery shelves (GIPSA 2002)."

The USDA already provides similar process verification programs for fruits, vegetables, and livestock. For example, Premium Standard Farms offers customers pork produced using USDA as the verification entity.

In contrast to the grain industry, most processors of plant protein feed ingredients do not possess the capability to segregate raw materials nor has the market signaled a demand for this practice. Several soybean crushers provide grower incentives for producing specific varieties that possess high oil and protein content and several have begun exploring traceability through a pilot project with the University of Illinois. Some smaller corn wet mills that process waxy corn may be able to implement segregation and documentation systems that trace corn back to a group of producers or production region.

RISK MANAGEMENT

Traceability systems put in place by the food industry mainly focus on the need to reduce business risk (Harding and Stockdale 2002). These systems enable rapid product recall at a reduced cost that can protect the reputation of the brand and business. This strategy was widely adopted by U.S. companies that process food grade corn following the recent Starlink™ problem.

To protect against market risk associated with off-grade grain and feed ingredients, U.S. exporter contracts typically require that the product conform to contract quality specifications at the U.S. export terminal. Sampling protocol for grain is contained in the Grain Inspection Handbook (USDA) of the Federal Grain Inspection Service of GIPSA. Disputes within the U.S. commodity grain trade are settled through the National Grain and Feed Association's Trade Rules and Arbitration System (2002). Soybean meal sampling protocols and dispute settlements are outlined in the National Oilseed Processors Association's (NOPA) Yearbook and Trading Rules (2001). Third party inspection, sampling, and laboratory evaluations may be performed at the purchasers' request.

Similar mechanisms that ensure contract compliance and resolve disputes are necessary risk management tools for future trade under EC regulation No 178/2002. The Process Verification Program offered by GIPSA may offer a comparable mechanism for ensuring traceability and managing risk to settle disputes. GIPSA recently implemented a Proficiency Program to evaluate the performance of laboratories that test cereals, oilseeds, and feed ingredients for the presence of GM events in the U.S. Results of these tests are posted at (http://www.usda.gov/gipsa/biotech/proficiency-program.htm). The mission of the USDA Grain Inspection, Packers and Stockyards Administration is to facilitate the marketing of grains, oilseeds, and related agricultural commodities. The Process Verification Program and the Proficiency Program offered by GIPSA address some of the new food safety requirements in EC No 178/2002. For example, in paragraph 15 of the opening remark the regulation contains the following:

> "Networking of laboratories of excellence, at regional and/or interregional levels, with the aim of ensuring continuous monitoring of food safety, could play an important role in the prevention of potential health risks for citizens."

EC "Implementing Regulations" should identify that these capacities exist in exporting countries that ship feed grains and ingredients to the EU.

CAPABILITY TO IMPLEMENT EU TRACEABILITY REGULATIONS

GRAIN

U.S. production agriculture successfully implemented traceability programs for seed production outlined by the Association of Official Seed Certifying Agencies' (AOSCA) seed production guidelines (http://www.aosca.org/ip.html) and through integrated food supply chains involving a network of producers, grain handlers, and processors. AOSCA procedures for corn seed production to prevent adventitious pollen contamination require field separation, e.g. 660 feet (201 m) between corn fields or a combination of separation from a field and border rows (61 m and 14 border rows). The AOSCA specifications for certified seed limit the amount of off-type corn, or off-type soybeans in these respective crops, to 0.5 percent.

Many of the production steps for producing non-GM food grade corn are outlined in Figure 6. This figure depicts the production steps, best management practices (BMPs) and points requiring implementation of standard operating procedures. These practices will also facilitate the implementation of a system-wide traceability program.

