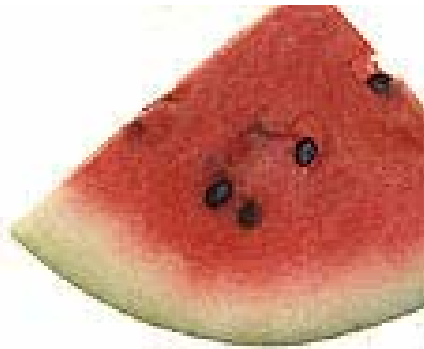
Produce Food Safety & Postharvest Handling







Jim Gorny, Ph.D.
Executive Director

POSTHARVEST TECHNOLOGY
Research & Information Center

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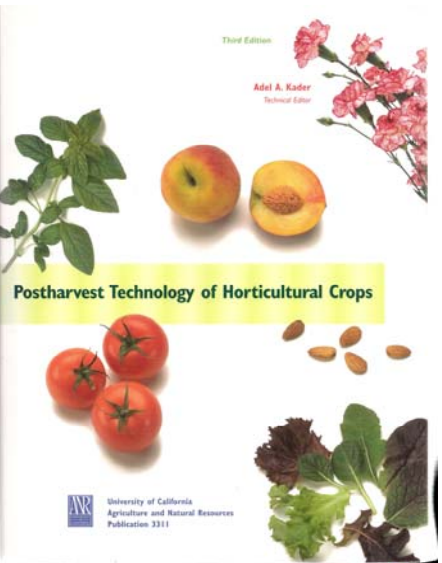
Mission: *To empower the produce value chain to make informed decisions that reduce postharvest losses, improve marketing efficiency and improve the quality, value, and safety of produce available to consumers.* **http://postharvest.ucdavis.edu**



UCDAVIS PLANT SCIENCES

Produce Commodity Markets

- **Increasingly A Global Marketplace**
- **Traditional "Price Taker" Model**
  - Homogenous Commodity Undifferentiated
  - Buyers are Indifferent Between Suppliers or Products
  - Sellers Have No Control Over Price
  - Weather/Supply and Demand Drive Prices
- **Downward Price Pressures**




Be A Price Maker, Not A Price Taker

- Create Customer Value
- Be Different
- Choose Customers That Recognize Value
- Deliver on Your Promise
- Develop Means to Charge Customer via Transaction Based Quality or Quantity of Value Provided.
- Be Courageous

B.P. Shapiro, 2003 Harvard Business School
http://hbswk.hbs.edu/item/3314.html

Strategies

1) Low-cost Producer/Shipper

Increasingly difficult as buyers place more demands on upstream suppliers.

2) Differentiated Premium Product with Commercially Perceived and Valued Preferred Characteristics

Superior Quality & Availability (Postharvest Handling)

Sustainability (Environmental Stewardship, Organic)

Assurances of Food Safety (Traceability, Authenticity)

Postharvest Handling

Marketplace Differentiation

- Market Windows
- Consumer Satisfaction = Repeat Buys
- Reduced Postharvest Losses = Sustainability

POSTHARVEST HORTICULTURE SERIES NO. 21
April, 1999

Postharvest Technology for Small-Scale Produce Marketers:

Economic Opportunities, Quality and Food Safety

Lisa Kitinoja and James R. Gorny
Department of Pomology, University of California, Davis

A publication of the UC Postharvest Technology Research and Information Center
In association with the USAID/Agricultural Commercialization and Enterprise Project (ACE-India)

Postharvest Horticulture Series No. 8E
July 2002
Slightly revised November 2003

Small-Scale Postharvest Handling Practices: A Manual for Horticultural Crops (4th Edition)

Lisa Kitinoja and Adel A. Kader

POSTHARVEST TECHNOLOGY UCDAVIS

University of California, Davis
Postharvest Technology Research and Information Center

Environmental Stewardship

- Sustainability (Carbon Footprints, Food Miles)
- “Green” Packaging
- Local Market Renaissance “Heritage Regions”
- “Green” Postharvest Crop Protection Methods

"Taste, freshness, support for local economy, confidence in knowing where the food comes from are all factors that come into play, as well as cost.

It costs less for grocers to transport local food,“

Bill Gree, Food Marketing Institute (Sept. 4, 2007)

Food Quality: Characteristics or attributes which make a food desirable or appealing to consumers. (Aroma, color, flavor, turgidity, nutrients,etc)

Negotiable

Vs

Food Safety: "Food product" implies that consumption will NOT cause injury.

