

AN ANALYSIS OF THE PRODUCER BENEFITS OF TRACEABILITY SYSTEMS WITHIN
THE CALIFORNIA FRESH STRAWBERRY INDUSTRY.

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Abstract

Food safety has become a major priority and concern in the agriculture industry within the last 5 years. Agriculture companies across the United States have begun to implement traceability systems in order to provide a safe and traceable product. This particular study analyzes the producer benefits of implementing a traceability system within the California fresh strawberry industry. An in depth research expedition has been performed through the cooperation of seven strawberry companies in California. Personal interviews with industry experts provided the bulk of the data, which were then analyzed and divided into different categories. Costs, reputation, quality, safety, and types of traceability systems were different topics that were asked to strawberry companies in order to better understand the concept of traceability. The study concluded that all major California strawberry producers currently have an item level traceability system in place, and traceability has recently become an industry standard.

Chapter 1

INTRODUCTION

Health and biosecurity concerns have become a major issue in the fruit and vegetable sector of the agriculture industry lately. Incidents of *E. coli*, *salmonella*, and other bacterial outbreaks have occurred in the United States agriculture industry. This has been a major concern for not only consumers of the product, but also producers. Precautionary measures are being taken in many sectors of the food industry, especially California fresh strawberries. Many strawberry producers are turning to modern technology in order to maintain quality, safety, reduce hazards, and most importantly to track their product. Strawberry producers across California are adopting traceability systems in order to trace their product back to the source in the event of a re-call. Traceability systems are extremely sophisticated, and have the capabilities of tracing the product back to the exact field and row that it was grown on.

Currently, traceability systems are voluntary, but many strawberry producers are choosing to implement this system within their company. Although many producers have voluntarily implemented a traceability system, there are still some producers that chose not to implement a traceability system, due to the high initial cost and maintenance fees. The high cost incurred by implementing a traceability system is an investment that that can be highly beneficial for strawberry producers.

Problem Statement

How beneficial is implementing a traceability system for California fresh strawberry producers?

Hypothesis

Implementing a traceability system will initially be expensive, costing approximately 5% of total annual revenues, but will have many long term benefits associated with it, including increasing revenues by 15%.

A producer majority of 85% will currently have a traceability system implemented, and 25% of those are able to charge a premium for their product.

Objectives

- 1) To evaluate the effects of implementing a traceability system for California fresh strawberry producers.
- 2) To analyze the reputations or views of California strawberry companies that currently have a traceability system.
- 3) To analyze the effects on quality and safety as a result of a traceability system.

Justification

Current biosecurity and health hazards have caused many strawberry producers to implement a traceability system. Contaminated fresh strawberries can potentially cause an extreme health hazard for strawberry consumers, by possibly infecting them with unpredictable contaminations such as *E. Coli*, *salmonella*, and other bacterial infections. These bacterial outbreaks will cause mandatory re-calls of the product, resulting in major consequences for

strawberry producers. Producers that currently do not have a traceability system are causing a major economic liability for themselves, and putting the reputation of the whole California strawberry industry in jeopardy. The California fresh strawberry industry is an extremely large industry, which produces approximately 2.0 billion pounds of strawberries annually. The 2.0 billion pounds of strawberries produced in California is equivalent to eighty five percent of the United States strawberry supply. It is essential for California strawberry companies to have traceability systems, in order to reduce the risk of bacterial outbreaks, and to improve the overall quality and safety of California fresh strawberries. In addition, a traceability system can possibly create more job opportunities in the agriculture sector, such as traceability inspectors, traceability software installers, and many other jobs associated with traceability and quality control. The implementation of traceability systems is obviously critical because it dramatically affects producers, consumers, and the United States strawberry industry.

