

**PRODUCT DIFFERENTIATION AND IDENTITY PRESERVATION:
IMPLICATIONS FOR MARKET DEVELOPMENTS IN U.S. CORN
AND SOYBEANS**

Karen Bender
University of Illinois – Urbana Champaign

paper presented at the

Symposium

**“Product Differentiation and Market Segmentation in Grains and Oilseeds:
Implications for Industry in Transition”**

Sponsored by
Economic Research Service, USDA
and
The Farm Foundation

Washington, DC

January 27-28, 2003

PRODUCT DIFFERENTIATION AND IDENTITY PRESERVATION: IMPLICATIONS FOR MARKET DEVELOPMENTS IN U.S. CORN AND SOYBEANS

Karen Bender

INTRODUCTION

When viewing the landscape of identity preservation (IP) in the U.S., one observation is that the characteristics of marketing channels supplying value added products are not constant across all products. The participants in the market channel, activities conducted by participants, and oversight and auditing provided by third parties may all vary within market channels from one value added crop to the next. This paper will outline commonalities and differences within identity preserved systems for value added crops, describe some of the drivers which account for these differences and then suggest where identity preservation systems may be headed within the United States.

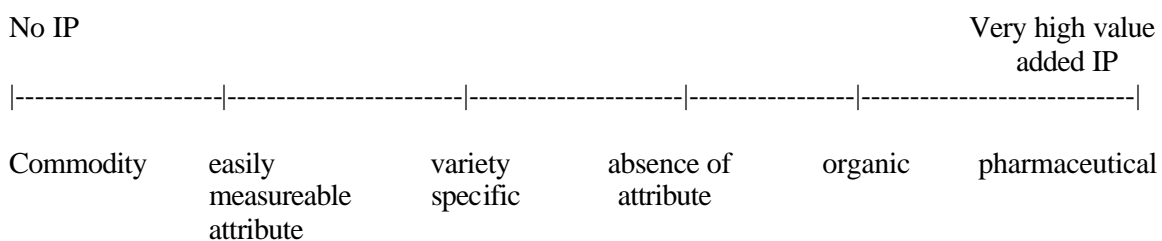
A starting point for understanding the varying structure and characteristics of current identity preserved systems is to review the types of identity preservation systems currently utilized in the United States. Two primary distribution systems have traditionally existed for corn and soybeans - one distribution system has focused on commodity crops, and the other distribution system has focused on very high-value traits. The distribution system for commodity crops is focused on homogeneity, where homogeneity drives the system toward average quality, and thus limits the opportunity to match the level of specific attributes available in different crop lots to the needs of different buyers. This distribution continues to service the supply of the majority of the corn and soybean crop production.

A small percentage of trade in corn and soybeans has been in high value crops, such as certified organic corn and soybeans. An identity preserved supply chain used for these high value crops typically consist of a specialty grain firm contracting variety specific grain production, with particular production and/or management requirements. The farmer stores this production on farm, and frequently delivers it directly for loading onto a container for export shipment, delivers directly to the processor, or delivers for direct loading onto trains for domestic shipment. The goals are to minimize the number of handlings so as to reduce quality deterioration and to minimize the potential for commingling with non-differentiated corn or soybeans.

A problem resulting from the reliance on two primary distribution systems is that neither channel can cost effectively supply many of the more recent differentiated value-enhanced crops. Many of these new value added crops are produced in larger volumes, relative to the very high-value trait crops. With the growing attention placed on biotechnology and genetic modifications and value-added crops, there has developed a need for market channels that will allow distribution of a product that is identity-preserved, but in a less rigorous system than is used for very high valued crops.

Figure 1 represents a continuum of marketing channel systems, which range from commodity market channels to the very high value added identity preservation systems. Many of the newer marketing systems developed for value added corn and soybean markets lie between the traditional commodity and very high value added IP market channels. Examples of these value enhanced crops include high oil corn, white corn, waxy corn, and high oil soybeans. In addition, these intermediate marketing channels are currently being used for non-genetically modified crops. The supply chain used for these crops is less production and management-intensive than for very high value added IP crops, but still requires segregation to preserve the identity of the differentiated crop that is not required in the traditional market channel.