NON Negotiable

Produce Food Safety Rationale

- **Its the LAW !**
- **#1 Issue**

  (Buyers, Consumers, Regulators, Media)
- **Business Survival**

“Yes, but take away the rodent droppings and the occasional shard of glass and you’ve still got a damn fine product.”

Liable:

To be responsible for, to be obligated in the law.

Negligence:

A duty on the part of the defendant to conform to a specific standard of conduct to protect others (consumer) against unreasonable injury.

Due Diligence:

The degree of care which is reasonably commensurate with a known danger and the seriousness of the consequences which are liable to follow its omission.

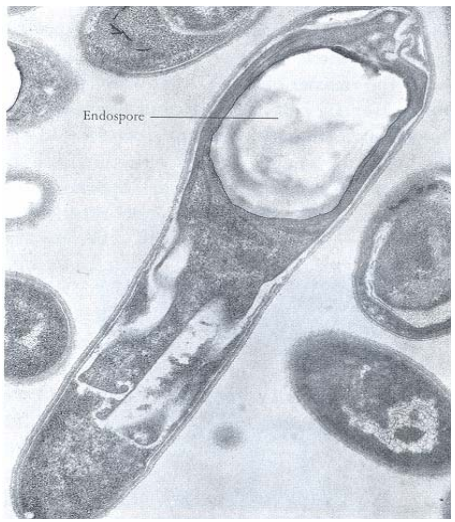
Why Have Concerns About Produce Safety Increased?

- Better Detection Methods
- Increased Surveillance
- Increased Per Capita Consumption
- Produce is Often Not Cooked
- Global Sourcing
- Longer Postharvest Storage
- Foodborne Illness Outbreaks

Produce Associated Pathogenic Bacteria

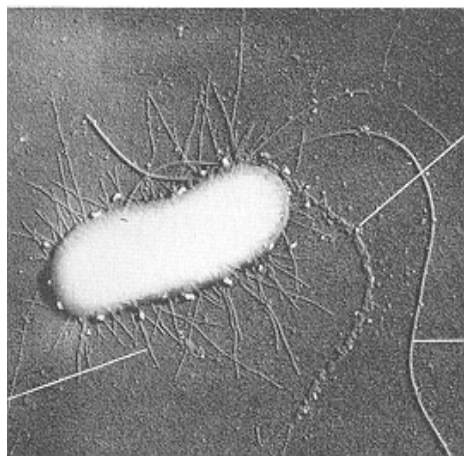
Soil Associated

- *Clostridium botulinum*
- *Listeria monocytogenes*
- *Bacillus cereus*



Feces Associated

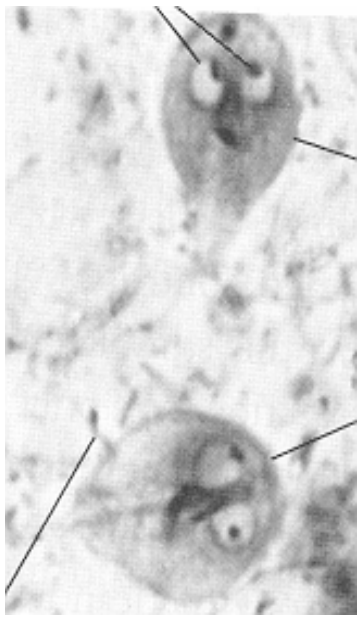
- *Salmonella species*
- *Shigella species*
- *Escherichia coli (ETEC, O157:H7)*



Pathogenic Parasites

Feces Associated

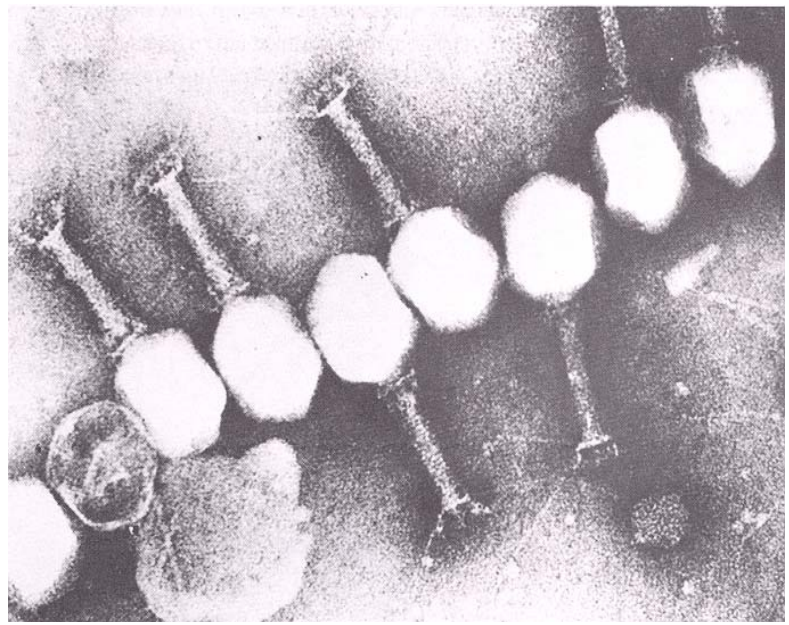
- *Cryptosporidium*
- *Cyclospora*
- *Giardia lamblia*



