

Research Updates

An Economic Analysis of Intelligent Transportation Systems in the Distribution of Agricultural and Food Products

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An economically efficient and effective transportation system is one of the essential components for the economic and social well-being of agribusiness firms that provide agricultural and food products to consumers and end-users in the state. One possible method for improving that system is the use of Intelligent Transportation Systems (ITSs). ITSs are systems that encompass several technologies, including information processing, communications, control and electronics. They provide the link between vehicles and infrastructure. In the transportation industry, Global Positioning Systems (GPSs) is a means of tracking and managing mobile assets. With the current level of technology, worldwide tracking is possible. GPSs encompass a number of technologies, including information processing, communications control, and electronics used to link vehicles and infrastructure for improving the efficiency and safety of transportation (Navigation Technologies, 1998). Policymakers and investors need information to examine the usefulness, cost, and applicability of ITS technology to the agricultural and food transportation industries. Such information will be valuable to firms contemplating investment in these systems. In addition, the availability of this information should enhance the competitiveness of the Mississippi agribusiness firms.

The specific objectives of this project are:

- (1) to identify and construct spatial data layers for key segment infrastructure data for Mississippi agribusiness;*
- (2) to provide a comprehensive inventory of GPS transportation data sources, research and extension publications in agricultural and food distribution;*
- (3) to analyze and characterize the various types of GPSs currently available for use in the transportation of agricultural and food products; and*
- (4) to determine the advantages and disadvantages of using GPSs for moving agricultural and food products within, from, and to Mississippi.*

The project will provide an economic evaluation of alternative types of ITSs used in the movement of agricultural and food products. The costs, types, and uses of different GPSs will be obtained using primary and secondary sources. On-site visits will be made to selected firms using GPSs. GPS users will be surveyed to assess the advantages and disadvantages of using GPSs in their operations.

Introduction and Problem

Intelligent Transportation Systems (ITSs) encompass several technologies, including information processing, communications, control, and electronics. These systems provide a link between vehicles and infrastructure to improve the efficiency and safety of transportation (Navigation Technologies, 1998). In the context of ITSs, positioning systems measure the location of cars, trucks, automobiles, buses, and trains. Examples of positioning systems include Loran, Omega, radar, sonar, Global Positioning Systems (GPSs), terrestrial-vehicle tracking systems, and dead-reckoning (DR) systems (Drane and Rizos, 1998).

According to Drane and Rizos, there are three major classes of positioning systems: signpost, wave-based, and dead-reckoning. Conceptionally, the signpost system measures position by the vehicle's proximity to a specific reference point, a signpost. A wave-based system uses the propagation properties of waves to determine position. The DR system relies on the sensing components of a vehicle's acceleration or velocity. This information is then integrated to determine the track of the vehicle.

Each system can be further divided into several subcategories. The wave-based system can be classified into several groups: satellite-based self-positioning systems; satellite-based remote-positioning systems; terrestrial-based self-positioning systems; and terrestrial-based remote-positioning systems. The signpost systems are divided into self-positioning and remote-positioning systems. DR systems are differentiated into pure dead reckoning and map-aided, DR systems (Drane and Rizos, 1998).

Based on Drane and Rizos' research, ITSs have five functional areas: advanced traffic management systems (ATMSs); advanced traveler information systems (ATISs); advanced vehicle control systems (AVSCs); advanced public trans-

Information in this paper is primarily taken from a project by Allen, Couvillion, and Parrish (1999).

portation systems (APTSs); and commercial vehicle operations. In addition, ITSs can include emergency management (EM), electronic payment services (EPS), advanced vehicle safety systems (AVSSs), and vulnerable traveler services (VTS) (Intelligent Transportation Systems, 1998).

Although there are several positioning systems in intelligent transportation systems, this research is primarily concerned with a GPS, the positioning system that consists of a constellation of 24 satellites orbiting the earth, transmitting precise time and position information 24 hours a day. Funded by the U.S. Department of Defense, this \$13 billion system is free to all users (Precision Mapping GPS Upgrade, 1997). In the transportation industry, a GPS is used to track and manage mobile assets; with the current level of technology, such tracking can be implemented worldwide. The use of computers, specialized software, GIS information, and GPSs is advertised to form intelligent systems (ITSs). Additionally, some advertisements say this information can be used to help produce reports (such as fuel usage in each state) that will help in the efficiency of an operation (*Transport Topics*, 1997). The problem is that little information exists on the cost of the systems and the true benefits to specific companies. These systems work with or need GIS packages that must be purchased or produced. More information is needed to ascertain the actual costs in time and money commitments from companies that wish to invest in these systems. The economic benefits of having ITSs using GPSs and GISs for the food and agricultural products transportation industry need to be researched. The benefits that might be derived from using ITSs for the transportation sector include reduced operating costs, reduced paperwork burden, improved safety performance, improved system operating efficiency, and better service to customers (Wei, 1998).

Standardized spatial data covering the agribusiness infrastructure in Mississippi are not available. This void has prevented or limited investigation and research applying spatial technologies to agribusiness. Also missing is information on research that examines the usefulness, cost, and applicability of the technology to the agricultural and food transportation industries. This information would be valuable to firms contemplating investment in such ITSs.

Objectives

This project seeks to begin the development of a systematic and standardized set of spatial data layers for strategic segments of Mississippi's agri-

business infrastructure; the layers will be useful to state leaders, decision-makers, and research scientists in agribusiness planning, in development, and in the decision-making process. The project will also provide basic cost data on ITSs used in moving agricultural and food products. These data are to be integrated to provide basic data for research in agricultural transportation.

Procedures

To complete Objective 1, several steps must be executed, namely (a) an examination of existing spatial data layers and the identification of strategic layers that need to be developed through contacts with agribusiness and GIS professionals, units, and agencies (that is, Mississippi Automated Resource Information System and Mississippi State University Extension GIS); (b) use of existing data sources and other data available within the Social Science Research Center to catalog and locate Mississippi's agribusiness infrastructure; (c) purchase of additional data sources to augment extant data sources and to develop new layers; (d) development of standardized metadata tables and information for each of the infrastructure layers so the data are readily available and usable for researchers; (e) development of standardized spatial layers for each identified agribusiness sector so that each layer can be related to other agribusiness layers, census data, and existing spatial data already available at the state and national levels.

To accomplish Objective 2 of the study, information will be obtained from the Internet, transportation associations, state departments of transportation, federal government, and other sources. This information will be published.

Information on the costs, types, and uses of systems available to the food and agricultural transportation sector will be the focal point of Objective 3. To accomplish Objective 3, secondary and primary data will be used. Published information from advertisements, trade associations, manufacturers, distributors, and actual users (when possible) will be compiled to provide an up-to-date list of the various systems available to the industry. Primary data will be obtained through on-site visits to firms using GPSs. Investment costs and a list of benefits (financial and other) of the systems will be used to analyze the role and potential role that GPSs have or will have in transporting food and agricultural products.

In Objective 4, information on the advantages and disadvantages that might encourage or discourage the use of current and future GPSs by agricultural and food transportation firms will be obtained through the survey developed in Objective 3 and the information gathered in Objective 2. This information will be made widely available and will provide invaluable feedback to manufacturers, distributors, users, and potential users of these types of systems.

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Small-Volume Fresh Produce Growers' Marketing Channels: A Case Study of Tennessee Producers

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Marketing practices of fresh produce growers in Tennessee were obtained from a sample of operators located in 29 counties surrounding six major farmer's markets in Tennessee. Information was gathered about farming practices, types of fresh produce grown, sizes of operation, and marketing activities. Together, 128 usable questionnaires were returned, which amounted to a 20-percent response rate. Respondents provided information about the distribution of their produce sales through three types of market outlets—farmer's market, on-farm, and wholesale.

Analysis of results indicated the following. The average size of a farm was 162.9 acres, which was somewhat larger than the Tennessee average of 145 acres. However, the average acreage used for produce production was 23.5 acres, suggesting that the respondents had relatively small produce operations. The average number of crops grown was 3.3 per farm, and three-quarters of the growers raised from one to four produce commodities. More than one-half used on-farm sales for at least one of the produce commodities grown by the enterprise. Almost 40 percent of the growers only sold at least one produce item through farmer's markets. Thirty percent only used the commercial distribution system. A chi square test led to the inference that there was a tendency for smaller growers not to use the wholesale type of outlet and the larger ones to use it. Labor was found to be the most limiting factor for the expansion of production. When asked what problems limited profitability, labor was noted by 47 percent of the respondents, followed by weather, which was reported by 37 percent of the respondents.

A logit regression model, in which the dependent variable was the probability of selecting a type of market outlet, was estimated. Independent variables included whether double or triple cropping was used, percent of farm income from produce operations, farm income as a percent of total household income, age of respondent, and amount of time spent in off-farm employment by the primary operator. Significant variables were acreage, acreage per produce crop grown, use of hired harvest labor, use of USDA grading, and produce income as a percent of farm income.

Results of the survey provide useful information about typical produce operations located near farmer's markets. Although a variety of markets were involved in selling the output, farmer's markets and direct sales seemed to be more prevalent than wholesale (commercial) channels. Within the channel, distributors were used most frequently, followed by grocery stores. No single limiting factor was found to be pervasive, but the availability of hired labor did appear to be the most problematic. Less than 20 percent of the producers used USDA grading standards.

