

Economic Implications of Voluntary Food Safety Practices at the Producer Level

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On-Farm Adoption of Voluntary Food Safety Practices for Fresh Produce

Food safety management is an increasingly visible component of fresh produce markets. Reasons for, and reactions to, heightened awareness of food safety issues at every step in the supply chain are important to understanding market structure and performance. The driving forces behind retail and consumer concerns about food safety and producer/handler responses to these concerns are shaping the food industry. As a case, we provide information on the NAFTA fresh strawberry market and then define three scenarios which could affect supply and demand conditions in the region.

Drivers of Adoption

Growing Consumer Awareness

Consumer awareness of food safety issues is reshaping the fresh produce supply chain.

- In 1993, hundreds of people in the U.S. west were made ill, and four died, after eating hamburgers contaminated with *E. coli* 0157:H7.



Market Access

Food processors and packers have addressed food safety issues through adoption of a mix of public and private guidelines. In fresh produce, compliance with some voluntary standards acts as a gateway to participation in the marketplace/supply chain. For example, Safeway Stores, Inc. now requires that all of its produce suppliers (producers and middle-men) undergo third party certification for food safety (Primuslabs, 2002). Foreign and domestic juice processors are required by law to implement HACCP systems. Other examples of efforts to address food safety issues include use of ISO 9000 certification to ensure quality, good manufacturing practices (GMPs), and full development of trace-back capabilities.

National Good Agricultural Practices Program

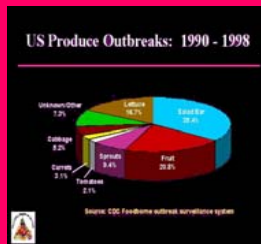
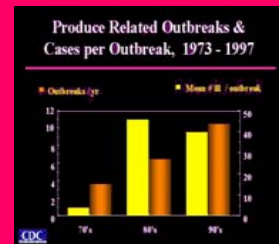
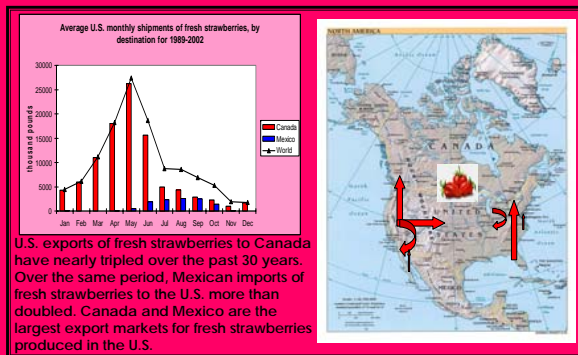
The National Good Agricultural Practices program was developed to educate growers about ways to avoid on-farm microbial contamination of their produce



The National Good Agricultural Practices (GAPs) program uses a HACCP-like approach to address on-farm food safety issues. While eliminating food safety risks at the farm level is impossible, lowering or preventing contamination at the farm or in the packing shed are reasonable goals (Rangarajan, Bihn, et al., 2000). GAPs help farmers and first-handlers identify areas where microbial contamination might occur, and then reduce the likelihood of that contamination by changing certain practices. Specific GAPs are available for many produce commodities, one of which is fresh strawberries.

Fresh Strawberry Production & Trade in NAFTA

- Production is concentrated in the U.S. and Mexico, especially CA, FL, and Baja. Many small u-pick and farm market operations are dispersed throughout the U.S.
- US and Canada consume most of the fresh strawberries produced in the region.
- Previous history with food safety outbreaks in both fresh and processed strawberries.



- In 1997, over 150 people in Michigan, many of them school children, were infected with Hepatitis A from frozen strawberries served in the school lunch.
- In 2001, there were over 13,000 diagnosed cases of illness from foodborne diseases. Of these cases, infants and the elderly had the highest rates of illness and death.

Between 1981 and 2002, U.S. per capita consumption of fresh produce increased 36 percent creating the potential for increased exposure to pathogens IF no adjustments are made in the way produce is handled.

Retailer Response

In a recent survey of produce buyers, food safety was ranked as the third most important challenge facing the retail industry, more important than attracting shoppers to produce, or the quality of the product being sold (Heller, 2002).

Retail buyers and wholesalers are demanding guarantees about the safety of fresh products either through third party certification or through a series of on-farm practices developed to address food safety (Rangarajan, Bihn, et al., 2000). Third party certification of production and handling practices is requested by many buyers of fresh produce, yet, there seems to be no standardization of certification methods used by different firms.

For some retailers, public standards for food safety fail to provide the level of assurance demanded by retail customers, so many are turning to private standards. The costs producers incur to comply with private standards are not public information. Disparate, or exceptionally high, costs of entry will likely keep some firms from entering the marketplace, and still others, to exit.

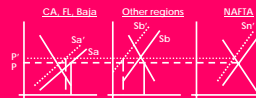
Litigation

- In 1998, juice maker Odwalla, Inc. was fined \$1.5 million for selling apple juice contaminated with *E. coli*. The tainted juice caused the death of one infant and illness in 66 other people.
- In 2001, Sara Lee Co. agreed to pay \$4.4 million for selling meat tainted with *Listeria monocytogenes* which caused the deaths of at least 15 people.

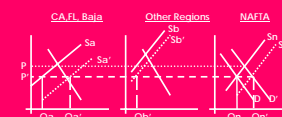
Economic Implications

Static Supply and Demand Scenarios

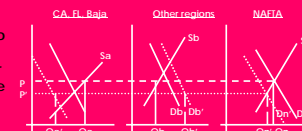
1. Strawberry growers in all regions adopt GAPs with no changes in consumer demand. Supply effects are a function of firms' abilities to allocate the additional costs. Supply decreases in all regions, but relatively more so from smaller firms who supply the u-pick and farm market segments.



2. Third party certification of production practices is possible for all growers; however, proportionately more large firms in California, Florida, and Baja receive certification. As consumer awareness of food safety issues increases, so does retail demand for safely certified fresh strawberries. Demand for non-certified strawberries decreases.



3. A catastrophic food safety event leads to a large reduction in demand for retail fresh strawberries. Demand increases for fresh strawberries sold through alternative markets, like road side stands or farm markets.



Econometric Estimation

With i fresh strawberry supply regions and j fresh strawberry consuming regions

- Demand: $Q_j = f_j(P_j, Y_j)$
 Q_j = quantity of fresh strawberries demanded in region j
 P_j = price of fresh strawberries in region j
 Y_j = demand shifters, such as income or preferences for food safety attributes
- Supply: $Z_i = g_i(P_i, W_i)$
 Z_i = quantity of fresh strawberries supplied by region i
 P_i = price of fresh strawberries in region i
 W_i = supply shifters, such as adoption of GAPs or third party certification

Under an assumption of perfect competition, the difference in price between region j and region i will be equal to the unit transportation costs, T_{ij} , so that $P_j = P_i + T_{ij}$

Inverting the demand and supply equations above, we have $P_j = h_j(Q_j, Y_j)$ and $P_i = u_i(S_i, W_i)$.

The following constrained optimization model will solve for equilibrium prices and quantities in scenario 1:

$$\max_{Q_j, Z_i} \sum_{j=1}^J h_j(Q_j, Y_j) Q_j - \sum_{i=1}^I u_i(Z_i, W_i) Z_i - \sum_{j=1}^J \sum_{i=1}^I T_{ij} X_{ij}$$

where X_{ij} is quantity of strawberries shipped from region i to region j

$$\text{s.t. } \sum_{j=1}^J X_{ij} \leq Z_i, \forall i=1, \dots, I \quad \sum_{i=1}^I X_{ij} \geq Q_j, \forall j=1, \dots, J \quad Z_i, Q_j, X_{ij} \geq 0$$

In scenarios 2 and 3, consumer demand (Q_j) for fresh strawberries is influenced by certification practices and a food safety incident, respectively, so two distinct markets for fresh strawberries develop in each scenario. Hedonic price models have been used to estimate supply and demand shifts when characteristics of goods change (Rosen, 1974). A linear hedonic price function for fresh strawberries can be given as:

$$p_j = \sum_{k=1}^K B_k Z_k + t_{ij}$$

- where p_j = the price of fresh strawberries in the supply region
 B_k = marginal price of the food safety characteristic
 Z_k = the presence of certification in scenario 2, or price of sale in scenario 3
 t_{ij} = as above

Supply and demand functions for fresh strawberries in the NAFTA regions will then be estimated using the estimated marginal prices of the food safety characteristic. Results will indicate how the NAFTA markets for fresh strawberries adjust with respect to food safety attributes.

References
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