In 2001, two workshops involved food processing representatives who discussed their IP procurement and handling systems: 1. Certifiable Quality Management Systems for the U.S. Grain Handling Industry conducted in Big Sky, MT (Maier and Herrman) and 2. Knowing Where It's Going, Minneapolis, MN (Fernandez and Smith). The InnovaSure program by Cargill Foods includes an approved list of corn hybrids that are non-GM and possess hard endosperm. These hybrids are delivered to 9 commercial elevators that are dedicated to the IP program to avoid commingling. The Frito Lay IP program also includes an approved list of hard endosperm corn hybrids that are grown under contract. Frito Lay currently requires field maps including identification of what is grown in neighboring fields and confirmation that producers will handle corn properly including application of approved herbicides and insecticides. General Mills' management anticipates that 50% of their total grain needs will be meet through IP systems by 2005. Key components of their IP program include clearly defined value, use of certified seed, field scouting, closed loop contracts, defined marketing plans, producer accountability, and product traceablity. IP programs' success depends on all participants giving up some control, according to Tom Willis, Manager of Special Products Division with General Mills.

Commonalities of these programs include establishment of a producer and processor working relationship prior to planting. These relationships commit each to certain obligations including seed selection, cultural practices, and record keeping by the farmer and defined contracts with premiums by the processor.

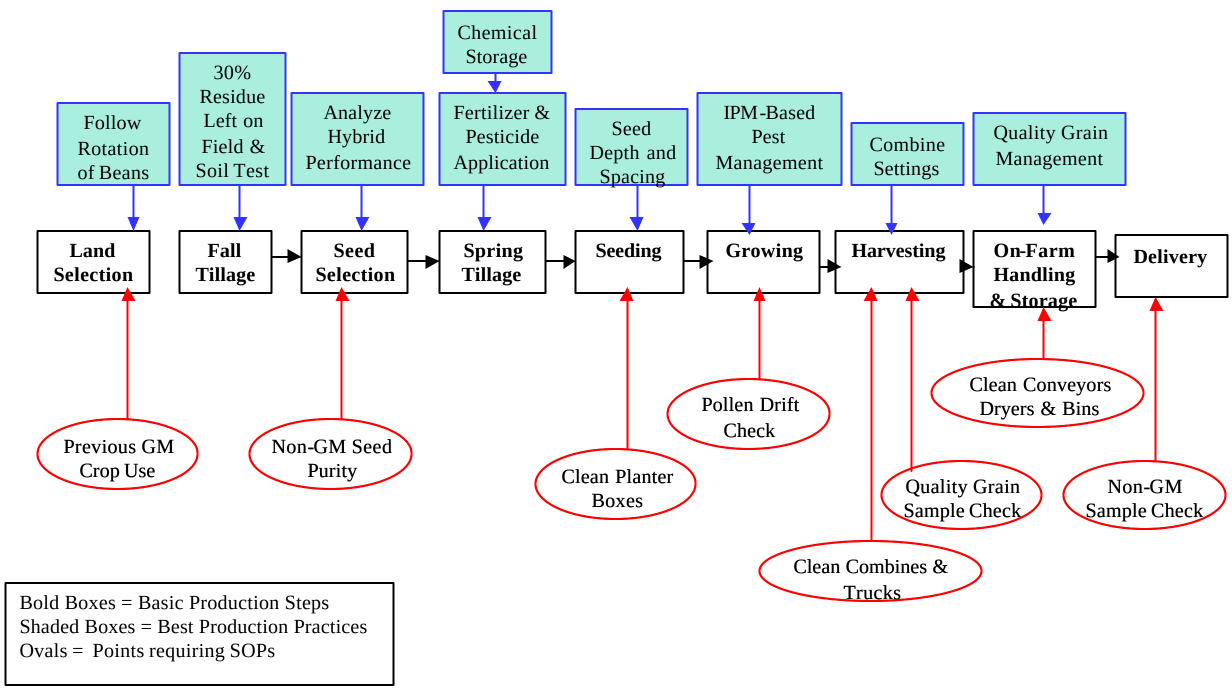

Figure 6. Steps in producing food grade non-GM corn including points requiring standard operating procedures that accompany best management practices (Source: Dirk Maier, Purdue University).

Ingles et al. (2002) studied the amount of commingling that can occur during handling using the research elevator facility of the USDA-ARS Grain Marketing and Production Research Center (GMPRC) in Manhattan, Kansas. Engineers ran white corn through the grain receiving system followed by yellow corn. They reported the overall commingling effect was below 1 percent and the amount of commingled grain was negligible after running grain through the system for several minutes. Commingling occurred at the following points: grain cleaner, receiving pit, boot of the bucket elevator, and weighing scale. The greatest amount of residual grain was recovered in the boot of the bucket elevator.