Chapter 2

REVIEW OF THE LITERATURE

The Traceability Study

Traceability is the ability to track a product along the supply chain from the time it was harvested to the consumer. It is a relatively new system that provides a higher level of safety, quality, reduces hazards, and ultimately benefits both producers and consumers. According to A. Regattieri, et. al (2007) a traceability system allows for accurate, efficient, and complete information of a product through a supply chain in order to minimize working costs and maximize profits. An in-depth study must display the effects of having a traceability system within a food industry, especially the California fresh strawberry industry.

Multiple studies have shown an increasing trend in the implementation of a traceability system in the agricultural industry, especially California fresh strawberries. This is due to the many benefits associated with a traceability system, and the current problems that have evolved within the food sector. It is difficult to acquire ample information on the traceability of California fresh strawberries, but the concept of traceability is a system that is currently utilized in many food industries.

Types of Traceability Systems

There are many different types of traceability systems in the food industry, but some are much more accurate and efficient than others. The different traceability systems that were examined by A. Regattieri, et. al (2007) were alphanumerical codes, bar codes, and radio-frequency identification (RFID). Alphanumerical codes are a series of different numbers and

letters that are attached to the packaging of the product that is being transported. The alphanumerical codes are simple and cost-effective, but require a significant amount of labor and have numerous managerial problems. Bar code systems are frequently used in many types of industries and are cost-effective, precise, and very reliable. The bar code system is regularly used in the retail sector, but in the food industry it is less attractive due to the fact that it is less precise and requires excess labor. Lastly, radio-frequency identification (RFID) is a technology that uses wireless microchips in order to trace a product through the supply chain. The RFID is fully automatic and needs a limited amount of human interaction (Waves 2004). It is very reliable and accurate, although it is extremely expensive to implement and may result in a product price increase, especially when dealing with a highly perishable item such as fresh strawberries.

Through the many companies that provide diverse traceability systems, the United States agricultural industry is able to control and monitor their product much more accurately and efficiently than ever before. A company that provides a somewhat different and excellent traceability system is *YottaMark Inc.* *YottaMark Inc.*, a company based out of Redwood City, California is the leader in traceability and authentication (Nakajima 2009). The *YottaMark Inc.* traceability system called *HarvestMark*, uses a datamatrix code rather than alphanumerical or bar codes. The datamatrix code allows for consumers to type in the code into the *HarvestMark* website, or into their 3G iPhones to see exactly where the product is traced back to (Shee 2009). The *HarvestMark* tracking system is capable of tracking item-level products such as individual packages, or case-level products such as flats of produce. According to Nakajima (2009), Foxy Farms has adopted the *HarvestMark* traceability system within their company. Foxy Farms will use the datamatrix system on individual strawberry containers or clamshells, which will make all

of their strawberries completely traceable from the field that it was grown on, to the retailer that is selling the product to the consumer. The *HarvestMark* tracking system allows for detailed information on harvest time, distribution, quality, safety, and all steps through the supply chain, which will significantly benefit both producers and consumers.

Traceability Case Studies

A case study was conducted by Engelseth (2009) which used a traceability system for Corona Strawberries that are grown in Norway. The supply chain for these strawberries consists of the product moving through farmers, wholesalers, distribution centers, retailers, and finally the consumers. The traceability system that was implemented on Corona Strawberries is mainly in effect when the quality of the product is tainted. The products may have been tainted by pests, poor handling techniques, and lack of temperature control (Mitchell 1996). The problem is usually detected when the strawberries arrive at the wholesalers or distribution center. All exchanges throughout the supply chain are documented in order to trace the strawberries back to the producer and exact field that they came from. The conclusion of the research was that product traceability is a very complex system that requires all aspects in the supply chain to cooperate in order to be successful.

