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Foreword

Tradition and Innovation – International Scientific Conference of (Agricultural) Economists
Szent István University, Gödöllő, 3-4 December, 2007

Tradition and Innovation – International Scientific Conference was held on December 3-6, 2007, in the frames of the anniversary programme series organized by the School of Economics and Social Sciences of the Szent István University. The aim of the conference was to celebrate the 50th anniversary of introduction of agricultural economist training in Gödöllő, and the 20th anniversary of the School of Economics and Social Sciences, which was founded in 1987.

The articles published in the special edition of Bulletin 2008 of the Szent István University were selected from the 143 presentations held in 17 sections of the conference and 30 presentations held at the poster section. The presentations give a very good review of questions of national and international agricultural economics, rural development, sustainability and competitiveness, as well as the main fields of sales, innovation, knowledge management and finance. The chairmen of the sections were Hungarian and foreign researchers of high reputation. The conference was a worthy sequel of conference series started at the School of Economics and Social Sciences in the 1990s.

Előszó

Tradíció és Innováció – Nemzetközi Tudományos (Agrár)közgazdász Konferencia
Szent István Egyetem, Gödöllő, 2007. december 3-4.

2007. december 3-6. között a Szent István Egyetem Gazdaság- és Társadalomtudományi Kara (SZIE GTK) által szervezett jubileumi rendezvénysorozat keretében került megrendezésre a Tradíció és Innováció – Nemzetközi Tudományos Konferencia, amelynek célja volt, hogy méltón megünnepelje a gödöllői agrárközgazdász képzés fél évszázada történt elindítását, s ugyanakkor a Gazdaság- és Társadalomtudományi Kar 1987-ben történt megalapításának 20. évfordulóját.

A Szent István Egyetem által kiadott Bulletin 2008 évi különszámában megjelentetett cikkek a konferencián 17 szekcióban elhangzott 143 előadásból, illetve a poszter szekcióban bemutatott 30 előadásból kerültek kiválasztásra. Az előadások jó áttekintést adtak a hazai és nemzetközi agrárközgazdaság, vidékfejlesztés, a fenntarthatóság és versenyképesség kérdései mellett az értékesítés, innováció, tudásmenedzsment, pénzügy fontosabb területeiről is. Az egyes szekciók elnöki tisztjét elismert hazai és külföldi kutatók töltötték be. A konferencia a Gazdaság- és Társadalomtudományi Karon az 1990-es években elkezdett konferencia sorozat méltó folytatása volt.

Dr. László Villányi
Dean / dékán

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APPLIED FARM FOOD SAFETY

ENDER, JUDIT – MIKÁCZÓ, ANDREA

Abstract

Recently there have been more and more foodborne illnesses being associated with fresh vegetable produce. In response to this, consumer confidence has been lowered with the safety of the vegetable industry. So, many retailers have recently announced programs requiring growers to have independent third-party inspections.
The goal with this essay is to introduce a vegetable farm and reveal its food safety procedures from the seeding through shipping,. reviewing, evaluating, and strengthening current good agricultural practices (GAPs) used on the farm and good manufacturing practices (GMPs) used in packing facilities, and the recall system which also can reduce microbial risks.

Keywords: foodborne illnesses, food safety procedure, GAP

Introduction

International trade in high-value food products has expanded enormously over the last decades, fueled by changing consumer tastes and advances in production, transport, and other supply-chain technologies. Growing demand for differentiated products from increasingly sophisticated consumers, along with the growth of integrated international supply chains, will provide continuing opportunities for competitive suppliers of high-value foods by allowing them to target a market segment that suits their competitive profile. But complying with food safety and agricultural health standards has been a major source of concern in the international market also, mostly because foodborne illnesses are prevalent in all parts of the world, and the toll, in terms of human life and suffering is enormous. Contaminated food contributes to 1.5 billion cases of diarrhea in children each year, resulting in more than three million premature deaths, according to the World Health Organization (WHO). Those deaths and illnesses are shared by both developed and developing nations. For example, in the United States, the Centers for Disease Control and Prevention (CDC) estimates that foodborne diseases cause approximately 76 million illnesses annually among the country's 290 million residents, as well as 325,000 hospitalizations, and 5,000 deaths (CNN, 2002).