Figure 7 illustrates points where commingling may occur in a commercial elevator. The grain delivery occurs via truck or train and is elevated via bucket elevator. The grain may be directed through a distributor, across a drag conveyor and into a grain bin, or run through cleaning equipment and placed in a holding bin above a scale that directly loads railcars for shipment to an export terminal or end-user. Commingling of grain may occur within each piece of equipment and between transition points.

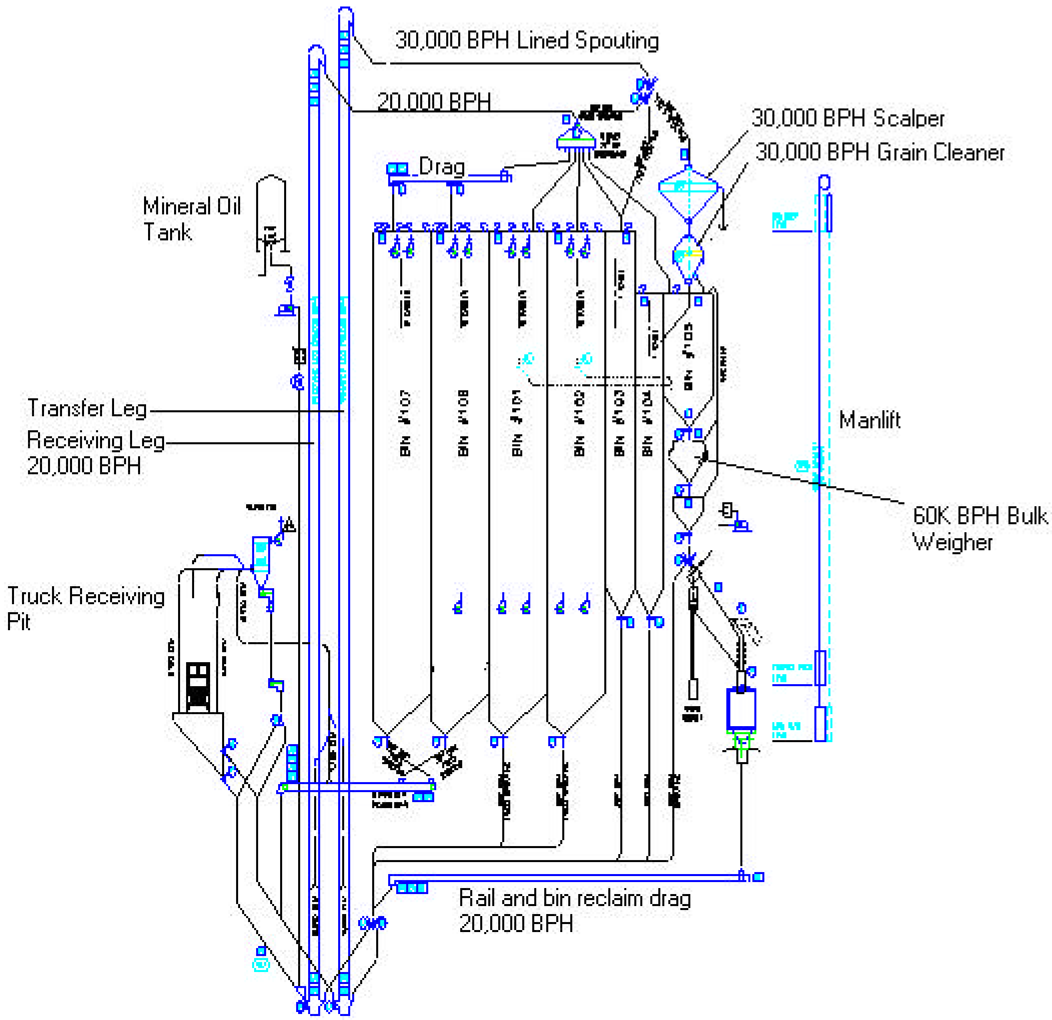

Figure 7. Inland grain terminal flow diagram (Lee Sargent of Todd and Sargent, Inc.).