Figure 1. Marketing Channel Continuum



This continuum suggests that the marketing channel closest in characteristics to the commodity marketing channel is for value added crop with easily measureable attributes. Examples of value added crops with easily measureable attributes include high oil and high protein soybeans, high protein wheat and high starch corn. For these attributes, near-infrared (NIR) measurement technology exists which can be utilized at fairly low cost at the place of first delivery (primarily country elevators) to measure the level of attribute in each lot. Varietal specification is not required for these attributes, and measurements at delivery can be used to segregate based on attribute level. For example, in some years there are market demands for higher protein wheat, and wheat may be segregated into lots below and above a certain protein level. In most cases, there is a minimum level (percentage) of attribute which must be achieved to receive a premium, and higher premiums may or may not be paid for increasing levels above this minimum. While some contracts exist for easily measurable attributes which require specification of a particular variety, many of these markets do not require the specification of variety. Therefore, producers are free to choose any variety which they find might meet the desired attribute level.

As one continues along the continuum from easily measurable attributes, the next marketing channel is characterized by the use of variety specific contracts. For these contracts, producers are required to produce a specific variety or allowed to choose from an approved variety list. Producers may need to be compensated for “yield drag” of the specified varieties, and often must submit seed tags or invoices for proof of which variety they planted. These varieties are segregated upon delivery to the elevator or processor, but rapid low cost tests to check for varietal purity are not currently available. Varietal

purity tests are typically based on visual inspection of pod and seed characteristics and are generally conducted in a lab environment.

The next marketing channel identified on the continuum is for value added crops that are purchased because of their lack of a specific attribute. This is a more complicated scenario due to the difficulty in testing sufficient quantities of the crop to provide assurance that the attribute is absent. The attribute most frequently marketed through this channel are non-genetically enhanced crops. For soybeans, the only current test is for determining the presence of the Roundup Ready® trait. For corn, the testing is more costly as there are multiple biotech events which have been introduced in corn.

The last markers along the continuum are for the certified organic and very high value added IP market channels. The market channel for organic was previously described. Examples of crops which would utilize the very high value added type of marketing channel are pharmaceutical crops. The characteristics of the very high value added IP systems continue to evolve, as only small quantities of these crops have been moved through any commercial system. However, one can expect that these IP systems will be the most rigorous of any marketing channel.

What this continuum attempts to demonstrate is that there are characteristics that differentiate the need for, and use of, different marketing channels. The differentiating characteristic used in this continuum is the ease and availability of testing to provide quality assurance when the value added product is delivered to the elevator or processor. Other marketing channel characteristics might change the order of product categories somewhat, but the result would be similar in that no single marketing channel would be sufficient to supply the breadth of value added crops in today's marketplace.

WHAT DO WE KNOW ABOUT IP?

Understanding that multiple marketing channels are necessary to service the variety of value added crops produced in the United States is important. Additionally it important to understand how these market channels differ in more detail. In this section, data used for analysis is collected from participants involved in value added markets in Illinois. The data is used to identify how various value added crops, and their associated marketing channels, differ in terms of use of contract, contract requirements and additional costs incurred by producers and elevators in delivery these crops. Much of this material is available in more detail in publications referenced below each of the tables presented in this section.

Table 1 presents the use of producer contracts for production of value added crops in Illinois during the 2000-01 marketing year. Except for yellow food grade corn, most crops handled were produced under contract. The yellow food grade corn production not under contract is an example of value added crops produced for easily measurable attributes, such as high starch or low stress crack corn.

Table 1. Utilization of Contracts in Illinois, 2000-01 for Selected Crops

Value added crop	Mean percent of producers contracting production
White food grade corn	79
Yellow food grade corn	38
Tofu soybeans	63
Non-gm soybeans	85

Source: Good, D. and K. Bender, 2001.

In addition to understanding the relevance of production contracts for value added markets, it is also helpful to understand the characteristics which are incorporated in some, if not all contracts. Table 2 demonstrates some of the characteristics specified for four value added crops in producer contracts in Illinois. The contract specification most frequently specified, regardless of crop, was delivery location. Over 80% of all value added crop contracts included a requirement on specific delivery location. Almost all yellow food grade corn and tofu soybean contracts included specification of variety, while only 50% or less of the white food grade and non-gm contracts include a variety requirement. Conversely, the percent of contracts including a requirement for quality testing was higher for these two value added crops where variety was not specified.

Table 2. Percent of Respondents whose Contract Included Each Specification, for Selected Crops

Value added crop	Variety	Production Management	Quality Testing	Delivery location	On-farm storage
White food grade corn	46	36	55	82	73
Yellow food grade corn	88	13	50	88	50
Tofu soybeans	93	47	27	93	33
Non-gm soybeans	50	50	63	100	44

Source: Bender, K. and L. Hill, 2000.