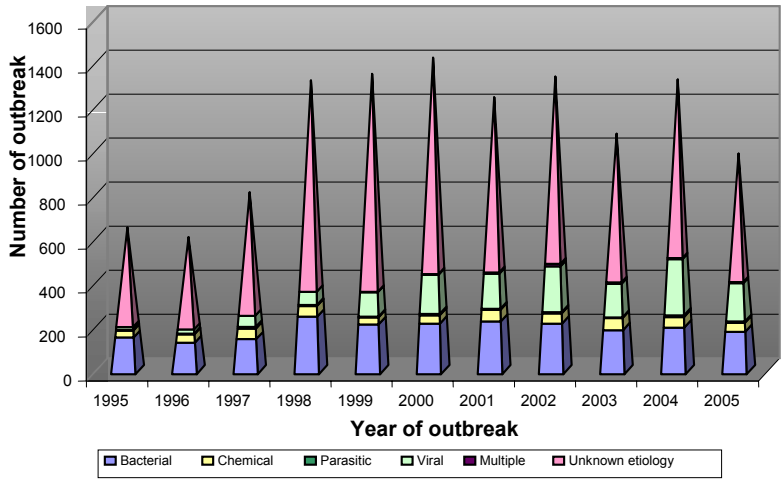

Figure 1: Number of foodborne outbreaks between 1995-2005 in the USA
Source: CDC, FoodNet surveillance system, own editing

By analyzing the Center for Disease Control and Prevention (CDC's) data between 1995 and 2005 on incidences of foodborne illness outbreaks and cases studies associated with produce, the following chart can be drawn.
Figure No. 1. shows how the number of foodborne outbreaks increased between 1995 and 2005 in the United States. With further break down of the data (figure No. 2.), one can see increased foodborne illness associated with fresh produce in absolute numbers and as a proportion of all reported foodborne outbreaks.

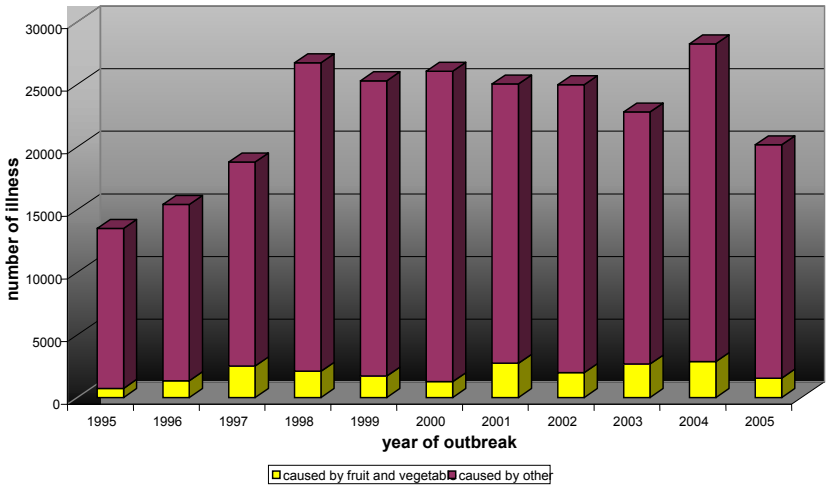

Figure 2: Number of foodborne illness according the causing factor 1995-2005
Source: CDC, FoodNet surveillance system, own editing

Of course the different vegetables have been implicated differently as vehicles regarding these outbreaks.