The complexity of the supply chain exposes producers to the moral hazards in the production of their product. Studies conducted by S.A. Starbird (2008) have shown that producers behave differently when a moral hazard or insulation from risk is in effect. Moral hazard can be mitigated by exposing the producer to the costs of unsafe food. A method to identify a supplier who has produced unsafe food is to implement a traceability system. A traceability system can track a product through the supply chain and is classified by breadth,

depth, and precision of information (Waves 2004). The breadth is the amount of information that is supplied through the supply chain. The depth is how far along the supply chain the information has passed through. The precision of the information refers to accurate sampling procedures, diagnostic methods, and overall precision of the product which depends on the type of product. Through these three aspects, Engelseth (2008) stresses the fact that a traceability system has many uses such as for controlling food safety, quality, and allocating costs to the producer responsible if a failure were to occur. The studies concluded that moral hazard influences error rates, unsafe food costs, and production costs. Buyers and sellers can use this information in order to create guidelines or restrictions when transactions are being made.

Unsafe food may be a result of poor Integrated Pest Management (IPM) techniques. Pest identification, along with consistent field monitoring, is a key factor in order to grow high quality, healthy strawberries (*Integrated Pest Management for Strawberries* 2008). This is a major factor in the traceability of strawberries through the supply chain. Consistent field monitoring would include keeping records of field surveys, weed surveys, pest identifications, pesticides, and any bacterial outbreaks. Without these essential steps, a successful Integrated Pest Management program would not be possible.

Extensive research on tracking and tracing of food products has been conducted in order to understand the views of many producers throughout Germany. A study was performed by Heyder (2009) which was based on data that was collected from a random sample of 234 food manufacturers in Germany. Online surveys were distributed among many food manufacturers. These food manufacturers included producers of meat products, beverages, frozen foods, sweets and snacks, fruits and vegetables, canned foods, and dairy products. The study analyzed the producer and the attitudes toward traceability systems. The hypothesis for the research was based

on the attitudes of the decision makers in the company. If the cost-benefit assessment and outside pressures in implementing a traceability system were evident, then a manufacturing company would most likely implement a traceability system (Ajzen 1991). Through the research, they found that about three-fourths of companies believed a traceability system was important and reasonable (Fitzgerald 1999). In addition, food industries with higher food safety risks such as fresh meat or fish can experience higher prices for their product, if a traceability system is implemented (Porter 1990). Producers can charge a premium for their product, and consumers are more willing to purchase the product at a premium price, due to the higher quality and safety that goes along with a tracking system. Tracking systems are now being voluntarily implemented due to the increase in company revenues and consumer satisfaction.

The study conducted by Pouliut (2010) analyzes the effects a voluntary or mandatory traceability system has on consumer welfare, and also on firm's profit. A voluntarily implemented traceability system increases the reputability of a firm and gains consumers trust. The tracking system is meant to specify the origin of a product if a re-call were to occur, and also can protect the reputation of producers. Through the extensive research, it concluded that a tracking system benefits both producers and processors, and gives incentives for both to produce and process a safe product. In contrast to the voluntarily implemented tracking systems, government mandated tracking systems may be put into action if the Produce Tracking Initiative (PTI) is completed in 2010. According to Shee (2009), the PTI seeks to ensure that a traceability system is applied to all produce commodities in the United States, including local growers. The mandatory implementation of a traceability system will cause many producers who do not have a tracking system to modify their company, and also cause some smaller companies to exit the

market, simply because they cannot compete with the larger firms. This will result in safer and better quality food in the United States.

The concept of implementing a traceability system has been something that many producers are partaking in. Although, most producers that have a tracking system implemented are large, commercial operations that are able to afford the high costs of a tracking system. Although according to Karst (2009), a new company is providing an affordable traceability system for small, family owned growers. Top 10 Produce LLC, a company that is based out of Salinas, California, is providing a traceability system that is known as GS1-item Specific Data Bar Labeling. The Top 10 Produce LLC is a firm believer in the Producer Traceability Initiative (PTI), and will be providing this traceability system for one hundred eighty dollars per year, as long as the company obtains its license by January 1, 2010. GS1-labels can be applied to individual cases or products and will be modified to fit the specific need of a grower. Top 10 Produce LLC is gaining access to the producer market by offering a high quality traceability system at a very low cost.