The decision about expanding production involves more than a consideration of the inputs. Labor requirements should be evaluated carefully. But ways of selling the increased output are crucial. If the operation is small and expansion is in terms of more commodities, then farmer's markets and on-farm sales may be adequate. However, adding to

overall production acreage should be associated with not only the labor needs but also with the availability and feasibility of selling through commercial channels. The latter would entail following USDA grading standards.

Specific Programs That the Past 28 Winners of the Malcolm Baldrige National Quality Award, 1988–1996, Have Undertaken to Implement Their Quality Strategies

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This study builds on previous work by Cangemi and Lopez (1999), which examined the strategies followed by the past 28 winners of the Malcolm Baldrige National Quality Award (MBNQA), 1988–1996.² The goal of the study is to share information about successful performance programs of MBNQA winners with companies in the food industry. Specifically, 2,028 entries were analyzed and classified according to 53 discrete programs that we identified from the winners' Baldrige application summaries. Among the areas that we wanted to examine was the frequency of program citations in each of the 11 Core Values (CV) and the differences that there may be among the four company categories (total (I): 28 companies; manufacturing (II): 15; small (III): 6; service (IV): 7).

**Summary of Key Results:
Percent of Companies That
Cited Programs vis à vis Core Values**

CV 1: Customer Driven Quality
Focus on Customer Needs:
I (21%); II (21%); III (25%); IV (20%)

CV 2: Effective Leadership
Focus on Customers:
I (25%); II (14%); III (0);

Participation by Leaders in Forums, etc.:
I (14%); II (14%); III (47%); IV (12%)

CV 3: Continuous Improvement & Learning
Benchmarking:

I (23%); II (16%); III (22%); IV (28%)

Design Improvement:

I (18%); II (13%); III (35%); IV (17%)

CV4: Valuing Employees

Human Resource Programs:

I (28%); II (22%); III (62%); IV (12%)

Opportunities to Show Skills:

I (28%); II (31%); III (4%); IV (32%)

CV5: Fast Response

Shorter Cycles for Products:

I (42%); II (48%); III (18%); IV (45%)

CV6: Design Quality and Prevention

Build Quality into Products & Services:

I (28%); II (20%); III (35%); IV (47%)

Diverse Sources for Design Quality:

I (38%); II (49%); III (13%); IV (28%)

CV7: Long-Range View of the Future

Anticipate Market Change:

I (38%); II (35%); III (22%); IV (63%)

CV8: Management by Fact

Analysis for Cause and Effect:

I (34%); II (38%); III (18%); IV (33%)

Use of Performance Measures:

I (27%); II (35%); III (25%); IV (8%)

CV9: Partnership Development

Long Term Objective (Internal/External):

I (32%); II (33%); III (58%); IV (8%)

External Partnerships

I (28%); II (25%); III (21%); IV (42%)

CV10: Corporate Responsibility and Citizenship

Concerned for Outside Environment:

I (53%); II (68%); III (67%); IV (11%)

Be a Partner in Community Activities:

I (30%); II (23%); III (23%); IV (50%)

CV11: Results Orientation

Monitor Performance and

Support Improvement:

I (41%); II (26%); III (100%); IV (32%)

¹Kristen Ryan, Research Assistant.

²Cangemi, Robert R. Cangemi and Raymond H. Lopez 1999. "Findings of Strategies Followed by the 28 Past Winners of the Malcolm Baldrige National Quality Award 1988-1996." *Journal of Food Distribution Research*. XXX(1): 167.

Implications of Changes in the Food Supply Chain for Small and Medium-Sized Produce Firms in the Pacific Northwest

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Introduction

Two major changes are occurring in the food supply chain. As a result of internal growth, mergers, and acquisitions, fewer larger firms are increasingly dominating the buying segment. Coupled with this trend is an increased emphasis on both electronic data interchange (EDI) and product attributes, ranging from appearance, condition, packaging, and food safety to growing and processing practices.

The chief concern of small and medium-sized agricultural suppliers is that they will gradually be excluded from doing business with major purchasers as the cost and sophistication of the EDI systems, quality assurances, and operational controls demanded by those companies continues to rise.

The goal of this research is to assess the current relationship between large purchasing companies and a sample of their small and medium-sized suppliers, and to project how the terms of that relationship is changing as large purchasing companies attempt to strengthen their competitive position.

Methods

In order to focus the research, this project looked only at small and medium-sized suppliers based in the Pacific Northwest. These suppliers were segmented into two categories, suppliers of fresh fruit or vegetables and suppliers of frozen fruit or vegetables. Various suppliers meeting these criteria were included in the study at the recommendation of a panel of experts familiar with the various industries involved. At their recommendation, small firms were defined as those with gross sales dollars of less than 10 million for fresh produce suppliers and less than 100 million for frozen produce suppliers. Medium firms were defined as those with gross sales dollars between 10 million and 50 million for fresh produce suppliers and between 100 million and 500 million for frozen produce suppliers. During the interview process, suppliers were asked to categorize themselves according to these definitions. These suppliers were requested to participate in the project on a voluntary and confidential

basis. Retailers will be selected on the basis of size and willingness to grant an interview.

The same panel of experts used to select the supplier participants aided the development of a series of interview questions appropriate for each segment of the study, taking into consideration information gleaned through a review of literature on the topics. Each questionnaire included questions pertaining to capabilities issues—such as order turn-around, order volume and frequency, special packaging, organic capabilities, relationship technology such as stock replenishment and EDI, business terms such as contracts, volume of accounts, payment terms, and pricing issues, and executive perspectives of the changes in the industry and where their firms fit into the emerging picture. Personal interviews were then carried out for each of the suppliers willing to participate and will soon be carried out on the retail side.

Results on the supplier side have been tabulated and assessed and the same process will be used with the retail response. Due to the non-random selection and small sample of executives included in the study, the analysis of the responses is subjective. They do, however, shine light on the dynamics of the relationship between the ever-larger retailers and small and medium-sized suppliers.

Results

At this point in the research, the only completed section available to present is the results of the supplier surveys. Of the nine fresh produce executives approached, executives with all nine different companies agreed to participate. Of those companies, five are involved in the tree fruit industry, two in the vegetable industry, and two with their main business in potatoes. Eight of the nine companies described themselves with sales between \$10 million and \$50 million, with one placing its sales below the \$10 million mark. On the frozen produce side of the project, 11 of the 13 company executives who were asked to participate agreed to do so. Of those 11 represented companies, five have their own brand while the other six sell for private label at the retail level. Business in this category included cut and mixed vegetables, berries, potatoes, fruit, and other processed fruit and vegetable products. Seven of these companies fell into the medium category with sales roughly in the range of \$100 million to \$500 million, with several firms going slightly over the \$500 million mark. Four firms had sales below the \$100 million mark.

Supplier Capabilities

Fresh Produce Suppliers

The first series of questions covered supplier capabilities. All firms claimed the ability to fill orders in one day or less although most said the need for this is not typically required.

All firms affirmed their ability to meet special packaging requirements for their accounts; however, the extent to which they were able to vary the packaging differed greatly. While one respondent stated there was nothing that could be done which was not currently an issue in the marketplace but whether it was actually done or not depended on the numbers, most firms described their abilities in different terms. Four firms could vary size; five could do box, bag, or banded packs; five could vary labeling; and one of the vegetable firms mentioned meeting special product mixes and cuts.

Ability to meet requests for organic products was somewhat of a mixed bag. While all but one firm has received requests for organic produce, only three seriously included organics in their product mix. Three additional firms have dabbled in organics but mentioned that it was either cost-prohibitive or that product is not readily available at this point. Each of these suppliers should be able to meet requests in the future should the organic market segment increase. Three firms do not handle organics at this point but are developing the ability to do so on a small scale. One of these firms refers all such requests to an organic sales company.

Frozen Produce Suppliers

Frozen firms tended to need much more time for filling orders. Four firms needed between one and four days, with several of them saying that it could be done faster. The buyer was discouraged from such requests by dollar penalties. Four firms needed about a week, and the remaining two firms replying to the question required between one and two weeks. Firms with brands tend to have the ability to respond more quickly than their counterparts in private label.

Most firms also have the ability to deliver or arrange delivery to buyer-specified locations—usually distribution centers—at an appointed time. Most firms also provide assistance in arranging transportation for their buyers although not all take advantage of it. All firms offer less than truckload volumes although

several offer full truckload discounts or require the buyer to deal with transportation or to pay penalties for small amounts. Most firms allow buyers to exercise their own discretion as to frequency of delivery since they are the ones paying for transportation. However, several firms do limit frequency according to the size of the account. Logistics and mode of transportation can also limit the frequency of delivery.

Although several firms have the capability to ship anywhere in the United States, most firms service mainly companies in the West and Midwest, with some international business as well.

As in the fresh segment, all frozen suppliers who were interviewed had the ability for some kind of special packaging. Variations on sizes, including bundled product, can generally be done by all of the firms, with capabilities such as product mix and recipes, style of package, promotional pallets, and pallet UPCs scattered among the firms.

When it comes to organic product capabilities, only one firm said that they had not had any requests for organic products, and three additional firms were not currently processing any organics although each of them are considering a change in that policy. Six of the interviewed executives predicted continued growth in the organic market, including each of those firms that were not processing organic product. However, two of the companies that currently process are considering dropping out of this market, and another is not sure that it has the growth potential needed to remain profitable. These companies see the segment as a niche market only. One other executive commented that organic product in their industry receives such high premiums on the fresh market that frozen production does not have an adequate supply.