Figure 8 outlines the necessary steps to implement a certifiable quality management program with traceability during grain handling and transport. The process flow includes receiving, grain placement, grain storage, and grain reclaim and shipping (un-shaded boxes). The shaded boxes represent all the activities required to implement traceability, and the ovals list activities that require standard operating procedures (SOPs). This model also represents the logic necessary to implement an ISO 9002 quality management program. Currently, there are 2 grain elevators in the U.S. that are ISO 9002 certified;

both are located in Iowa and were part of a pilot program that started in June 1999 (Huston 2001).

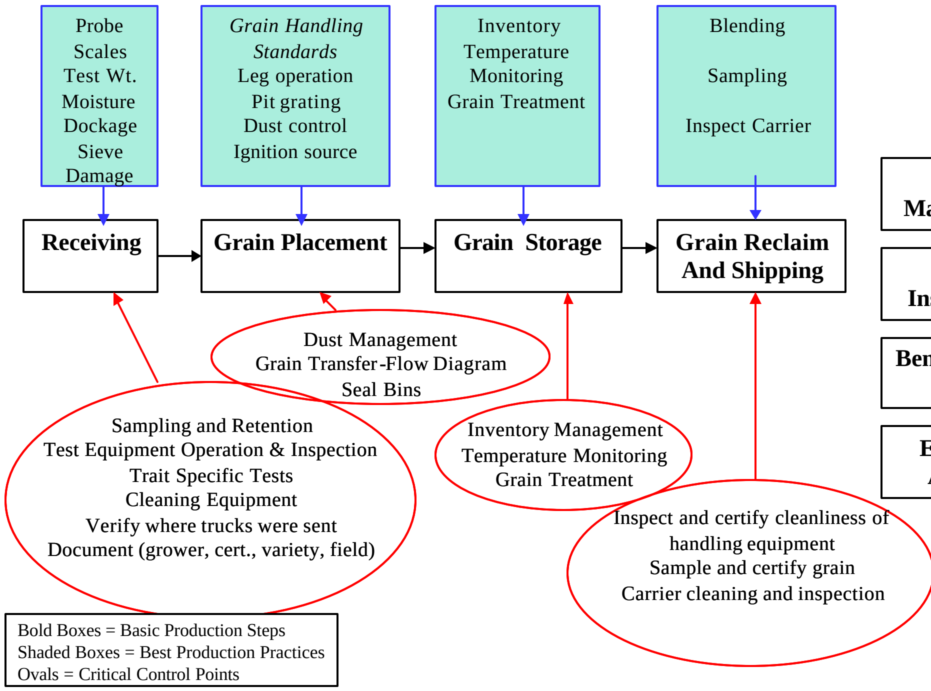

Figure 8. Steps in handling cereals and oilseeds in commercial grain elevators and points requiring SOPs necessary for traceability.

PLANT PROTEIN FEED INGREDIENTS

Currently, several of the soybean crushers using solvent extraction are working toward implementing quality management systems that enable trace back to an individual field. Smaller corn wet milling operations that process waxy corn probably can implement a protocol that can trace a product back to a group of producers. U.S. farmers who produce food grade corn also raise crops that go to wet millers and soybean crushers, thus, the capacity to implement traceability from producer through grain handler does exist. A major hurdle at the processor level involves the large capacity of corn wet mills and soybean crushing plants. These facilities frequently utilize raw material from large geographical regions (multiple states) and receive grain via unit trains that have 100+ cars and each car contains approximately 90 mt.

The Center for Veterinary Medicine of the Food and Drug Administration initiated investigation into developing HACCP regulations for this industry in 2001 (McChesney). "The 2002 budget for CVM has approximately $300K for developing HACCP for the protein industries involved in feed manufacturing. The money is for writing the proposed rule, developing pilot programs with at least 2 firms, educating the industries involved and training Federal and State inspectors in the application of the program." This regulation will not require traceability, however, it will begin to address Article 17 (Responsibilities),

> "Food and feed business operators at all stages of production, processing and distribution within the businesses under their control shall ensure that foods or feeds satisfy the requirements of food law which are relevant to their activities and shall verify that such requirements are met."

The European Feed Manufacturers Federation (FEFAC) encourages the adoption of HACCP-based QA systems all along the feed and food chain to ensure and document that everything has been done to ascertain the sanitary status of agricultural products sold to the final consumer and to facilitate any recall action if necessary (Doring 2002) . Doring concludes that a HACCP program fulfils the traceability requirements of EC No 178/2002.

Thus, altering EU traceability language to permit a HACCP-based quality assurance (QA) system for the U.S. plant protein industry could be achieved without requiring trace back to an individual field, which is currently viewed as impractical by some industry representatives. The major SBM exporting companies in the U.S. also own SBM processing and shipping assets in South American countries. Harding and Stockdale (2002) report that many non-EU countries see traceability as disproportionate and thus, there is little likelihood that there will be any international agreement on mandatory traceability.

Agricultural economists at the University of Illinois initiated a project titled "Development of a Pilot Electronic Information and Certification System for Value Added Soybeans". The project tracks movement of the soybeans through production, storage, handling and transportation activities. The Illinois Department of Agriculture is responsible for audits at the elevator and processor level and provides oversight for the entire system.

COSTS TO IMPLEMENT TRACEABILITY REGULATIONS

In an attempt to answer the question, "What are the likely costs of large-scale segregation of non-GM crops?" Lin et al. (2000) prepared a special article on *Biotechnology: U.S. Grain Handlers Look Ahead*. In their report, they projected the cost of segregating non-GM crops at $0.22/bu for non-GM corn to $0.54/bu for non-GM soybeans, excluding producer premiums. Their cost estimates reflect a scenario analysis, using a University of Illinois study (Bender et al. 1999) that explored the costs of segregating specialty corn and soybeans. The study characterizes segregation and marketing costs from the country elevator to the export elevator. Lin et al. defined segregation activities as less stringent than IP marketing systems; the later requires a more strict separation, typically involving containerized shipping, be maintained at all times. Lin et al. did not offer a cost estimate for IP marketing of non-GM cereals and oilseeds.

Good and Bender (2001) reported results of a mail survey sent to over 343 U.S. firms that were identified as possible handlers of special grains and oilseeds. They obtained 81 usable surveys, of which 7 handled non-GMO corn and 23 handled non-GMO soybeans. The additional average cost for handling non-GMO corn was $0.0385 with premiums ranging between $0.08 and $0.12 per bushel. For non-GMO soybeans, the additional average handling costs (excluding grower premiums) were $0.0808/bu with premiums ranging from $0.10/bu to $0.15/bu, respectively.

Bennett and Kitching (2000) examined the economic implications of imported GM soybean and corn livestock feed ingredients in the United Kingdom using a gross margin analysis and three scenarios. They highlighted the cost savings using GM feed ingredients by species and scenario (e.g. £0.30 ($0.46) per pig, medium scenario for GM soybean meal) and added cost using non-GM feed ingredients (£0.81 ($1.25) per pig medium scenario for non-GM soybean meal). They concluded that swine production costs would increase between 3 to 4 percent using non-GM feed ingredients or add £1.64 ($2.53) to the price of each finished pig using accredited non-GM corn and soybeans.

Maltsbarger and Kalaitzandonakes (2000) reported hidden (opportunity) costs when performing IP marketing of high oil corn including grinding of corn for feed, difference between the cash market and futures market (also referred to as basis), and under-utilized storage. Blending and transportation opportunities, which are the major sources of revenue in the grain industry, also may be lost in an IP marketing system. Their study projected costs ranging between $0.17 and $0.37 per bushel for total IP costs.

Hurburgh et al. (1994) developed an engineering economic model to estimate the costs of segregating corn and soybeans using data from Iowa country grain elevators. They found that most country elevators could segregate inbound grain for 3 cents per bushel or less while only 10% of the elevators in the study had costs greater than 4 cents per bushel when testing required 60 seconds or less. Their cost estimates were based on NIR identification of protein and oil as opposed to the lengthy and costly process of GM-testing.

Berruto and Maier (2001) modeled the effect of segregating non-GM soybeans at a major Corn Belt elevator. They predicted that the service times for trucks delivering commodity products would increase by 5 to 7 minutes per truck when 50% of the trucks delivering soybeans (equal to 12.5% of all trucks) were tested for non-GM certification. Non-GM declared soybean trucks had to wait more than 21 minutes longer than trucks delivering commodity soybeans. This had a significant cumulative effect on the actual time all customers spent waiting in line.

Herrman et al. (2002) modeled wheat harvest activities for three different elevator configurations with the sampling station located before and at the weighing station. The total time required to collect and evaluate a sample for grading factors varies between elevators, with numbers ranging from less than 1 minute to over 3 minutes. The length of time required to assess the grain quality, in most cases, prohibited delaying the truck on the scale until test results were known (Herrman et al. 2001). Placing the sampling station before the scale facilitates grain segregation during harvest delivery. Heishman (1998) reports that delay costs associated with segregating wheat during harvest accounted for 15.8% to 27.5% of the total segregation costs.

LABELING AND PRODUCT RECALL

The labeling of food and feed is practiced throughout developed countries. In the U.S., the Current Good Manufacturing Practices, contained in the Code of Federal Regulations Title 21 Part 225, require labeling that,

> "… identifies the medicated feed and provides the user with directions for use which, if adhered to, will assure that the article is safe and effective for its intended purposes" (225.80).

Feed labels include a quality statement, product name and brand name, guaranteed analysis, common name of ingredients or use of collective terms, name and mailing address of the manufacturer, directions for use, and precautionary statements (AAFCO, 2001).

The requirement for records will permit the manufacturer to relate complaints to specific batches and/or production runs of the medicated feed and will help in instituting a recall.

Within Article 20 of EC No 178/2002, the regulation states:

> "If a feed business operator considers or has reason to believe that a feed which it has imported, produced, processed, manufactured or distributed does not satisfy the feed safety requirements, it shall immediately initiate procedures to withdraw the feed in question from the market and inform the competent authorities thereof."

The use of labels as a mechanism to withdraw feed in question from a market is a sound regulatory practice. The Center for Veterinary Medicine for the Food and Drug Administration regulates this activity within the U.S. and this practice reduces food/feed safety threats.

A need for labeling/guarantees of attribute levels in seed is a need identified in a recent study being conducted by faculty at the University of Illinois who are working with producers, handlers, and soybean crushers to implement a system-wide traceability program.

SUMMARY AND RECOMMENDATIONS

- Currently, some producer-processor supply chains in the U.S. food sector have implemented programs that can trace grain through all stages of production, processing, and distribution.

- IP programs are designed to meet tight thresholds (e.g. 1% GM threshold in non-GM grain or feed ingredient). Segregation programs designed to meet less stringent thresholds (e.g. 5% GM threshold in non-GM grain or feed ingredient) are less costly to implement and most studies that quantify costs address the later scenario.

- A need exists to develop protocols and cost estimates to implement a traceability program for plant protein feed ingredients (corn gluten meal and SBM).

- The Center for Veterinary Medicine (CVM) will begin writing a proposed HACCP rule for the protein industries involved in feed manufacturing. HACCP implementation in the protein industries should be explored as an alternative for traceability requirements within the EU food safety regulation.

- A trend toward implementing certifiable quality management systems has emerged in the U.S. grain industry as a mechanism to ensure food safety and product quality. This type of program focuses more on process verification than on inspection. The USDA will begin offering an auditing service to certify third party verification programs for the IP markets.

- Flexibility, cost control, and risk aversion are commonalities among many of the grain handlers within the U.S. U.S. companies supplying feed grains and ingredients to customers bound by regulation EC No178/2002 will need a mechanism to manage market risk prior to grain and feed ingredient export. Risk management may present the greatest hurdle for the U.S. feed ingredient industry as export customers promulgate new regulations that increase the shippers' liability.

- Most successful U.S. examples of supply chain management of cereals and oilseeds have been initiated by processors and involve contracts. To control planting decisions, these supply chain systems require supply commitments that can extend for 18 months or longer.

- Research directed toward characterizing the feasibility of implementing traceability protocol for corn gluten meal and SBM including simulation model, quantifying costs, and creation of science-based performance standards, should be performed. Additional research that identifies inefficiencies in existing IP and segregation programs and development of technical training materials to facilitate wider adoption and portability of quality management systems are needed.

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