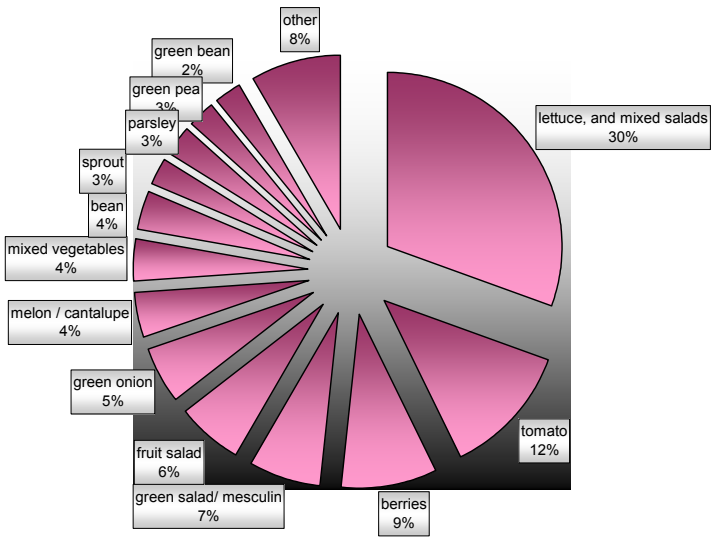

Figure 3: Most common vehicles for foodborne disease from 1995-2005
Source: CDC, FoodNet surveillance system, own editing

Seemingly, vegetables with large surface areas – that can trap and hold a lot of moisture, like lettuce, and spinach-, are at greater risk of containing living pathogens**.** Because these

lettuce/leafy greens may be hand-harvested and hand sorted for quality, there are numerous "touch points" early in the supply chain and a similar number of "touch points" later in the supply chain as the products are used in foodservice or retail operations. Considering these fresh vegetables are likely to be sold and served to consumers in an unprocessed or minimally processed (i.e., raw) form, the risk for contamination increases as well. Each of these "touch points" represents a potential opportunity for cross contamination.

To help to protect the health of consumers from risks that may be present in their food, or associated with agricultral products the Codex Alimentarius Commission (CAC) -a commission created by the Food and Agriculture Organization of the United Nations and the WHO- has produced guidelines and principles that should lay a firm foundation for ensuring food hygiene in conjunction with other specific practices. The Codex Alimentarius contains standards or other recommendations in the following areas:

- food hygiene (mainly dealing with measures to protect against microbiological hazards) and meat and poultry hygiene;
- food additives;
- residues of pesticides and veterinary drugs used in agriculture and animal production;
- environmental and industrial contaminants; and
- food labelling to provide information about potential risks, such as allergens.

The Codex standards, guidelines and recommendations are "soft law". Governments are invited to accept these standards by ensuring that the product to which the standard applies may be freely distributed within the territory of the country concerned. Although there is no obligation in the rules or procedures of the Codex Alimentarius standards.
In the United States of America the Food and Drug Administration (FDA) is responsible for ensuring the safety of all domestic and imported fresh and fresh-cut fruits and vegetables consumed in the United States. In 1998, the FDA issued its "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables." It does have recommendations on the following areas of the good safety:

- water, including agricultural and processing water, testing, and water treatments
- manure and municipal biosolids, the usage and treatment of these
- workers health and hygiene
- sanitation of the different areas as the field and packing facilities
- traceback system

This document gives guidance which alerts to the potential microbiological hazards associated with various aspects of the production chain including: land history, adjacent land use, water quality, worker hygiene, pesticide and fertilizer use, equipment sanitation, product transportation and storage known as Good Agricultural Practices or GAP's. It also contains an advised processing operation, with basic principles of Good Manufacturing Practices (GMP's), sanitation and processing operating procedures which can be commonly employed in order to produce possibly safer products.
It has been suggested that produce farmers follow risk-based guidelines in the USA, although there is no uniform obligatory food safety system for fruit and vegetable producers. The National Advisory Committee on Microbiological Criteria for Foods (1999) suggests while hazard analysis critical control point (HACCP) should be used. By understanding where potential problems exist, it is possible to develop strategies to reduce risks of contamination (Tauxe et al., 1997). The programs need to be flexible, but still based on what is scientificly known. They also suggest that a formal HACCP system is too rigid for the farm, but the principles can still be applied to reduce risk. Translating HACCP-based strategies to the farm

has resulted in a set of generic guidelines described as good agricultural practices (GAPs) and include the following:

- equipment maintenance program
- sanitation program within facilities/packing areas
- end of season cleaning
- washroom/ packing facilities
- employee training
- pest control program
- storage maintenance program
- transportation program
- microbiological sampling

(Luedtke et al., 2003)

Consequently for the increased number of outbreaks associated with the leafy greens and the governmental suggestions has put pressure on the vegetable growers to improve food safety practices. This becomes difficult because plant growth takes place in a natural environment where the product is vulnerable to microbial contamination. Contamination can occur from anything in the production environment that comes in contact with the plant. Consequently, the manner in which fresh produce is grown, harvested, packed, processed, transported, distributed, and prepared is crucial to minimizing the risk of microbial contamination.