Relationship Technology

Fresh Produce Suppliers

On the technology side of things, only two of the nine firms participate in stock replenishment programs. Both of these firms could be considered the largest tree fruit companies included in the study. Most firms did not participate in such programs due to the lack of a request to participate. Only one firm admitted that their lack of such a program was due to its lack of year-round supply. This firm was also the smallest firm surveyed.

Five firms are currently using some form of EDI with a very low number of suppliers who typically represent large volumes. Two other firms are in the

process of acquiring a workable EDI system. Of the firms that have an operable system, most use it only for invoicing at this point. Several firms mentioned the inadequacies of available software for an integrated EDI system for their particular businesses.

Frozen Produce Suppliers

All but two of the firms do not participate in stock replenishment programs. The main reason for not participating in such programs was, like the fresh segment, the lack of requests from buyers. Other reasons included the lack of proper information systems and the bulk of a company's sales occurring through brokers who handle EDI for them.

Frozen produce firms tended to be ahead of fresh firms in the EDI category. Eight of the 11 firms surveyed are using EDI to some degree although, in practice, the EDI systems tend to be primarily external. Two firms use their EDI system internally, with glitches in information systems prohibiting external use. Several other firms use EDI for inventory control for the receipt of purchase orders, invoicing, and shipment confirmation.

Business Terms

Fresh Produce Suppliers

When asked how most of their business is done, every fresh produce firm replied that virtually all is done via contracts and ongoing relationships, with an emphasis on relationships. All but two firms admitted that cold calls were all but extinct for them. Most contracts are for periods of less than one year, but one firm does about 50 percent of its business via contracts of at least a year. Other than this, such contracts were entered into by only one other firm, and those contracts comprised a small percentage of its business. Only one firm does any business with bids based on product specifications, and only two do business on the spot market.

The number of companies with which firms do business varies widely from 20 plus to 300. All firms surveyed do some business with wholesalers, and while a large percentage of the companies with whom they do business are wholesalers, that segment represents a small and steadily decreasing percentage of the volume. As another sign of consolidation occurring in the grocery industry, all but two of the queried firms said that the number of companies to which they sell is decreasing, but

volume is increasing. The remaining two firms said that the number of companies to which they sell is remaining steady.

Payment terms in the fresh produce industry tend toward net in 30 days with some variation. Only one firm offered discounts for early payment, and several others had terms for net with less than 30 days. One firm mentioned that buyers are pushing for longer terms due to "money transfer technology."

When it comes to price, about one-half of the firms negotiate with buyers off of the general or federally published market price while the other half negotiates off of a company price list or have contracts with built in-pricing formulas.

Frozen Produce Suppliers

Like the fresh produce segment, the frozen produce suppliers overwhelmingly do the majority of their business through ongoing relationships and contracts, with an emphasis on ongoing relationships. One firm does most of its industrial business this way but maintains that most of its retail business is mainly via cold calls. Every other firm does very little or no business through cold calls. Quite a few firms do some contract business with the majority of that for one year or less although some companies do have contracts for more than one year. Very little business is done with bids based on product specifications or on the spot market.

The number of companies with which firms do business varies from 15 to more than 200. One firm does business with a number of companies through brokerage firms. The other firms handle their accounts on their own. Two firms do not have any wholesalers in the mix, and most others have only small numbers of wholesalers. Unlike fresh produce suppliers, three of the frozen produce suppliers have seen an increase in the number of companies with which they do business. This is due in part to growth in international accounts, but for one firm, some of it also comes from domestic business. The one firm that has had increases in domestic accounts also commented on niche business as a company asset, possibly explaining part of the increase. Three firms have decreasing rolls while four firms have rolls that are remaining steady in terms of numbers although there is some flux in smaller accounts. Several firms also mentioned that, while accounts are decreasing or remaining steady, the size of accounts is increasing.

Payment terms used by frozen produce suppliers typically allow a 2 percent discount if paid within 10 days with the net amount within 30 days with minor adjustments for several different firms. While four firms expect payment within the allotted discount period, the majority of the firms queried said that payment is typically late and that discounts are taken regardless of the payment date.

Pricing schemes in the frozen produce industry vary greatly. While several firms offer a take-it-or-leave-it price list, others begin negotiations from their price list. Still others negotiate from the market price or attempt to stay a given percentage below national brands. Some firms negotiate price once a year as the price comes in, and some use a federally published price list, with allowances for region and transportation.

Executive Perspectives

Fresh Produce Suppliers

Executives have seen their companies' relationships with large buyers change dramatically during the past several years. Market power has shifted even further toward ever-larger accounts, putting downward pressure on price. Accounts are continually requesting new services and insisting on stricter standards. Another common comment was related to the lack of time that buyers for large companies have. Many executives referred to past experience when having some kind of relationship with a buyer was not uncommon. This seems to have changed with buyers being given increasing stores as consolidation occurs as well as having less influence in the corporate office. These trends are expected to continue with the addition of several new changes. Food safety issues are expected to be a hot item during the next few years, with recent requests for quality control hotlines and other similar programs. Most executives also mentioned a move toward consolidation on the supply side in order to maintain market viability. It was also mentioned, however, that such consolidation on the supply side may not necessarily result in market viability but in large suppliers that make the same mistakes the small firms did.

Also mentioned were a number of advantages that these Northwest firms have to offer. Most provide year-round supply and focus on high and consistent quality produce. Many firms see themselves as flexible and service-oriented, and one individual even mentioned what seems to be a dying cry—that the firm offers reliable quality, service, value, honesty, and

integrity. Challenges that these firms are facing from large accounts include unrealistic expectations and short-term thinking, labor availability, adaptability, capital demands, capacity, cost control, and developing niches that will value differentiated produce.

Frozen Produce Suppliers

Executives on the frozen produce side have witnessed many of the same trends in their own dealings with large accounts. They are seeing fewer buyers and lower prices with increased competition with fewer personal relationships due to pressures on buyers and the high turnover of buyers. Also mentioned is a drive toward private label by retailers. Several firms feel that these trends have made them stronger and have enhanced their relationships with large buyers because of the way in which they have handled the changes. These trends are expected to continue overall with increased demands for services and information systems capabilities. Also mentioned was the continuing difficulty for smaller suppliers to introduce new products.

While only one firm replied that it had nothing special to offer large buyers, most interviewed firms think that they offer something special to large buyers. Most list quality, and several include such attributes as flexibility, expanse of product line, financial stability, and customer service. Several of the firms have brands that offer increased category sales and consistent strong margins.

Almost every firm cited consolidation on the supply side as a challenge that they would face during the next few years in order to remain viable suppliers. Several mentioned cost reduction and increasing efficiency along with capital restraints that may prevent or limit a presence in markets due to slotting fees. Another issue that was considered was maintaining flexibility and consistent supply with variations in the volume and timing of the available crop.

Customers' Willingness to Travel to Farmer's Markets¹

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Changing lifestyles and improved understanding about the relationships between diet and health are leading many people to increase their consumption of fresh produce. These commodities are sometimes sold in alternative retail outlets. Farmer's markets have the potential of becoming important sources of fresh produce for many food shoppers, but they operate in highly competitive environments in which grocery stores have the advantage of convenience.

Food shoppers at six farmer's markets in Tennessee were surveyed in the summer of 1997. Part of the questionnaire focused on the distance that a person would be willing to travel to patronize a farmer's market under different quality and price situations. The former pertained to the same or better quality than that available at the supermarket where the respondent shopped, and the latter involved prices that were 10 percent and 20 percent below those of the supermarket that the person patronized.

This problem setting is a type of contingent valuation methodology. There were six questions that asked respondents how far they would be willing to travel to a farmer's market given either the same or better quality than at supermarkets and prices were the same, 10 percent lower, or 20 percent lower than at supermarkets. A double-bounded tobit regression model was used to estimate the relationship between the distance people indicated they would be willing to travel and shoppers' perceptions of the farmer's markets, distances to and frequencies of patronage of alternative outlets, and demographics.

Respondents indicated that the average distance to the farmer's markets, where they received the survey, was 8.5 miles. Respondents only had to travel 3.3 miles, on average, to the supermarket where they typically shopped for food. Given the same quality that was available at the supermarkets where they shopped, the predicted distances were 6.6, 8.2, and 8.6 miles for the same prices, 10 percent lower prices, and 20 percent lower prices, respectively, at farmer's markets. In the first two instances, the distances are less than the average actual distance, and the third is about equal. Thus, significant price reductions at farmer's markets, by themselves, may not result in increased patronage. However, the corresponding willingness to travel distances for better quality with the same, 10 percent lower prices, and 20 percent lower prices has predicted mileage of 10.1, 15.7, and 18.4. These results indicate that quality is an extremely important factor used by food shoppers in deciding whether to patronize farmer's markets.

Building a World Wide Web Infrastructure for Regional Food Systems Education and Outreach

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Introduction

The World Wide Web (WWW) is revolutionizing access to and delivery of information with timely and easy-to-use technology. The extension-outreach system of land-grant universities can utilize this powerful tool to enhance educational opportunities for food system professionals and consumers. The issues facing the industry are complex, and an effective method of addressing them is needed. Extension education on the WWW that is developed around a food systems model will allow delivery of personalized instruction while providing multi-disciplinary answers, which are not logistically feasible with traditional programming methods. Transforming the mode of access to university resources maintains the leadership position of the land-grant system and collaborating institutions in the delivery of research-based food system information to stakeholders and citizens of the region.