In conclusion, the previous studies have shown that a traceability system has the capabilities to improve overall price, consumer satisfaction, internal company processes, advertising for producers, and most importantly safety and quality of the product.

Chapter 3

METHODOLOGY

Procedures for Data Collection

The procedures for data collection in regards to the benefits of implementing a tracking system for California fresh strawberries are a meticulous process that involves significant companies in the strawberry industry. The benefits and effects of implementing a traceability system for California fresh strawberry producers may be evaluated by collecting current and accurate data in the strawberry industry. First, a random sample of strawberry companies that produce a minimum of five million flats per year will be collected from all over California. The companies that will be interviewed will be Dole, Foxy Farms, Nature Ripe, Driscoll's, Red Blossom, Well-Pict, Sunrise Growers, and California Giant. The majority of the companies are headquartered in Salinas, California and grow their products in the Salinas Valley, Watsonville, Santa Maria, Oxnard and many other cities in California. In addition, the information that will be collected will include the current involvement of a traceability system within their company. If a traceability system is currently used, how specific or in depth does the system trace the product. Since most traceability systems have been implemented approximately within the last five years, interviews will be conducted in order to better understand the effects producers are experiencing. The interviews will be personal interviews with industry experts such as owners, managers and supervisors. The interviewee will be asked a series of questions pertaining to their traceability system or potential traceability system, and effects that it has had on the company, especially within the last five years. Questions will include what compelled the company to implement a system, current benefits that are a direct result of a traceability system, and the quality and safety

effects that tracking system has had on their product (refer to appendix for interview questions). The questions will remain constant for all companies that will be interviewed.

Costs are an important factor to consider in the implementing of a tracking system. Initial starting costs of implementing a system and maintenance costs must be determined to evaluate the cost benefits for producers. Data from financial records was collected such as traceability system costs, total annual revenues, and other financial costs associated with a tracking system from the previous five or more years. The financial records will be collected from the accounting sector of the company, or it may be obtained publically if the company is publicly traded. In addition, the current average price for fresh strawberries will be evaluated and compared, in order to determine if a tracking system can differentiate a company's product, and if producers are able to charge a premium for their strawberries.

Procedures for Data Analysis

The procedure for data analysis will be used in order to better understand the information collected by interpreting the data into a graph or matrix. Once the results are collected from the interview questions from the different strawberry companies, the data will be reviewed and formulated into graphs. The results of the questions were organized in a fashion where it will be entered in a program such as Microsoft Excel, where graphs were formulated in order to better understand the data collected. The strawberry companies, which constitute the majority of the strawberries produced in the United States, was broken down into different categories such as "current traceability system" and "no traceability system." The analytical technique of a case study was used in order to analyze both types of management styles, and ultimately understand the benefits of implementing a traceability system. An analysis of product prices, product quality

and safety, and company reputation were taken into consideration when analyzing both management styles.

The data collected from financial records was examined in order to evaluate all the costs associated with a traceability system, and conclude if the implementation of a traceability system has increased revenues or helped the company financially. The financial records from companies that currently have a traceability system were compared to their previous year's financial records before a traceability system was implemented. The data from the financial record was collected, and formulated into a graphic table to better illustrate the information at hand. Also, a correlation was analyzed if a traceability system allows for product differentiation, and relates to higher prices for the product. The information was formulated into a graph for visual clarity and to better understand the data. The key function of this analysis is to better understand if implementing a traceability system is beneficial for California strawberry producers in an overall industry, reputation, and cost standpoint.

Assumptions

This study assumes a traceability system will have some type of positive impact for strawberry growers and their product. The high cost of a traceability system will also be assumed, given the fact that mainly larger companies are financially able to implement a system.