The relevance of differences in marketing channel characteristics, as identified above by either differences in the use of contracting or the contract specifications can be viewed in terms of the impacts on the additional costs incurred in the production, handling and marketing of value added crops relative to costs incurred for traditional commodity markets. Illinois producers and grain and oilseed handlers were surveyed to identify the additional costs they had incurred when participating in value added crops. Tables 3 and 4 demonstrate some of the costs identified by survey respondents at the producer and grain handler level, respectively.

Producers were asked to quantify the additional costs they incur for specific production, handling and marketing activities for each value added crop they raise. Table 3 illustrates that there is a wide range of both additional production and harvesting/marketing costs

incurred by producers across different value added crops. For the crops presented in Table 3, total added costs, as documented by producers, ranged from \$0.17/bu for non-GM soybeans to \$3.02/bu for tofu soybeans. For Illinois elevators, the total additional costs of handling value added crops ranged from a low of \$0.06/bushel for tofu soybeans to \$0.15/bushel for white food grade corn (Table 4).

Table 3. Total Average Additional Production Costs (\$/bushel), for Selected Value Added Crops in Illinois

Value added crop	Production Costs	Harvesting and Marketing Costs	Total Producer Costs
White food grade corn	0.03	0.46	0.49
Yellow food grade corn	0.40	1.21	1.61
Tofu soybeans	0.48	2.54	3.02
Non-gm soybeans	0.07	0.10	0.17

Source: Bender, K. and L. Hill, 2000.

Table 4. Total Average Additional Handling Costs (\$/bushel), for Selected Value Added Crops in Illinois

Value added crop	Total Handler Costs
White food grade corn	0.15
Yellow food grade corn	0.11
Tofu soybeans	0.06
Non-gm soybeans	0.10

Source: Good, D. and K. Bender, 2001.

FACTORS INFLUENCING THE USE AND FURTHER DEVELOPMENT OF IDENTITY PRESERVATION

Numerous factors have and will influence the need for non-commodity market channels for supplying value added products. The influence of six specific factors on the use and development of IP systems will be described in this section: biotechnology, precision agriculture, measurement technology, food safety, competition and the role of non-traditional players.

Biotechnology

Two broad categories of biotechnology applications in the grains and oilseeds sector are envisioned as the engines of structural change in the production and use of corn, soybeans, and other crops: modification of traits that affect agronomic performance and modification of output traits that affect value in end use. Input trait biotechnologies arrived to market first. This was seen by holders of biotechnology patents, *ex ante*, as an important element of the rollout of biotechnologies. Genetically modified input traits did not affect the use value (in processing or consumption) of the product since its nutritive attributes remained the same. Producers would adopt the GMO for economic reasons,

perhaps, with positive environmental impacts. New output traits would follow as the technology developed, after the market -- buyers and sellers -- had been accustomed to new input traits.

Traditional supply chains were envisioned for distribution of input trait-modified soybeans, since these soybeans do not affect value to the end-user and therefore are not physically differentiable from non-modified varieties. However, with the recent development of international concerns about the basic technologies of genetic modification (particularly in Europe, but also extending to Japan and other countries), some or all types of genetically modified soybeans may need to be segregated from non-modified soybeans. Firms must identify which of their customers require non-genetically modified soybeans, identify how the soybeans can be segregated throughout the supply chain, and evaluate whether existing testing technologies can ascertain if soybeans they receive are genetically modified.

Precision agriculture

Although the role of precision agriculture was highly touted in terms of its economic benefits to commodity agriculture, a role for precision agriculture may develop for value added crops. If consumer demand for historical information on their foods increases, such as when their food was grown, what was applied, and when it was harvested and delivered, precision ag technology might enable electronic capture of information in real-time. For example, the use of global positioning systems (GPS) data could allow a producer to document the date and time of production activities, such as planting, pesticide or fertilizer applications, and harvest within a specific field or area of a field. If GPS capabilities were more fully utilized, the producer could also capture what time the combine unloaded into the grain cart, when the grain cart unloaded into a grain truck, and when the grain truck delivered to a specific elevator facility.

Measurement technology

Measurement technology is a key factor in the development and growth of value added crop markets. The need to test for the presence, or absence, of specific product attributes, and to quantify the level of the attribute is an inherent component of almost all IP systems. Additional demands on measurement technology are that it be rapid, accurate and repeatable. Measurement of basic attributes such as protein, oil and starch is available that meets these characteristics. However, the need for measurement is moving toward more sophisticated attributes, such as isoflavones and amino acids. In some instances, the need for measurement technology is further complicated by proprietary constraints – for example, what happens when the attribute is developed by an individual company for a specific product and measurement of the attribute is not available to all market channel participants? It is difficult to measure the amount of public resources necessary to ensure that the criteria of accurate and repeatable results are met, since the number of new attributes that need to be measured could potentially increase exponentially due to biotechnology.