The purpose of this project is to develop a model infrastructure for interdisciplinary educational efforts, building on the strengths of the collaborating institutional partners within the region. The interaction of many disciplines—such as agricultural production, marketing, safe handling of a regional food supply, environmental issues, and nutritional sciences—illustrates the diverse educational needs of stakeholders. Increasing the understanding of the interrelationship of the entire food system, including its relationship to the environment and the value of its various components, ultimately contributes to the viability of the regional agricultural industry. This, in turn, maintains the quality of life for residents.

Objectives

- (1) To formulate a stakeholder review committee of Mid-Atlantic representatives for each component (including, as appropriate but not limited to, leading agricultural direct farm marketers, state Department of Agriculture, environment or health personnel, university and extension specialists, industry representatives, community members, and farmers).
- (2) To gather research-based information, including case studies on farm retail/wholesale direct marketing, women's health, food safety, and environmental issues.
- (3) To create and launch the Mid-Atlantic Regional Food Systems Web Site (featuring an easily accessible and searchable database of basic and advanced resources, multimedia educational presentations, searchable directories of experts, current bibliographies, calendars of related meetings, on-line journals/newsletters for publication of timely research and news, discussion forums, and an expanded Farmer's Market Line to include the entire region).
- (4) To enhance the function of the direct-market and to develop other appropriate E-mail discussion groups as sounding boards for the identification of needs and the gathering of responses for individuals, organizations, and agencies, including the development of searchable archives of each discussion group.
- (5) To develop evaluation mechanisms to determine impact and to allow continual feedback for improvement of the system.

Mission

Incorporating the disciplines of nutrition, food safety, marketing, and environmental issues, the project mission is to illustrate how the collaboration of institutions can aid in the development of more efficient WWW-based educational and outreach tools. Appropriate stakeholder representatives will drive the infrastructure to be developed, supporting and directing professionals in content development and who, in turn, direct a web-master and team of programmers to produce the end product for the information consumer. Both consumers and

stakeholder review boards will provide feedback for continually updating and improving the site, identified as the Mid-Atlantic Regional Food Systems World Wide Web Site (MARFSWS). The goal of the MARFSWS is to increase accessibility to resources and expertise across institutional boundaries in the Mid-Atlantic region. This will help to meet the range and urgency of the technical needs of professionals in business, government, private, voluntary and non-governmental organizations, students, agricultural producers, and consumers.

Project Components

The web site will initially be comprised of the following five components:

- (1) **Dietary Intervention**—The goal of this component is to bring together a consortium of nutrition educators from Mid-Atlantic Consortium (MAC) institutions to develop and implement a Food Systems Nutrition Education Program. The Program's goal is to have a positive impact on women's health and to raise awareness among nutrition professionals and the public about the interconnection of food, health, agriculture, and the environment.
- (2) **Consumer Interface with Regional Food Producers**—This component will provide a direct link between consumers searching for local food supplies and producers looking to sell directly to consumers.
- (3) **Agricultural Direct Marketing**—Marketing specialists and agents from several Northeastern states have proposed the creation of an information resource center for farm retail direct marketing. The center will become a centralized clearinghouse for information and will coordinate research and educational activities from across the region. Alternatively, a WWW site will facilitate the transfer of information and expertise and will increase the effectiveness and efficiency of public sector efforts to enhance the industry. This will be accomplished through group interaction between educators, industry representatives, farm retail market operators, and direct wholesalers.
- (4) **Food Safety**—This component is targeted to appropriate end users to maintain the food safety and quality of the regional food supply.

The goal of this component is to coordinate efforts among food safety and production scientists to develop and disseminate pertinent information to producers and consumers.

- (5) **Environmental Issues**—This component is aimed at promoting sustainable agricultural practices to help strengthen the food system. The adoption of improved farming practices can lead to better soil health, a healthier food supply, and greater ecological benefits. Information will be provided to stakeholders about collaboration in agriculture and watershed management issues.

Current Status

This project was funded in June by a competitive grant received from the Mid-Atlantic Consortium (MAC). Work has begun on programming the farm market database for the consumer interface and on programming for the agricultural direct marketing component.

Partners

Universities and Higher Education

Middlesex County College, NJ; Penn State University, PA; The University of Delaware, DE; Rutgers, The State University, NJ; Sussex Community College, NJ; University of Maryland, College Park; University of Maryland, Eastern Shore; University of Maryland, Wye Research and Education Center, MD.

Industry

Brandywine Farming Traditions, DE; Brodhecker Farms, NJ; Fifer Orchards, Inc., DE; Filasky's Produce, DE; Matarazzo Farms and RJM Marketing, NJ; New Jersey Dietetic Association, NJ; Produce Marketing Association, DE; Springdale Farms, NJ; Wakefern Corporation, NJ; Walker Brothers, Inc., NJ; Walnut Grove Farm, NJ; Windy Brow Orchards, NJ; and others.

Community

Food Bank of Monmouth/Ocean Counties, NJ; Produce for Better Health, DE; Sussex County Agriculture Development Board, NJ; Sussex County Board of Agriculture, NJ.

Government

Delaware Department of Agriculture; New Jersey Department of Health; New Jersey Department of Agriculture; U.S. Food & Drug Administration; U.S. Department of Agriculture (USDA)-CSREES; USDA-ARS.

Project Duration

June 1999 through June 30, 2002

Evaluating the Willingness-to-Purchase IPM-Grown Fresh Produce

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Demographic characteristics that cause consumers to be more likely to purchase integrated pest management (IPM)-grown produce are empirically evaluated. A willingness-to-purchase model for IPM produce is estimated along with a model that predicts which consumers strictly purchase only conventional produce. The two separate logit models decompose the effect of several consumer characteristics and demographic factors that influence the willingness-to-purchase conventional and IPM-grown fresh produce. Participants with higher annual incomes were more likely to express an interest in purchasing IPM produce and also appeared less likely to strictly purchase conventional produce. The results also indicate that younger individuals—those who frequently purchase organic produce, those who visit farmer's markets, and those who live in suburban areas—will all be more likely to purchase IPM-grown produce. The likelihood of purchasing only conventional produce was found to increase with age. Those who had knowledge of IPM were both more likely to purchase IPM-grown produce and less likely to purchase only conventionally grown produce.

Research into consumer response toward IPM produce is currently underrepresented in the literature. Nearly all existing IPM literature has been supply- or production-oriented. The majority of studies regarding consumer demand for IPM present only descriptive statistics or aggregate tabulations of willingness-to-purchase and willingness-to-pay measures. This study attempts to further the chances that IPM-labeled produce can be successfully marketed side-by-side conventional and organic produce by identifying and isolating the market segments that would respond favorably to it.

Consumer Patronage of Farmer's Markets: The Influence of Sociodemographic Characteristics

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Qualitative choice modeling was used to determine which market factors and sociodemographic characteristics cause consumers to be more likely to purchase products at farmer's markets. The sociodemographic background, attitudes, and preferences of consumers who visit farmer's markets at least twice a month and of those who purchase all or most of the fresh produce that they consume at these locations were identified.

The data for this study were gathered from a survey of New Jersey farmer's market patrons that was conducted from July through September 1997. Five hundred surveys were distributed at 21 farmer's markets located in North and Central New Jersey. In order to ensure a well-representative sample, towns with different socioeconomic backgrounds were visited.

The results indicated that those who have three or more children and those who make at least \$80,000 a year are less likely to patronize farmer's markets at least twice a month than are those with lower incomes and those who have fewer children. Consumers who are younger than 36 years of age are less likely to visit farmer's markets frequently and less likely to buy all or most of the household fresh produce from farmer's markets. The results also indicate that women who reside in urban areas are more likely to purchase the majority of their fresh produce from farmer's markets.

The findings of this research suggest that various socioeconomic factors affect frequent visitation and quantity of produce bought at farmer's markets. In general, consumers tend to agree that freshness and direct contact with farmers are the main factors that drive people to farmer's markets; that these facilities help support local agriculture; and that, by attracting customers to downtown areas, farmer's markets boost local economies.

Industry Strategic Planning and Coordination: The Case of the Texas Vegetable Industry

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Using the South Texas Vegetable Industry as an example, this case study research empirically tests an Industry Strategic Planning and Coordination (ISPC) conceptual framework that has been previously developed by fellow researchers (Lyford et al.) and discussed in the literature. It is designed to be potentially useful to practitioners of ISPC in a wide variety of produce industry contexts.

In the past, the Texas vegetable industry has ranked in the top three states in terms of production, but now, it only produces a little more than one-half of what the third-ranked state produces. The problems that have caused this decline cover topics ranging from uncontrollable weather to slow adoption rates of new technology by Texas producers. It became obvious that these problems were too complex for any one grower to solve on his/her own. Producers in the Rio Grande valley realized that, if progress were to be made, it would have to be done as a collective unit. Due to this realization, the South Texas Produce Initiative Task Force (STPITF) was established.