Limitations

The limitation of the study is that only the major companies producing a minimum of five million flats of strawberries per year are being taken into consideration. Smaller growers are responsible for a fair share of the local fresh strawberry market, but they are not taken into consideration in this study. The methodology that was constructed will be significant for other

types of traceability studies in the United States, but the actual outcome will be very important for California fresh strawberry producers, and the future of the California fresh strawberry market.

Chapter 4

DEVELOPMENT OF THE STUDY

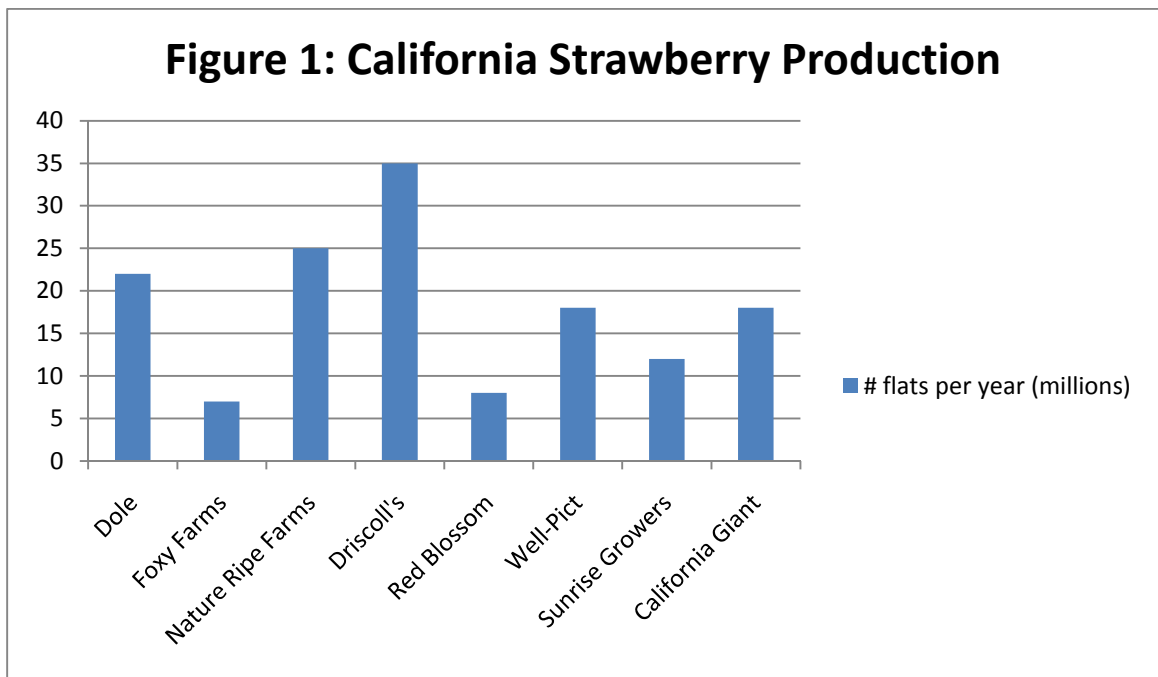
Analysis

The data that were collected through personal interviews, with the eight major strawberry producers in California. The interviews and survey results took approximately six weeks to arrange and complete. For a six week period, one to two interviews per week were scheduled and conducted at various strawberry producers' headquarters in Salinas, California. All of the strawberry producers were asked the same questions, and many of the producers also had very similar answers. In addition, all people that were interviewed were sales managers, food safety managers, or owners of the company. The results were very interesting and partially contradicted the hypothesis.

Once all of the data were collected, it was organized into categories that separated strawberry producers with a traceability system currently in place, and producers with no system in place.