The purpose of this essay is to follow up on these potential contamination points and the preventative action which can be implemented to prevent their occurrence, through an active farm operation system, and help to identify and support to fill gaps in food safety knowledge.

Materials and methods

Based on evidence from the previous chart above we chose leafy vegetables, particularly lettuces, and other leafy greens and tomatoes as the focus plant type for this study. Through a partnership with the Chef's Garden we were able to track these plant types from seeding through shipping. The Chef's Garden has an active food safety system in place, cooperating with the American Institute of Baking, and other third party food audit facilities.

As its name implies the Chefs Garden supplies vegetables directly to high-end chefs and restaurants all over the United States and internationally as well. The mid size farm is currently farming about 150 acres (about 70 hectares) including indoor (greenhouse), and outdoor (field) production. The farm is located in northwest Ohio in city of Huron, on the shore of Lake Erie and enjoys a relatively mild climate. The area has a lake bottom and sandy fertile soil, where they are producing sustainably, a wide variety of miniature vegetables and lettuces, and also some kales, carrots, peppers, onions, and tomatoes. The produce is being sold as fresh cut produce.

As used in this document, the term ‘‘fresh-cut produce’’ refers to minimally processed vegetables that have been altered in form by peeling, chopping, coring, or trimming, with or rarely without washing, prior to being packaged for use by the consumer or retail establishment. These fresh-cut produce does not require additional preparation, processing, or cooking before consumption, with the possible exception of washing or the addition of salad dressing or seasoning. Most of these products are generally considered “ready-to-eat” owing to the wash process used during their preparation and the protective packaging employed in their distribution.

The Codex Alimentarius standards and the USA. Food and Drug Administration (FDA) recommendations were used as guidance to set up checking point for this following study. The method of the study was observation; it could be possible because we have been

employed by the farm, so we had the chance to get a hand on information on the daily basis, and participate in the development of the farm food safety system.

Results

In relation to food safety, there are many examples where a food item supplied to the consumer may not be free from a hazard. Knowing this, it is important that appropriate food safety measures are understood and put into practice to eliminate such risks. Food manufacturers like the Chef's Garden knew this when they established their food safety program. The food safety system built on a detailed understanding of the interaction between process and product and the identification of control points in the manufacturing packing and storage process. They are using HACCP (Hazard Analysis Critical Control Point) as an analytical tool to control and help to continuously develop their food safety system. See below the brief introduction of their system based on critical control points, through the production and the processing cycle of the product.

1. LOCATION SELECTION

Primary focus was at the location choice for farming the absence of any surrounding livestock. Also topographically the farm area is flat so it is prohibiting any kind of contaminated runoffs to the site or premises. Also, a few meter (3-5m) wide buffer zone between the fields and the undisturbed, open, non-farmed land with evidence of wildlife.

2. SITE/PREMISES PREPARATION

This step involves the preparation of the environment and not the material itself. On the fields a permanent tile system has been installed which helps to drain the occasionally accrued access water from heavy rainfalls. Any kind of chemicals such as fertilizer, pesticides, oil, fuel or paint have been stored in designated locations at least 10 m. away from production areas and their premises is being cleaned regularly. Since the farm is using sustainable agricultural methods they use only mechanical weed control (cultivation and/or manual) and sustainable methods to prevent wildlife activities.

Pest control program for rodents are currently used inside and outside of the greenhouse and the packing room facilities. Also the farm has brittle policy in effect, according to this all breakable item needs to be labeled inventoried and monitored on a regular basis.

3. APPLICATION OF INPUTS

On the yearly basis for some of the crops use raised, covered beds to protect water flash ups. For similar reasons dripping irrigation lines are being installed on most of the crops (except the too arid summer weeks, when they use overhead watering for reduce the temperature for the lettuces and greens). On all of the field locations chlorine treated, city water is being using for watering purposes. For food safety reasons the farm prohibits the use of any kind of animal manure, but from cover crops, and other additional ingredients aged compost is being created on a separate location and used to raise biological life on the farm.