The ISPC framework (model) mentioned above consists of four phases, with each phase having specific steps that typify the progression of that phase. The first phase is the *Process Initiation Phase*. In this phase, industry participants start the ISPC process and take necessary actions to gather the required personnel and to accumulate the funds needed to conduct the meetings and research functions that are vital to complete the ISPC process. The second phase is the *Strategic Planning Phase*, which involves conducting the appropriate research and establishing the objectives and strategies that are considered the heart of the ISPC process. The third phase is the *Implementation and Coordination Phase*. It entails, as its title suggests, the strategies put into action, with an elected committee overseeing the progression of the strategies to ensure that they are conducted properly. The fourth phase is the

Strategic Review and Re-evaluation Phase. Here, the committee examines the actions that have been taken thus far and determines if they are keeping in line with an established vision statement.

The STPITF went through a process nearly identical to the ISPC model to combat the problems that were hindering its production and profitability. The case study describes the ISPC model in greater detail and reveals how the STPITF actions mirrored the model in many aspects. As a result of the STPITF, members have begun to notice an improvement in communication and coordination, and a willingness by South Texas produce growers and shippers to work cooperatively. Some of the tangible benefits of these cooperative actions include a newly formed onion exchange and industry-wide promotional efforts. Because this effort was successful, other produce-growing regions of Texas are considering the adaptation of this initiative planning process for their own unique requirements. Based upon the case study experiences, the research serves as a basis to assess, revise, improve, and further develop the ISPC framework.

Changes in Transportation Patterns of Refrigerated Cargoes

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Several factors contribute to world trade in agricultural products that require refrigeration. Production areas having comparative advantage with respect to some production factors, such as labor cost or climate, may be distant from demand centers. For example, production seasons in the Northern and Southern Hemispheres are inverted, so perishables, such as fruits and vegetables, are transported in the off-season to meet consumers' expectation of year-round availability. Consumer preferences differ by geographic and other factors, leading to trade. Changing phytosanitary laws (the opening of mango shipments into the United States) and trade liberalization policies (the opening of Japan's meat sector) have generated increased shipments of refrigerated cargoes. Economic conditions in individual countries and regions influence product prices and trade volumes.

This presentation reviews world demand for waterborne refrigerated cargo transportation, overall and by major trade lane. The World Sea Trade Service (WSTS) categorizes commodities into 40 groups. Two groups relate to refrigerated cargoes: (1) Meat, Fish, and Dairy Products and (2) Fruit and Vegetable Products. World trade in these cargoes, as tracked by WSTS, is presented for 1992 and 1997. For convenience, countries are grouped geographically so that major regions of the world may be identified as sources of and markets for products. Using these regions, the top 10 origins and destinations are ranked by shipment volume and by year, and are discussed in terms of changes in absolute volume and in changes in rankings between the two years.

The overall reefer market experienced average annual growth of 3.7 percent between 1992 and 1997, increasing to about 44 million metric tons; however, the market became somewhat more fragmented. In 1992, the top 10 trade routes accounted for 41 percent of the total shipments, but by 1997 that percentage had decreased to 38 percent. Growth was concentrated primarily along two trade lanes. U.S. exports of poultry products to Eastern Europe (including Russia) increased dramatically, as did shipments of U.S. exports to the Far Eastern NIEs (mostly meat products). Together, these two lanes accounted for almost one-third of the overall growth in the global reefer market between 1992 and 1997. The four major inbound markets for reefer cargoes are Northern Europe, the United States, Japan, and the Far Eastern NIEs. In terms of outbound shipments, the developing regions were the major suppliers. Latin America accounted for almost one-third of refrigerated products imported by WSTS reporters in 1997, while the North American share was about 25 percent.

Segmenting Households Based on Food Nutrition Attitudes and Behavior

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Some people are aware of the need for good nutrition, know how to eat nutritiously, believe what they eat is nutritious, but do not eat a healthy diet. Others may be unaware of the need for good nutrition or do not know how to improve the quality of their diet. Food nutrition educators face the challenge of providing information that is relevant for each group and that will help them improve their diets. Marketers of nutritious food products confront a similar problem when they try to tailor their advertising and promotion messages to address the perceived needs of consumers. In this research, we profile the consumer segments that have good diets or poor diets and who have strong or weak interest in or knowledge about food nutrition.

Besides information about what people eat, the 1994–96 *Continuing Survey of Food Intakes by Individuals* (CSFII), conducted by the U.S. Department of Agriculture, and the 1994–96 *Diet and Health Knowledge Survey* (DHKS) include information about how important people think some healthy eating practices are for them, how they use food labels, and what dietary practices they follow to lower fat consumption. Respondents answered between seven and 11 questions in each of these three areas. We developed a summated score for each area from the questions with high positive factor scores. These scores were used to classify people into three approximately equal groups (Strong, Medium, and Weak), based on their interest or knowledge. Consumption patterns were also classified using the Healthy Eating Index (HEI) categories (Good, Needs Improvement, and Poor), resulting in a grid with nine cells for each of the three areas. Chi-Square tests found these cells significantly related—with many background variables, including region, household size, gender, ethnic origin, education, age, employment status, and housing tenure. Profiles of the households in the corner cells—Strong-Good, Strong-Poor, Weak-Good, and Weak-Poor—were used to develop possible educational and marketing strategies needed to reach these segments.

Contingent Valuation of Health Risk Reductions Through Beef Irradiation

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Background

The Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) have approved the use of irradiation for beef. Consumers' acceptance of irradiated beef products and their willingness to pay premiums for increased food safety is of paramount interest to beef producers, processors, and marketers.

In the case of food safety, researchers must resort to non-market valuation techniques to measure consumers' willingness to pay (WTP) for reduced food risks when market data are not available. Contingent valuation (CV) is generally considered the most appropriate choice for measuring food safety (Misra, Huang, and Ott, 1991; van Ravenswaay, 1990). CV is commonly used in food safety issues to present respondents with hypothetical scenarios of risk reduction and to ask them to name a price that is the most they are willing to pay above the normal purchase price to reduce the food safety risk. Individuals should be willing to pay more for a larger risk reduction than for a smaller risk reduction (Jones-Lee, 1974; Harrington and Portney, 1987). The question, however, is the threshold between the two levels of risk reduction. If, for a consumer, the difference between two levels is insignificant, there may not be any significant difference between the amount that s/he is willing to pay for the two levels of risk reduction. The invariability in valuation responses was reported by Buzby, Skees, and Ready (1995) and Eom (1992).

Objectives

The first objective of the study is to obtain an empirical estimate of the value that consumers place on the reduction of food risk through the use of irradiation technology on beef products. The second objective is to evaluate the validity and effectiveness of dichotomous choice with follow-up question approach in the contingent valuation method. The issue of starting-point bias in this kind of approach is also addressed. Finally, the relationship between the amount that a consumer is willing to pay for a

risk reduction and the magnitude of the reduction is evaluated using a relative risk information format and an absolute risk information format.

Methodology and Data

Although single bounded dichotomous choice method represents a dominant format for contingent valuation of non-market goods (Herriges and Shogren, 1996), it has many weaknesses. According to Cameron and Quiggin (1994), it is statistically inefficient because a large number of observations are required to identify the underlying distribution of resource value with any given degree of accuracy. An alternative CV survey strategy intended to reduce this inefficiency was introduced by Carson, Henemann, and Mitchell (1986). It involves the use of a second threshold offer as a follow-up dichotomous choice. This approach is popularly known as a double-bounded referendum approach in CV method. Under this method, if a respondent indicates a willingness to pay the first threshold amount, the new threshold amount, which is about two times the first threshold amount, is offered. If the respondent indicates unwillingness to pay the first threshold amount, then the second threshold amount, which is about one-half of the original amount, is offered.

The efficiency gained by using a follow-up bid in the CV method may be subject to the starting point bias—that is, the first bid amount may unduly influence the response to the follow-up bid. When the respondents are uncertain about the value of the non-market goods, they are likely to anchor their WTP amount on the first bid value (Herriges and Shogren, 1996).

A national telephone survey of 750 households will be conducted at the end of September 1999. Primary shoppers in the households will be asked questions in five broad categories. A double-bounded dichotomous choice CV technique will be used to measure willingness to pay for irradiated beef within the formats of relative and absolute risk reductions. Two alternative techniques for model estimation will be used. One technique would be to estimate two sets of models independently for the two responses. The underlying hypothesis is that the two responses are independent of each other. The other alternative would be to include both the responses in a joint specification. The difference between WTP distributions implied by initial and

follow-up bid responses will be determined by estimating changes in mean willingness to pay (MWTP) due to the starting bid amounts. The impact of demographic factors, personal experience of food poisoning, and belief and attitude about food-borne risks on the willingness to pay for risk reduction by beef irradiation will be evaluated.

Expected Results

It is expected that the WTP at the instant of the initial contingent-valuation question and the WTP at the instant of the follow-up question are not statistically different. This will allow us to estimate a lower bound and an upper bound of the estimated value of food risk reduction through the use of irradiation technology on beef products although the true underlying point value will be the same. We expect that starting point will not significantly distort the respondents' answers to willingness-to-pay questions. We expect that consumer valuation of risk reduction through irradiation technology under an absolute risk reduction program varies significantly compared to that under a relative risk reduction format. However, significant correlation may not exist between the magnitude of risk reduction and consumer valuation of risk reduction through beef irradiation.