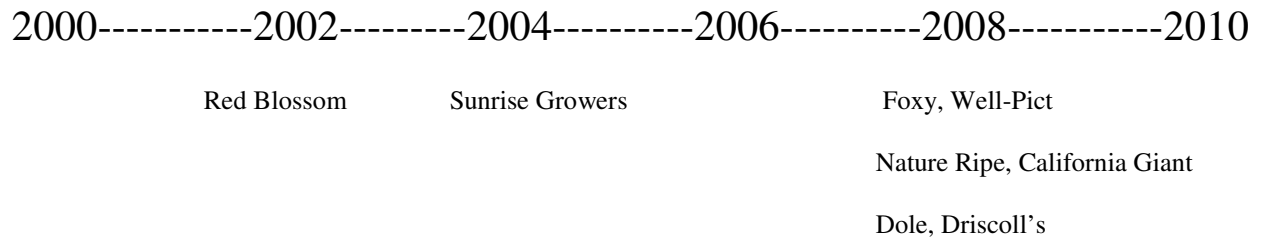
Of the eight major California strawberry producers that were interviewed, all of them currently have a traceability system in place within their company. A traceability system in the strawberry industry has become industry standard within the past 2 years due to safety concerns that have affected other sectors of the produce industry. All major California Strawberry companies have adopted a tracking system as a safeguard, if a re-call were to be put into effect. The current use of traceability systems is absolutely necessary in order to compete with other companies in the fresh strawberry industry. In addition, all the major producers use an item level

trace back system, provided by a company called *Yodamark*, except Nature Ripe which uses *Harvestmark* as a tracking system. The item level tracking systems are very accurate and detailed. It will show the day the product was harvested, as well as who harvested it, and in which particular field it was harvested. Every clamshell has a traceback number on the bottom, which allows every item to be traced accurately.



Although the number of flats per year each company produces varies dramatically, every company has implemented this system within the last five years. The first to implement a traceability system was Red Blossom in 2002, and since 2007 every major strawberry producer has implemented the system.

Figure 2: Strawberry Producers' Traceability Implementation Timeline



The current benefits of a traceability system are very important for the producers. The survey data show that every producer responded with a similar answer to this question.

Producers responded on behalf of their consumers and customers. The customer/consumer confidence, assurance, and loyalty were their main concern as a direct benefit to implementing a tracking system for their product. It also provides a safety net if there were any type of food safety recall of their product. In addition, all producers believed that having a traceability system enhances their reputation in a positive way. Its reputation is essentially shown within fellow companies in the industry and also by their customers.

Start-up and maintenance costs were factors that were considered in the study. The data have shown that both start-up and maintenance costs for a traceability system are directly correlated with volume. The more strawberries a company produces, the higher tracking costs they will incur. On average, start-up costs are about \$40,000 per 5 million flats depending upon acreage of the farm and yield. This includes both equipment and training. Maintenance costs average \$25,000-\$30,000 per 5 million flats of strawberries. With the average price of \$10 for a flat of strawberries, and companies producing anywhere from 7 to 35 million flats per year, the costs that are incurred for traceability systems are merely insignificant.

Figure 3: Traceability Expenses compared to Annual Revenue



According to the major strawberry producers in California, data have shown that the implementation of traceability systems has no effect on quality, as well as price. The survey results have confirmed that traceability systems do not allow for the product to have a premium price associated with it. Since all producers now have a tracking system currently in place and traceability has become an industry standard, traceability does not differentiate the product from other companies. This immobilizes producers to be able to charge a premium price for their product as a direct result of a traceability system. Although, some strawberry producers have seen a slight increase in revenues because now strawberry producers are able to ship to more retailers that require higher standards of food safety. It also allows the producers to sell to higher end customers that are willing to buy more of the product because of the increased safety.

Table 1: Noticeable Increase in Annual Revenues as a Result of a Traceability System

	YES	NO
Dole		X
Foxy Farms	X	
Sunrise Growers		X
Driscoll's	-	-
California Giant		X
Red Blossom	X	
Nature Ripe		X
Well-Pict		X

Foxy Farms and Red Blossom both experienced a slight increase in annual revenues as a direct result of a traceability system. Although, no exact financial numbers were given by any of the companies that were interviewed.