4. ESTABLISHMENT AND PRODUCTION

This period include from seeding to harvesting the product life cycle. During this period the growers need to assure the cleanliness of the surrounding areas, and eliminating every chance to contact with any kind of possible food product as well.

5. CHEMICAL STORAGE AND TREATMENT

Chemical treatment refers to any use of a chemical agent, to the material itself, during any stage. Every pesticide handler must receive special training regarding to the proper procedures. All chemicals must be stored under a lockable well ventilated separate area. Any of their usage must be authorized, recorded, and the disposal of any empty container must follow environmental friendly regulations. Mainly three type of chemical is being used:

Liquid fertilizer is being applied as foliar application through the water system or as individual spraying application. To prevent backflow of the fertilizer to the water system backflow devices are installed, also the injectors are being calibrated on a regular basis.
Pesticide applications must follow label recommendation. Sprayers must be calibrated regularly and cleaned after each usage. The sprayed area must be signaled and clearly shown the possible reentry interval.
Disinfectant agent is being used to clean equipments, greenhouse surfaces, greenhouse soil, and the surface of the plants to reduce any kind of microbial risk.

6. HARVESTING

This method of collecting materials can include picking, cutting or digging vegetables. Usually the harvesting is done by hand with or without use of knife or scissors. The applied utensils are cleaned and disinfected on the daily basis. The harvesters wear protective clothing (hairnet, gloves, mask as well as needed) during the harvesting period to avoid cross contamination. The harvesters are excluding any kind of physically damaged or contaminated plant from harvesting. The harvested product is being placed into sanitized tubs.

7. TRANSPORT AND STORAGE

After harvesting, the products are being transferred to the packing facility by refrigerated trucks. The tubs are labeled according to their contents, dated and separated from each other by a protective sheet. The packing facility has separate coolers according to product groups, like root crops, tomatoes leafy vegetables (washed and unwashed).

8. COOLING/CHILLING

Cooling of vegetables is necessary to remove field heat and reduce the multiplying of any contaminants and preserve quality. The temperature in the cooling and packing units are about (36-45 ˚F) 1-5 ˚C.

9. SORTING AND GRADING

This is a visual inspection to remove defective materials, and select the product based on the size or shape and quality. This step is being recorded as part of the harvesting process.

10. WASHING/DECONTAMINATION

This process involves the removal of dirt, soil, from the food material. Examples include, washing soil of root vegetables, and washing lettuce and greens. In the packing facility the quality of the water is crucially important, so in this area the chlorine level is continuously being monitored, and as well as needed additional chlorine is being injected to the water.

11. TRIMMING, CUTTING, SHELLING

This refers to the operation of removing unwanted or defective parts of the food material, by trimming or cutting, or altering its size or shape. Usually this include trimming of leaves or roots from vegetables, peeling of beets, shelling beans etc.

12. PACKING

After all of these cleaning procedures the product is being pack according to the customer's order into plastic bags, containers or boxes. Each individual unit is being labeled. The custom made label contains the name of the customer, the name and the size of the product, quantity of ordered product, shipping date, lot number for recall purposes, and the name of the packer. If the package contains any possible allergen item it needs to be labeled separate to create awareness for it. When the product is packed each individual package needs to be send through the metal detector for a final screen for any "foreign" metal pieces.

13. WASTE DISPOSAL

Any kind of agricultural waste produce, excess or trimmed material, defective product, is being transferred on the daily basis to the compost area and recycled accordingly the company compost procedure.

14. PERSONAL HYGINE

The good personnal hygine is including the following: Hygienic hand practices (how to wash hands properly), focusing on maintaining personal cleanliness. It forces to wearing clean and appropriate uniforms and following dress codes, as wearing gloves, hairnets and white lab coat during poduct handling. With the help of this program try to avoid unsanitary habits and actions during handling product. Another part of this program the illness reporting, according to this no person with potentially hazardous condition can contact with product neither in growing areas nor in the packing facilities. With continous trainings and presentations the farm try to help the workers, to gain more understanding in the huge importance of this matters.