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Marketability and Economic Advantages of Transgenic Sweet Corn for South Georgia Vegetable Growers

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Introduction

South Georgia agriculture is familiar with the concepts of transgenic varieties of row crops, especially cotton and soybeans. These crops are not typically viewed as food crops, although the oils may be a food product. New transgenic varieties for these crops and additional crops are announced with moderate regularity. Could transgenic sweet corn varieties offer management options to vegetable growers as well as to the mainstream field/feed corn producers? Could transgenic sweet corn varieties offer food processors a more uniform, perhaps even higher-quality, product that consumers will purchase and approve?

Transgenic (Bt) sweet corn varieties are touted as offering an economically viable extension to the production season by overcoming the late-season humidity and the intense, late-season insect pressures in South Georgia. However, with food crops such as sweet corn, more than just the cost of production versus the revenue potential must be considered. After all, if the consumer does not like the food item, the consumer will not buy the food item. Hence, the revenue "potential" to the producer remains just that—a potential, but not a reality. So, not only must the economics of production be analyzed, the consumer acceptability and consumer markets must also be tested or reviewed. The legitimacy of Bt sweet corn as an agronomic possibility in South Georgia is not being questioned; traditional sweet corn varieties for both fresh and frozen ears of sweet corn have been produced for numerous years for fresh produce sales throughout Georgia and for a frozen vegetable processing and packaging facility in Southwest Georgia. Field corn and feed grains

have likewise been an economic mainstay for South Georgia farmers.

Research Methodology

Small plot tests of transgenic and non-transgenic sweet corn varieties were grown in randomized blocks on a cooperating vegetable producer's farmland in 1999. The cooperator has experience raising sweet corn and other vegetable crops under contract for the frozen food processor. The test plots of sweet corn were grown under pivot irrigation and raised beds, and under the supervision of crop and soil scientists and vegetable crops specialists, following all the recommended production practices encouraged from Georgia's land-grant universities. Enterprise budgets and cost data were monitored for the production season. Project design consisted of a factorial plot layout, with both Bt and non-Bt varieties under-sprayed and with non-sprayed insect controls.

Seeds for the sweet corn varieties were provided by Novartis Seeds: Attribute™ (the Bt variety) and Bonus™ (the non-Bt variety) for both a spring planting and a summer planting (similar in timing to doubled-cropped vegetable production). The Spring sweet corn harvest was completed in late June, and the Fall sweet corn harvest results were completed in late September for both the Bt and non-Bt sweet corn varieties.

Data on the sweet corn test plots were collected for both the transgenic and non-transgenic varieties. Data included ear numbers, ear length, kernel fill, and damage ratings. This information was used to assess the marketability of the ears, whereby the criteria corresponded closely to U.S. No. 2 or better sweet corn grades, as defined in the U.S. Code of Federal Regulation Standards for Grades of Sweet Corn. Revenue projections were developed for the number of marketable ears harvested, as in fresh produce marketing.

Consumer preference studies were conducted with the harvested ears of both the transgenic and non-transgenic varieties of sweet corn. The focus of the consumer preference studies was to learn of consumer perceptions on visual acceptability and on taste or palatability. Ears in the husk, as well as ears cleaned but uncooked, as well as ears ready to eat (corn on the cob) were presented for evaluation. The consumer preference studies were conducted at the State Farmer's Market in South Central Georgia. Scores of the consumers' comments and evaluations

of such things as general appearance, kernel fill, kernel color, silks, milkiness, and taste were recorded, but without any identification (variety names nor Bt/non-Bt descriptors) to the consumers. A priority ranking of purchase order was also collected. The only commercialization conveyed was a note of thanks to Novartis Seeds for having provided all the sweet corn seed used in the plot trials.

Results and Observations

Ear Data

Ear numbers and ear lengths were recorded by replicated plot, and percentage ratings were assigned for kernel fill and insect damage—for the spring and fall harvests and the transgenic and non-transgenic varieties. All ratings were made after allowing for a one-inch ear tip cutoff, as is commonly used in sweet corn marketing. The rating scales are presented below in Tables 1 and 2.

“Marketable sweet corn” was defined as ears with at least 80 percent kernel fill and a damage

rating of slight or better. This criteria corresponds to the U.S. No. 2 or better sweet corn grades as defined in the U.S. Code of Federal Regulation Standards for Sweet Corn.

A random sample of 10 ears were taken from the harvest of each randomized plot and evaluated. For the late June sweet corn harvest, ear length was not statistically different between the Bt and non-Bt varieties. Percent kernel fill was fair for both sweet corn varieties, but the traditional, non-Bt variety had a slight, yet non-significant, advantage. The significant difference was in the percent damage rating, where only 14 percent of the Bt ears had any damage, versus 56 percent of the non-Bt ears and damage being more severe (more than one-half of the kernels on some ears) on non-Bt ears. Combining the three criteria, marketable ear percentages were 50 percent for each variety. Because of the unfavorable planting, growing, and pollination conditions in 1999, marketable percentage values were adjusted by eliminating the criteria of kernel fill, resulting in the Bt variety having 100 percent marketable ears and only 60 percent marketable ears for the non-Bt sweet corn (Table 3).

Table 1. Kernel Fill Rating Scale.

Rating	1	2	3	4	5	6	7	8	9	10
% Fill	10	20	30	40	50	60	70	80	90	100

Table 2. Ear Damage Rating Scale.

Rating	1 none	2 slight	3 moderate	4 severe	5 very severe
% Damage	0	< 10	10 - 25	26 - 50	> 50

Table 3. June Harvest Results.

Variety	Ear Length (cm)	Kernel Fill Rating (1-10)	Damage Rating (1 - 5)	Raw % Market. Ears	Adjusted % Market. Ears
Bt	19.25	6.80	1.40	50	100
non-Bt	19.40	7.25	3.20	50	60

Similar results were observed for the September sweet corn harvest. Mean ear length was insignificantly longer for the non-Bt variety as was the kernel fill rating in favor of the non-Bt variety (Table 4). As with the June harvest, the Bt variety had a significant edge in the percent damage rating. Raw

score marketable ear percentage was 7 percent higher for the Bt variety (40 percent versus 30 percent). When adjusted to disregard the kernel fill rating, again 100 percent of the Bt ears were marketable, while only 70 percent of the non-Bt ears met the required damage rating for marketable ears.

Table 4. September Harvest Results.

Variety	Ear Length (cm)	Kernel Fill Rating (1-10)	Damage Rating (1 - 5)	Raw % Market. Ears	Adjusted % Market. Ears
Bt	19.15	6.50	1.10	40	100
non-Bt	19.30	7.00	2.25	30	70

Economic Value

Rather than extrapolating the small plot data to a one-acre scale, a regional market price observed at the local State Farmer's Market and an average yield for commercial South Georgia sweet corn producers was used to develop an economic value comparing the varieties (Table 5). Using the 30 percent value of marketable ears for non-Bt sweet corn as a baseline value, the increase to 40 percent marketable ears for the Bt variety represents a 33.3 percent yield increase. The regional average yield of 600 dozen ears per acre is then adjusted to 800 dozen ears and an additional economic gross revenue of \$ 350 per acre (\$ 1.75/dozen times 200 dozen). The incremental cost differences observed between the Bt versus non-Bt varieties were higher seed costs but lower ag chemical costs and lower application expenses (weed control only).

Consumer Preferences

Five-point Likert Scales were developed to evaluate and score consumer opinions and preferences (Table 6). The Bt variety was a clear favorite

when ears-in-the-husk (with the one-inch ear tip plus exposed silks cutoff) as no worm or insect entry points were noticeable when compared to the non-Bt variety ears (4.89 mean score for Bt; 3.06 for non-Bt as to appearance). In viewing the ears-cleaned-but-uncooked, a less distinctive difference was observed as an overall mean score between the Bt and non-Bt sweet corn variety, although the Bt variety did get the more favorable score (4.26 for Bt; 3.54 for non-Bt), with the non-Bt variety's visible damage being of concern.

When reporting on the sensory experience of eating the corn-on-the-cob (ears cooked, ready-to-eat), there were nearly identical scores compiled for the Bt and non-Bt ears, although the non-transgenic ears were a sugar-enhanced variety. Participants in the survey signed a human resources/subjects research release as a standard procedure for taste studies, and although a reference to transgenic varieties was included in the release, few participants understood the term to raise issue with the Bt concept or few were concerned about a transgenic food product anyway, as no one declined to participate upon reading the release. Neither verbal pronouncements nor signage divulged the nature of the sweet corn.

Table 5. Economic Value Gained From Bt Variety Sweet Corn.

	% Marketable Ears	Regional Average Yield (doz. ears/acre)	Gross Revenue
Non-Bt	30	600	\$ 1,050
Bt	40	800	\$ 1,400
Change	+ 33%	+ 200	+ \$ 350

Table 6. Consumer Acceptability of Sweet Corn Varieties.

	Mean Scores, 5-Point Likert Scale	
	Bt Variety	Non-Bt Variety
Visual Acceptability		
General Appearance	4.26	3.54
Kernel Fill	4.05	3.35
Kernel Color	4.51	4.55
Silks	3.97	3.89
Palatability		
Overall Taste	4.48	4.34
Milkiness	4.40	4.32
Sweetness	4.26	4.30

Conclusion

The research results suggest the following:

- (1) Bt sweet corn gives an opportunity for increased economic revenue to South Georgia vegetable growers from a cost-accounting perspective.
- (2) Frozen food processors could gain a more uniform product from the field using Bt varieties, leading to less waste and a higher pack-out for freezing.
- (3) Consumer tastes and visual preferences suggest the Bt variety tested is not as well received as some non-transgenic varieties of

sweet corn but was comparable to the non-Bt variety in the test trials.