Through the collection of the data, the hypothesis was partially confirmed. The statistics confirmed that the initial costs of the traceability were very expensive at \$40,000 per 5 million flats produced, but it did not cost 5% of total annual revenues, as stated in the hypothesis. In addition, the implementation of a tracking system did have long term benefits, such as increasing customer trust, attracting new/higher end customers and sometimes increase revenues, though it did not increase revenues by 15%. Furthermore, as stated in the second part of the hypothesis “A producer majority of 85% will currently have a traceability system implemented, and 25% of those are able to charge a premium for their product,” was proven to be false. 100% of all producers interviewed had a traceability system in place, and none were able to charge a premium for it.

Data Collection Problems

During the data collection, some problems arose that skewed the results and affected the analysis. First, there was no response from Driscoll's, who is the largest strawberry producer in the country. They were completely unwilling to release any information or even schedule an appointment to conduct an interview. They would only cooperate with current employees or interns that work for them. In addition, financial records such as income statements and balanced sheets that showed the exact costs of traceability systems, total annual revenues, and other financials that are associated with the traceability systems were not obtainable. Since most the strawberry producers are private companies, they were not willing to release any financial data. The only numerical financial data given were the approximate estimates for each company.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Once the analysis was concluded, it was evident that traceability systems within the California fresh strawberry industry are essential. Traceability systems are extremely beneficial for producers because it dramatically increases consumer loyalty, potentially attracting larger customers, enhancing company reputation, and also it has become an industry standard. The statistical data have proven that all of the major strawberry companies in California are currently using an item level tracking system, and have been doing so since 2008.

Overhead costs and increases in annual revenues as a direct result of a traceability system have been tested and confirmed. Traceability costs, both initial and maintenance, are both directly correlated to product volume, according to strawberry producers. The more strawberries a company grows, the higher the costs are in regards to its traceability system. For example, the average starting costs of a traceability system is \$40,000 for each 5 million flats of strawberries produced, and an average maintenance cost of \$25, 000 for each 5 million flats of strawberries produced. Therefore, larger companies such as Driscoll's or Nature Ripe are spending much more on traceability than their competitors, but in terms of scale they are paying the equivalent to other producers. When these figures are compared to the total annual income of any strawberry company, the traceability costs are insignificant. Most strawberry producers did not notice any significant increase in annual revenues, though it was reported by Foxy Farms and Red Blossom that they did observe a slight, long term increase in their revenues.

The data that was collected from the major California strawberry producers clearly rejected the hypothesis, but confirmed the importance of having a traceability system implemented within a company.

Conclusion

Throughout the extensive research and data collection, it was concluded that a traceability system is absolutely essential, as well as beneficial in the current strawberry industry. After the E. coli, salmonella, and other bacterial outbreaks in 2006, all strawberry producers have made traceability an industry standard. It gives strawberry producers a safe guard in the case of a product re-call, and at the same time increases company trust and reputation. Traceability is absolutely essential, and highly recommended by every California strawberry producer that was interviewed.

Recommendations

Since most of the strawberry companies in California are privately held, it is very difficult to obtain specific information, such as financial information. Companies are not willing to release such vital and detailed figures. Therefore, it is recommended that potential studies involving strawberry industries should be focusing on a case study, rather than a feasibility or profitability study.