Food safety

Food safety concerns have received much attention over the past year. Concerns over terrorism in general, and more specifically bio-terrorism, have combined with consumer demands to know more about what they're eating, where it's from and how it was grown. Consumer demands for more information about their food may require additional documentation of activities at the production, handling, storage, processing and manufacturing sectors. In these first sectors in particular, much of the record keeping of activities is still done using paper and pencil. Anecdotes of the huge piles of papers being sent along on individual barges and even larger mounds of papers delivered on ocean vessels suggest that the need for capturing activities in electronic format are either already here or quickly coming down the pike. The transfer of actual documents can be burdensome in terms of both quantity and risk, i.e. the risk of losing important papers or the risk of forgetting to provide specific paperwork.

Information technology may also be needed to improve market signals that are driven by consumers, but must flow back to producers, seed companies, and even biotechnology companies to allow complete feedback loops.

Competition

Competition for value added markets arises in several forms. First, there is competition across suppliers, both domestically and globally, for these markets. Countries such as Australia and New Zealand are competing with suppliers from the U.S. and South America for markets in both Europe and Japan. Secondly, there is competition among ingredients. If the cost to a food manufacturer of purchasing a particular value added attribute is too high, the manufacturer may simply choose to substitute another ingredient. For example, anecdotal evidence indicates that some food manufacturers have shifted away from purchasing corn starches because the cost of assuring that the supply was from non-genetically enhanced corn was too high. Instead, the manufacturers shifted to other starch supplies such as wheat or potato starch.

Pursuing some value added market opportunities may be prompted by needs for higher returns, however pursuing other value added market opportunities may simply be required to maintain market access. From the producer perspective, this may mean there is a need for new management and service activities. If new value added markets follow the same trends as traditional value added markets in the U.S. (e.g. food grade corn and soybean markets), in the sense that once those contracts have been made with producers there is very little turnover, then those suppliers who participate in these new developing markets may be very well positioned to continue supplying these markets, as well as new market opportunities. Those producers who choose to not initially participate, may lose the opportunity to supply these markets, and perhaps future markets, for good. This is partly because those producers participating early on are most likely to learn any new needed skills and improve current skills as their involvement in the supply chain for the new market continues.

Non-traditional players

In the development of global value added markets for corn and soybeans, consensus must extend beyond local transactions between seed companies, farmers and country elevators to include domestic and international merchandisers, processors, consumers, and regulatory agencies. Particularly for biotech crops, actors outside the boundaries of the “traders carrying on extensive transactions”, such as environmentalists and consumer groups, have leverage in deciding not only what value added crops may be acceptable (such as only non-GM), but may also influence some of the rules of the market that may be required for acceptance, such as labeling requirements.

As is evidenced by the role of Greenpeace and other consumer groups in Europe, by ignoring the perspectives of non-traditional players in the development of genetically enhanced crops the initial acceptance of these crops in that marketplace was significantly harmed. Domestically, concern has been raised by food companies and others about the production of pharmaceutical crops in major production areas.

IMPLICATIONS FOR MARKET DEVELOPMENTS FOR U.S. VALUE ADDED CROPS

In a 1999 statewide survey of Illinois handlers, those country elevators which were handling value-enhanced soybeans anticipated that over 20% of soybean production in their area would be committed to value-enhanced soybeans in 2005, while those elevators not currently handling value-enhanced soybeans expected value-enhanced soybeans to comprise 14% of soybean production in 2005 (Good et al., 2000). Country elevators handling value-enhanced corn estimated that 30% of corn production in their trade area would be dedicated to value-enhanced corn, while those not currently handling value-enhanced corn estimated that 19% of the corn production in their area would be committed to value-enhanced corn.

What these numbers demonstrate is an expectation that the demand for differentiated crops would continue to grow. With an increasing quantity of value added crops flowing through alternative marketing channels, and with an increasing number of value added crops either on the market or in the pipeline, the need for and use of identity preservation will also continue to grow. While many of the factors influencing the current and future development of alternative marketing channels were described above, this section will focus on the potential shift within marketing systems from product attributes to process attributes.