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Commercial Fruit and Vegetable Growers' Satisfaction With Retail Seed, Fertilizer and Pesticide Suppliers in the Georgia Coastal Plain

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Introduction

Modern food horticulture crop farming (fruits and vegetables) has become an increasingly complex business. Technological advances have led to the development of many new seed varieties, fertilizers, and pesticides, as well as to the evolution and adoption of specialized machinery and equipment, including precision farming techniques. Commercial producers draw best management practices and advice from numerous sources in both the public and private sectors.

Retail suppliers of the critical inputs have been an integral part of the information transfer network for decades. Besides the inputs (seeds, fertilizer, pesticides, equipment) and information (production and agronomic advice, product/service information, equipment leasing, innovations, market developments), retail suppliers and dealers may also provide services (scouting, consulting, record-keeping, credit, custom applications). Hence, retail production inputs suppliers play a necessary role by assisting growers in getting food horticulture from planting to processor and/or purchaser.

This study focuses on the potential influences of such factors as price, convenience, services provided, financing capabilities, company reputation, employee knowledge, production skills and technology characteristics, and tenure of relationship between grower and retailer (firm and/or salesperson) on producer preferences about retail inputs suppliers. Of particular concern is the impact of these factors on grower/farm operator satisfaction, supplier characteristics, and the minimum service bundles/packages required of a supplier. Retail suppliers can use this information to explore critical aspects of non-price competition and to establish benchmarks for evaluating purchaser satisfaction of the marketing firm's four marketing Ps and to potentially increase their respective market shares.

Research Methodology

Most of Georgia's commercial fruit production (namely peaches and berries/brambles) and nearly

all of the commercial vegetable production occurs in the Coastal Plain region of South Georgia. The retail inputs suppliers in the Coastal Plain were the focus of a commercial fruit and vegetable grower survey mailed in the Winter (January–February) of 1999 to the memberships of commodity organizations and commodity committees (specific fruit and/or vegetable crops). If a producer was a member of more than one of these activities, only one copy was sent to an address, due to screening and purging of the individual mailing lists. A follow-up survey was mailed to any of the initial 304 operators not returning the first questionnaire, with 102 completed surveys being tallied for the results.

In the 1998 growing season, the supplier concentration suggested that fewer than a dozen inputs suppliers accounted for three-fourths of the sales activity. The univariate analyses cited in the following figures pertain to the grower's main retail inputs suppliers of seed (or plants), fertilizer, and pesticides. Frequency counts and a five-point Likert Scale were used to rate the importance of reasons, attributes, and services provided by retail inputs suppliers.

Results and Observations

Respondents were provided a given list of reasons why they chose their current main retail inputs supplier. The respondents were asked to rate (not rank) the importance of each reason on a scale of 1 (unimportant) to 5 (critically important). Reputation, delivery services, and long-term relationship with a salesperson had the highest ratings, with means of 4.33, 4.26, and 4.24, respectively (Figure 1). Financing, equipment rental, and scouting services had the lowest ratings as reasons why the producers chose their current primary supplier, with mean scores of 2.89, 3.09, and 3.10, respectively. The write-in attributes that were frequently cited included friendly sales people, knowledgeable employees, and good services.

The relatively lower mean scores of financing, equipment rental, and scouting services do not imply that retail suppliers can ignore these services. These services may be offered by almost all suppliers and are, thus, deemed unimportant when growers select among suppliers. The necessity for these services is pursued later in the questionnaire.

Price and location were anticipated to be more highly rated. The observed lack of prominence of price as a selection criteria might be reflective of a

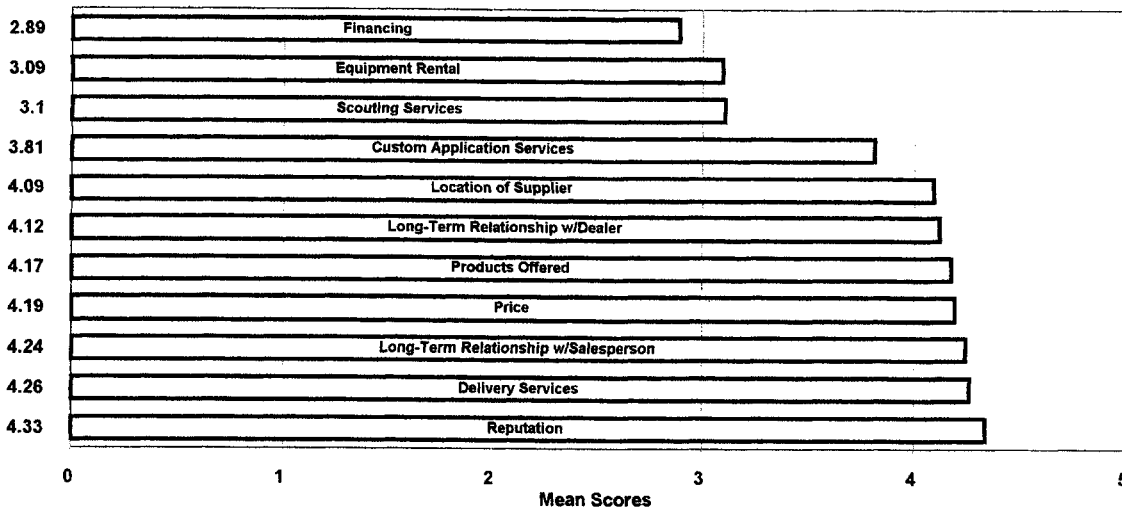


Figure 1. Main Retailer Attributes That Are Most Important to the Fruit/Vegetable Producer.

competitive environment in the marketplace, or price leadership by a few firms. Although location's rating was unexpectedly lower than that of many attributes, four out of five growers claimed that their primary supplier was also the closest supplier of seeds, fertilizer, and pesticides.

While nearly one-half of the respondents used only one supplier in 1998, the remainder used at least two suppliers (as many as six suppliers were cited by a few producers). Reasons that food horticultural crops producers gave for using multiple retailers are listed in Figure 2 along with the proportion of growers who claimed a particular or specific reason as a justification for using multiple retail suppliers. The three most common reasons for the respondents to use more than one supplier in 1998 were: availability of certain pesticides (78 percent); long-term relationship with a supplier (77 percent); and availability of specific services (73 percent). The three least important

reasons cited were: amount of credit extended by a supplier (40 percent); availability of fertilizer (56 percent); and availability of specific equipment for rent (58 percent).

Operators were asked which services a supplier must provide for an operator to do business with them. The seven items listed in the survey are presented in Figure 3, along with the proportion of respondents requiring that service. The three most frequently mentioned services were: delivery of products (60 percent); full-time salesperson (54 percent); and custom applications (52 percent). Note that these responses are similar to what was important for selecting the main supplier. The three least necessary services that a supplier must provide were: scouting services (23 percent); parts and repair services (29 percent); and financing (36 percent).

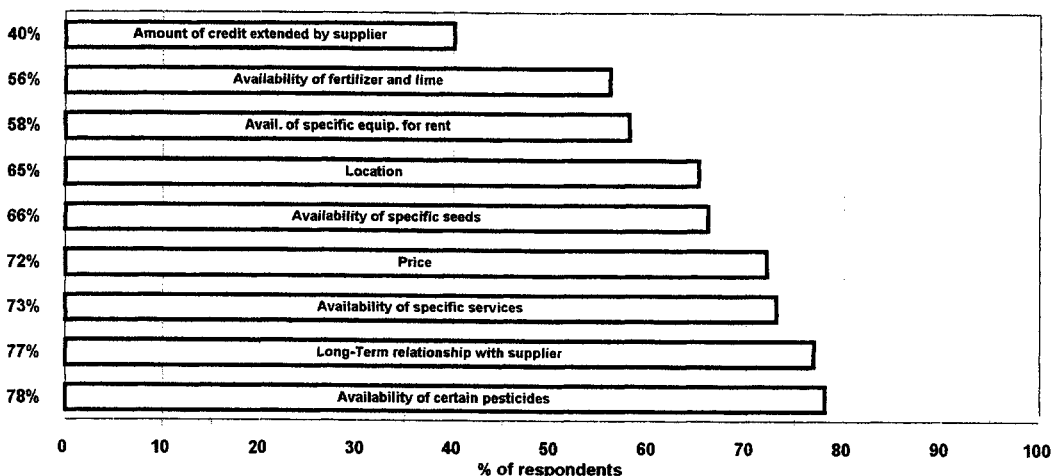


Figure 2. Reasons for Producers to Use Multiple Retail Suppliers.

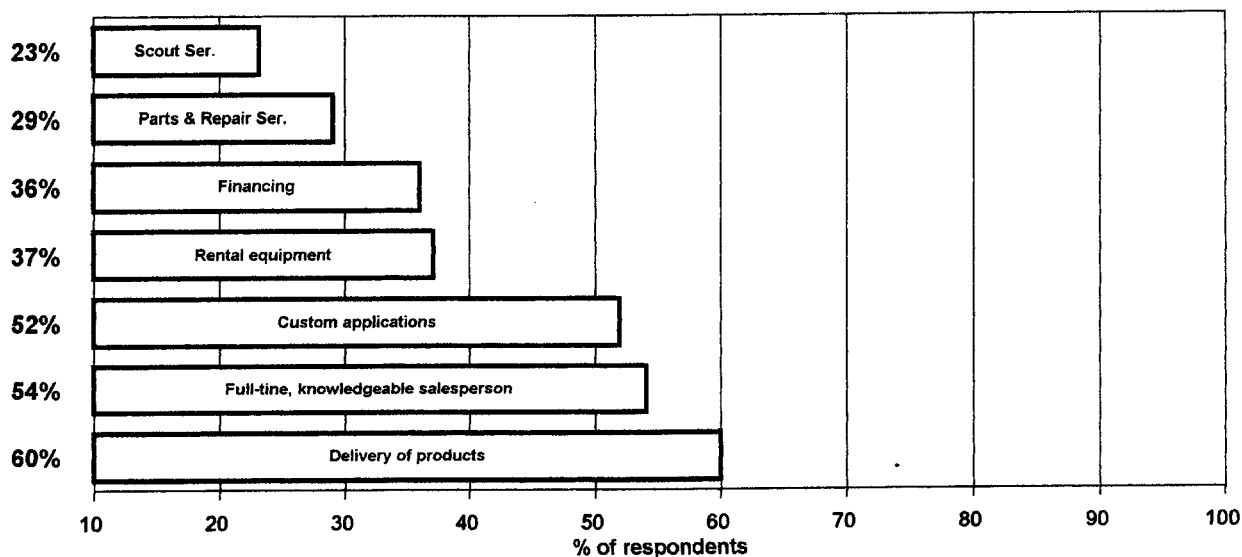


Figure 3. Minimum Services Expected of Retail Suppliers.

Conclusions

It would appear that suppliers cannot increase producer satisfaction levels by segmenting their clients into different operator groups and trying to appeal to those groups rather than to those operators using multiple suppliers. This lack of substantial market segmentation probably reflects a highly competitive marketplace/industry where producers are quick to adopt least-cost behaviors regardless of their particular idiosyncratic farm characteristic classifications. This does not imply that fruit and/or vegetable growers are dissatisfied with their supplier(s). Nonetheless, some services and supplier attributes are more important than others in a patron's preferences, indicating that suppliers must carefully weigh which services to offer.

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Changing Structure in the Florida Citrus Markets

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Recent mergers and acquisitions, primarily at the retail level, have been the impetus for an increased focus on market structure in the horticultural industries (Dimitri, 1999; Gilmer, 1999). Such structural changes may be especially critical in Florida citrus markets where Florida growers produce approximately 75 percent of U.S. oranges (20 percent of world supply) and 79 percent of U.S. grapefruit (54 percent of the world supply).

The purpose of this study is to provide a descriptive analysis of structural changes occurring in Florida citrus markets. Specific objectives are:

- (1) to document the marketing channels for Florida citrus, both fresh and processed;
- (2) to provide evidence concerning changes in these channels over time through the use of sales volume data; and
- (3) to collect and analyze anecdotal evidence from both buyers and sellers along the marketing chain to focus attention on critical issues.

As data on both horticultural markets and market structure in general are often difficult to compile, this study will provide a critical first-step in the analysis of economic market performance for Florida citrus products.

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Changing Patterns of Sweet Corn Marketing and Consumption in New York State

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Introduction and Justification

Traditional sales tenets practiced by U.S. produce distributors and retailers are changing rapidly as a growing number of Americans place emphasis on value-added and quality characteristics when making produce purchase decisions. Better quality, increased variety, year-round availability, and health-conscious lifestyles have boosted the consumption of fruits and vegetables. The dynamic production and marketing systems of fruits and vegetables often complicate local, regional, and national supplier efforts to match available supplies with market demand. There is a wide range of fruits and vegetables produced in New York. Sweet corn is the focus of this study because of its importance to vegetable production and consumption in the state. Combining fresh and processed production, it had the highest farm production values and the largest acreage for all vegetables produced in New York (New York Agricultural Statistics, 1999).

Sweet corn is one of the most popular vegetables in the United States and Canada, and consumption is rapidly increasing in eastern Asia and parts of Europe (Tracy, 1994). It is consumed fresh and in many forms of processed products and is marketed through a wide range of distribution channels, including various shipping operations, local wholesale, and direct sales. In addition, it has a strong seasonality in production. In many regions of the United States, fresh sweet corn is also a symbol of summer for consumers. The viability of sweet corn production in New York depends on the industry's competitiveness in terms of cost of production, the ability to implement alternative marketing strategies, and consumers' acceptance of New York-produced sweet corn. Understanding the marketing and consumption of sweet corn in New York will allow us to understand many different aspects of the marketing and distribution system of the vegetable industry.

Objectives

The overall goal of this project is to better understand the changing supply-chain structure of the produce industry and consumption patterns, and to enhance the marketing of sweet corn produced in New York state. Specific objectives are:

- (1) to determine the current levels of sweet corn production in New York for fresh and processed markets;

- (2) to develop up-to-date descriptions of sweet corn production and marketing characteristics and consumption patterns of fresh and processed sweet corn in New York;
- (3) to determine trends in sweet corn production and consumption in New York and to better understand factors influencing these changes; and
- (4) to identify opportunities and barriers for New York sweet corn marketing.

Procedures

Both primary and secondary data will be utilized to identify the production origin of sweet corn products marketed in New York state, to estimate product volume by point of origin flowing through identified channels, and to analyze consumer data for fresh and processed products. The available data have been reviewed and coordinated to summarize the current and historic production and consumption levels of fresh and processed sweet corn in New York. New York sweet corn producers, marketers, processors, and consumers will be surveyed to collect information on production, harvesting, and packing practices, alternative marketing strategies, and consumption patterns.

Research Update and Discussion

According to USDA reports, the sweet corn production in New York has increased from 19,504 hectares (48,760 acres) in 1982 to 26,632 hectares (66,581 acres) in 1997, which is the largest acreage for all vegetables produced in New York. Sweet corn is produced throughout the state with concentration in the lower Hudson Valley and in Western and Central New York. In 1997, the top four production counties were Cayuga (15.1 percent), Orleans (10.5 percent), Livingston (9.7 percent), and Ontario (9.4 percent). The total crop value in 1998 was \$63.1 million, a 40.7 percent increase from \$44.8 million in 1997. The 1998 sweet corn production placed New York third in fresh market and fifth in processed tonnage among states. The major growth came from fresh market production. Harvested sweet corn acres for fresh market were predicted to reach 12,080 hectares (30,200 acres) in New York in 1999, up 3 percent from 1998 and up 11 percent from 1997. In contrast, processors contracted 12,560 hectares (31,400 acres) of sweet corn

in New York in 1999, which is down 25 percent from 1998 (16,800 hectares, or 42,000 acres).

After its growth in the 1980s, the per capita consumption of sweet corn has been steady at about 12.7 kg (28 pounds) during the 1990s. Nonetheless, a gradual increase in fresh use has been seen. The retail-weight equivalent of the per capita use of fresh sweet corn is 4.1 kg (9.0 pounds) in 1998, increased from 3.6 kg (7.9 pounds) in 1995 and 3.0 kg (6.7 pounds) in 1990. On a fresh-equivalent basis, the per capita use of processed sweet corn totaled 8.8 kg (19.4 pounds) in 1998. Although sweet corn is the most popular processing vegetable in the United States, after potatoes and tomatoes, this level of use has been virtually the same for the past three decades. There has been a gradual shift from canned to frozen sweet corn over the years, and this shift has continued during the 1990s. In 1995, frozen use caught up and exceeded canned use. However, despite the long-term growth, domestic demand for frozen sweet corn may have softened slightly since peaking in 1996.

The United States and Canada dominate world production of sweet corn. Other major producers include France, Italy, Hungary, Japan, and Australia. The major competitors for U.S. export markets are Canada, Israel, Hungary, France, and Australia. The major markets for U.S. sweet corn exports are Canada, Japan, Taiwan, and Hong Kong for processed products, and Canada and the United Kingdom for fresh products. The U.S. sweet corn export has increased steadily and topped \$241 million in 1997. Canned exports accounted for \$159 million, or 66 percent of all U.S. sweet corn exports, while frozen and fresh exports made up for the remainder of 25 percent, and 8 percent, respectively. The decline of U.S. sweet corn exports to \$231 million in 1998 was largely due to recessions in Asia, particularly in Japan. The major U.S. import suppliers are Mexico for fresh products and Canada for processed products.

There were 1,542 New York farms that reported sweet corn production in 1997. The average size of sweet corn production area was 17.27 hectares (43.18 acres) per farm. This is relatively small compared to other major sweet corn production states, including Minnesota (24.81 hectares, or 62.02 acres), Wisconsin (26.14 hectares, or 65.34 acres), Washington (59.81 hectares, or 149.52 acres), and Oregon (32.63 hectares, or 81.58 acres). Also, the supply of New York fresh sweet corn is highly seasonal—limited to July through November, with August through October being the

primary season. Therefore, the production and marketing strategies for the viability of the New York sweet corn industry could be challenging and unique. This study attempts to better understand the connections of produce marketing channels and to identify marketing barriers and opportunities for New York producers. Recommendations based on the above finding will help the produce industry to increase the efficiency of the distribution system. New York sweet corn producers can utilize the information to minimize barriers and to identify opportunities and marketing windows for their products. Retailers and distributors

can benefit from an understanding of the industry and consumption trends.

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