References Cited

- Ajzen, I. 1991." The Theory of Planned Behavior : Organizational Behavior and Human Decision Processes." 90: (February), pp. 179-211
- Engelseth, Per. 2009. "Tracking Goods and Tracing Products in Food Chains." Department of Strategy and Logistics. (May): 1-10.
- Engelseth, Per. 2008. "Food Product Traceability and Supply Network Integration." Journal of Business & Industrial Marketing 24 (May): 421-430.
- Fitzgerald, A. 1999. "Impediments to Adoption of On-Farm Quality Assurance". In Proceeding of the 12th International Farm Management Congress (IFMA 99). July 18-24, Durban, South Africa.
- Heyder, Matthias . 2009. "Agribusiness Firm Reactions to Regulations: The Case of Investments in Traceability Systems." Georg-August-University Goettingen. 16 (February): 189-198.
- Integrated Pest Management for Strawberries*. 2008. Publication 3351. Statewide Integrated Pest Management Program: University of California Agriculture and Natural Resources: 11-30
- Karst, Tom. 2009. "Handling & Distributing: California Startup to Give Small Growers Traceability Help." *The Packer*. (June 2): 1-4.
- Nakajima, Miz. 2009. "Foxy Brand Strawberries Becomes Traceable with HarvestMark." HarvestMark: Yottamark Inc.
- Mitchell, Gordon F. 1996. *Handling Strawberries for Fresh Market*. University of California: Division of Agriculture and Natural Resources Publication 2442.

Porter, M.E. 1990. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: Free Press.

Pouliut, Sebastien. 2010. "Welfare Effects Mandatory Traceability When Firms are Heterogeneous." Department of Economics: Iowa State University. PP 1-25.

Regattieri A., M. Gamberri, R. Manzini. 2007. "Traceability of Food Products: General Framework and Experimental Evidence." Journal of Food Engineering 81 (January): 347-356.

Shee, Jody. (2009). "Tracking with Traceability." *Produce Retailer*. (September 17): 12-16.

Starbird, S.A., Amanor-Boadu,V., Roberts,T. 2008. "Traceability, Moral Hazard, and Food Safety." 12th Congress of the European Association of Agricultural Economists.

Waves, Amber. 2004. "Food Traceability: One ingredient in a Safe and Efficient Food Supply." U.S. Department of Agriculture: Economic Research Service. (March 12).

Appendix

- Survey Instrument

A series of questions will be asked during personal interviews with California fresh strawberry producers. All questions will be the same for each producer.

Company Name: _____

Interviewee: _____

Flats per Year : _____

Position of Interviewee: _____

1. Do you currently have a traceability system? If so what kind? If not explain why not?
2. How long ago did your company implement a traceability system?
3. How accurate or detailed is the system?
4. What compelled the company to implement a traceability system?
5. What are the current benefits that are a direct result of a traceability system?
6. What are the quality and safety effects that tracking system has had on their product?
7. Do you believe your company's reputation is related to having a traceability system?
8. What are the initial starting costs of implementing a traceability system? Maintenance costs?
9. Does a traceability system able you as a producers to differentiate your product and charge a premium for it?
10. Have your annual revenues increased due to a traceability system?

11. Would you recommend a tracking system for other strawberry producers that currently do not have one?

- Sample Population

The population that will be sampled will be major fresh strawberry producers in California. The companies are all located in the Salinas Valley, Watsonville, Santa Maria, and Oxnard. The companies will include Dole, Foxy Farms, Nature Ripe, Driscoll's, Red Blossom, Well-Pict, Sunrise Growers, and California Giant.

The sample size will be companies that produce at least 5 million flats of fresh strawberries per year. (1 flat = eight 1 pound clam shell unit)

Bassetti, Casey. 2010. Food Safety Manager, Red Blossom Inc. Personal Interview, Salinas (Nov 5).

Blazer, Scott. 2010. Owner/Partner, Blazer Wilkinson LP (Foxy Farms). Personal Interview, Salinas (Oct 23).

Beno, Eric. 2010. Sales Manager, Sunrise Growers Inc. Personal Interview. Salinas (Nov 5).

Crawley, Dan. 2010. Sales Manager, Well-Pict Farms. Personal Interview. Salinas (Nov 16).

Ferrante, Vince. 2010. Director of Operations, Dole Berry Co. Personal Interview, Salinas (Oct 30)

Sergent, Douglas. 2010. Retail Sales Manager, Nature Ripe Farms. Personal Interview, Salinas (Oct 30).

Tietz, John. 2010. Sales Manager, California Giant. Personal Interview, Salinas (Oct 29).