15. RECALL PROGRAM / TRACEBILITY

The purpose of this program is to be able to recall from the end user all products that have been determined to be hazardous to the health of individuals. The program requires 100% accountability of product from source to destination within two hours. This is accomplished through a system of coding from source to customer. To suport the recall program the Chef's Garden is using a custom design program. Through this program with a bar coding system every grown item can be traced back from seeding to the packing. The trace back of the information is fairly simple because the information is digitalized. It is a critical step for the good agricultural and management practices to minimize liablity and prevent the occurance of food safety problems.

16. SANITATION

The packing facility utensils, tables and the harvesting utensils are assigned to the actual users. The person with assigned responsibilities needs to ensure that the equipment is functioning properly and to ensure proper sanitation during usage and cleaning and sanitation on the end of the shift. The repeatedly used harvesting tubs are being cleaned and sanitized after each load of product to prevent cross-contamination. Other equipments need to be cleaned and disinfected on a regular basis.

17. MICRBIOLOGICAL PROGRAM

The purpose of this program to randomly test product, utensils, packing locations and other growing related materials for E.Coli, Salmonella, Listeria, and Staphylococcus Au. This is a proactive approach and used as a managment tool for looking for possible infections, but in case of a positive test it triggers automatically a re-cleaning step or potentially the recall program.

18. MAINTENANCE

All equipment needs to be inspected after usage, any problem needs to be fixed or reported through a maintenance request sheet. This is an important step to protect the employee safety, and ensure the best and safest growing environment.

On all of these above specified controlled points of the fresh-cut produce proper documentation is required which proves the certain activities had actually taken place. Also this documentation is usually the base for the regularly occurred food safety inspection, and the self inspections as well. As we look through these listed control points, we can separate the good agricultural practices (GAP's), and the good manufacturing practices (GMP's) fairly simple.

For easier separation we can say the turning point to the process is the harvesting. All of the steps which occurs till the harvesting can be considered to GAP, all of the steps that take place in the packing facility can be considered as GMP. Some steps as the personnel hygiene and the sanitation are part of the GAP's and also for the GMP's.

Table 1: Searched control points separated according to GAP or GMP

Good agricultural practices (GAP)	**Good manufacturing practices (GMP)**
1. LOCATION SELECTION	7. TRANSPORT AND STORAGE
2. SITE/PREMISES PREPARATION	8. COOLING/CHILLING
3. APPLICATION OF INPUTS	9. SORTING AND GRADING
4. ESTABLISHMENT AND PRODUCTION	10. WASHING/DECONTAMINATION
	11. TRIMMING, CUTTING, SHELLING
5. CHEMICAL STORAGE AND TREATMENT	12. PACKING
	13. WASTE DISPOSAL
6. HARVESTING	14. PERSONAL HYGINE
14. PERSONAL HYGINE	16. SANITATION
15. RECALL PROGRAM / TRACEBILITY	17.MICRBIOLOGICAL PROGRAM
16. SANITATION	
18. MAINTENANCE	

Conclusion

Protecting the safety of the fresh produce supply requires a comprehensive and coordinated effort through the production and processing system. In this document we provided some basic principles and practices from the analysis of the Chef's Garden farm fresh-cut produce food safety operational system. Based on the life cycle of the vegetables we outlined 18 potential microbial contamination points through the production, transport and processing on the farm. Most of these steps are being documented on the daily/ weekly/ yearly basis as they occur. We need to mention that, this documentation requirement does put a lot of pressure on the employees and on the management because besides accomplishing this, the daily work still needs to be done efficiently and productively.

Obviously these outlined steps can vary between farm to farm. Growers and packers should consider the variety of physical characteristic of their produce and practices that effect the potential sources of microbial contamination associated with their operation, and decide on which combination of good agricultural, good manufacturing and management practices are the most (cost) effective for them. Once the good agricultural and manufacturing practices are in place two operational approaches should be followed. First of all the operators need to ensure that the process is working correctly at all the time. Secondly, the applied technologies need to be continuously improved according to how the food safety research is continued to provide more and more information.

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