Product versus Process

One of the trends occurring in value added crop markets is a shift from product certification to process certification. The introduction of biotechnology, and the resulting need to segregate genetically enhanced crops from non-genetically enhanced crops for some markets, has been a major driver of the shift toward process certification. It is easier to detect the presence of a specific attribute in a given crop lot than to detect the absence of a specific attribute in the same crop lot. While contracts for non-genetically

enhanced crops have developed which require the marketing channel to deliver a product that does not exceed a specific threshold level, there are instances where best management practices are followed and yet the threshold is exceeded. How can this happen? It starts with the seed. Suppose a producer purchases a seed that is promoted as non-genetically enhanced. There is no requirement for seed companies to label the percentage of genetically enhanced or non-genetically enhanced seed in this seed bag. Thus, the producer has no information as to the level of genetically enhanced seed that may exist in the seed. Particularly for soybeans, with the high adoption rate for Roundup Ready® soybeans, the seed bag may contain some genetically enhanced seed. Depending on the threshold level and the percentage of seed that is actually genetic enhanced, a scenario may occur where the producer has exceeded the contract threshold upon planting. Adventitious commingling may occur at harvest, in on-farm storage units, at the elevator delivery pit, in elevator bins or handling systems, in transport vehicles from the elevator (example: trucks, rail cars), etc. etc.

Because the cost of segregation and testing must be lower than the value added for the particular crop, there are limits on the amount of cleaning, segregation and testing that can occur for costs to not exceed benefits. Thus, some marketing systems have begun to shift toward process-oriented systems from product-oriented systems. In process certified systems, the emphasis is on identifying the best management practices which would result in delivery of high quality products. Then documentation, auditing and testing activities are incorporated in the process to ensure that participants are adhering to the practices developed for the system. In a process-oriented system, specific activities can be added and removed for each value added product based on the cost and benefit of the activity. For example, a buyer might want to purchase non-gm soybeans that meet a threshold of 0.5% tolerance. Instead of basing the contract solely on testing, which as identified above could become quite expensive, the buyer and seller might agree to use a process-oriented system. In this example, the system might include having the seed tested to identify the level of genetically-enhanced seeds before planting. If a certain level was identified, then the producer would switch to an alternative seed. Similarly, the system might require cleaning of planting and harvesting equipment, bin cleaning both on-farm and at elevators and processors, and record-keeping to identify planting, harvesting, storage, handling and delivery activities within the market channel. If these activities are accurately completed, then the buyer would accept delivery of the product, regardless if the final product exceeds the desired threshold.

Numerous approaches are being taken by individual producers, producer groups, grain handlers and processors as they develop or expand their participation in identity preserved markets. Certification programs, quality assurance programs, and auditing and testing mechanisms are being explored as players attempt to meet market demands, or differentiate themselves from their competitors. For example, some individual producers and elevators are either undergoing or have completed activities required to become ISO certified. Others are looking for public agencies or private businesses that will certify them as trained in various activities, such as proper equipment cleaning techniques, appropriate record-keeping methods.

Within Illinois, an applied research project is underway to develop a prototype Illinois SoySelect™ electronic information system. This research has identified quality control activities that are relevant for producers to conduct regardless of the attribute they provide. Other activities may be added or removed depending on specific contract requirements. Producer documentation of production, handling and storage activities is available through a web-based system and third-party auditing activities have been incorporated to provide validation throughout the system. Documentation and auditing activities at both elevator and processor facilities is currently under development. The relevance of this project towards developments in future value added crop markets is again that the focus is on developing process-oriented systems that can support the production, handling, storage and distribution of value added crops regardless of the specific crop attributes.

SUMMARY

This paper focused on the current use and potential developments of identity preserved systems used for value added corn and soybeans in the U.S. A continuum was developed which illustrates the range of IP systems utilized for current value added crops, beginning with value added crops containing easily measurable attributes and moving towards very high value added crops that involve intensive identity preservation system. The point to be made is that there is no single IP system that can service all value added crops. The characteristics of IP systems will vary, depending on factors such as the ease of measurement, whether testing is conducted to validate the presence or absence of attributes, and potential harm or loss resulting from commingling of the specific crop (e.g. pharmaceutical) with commodity market channels.

Many factors have and will influence the continued development of IP systems. Factors discussed in this paper include the introduction of biotechnology into crops, the use of precision agriculture, availability of accurate, rapid and repeatable measurement technology, food safety concerns, competition and the influence of non-traditional players. A major implication resulting from these factors is the shift from product-oriented systems to process-oriented IP systems.

REFERENCES

- Bender, K. and L. Hill, 2000. "Producer Alternatives in Growing Specialty Corn and Soybeans". AE-4732, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign.
- Good, D. and K. Bender, 2001. "Marketing Practices of Illinois Corn and Soybean Handlers". AE-4743, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign.
- Hill, L., and K. Bender, T. Doehring, A. Bekric, 2001. "Illinois Farmers' Selection Criteria for Soybean Varieties, 2000". AE-4742, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign.