

Testimony

to the

**United States Department of Agriculture
Hearings on the Proposed National Marketing Agreement No. 970
Leafy Green Vegetables Handled in the United States**

Presented by:

**Dr. Mechel S. Paggi
Director, Center for Agricultural Business
Jordan College of Agricultural Science and Technology
California Agricultural Technology Institute
California State University, Fresno**

**September 23, 2009
Monterey, California**

EX. 31

My name is Mechel Paggi, I am the Director of the Center for Agricultural Business at California State University, Fresno. I appreciate the opportunity to testify today on the proposed federal marketing agreement for leafy green vegetables handled in the United States.

California is the major producer of leafy green vegetables consumed in the United States.¹ For example in value terms California accounted for 82 percent of the fresh head lettuce, 79 percent of the fresh leaf lettuce, 80 percent of the fresh romaine lettuce and 70 percent of the fresh spinach produced in the United States in 2008.²

Historically, the United States has been perceived as having the safest food supply in the world. While this may still be true, a number of microbiological contamination incidents have led to questions regarding the safety of the U.S. food supply and the need for improved food safety control initiatives and standards by both the private and public sectors.

As noted in the Federal Register the motivation for this hearing can be directly linked to the September 2006, FDA alerts of a multi-state *Escherichia coli* (*E. coli*) outbreak linked to fresh spinach grown in California. The resulting recall was the largest ever for leafy green products. Investigations by the FDA and the California Department of Health Services, in cooperation with the Centers for Disease Control and Prevention and USDA's Animal and Plant Health Inspection Service, concluded that the *E. coli* contamination might have been attributed to environmental factors in the production area.

In response to this outbreak, members of the California industry initiated the establishment of a State marketing agreement for handlers of leafy greens, which became effective February 10, 2007. Currently, signatory handlers under the California state program represent 99 percent of leafy green vegetable production volume in that state. In October 2007, a similar program was implemented in Arizona, which covers approximately 75 percent of leafy green vegetables produced in the state. While both the California and Arizona programs are voluntary, the requirements of these state agreements are mandatory for all signatories.

The purpose of this testimony is to provide information related to the economic and marketing conditions related to the effects of the agreement and impact on growers, handlers, other industry members and consumers. The testimony focuses on the rapidly evolving nature of the standard- setting process for food safety in the public and the private sectors; the costs borne by the industry when an agriculture-based incident occurs; and the ways in which producers have exercised leadership and can react to these evolving concerns. While more recent examples may be cited in a number of other

¹ *Leafy greens* means the fresh mature and immature leafy portions of any of the following: Arugula, cabbage (red, green and savoy), chard, cilantro, endive, escarole, kale, lettuce (iceberg, leaf, butter, head and romaine), parsley, radicchio, spinach, spring mix (baby leaf items including, but not limited to, cress, dandelion, endigia, mache, mizuna, tat soi, winter purslane) or any other leafy green vegetable recommended by the Committee and approved by the Secretary.

² USDA, National Agricultural Statistics Service, Vegetables Summary 2008, January, 2009.

commodities, such as in peanuts and pistachios, the quantitative analyses in this testimony focuses on the costs born by producers and by those who handle produce utilizing two specific incidents as examples. These incidents include:

- The 2006, multi-state *Escherichia coli* (*E. coli*) O157:H7 outbreak associated with the consumption of bagged spinach where in addition to the toll on human health, the fresh spinach industry experienced significant negative economic effects. This occurred despite the fact that the outbreak could only be conclusively linked to spinach grown in one field in California.
- The 2008, *salmonellosis* outbreak linked to consumption of certain types of raw red tomatoes and tomato products (*Salmonella Saintpaul* Outbreak, 2008). The bacteria causing the illnesses was a *Salmonella* serotype, *Saintpaul*, an uncommon type of *Salmonella*. In the notification, the FDA recognized that the source of the contaminated tomatoes might be limited to a single grower or packer or tomatoes from a specific geographic area. Ultimately the CDC reported 1,200 cases of *salmonellosis* caused by *Salmonella Saintpaul* were reported across New Mexico, Texas, Arizona, Colorado, Idaho, Illinois, Indiana, Kansas, and Utah. However, the source of the outbreak was finally attributed to Jalapeno and Serrano peppers produced in Mexico.

These outbreaks are not unique. According to the CDC, more than 76 million people are affected and 5,000 die as a result of food poisoning outbreaks every year. The most common food-borne illnesses are *campylobacter*, *salmonella* and *E. Coli*. Over the past 12 years, all of the 22 leafy green associated *E. coli* O157:H7 incidents indicated a California source. Other products, both domestically produced and imported, have also been linked to other food-borne illnesses such as *salmonella* and *hepatitis*. Since the mid-1990s outbreaks in produce have occurred that were linked to raspberries, green onions, and strawberries. Many other examples could be cited in meats, eggs, and dairy products.

As a reaction to these incidents, increased efforts have been undertaken to enhance food safety by the government and associated industry groups. These efforts have focused on increased scrutiny of imported products and the improvement in domestic standards. In some cases, product standards have established tolerance levels for certain pathogens; in other cases process standards have been adopted that recommend or prescribe Good Agricultural Practice (GAP) standards for production and Good Handling Practice (GHP) standards for handling products. These GAP standards are designed to reduce the potential for contamination. However, additional regulatory actions are being considered, such as the consolidation of food safety regulatory activities currently located in Federal government agencies such as FDA and United States Department of Agriculture (USDA) in a new food safety regulatory agency.

The testimony speaks to actions in the public and private sectors that affect their present and future operations. It also analyzes the specific costs incurred by the produce industry

when these incidents occur. The final section analyzes some of the steps that producers have taken and can take to deal with food safety issues and the associated costs incurred.

Standards setting organizations

Contemporary concerns about food safety, arguably, began in 1992 with *e-coli* contamination of improperly cooked hamburgers. This and subsequent incidents involving the e-coli and salmonella bacteria led to revolutionary changes in state and federal meat and poultry inspection policies. The most significant of these changes was the federally-mandated adoption of a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product (HACCP) for the slaughter and handling of fresh meat and poultry. Briefly, HACCP specifies Good Manufacturing Practices (GMP) that must be used to identify and reduce the likelihood of harmful microbiological contamination incidents.³

An important lesson from the hamburger food safety incident is that, regardless of where or in what food supply chain subsector a food safety incident occurs, it has potential process standard implications for the other products and subsectors. Therefore, an important current food safety policy issue is the extent to which HACCP procedures should be applied broadly to additional segments of the food supply chain. Such a policy change could include application of HACCP principles to all segments of the food supply chain from farm production through sales at retail. Some would assert that this is already happening. A related issue involves the potential adoption of standards requiring a labeling system whereby the origins of biocontamination could be traced to the farms where the products are grown. For both HACCP and traceback, there is the issue of how the responsibility for food safety should be divided between the public and private sectors.

A great many private and public sector resources are being invested in developing systems and standards that address food safety concerns at all levels of the supply chain. The proliferation of these standards, guidelines, and certification programs has created a situation that some have likened to an “arms race” to prove who is providing the safest food. In the absence of one universally accepted set of standards, producers and food providers are often faced with having to comply with a different set of standards for different customers. This results in increased costs with little evidence of a corresponding increase in compensation in the form of higher product prices. The current labyrinth of food safety and protection standards include, but are not limited to, those being promoted by international organizations, governments, producers, and food retailers (particularly supermarket and fast-food chains).

³ HAACP: A State-of-the-Art Approach to Food Safety. Available: <http://www.cfsan.fda.gov/~lrd/bghaccp.html> for a more comprehensive treatment see Hazard Analysis Critical Control Point <http://www.cfsan.fda.gov/~comm/haccpov.html>

U.S. Government Standards

In the U.S. Federal government, the responsibility for food safety is distributed among the Food and Drug Administration (FDA), USDA, the Centers for Disease Control and Prevention (CDC), and Homeland Security (HS). USDA's food safety responsibilities center on meat and poultry inspection, certification of safe process practices in production and marketing, controlling plant and animal diseases that affect safety, and generating technological progress in dealing with food safety and disease issues. Several of USDA's food safety inspection and disease control functions are performed on a mandatory basis. FDA's responsibilities center on processed foods, including produce. FDA does not have the authority to provide mandatory standards related to practices to assure food safety in the case of fresh produce. Instead, the FDA provides guidance in the form of steps that are designed to minimize microbial food safety hazards in produce. CDC is responsible for helping to identify the sources of biological and disease contamination of the food supply. EPA is responsible for regulating the safety of chemicals used in food production and processing and for dealing with issues of water quality as they affect food safety. HS is responsible for insuring that imported products meet U.S. standards for food safety.

It is important to point out that these federal agencies, to varying degrees, have state government counterparts that they delegate to and interact with to carry out their respective food safety responsibilities.

Producer/Industry Standards

While *E. coli* contamination of hamburger precipitated USDA to mandate HACCP regulations be applied to meat and poultry inspection, the 2006 *E. coli* outbreak in spinach is often cited as the cause for an aggressive response by industry to establish stringent food safety standards to be imposed upon their own members. In 2007 the California leafy green industry came together to establish the California Leafy Green Products Handler Marketing Agreement (LGMA). To date nearly 99% of the volume of California leafy greens are grown with practices that fall within the standards of the voluntary grower, packer, and shipper initiative. Under the terms of the LGMA, signatory members are required to verify compliance with a specific set of food safety practices by submitting to mandatory government audits.

The process guidelines used by LGMA are GAP standards for production and GHP standards for the harvest and processing of lettuce and leafy greens. These standards are provided to all members in regularly updated publications.⁴ The standards include general requirements for a Best Practices Plan developed by each member that addresses issues related to:

- Water quality,
- Soil amendments,

⁴ California Leafy Green Products. <http://www.caleafygreens.ca.gov/members/resources.asp>

- Control of environmental factors such as runoff from animal feeding operations,
- Work and field sanitation practices,
- Up-to-date growers list for handlers,
- Handler compliance with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (farms are currently exempt from the act) including the traceability requirements,
- 24-hour contact information for responsible individuals in case of food emergencies,
- Regular audits to monitor and assure compliance.

Details covering each issue are provided as well as special guides for in-depth coverage of water surveys; technical baseline information; product testing protocol; and preparation for the process-compliance audits.

Individual Initiatives

Producers can take it upon themselves to comply or not with the set of standards. It may be easier for large producers to comply if most of the costs associated with complying with the new standards are fixed costs. For example, HEB is requiring that all of its suppliers in the U.S. and Mexico attend produce training safety courses and comply with the LGMA requirement.

For producers that choose not to comply or are unable to comply, there may be other niche markets that they can target such as farmers' markets and other direct marketing approaches. The numbers of farmers' markets have increased substantially over the past few years and are actively supported by USDA. According to AMS/USDA, since 1994 the number of farmers' markets has grown by 6.8 percent, from 1,755 to a total of 4,685 in August 2008.⁵ Just last week UDSDA announced 86 new grants totaling \$4.5 million in funding for the Famers Market Promotion Program (FMPP).⁶ Although farmers markets are gaining popularity, they are usually seasonal and riskier as there are no secure buyers. In addition, growers who sell their products through farmer's markets not only have to be good agricultural producers, they also have to spend time and resources in marketing. One element of that marketing will be to provide assurance that the products being purchased are safe. For this reason, all producers will need to seriously consider the potential consequences of not taking actions that assure the safety of products they market.

5

<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateS&navID=WholesaleandFarmersMarkets&leftNav=WholesaleandFarmersMarkets&page=WFMFarmersMarketGrowth&description=Farmers%20Market%20Growth&acct=frmrdirnkt>

⁶ USDA, News Release No. 045109.

Private Sector Retail Buyer/Seller Standards

While not explicitly linked to the spinach outbreak, a group of large buyers and retail sellers of produce published their own set of safety standards in 2007. In an apparent effort to have their suppliers conform to uniform codes of conduct, a consortium of firms, the Food Safety Leadership Council (FLSC), published their On-Farm Produce Standards on September 10, 2007.⁷ The FLSC is composed of, among others, Darden Restaurants, owner-operators of Olive Garden, Red Lobster, the Capital Grill and others; McDonald's Corporation; Publix Super Markets; Wal-Mart Stores, Inc.; Walt Disney World Company; and Avendra LLC, a food service procurement company.

The FLSC standards demonstrate the complexity of the issues that emerge when an influential buyer group sets its own food standards with which suppliers are expected to comply. While the FLSC standards provide details for practices in much the same fashion and for almost an identical set of activities and areas as the LGMA, the specifics of the standards vary in some categories. For example, the FLSC water quality standards were far more restrictive than those of the LGMA. Additionally, required buffer distances of fields from animals lacked uniformity. Such conflicting standards set up a confrontational and confusing setting for individual producers who strive to adhere to GAP and GHP standards to satisfy their customers.

International Standards

The increasing globalization of the food supply in the United States and other countries has resulted in an attempt to develop food safety standards that are recognized across national boundaries. International food marketers such as Wal-Mart, Costco, and Carrefour require the ability to source products from around the world to provide their customers with a daily supply of fruits and vegetables that are not always in season or available from local producers. In sourcing products globally, the ability to have confidence in product safety is essential and a distinct competitive advantage. Recognition of uniform standards among traders is the motivation behind the development of the GlobalGAP system of insuring food safety through third-party audits that guarantee production practices in accordance with detailed guidance criteria.

GlobalGAP, launched in September 2007, sets standards and an accredited certification program developed from the original European Retailers Environmental Protocol. EurepGAP was a consortium of European retail chains, importers, and suppliers formed in 1997. As the original program grew in acceptance among the industry world wide, other countries developed their own programs such as ChinaGAP, ThaiGap, etc. The evolution to GlobalGAP is designed to help prevent confusion in the growing world of food safety standards. It now has established programs in over 80 countries around the world. GlobalGAP's accredited certification program covers a broad range of crops, livestock, aquaculture, compound feeds, and plant propagation materials. Growers are required to comply with a series of specific practices and are audited by accredited agents

⁷ Food Safety Leadership Council On-Farm Produce Standards, Copyright©2007 Food Safety Leadership Council Version 1.0 September 10,2007.

consistent with the International Standards Organization (ISO) 62 and 65 guidelines for certification programs. In addition, auditors must have undergone training according to ISO 9000 quality management or ISO 14000 environmental management standards.

The Global Food Safety Initiative (GFSI), in April 2000, was the product of discussions among a group of international retailers who identified the need to enhance food safety, ensure consumer protection, strengthen consumer confidence, and set standards for food safety schemes that would hopefully improve cost efficiency throughout the food supply chain. The GFSI was officially launched in May 2000 and is facilitated by the Food Business Forum. The GFSI vision of being once certified, accepted everywhere has been adopted by Carrefour, Tesco, Metro, Migros, Ahold, Wal-Mart, and Delhaize. These major international food retailers have agreed to reduce duplication in the supply chain through the common acceptance of any of the four GFSI benchmarked schemes.

This brief review of the current state of food safety standards illustrates the various programs that growers and handlers face as they attempt to qualify their products for acceptance by today's food supply chain. Increasing consolidation on the buyer side and concerns over the liability associated with food-borne illness events create demands on producers to be in line with specified standards or to face exclusion from the marketplace. At the same time, knowing which standards to accommodate, for what buyer, and for what product is increasingly challenging. For growers, having one set of specific standards for specific products will simplify management decisions and should reduce the cost of compliance. It appears to be desirable to have the industry and their associations at the state, regional, national, and international levels work collaboratively to establish a uniform set of standards.

Economic Impacts on Producers and the Food Industry⁸

In this section, the economic consequences for producers of a biological contamination incident are quantified. This analysis is limited to the costs borne by producers and handlers so that they can have a guide for knowing the direct revenue and cost consequences for their operations of a food safety incident. It does not attempt to estimate that cost to the consumers who experience food poisoning. In a related manner, it does not analyze the risk exposure for liability in food safety incident litigation.

In general terms, following public awareness of a biological contamination incident, consumers would be expected to reduce their consumption of the affected products. Following official government notification of an incident, there may be a period of time when the affected products are banned for sale in the market until the contamination source is identified, the affected products are withdrawn from the market channel, and the

⁸ Details of the analysis results presented are contained in Palma, Marco, Luis Ribera, David Bessler, Mechel Paggi and Ronald Knutson. "New Generation of Standards and Potential Impacts of Food Borne Ill Incidence on Market Movements and Prices of Fresh Produce in the US", selected paper, IAMA 19th Annual Food and Agribusiness World Forum and Symposium, Budapest, Hungary, June 20-21, 2009.

source of contamination is brought under control. Even after the products are allowed back in the market following an outbreak, consumption levels may not rebound due to the perceived risk by consumers. The reduction in sales depends on the severity of the outbreak, in terms of the number of people affected, number of deaths, regional scope, the type of product, and its origin.

For the two incidents of contamination studied, the contemporaneous effects were analyzed primarily from a U.S. perspective. The variables quantified for the affected product included: industry shipments, including imports; prices; the length of time required for consumption to return to normal levels; and the associated revenue reductions to the U.S. and the supplying countries' producers. In order to estimate the impacts of these food illness outbreaks on each produce subsector, we forecasted domestic shipments, imports, and prices that would have existed in the absence of the outbreak. The market news data from production periods prior to the food outbreaks were used to make these forecasts. These market news data were obtained from the Agriculture Marketing Service (AMS)/USDA, which are regularly relied upon by the produce industry for market information. The specific data used were monthly shipments, and average prices for domestic production and imports of spinach and tomatoes from AMS, USDA. The difference between forecasted variables and actual values was attributed to information arising from the outbreaks.

The forecasting technique used to estimate domestic shipments, imports, and prices is referred to as triple exponential smoothing. This is a commonly used price forecasting method used to produce results that account for both trend and seasonality, which are very important in agricultural products.

While the emphasis was on estimating changes in producer revenue flows, the analysis was extended to the retail level by utilizing an estimate of the marketing margin. Marketing margin is the difference between the retail price and the farm level price, which includes expenses associated with packing, wholesaling, distributing, and retailing. According to USDA, in the 1990s and early 2000s, marketing margins for fresh leafy greens averaged 81 percent, while fresh tomatoes averaged 72 percent. The inclusion of the retail margin was performed because in certain products, such as leafy greens, the industry is becoming sufficiently producer-handler integrated that the levels of the marketing chain are difficult to distinguish. Not studied were the effects of other related products (substitutes or complements) on prices, shipments, or imports. Also not studied were the human costs associated with illness, deaths, or the effects on farm labor, management, and asset values.

The incidents analyzed were those described at the beginning of this paper, namely the tomato incident officially acknowledged on June 3, 2008; and the spinach incident acknowledged on September 13, 2006.

Tomatoes

While FDA did not officially acknowledge incidents of *Salmonella* food poisoning attributed to raw tomatoes and tomato products until June 3, 2008, the CDC identified the onset of the outbreak as occurring in mid-April. Tomato sales declined immediately as news began to spread that tomatoes produced in both the United States and Mexico were implicated as being the potential source. The movement data began to indicate below normal sales near the time of the CDC findings. In April, as illness incidents were reported, shipments of U.S. tomatoes declined by 20,700 MT while imports, mainly from Canada, increased by 37,000 MT. In May, imports increased even more by 40,900 MT as speculation shifted to Mexico as the potential source of the problem, while U.S. tomato sales rebounded. Below normal sales of both Mexican and U.S. tomatoes continued through July as the source of contamination, jalapeno peppers, was not identified until July 21, 2008. During the outbreak, tomato prices decreased by an average of \$3 per cwt or 7 percent at farm level as demand decreased and returned to normal levels by August. In value terms, the farm level loss in U.S. tomato sales was \$25 million, and the retail loss was \$89 million. While U.S. and Mexican producers lost revenue, producers from Canada and other tomato exporting countries gained as U.S. tomato imports increased by 96,900 MT (\$97 million) at farm level.

Spinach

While FDA did not officially acknowledge incidents of *E.Coli 0157:H7* food poisoning attributed to spinach until September 13, 2006, the CDC identified the onset of the outbreak as being as early as August 25, 2006. Once again, the data immediately began to indicate below normal movement began in the August reporting period for both U.S. production and for imports. Sales of U.S. spinach declined by 4,175 MT, while imports declined by 2,170 MT in September. In October, as attention shifted to California production as the source of the problem, U.S. spinach movement dropped by 2,912 MT while imports declined by 1,361 MT as consumers were still concerned about the safety of both domestic and imported spinach. Despite an early October indication that the source of the problem was under control, it was November before spinach sales rebounded from both U.S. and imported sources. Spinach prices followed the same pattern as spinach shipments; farm level prices were down by an average of \$4.07 per bunch or 58 percent in September and October. Prices stayed low through November by an average of \$3.37 per bunch and went back to normal levels by December. In value terms, the farm level loss in U.S. spinach sales was about \$12 million, and the retail loss was over \$63 million. Marketing margin for spinach is higher than for tomato because spinach is mainly sold bagged and ready to serve

Compliance Costs

From a grower perspective, making decisions on actions that need to be taken to deal with the issues of food safety are highly complex. It is simplistic to assert that it is a matter of weighing the costs and the benefits, although that is a starting point. The

benefits to growers accrue not only from taking leadership to prevent occurrence of incidents that disrupt revenue flows but also from adjusting the organization of their operations to be in compliance with process standards. These benefits may be in the form of higher product prices, maintaining and growing sales in existing markets, expanding to new markets, reducing the adverse revenue effects of an incident, reducing legal liability and insurance costs, and improving operational efficiency. While the benefits accrue over time and are uncertain, the costs of compliance are upfront and in many cases are required to participate in a preferred market. Clearly, taking actions to be in compliance with process standards represents an added cost of doing business.

Information on costs is difficult to find and document. Many examples are more anecdotal than reflective of the result of careful economic analysis. In a survey of participants in the California LGMA, the annual cost of compliance for industry members reported the following major areas where costs increased as a result of compliance with the LGMA included:

- **Third Party Audits:** One of the substantial additional costs is that of obtaining third-party compliance audits and of performing required self-audits. The costs of third-party audits are typically reported on a per farm or ranch basis and appeared to run about \$400-500 in 2008.
- **Staffing:** Those members who responded to the survey reported having one trained staff person overseeing food safety issues before the leafy green incident; they now have two.
- **Water Testing:** The mandatory requirements that all sources of water used in production of leafy greens be tested resulted in the approximate number of monthly water tests increasing from 10 to 52 at a projected total cost of \$3,657 monthly.

Summary and Conclusions

The bottom line is there is a role for government in helping promote a common set of standards and regulations that provides a win-win situation for all players in the industry. The challenge involves finding a mix of private and government sector initiatives that facilitate an equitable sharing of the costs of assuring a safe food supply. Extending the existing LGMA to the national level appears to be a first step in the right direction.

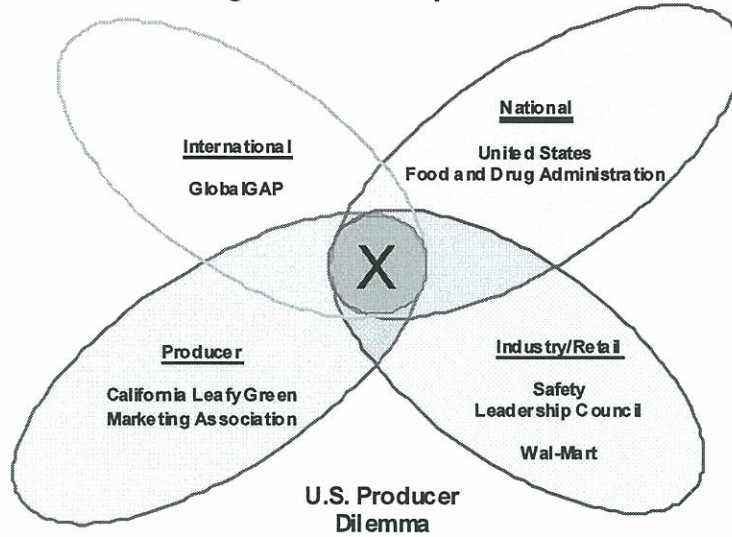
Extension of the provisions of the LGMA to all green vegetables handled in the United States would appear to be an attractive option for industry participants for many reasons, including but not necessarily limited to:

- Participation in the agreement is voluntary, participants are bound by the terms of the agreement, however non-participants are free to market their products without restriction
- Having one set of standards provides a clear set of goals and objectives that once obtained insure participants the ability to compete on a level playing field for sales in all markets

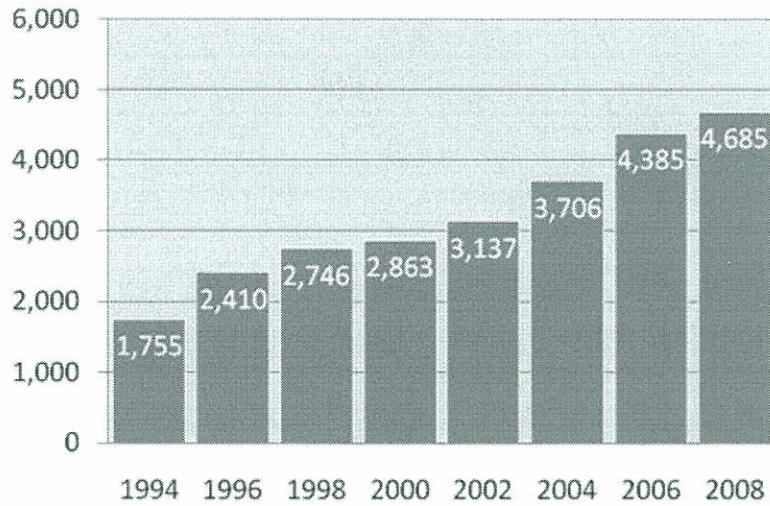
- Existing members of the LGMA, representing a large proportion of total production, will not face additional compliance costs, except as standards are modified over time to reflect increased knowledge on practices that reduce the probability of food borne disease occurrences

Thank you for arranging this public hearing to better understand the issues surrounding the proposal for a national LGMA and for allowing me to share information and my views on this initiative.

**Major Challenge
Need for Convergence of Multiple Process Standards**



Number of Operating Farmers Markets



Source: USDA - AMS - Marketing Services Division

**6.8%
Increase**

References

- Bernanke, B.S. 1986. "Alternative Explanations of the Money-Income Correlation." Carnegie-Rochester Conference Series on Public Policy 25: 49-99.
- Bessler, D.A. and Akleman, D. G. 1998. "Farm Prices, Retail Prices, and Directed Graphs: Results for Pork and Beef" *American Journal of Agricultural Economics* 80(5): 1145-1150.
- Busby, J.C. 2001. "Effects of Food-Safety Perceptions on Food Demand and Global Trade" Changing Structure of Global Food Consumption and Trade. Economic Research Service, United States Department of Agriculture WRS-01-1. Washington, DC.
- Calvin, L., Avendano, B., and Schwentesius, R. 2004. "The Economics of Food Safety: The Case of Green Onions and Hepatitis A Outbreaks" United States Department of Agriculture. VGS-305-01. December, 2004. Washington, DC.
- Dermilap, S. and Hoover, Kevin D. (2003): "Searching for the Causal Structure of a Vector Autoregression," *Oxford Bulletin of Economics and Statistics*, 65:745-767.
- Food and Drug Administration. (September 14, 2008) FDA Warning on Serious Foodborne E. Coli O157:H7 Outbreak. Available at:
<http://www.fda.gov/bbs/topics/NEWS/2006/NEW01450.html>
- Food and Drug Administration. (October 6, 2006). FDA Statement on Foodborne E. coli O157:H7 Outbreak. Available at:
<http://www.fda.gov/bbs/topics/NEWS/2006/NEW01486.html>
- Food and Drug Administration. (March 21, 2008). Archived Updates on the FDA Investigation in Honduras. Available at:
<http://www.fda.gov/oc/opacom/hottopics/cantaloupearchive.html>
- Food and Drug Administration. (March 22, 2008). FDA Warns of Salmonella Risk with Cantaloupes from Agropecuaria Montelibano. Available at:
<http://www.fda.gov/bbs/topics/NEWS/2008/NEW01808.html>
- Food and Drug Administration. (June 3, 2008). FDA Warns consumers in New Mexico and Texas Not to Eat Certain Types of Raw Red Tomatoes. Available at:
<http://www.fda.gov/bbs/topics/NEWS/2008/NEW01843.html>
- Food and Drug Administration. (July 17, 2008). FDA Lifts Warning About Eating Certain Types of Tomatoes. Available at:
<http://www.fda.gov/bbs/topics/NEWS/2008/NEW01862.html>
- Food and Drug Administration. (August 28, 2008). Salmonella Saintpaul Outbreak. Available at: <http://www.fda.gov/oc/opacom/hottopics/tomatoes.html>

- Hoover, Kevin D. (2005): "Automatic Inference of the Contemporaneous Causal Order of a System of Equations," *Econometric Theory*, 21:69-77.
- Hyndman, R.J., A.B. Koehler, J.K. Ord, and R.D. Snyder. "Forecasting with Exponential Smoothing: The State Space Approach." Springer, 2008, XII, 360 p.
- Onyango, B., Miljkovic, D., Hallman, W., Njanje, W., Condry, S., and Cuite, C. 2007. "Food Recalls and Food Safety Perceptions: The September 2006 Spinach Recall Case" Selected Paper Presented at the Agricultural and Applied Economics Association Meeting. Orlando, Florida.
- Pearl, J. 2000. *Causality*, New York: Cambridge University Press.
- Sims, C. 1980. "Macroeconomics and Reality, *Econometrica*, 48:1 – 48.
- Spirtes P, Glymour C, Scheines R. 2000. *Causation, Prediction and Search*. MIT: Cambridge, MA
- Swanson NR, Granger C. 1997. Impulse response functions based on a causal approach to residual orthogonalization in vector autoregressions. *Journal of the American Statistical Association* 92: 357-367.
- United States Department of Agriculture. Agricultural Marketing Service. *Fruit and Vegetable Portal News*. Price and Shipment Information. 2000-2008
- United States Department of Agriculture. National Agricultural Statistical Service. 2007. "Vegetable Usual Planting and Harvesting Dates". Agriculture Handbook Number 507, May 2007. Washington, DC.
- Worth, T.W. "The Cost of an Outbreak in the Fresh Strawberry Market" *The Economics of HACCP: New Studies of Costs and Benefits*. (Ed.) L.J. Unnevehr, Eagan Press, St. Paul, NM, Chapter 12.