Pathogenic Viruses

Human Feces Associated

- *Hepatitis A*
- *Enteroviruses*
- *Norwalk Virus*



Prelude to Crisis

- **February 2004 - FDA Letter to Firms that Grow, Pack, or Ship Fresh Lettuce and Fresh Tomatoes**
  "review current operations consider modifying operations and ensure appropriate measures to provide a safe product to the consumer"
- **October 2004 - FDA Produce Safety Action Plan**
  Communications, Prevention, Minimize Impact, Research
- **September 2005 - Fresh-cut Lettuce *E. coli* O157:H7**
  32 Illnesses, 3 States
- **November 2005 - FDA Letter to California Firms that Grow, Pack, Process or Ship Fresh and Fresh-cut Lettuce**
  "claims that we cannot take action until we know the cause are unacceptable"
- **April 2006 - Lettuce & Leafy Greens Commodity Specific Guidance Issued**
- **August 2006 – FDA Announces Lettuce Safety Initiative**
  Best Practices Survey, Rapid Response, Research, Communications/Outreach

Spinach Crisis 2006

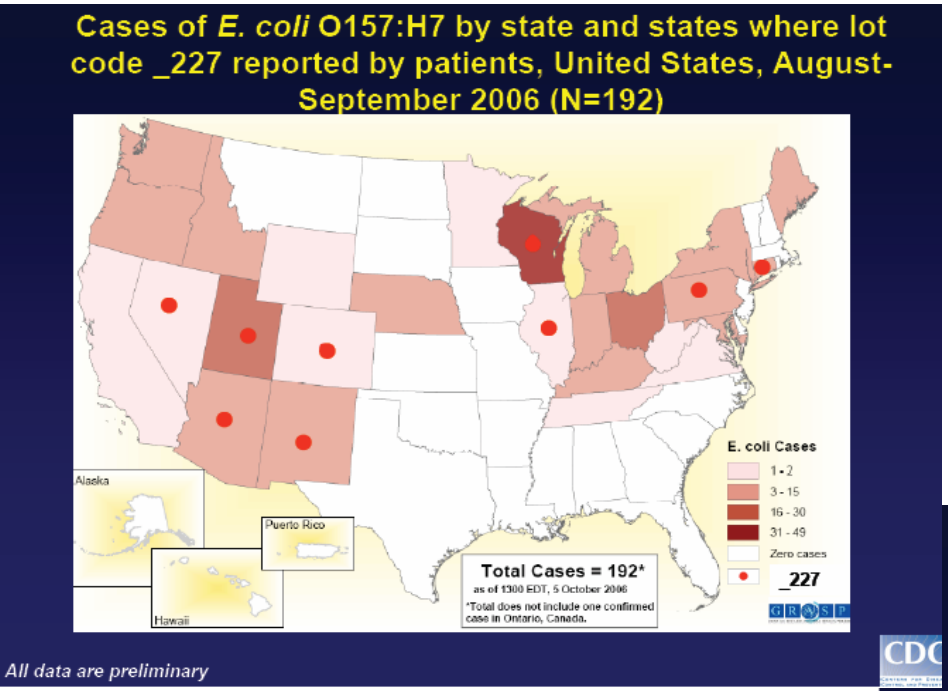
Thursday September 14, 2006
FDA Warning on Serious Foodborne *E.coli* O157:H7 Outbreak

"FDA advises that consumers not eat *bagged fresh spinach* at this time."
50 illness, 8 HUS, 1 Death, 8 States

- **All retail and food service product pulled from shelves.**
- **Distribution chain stopped in motion.**
- **Harvesting / processing stopped.**
- **Planting decisions on hold.**
- **An entire industry shut down.**

Kyle Allgood
Jane Dunning
Marion Graff

Anatomy of an Outbreak



204 Illnesses

31 HUS

104 Hospitalizations

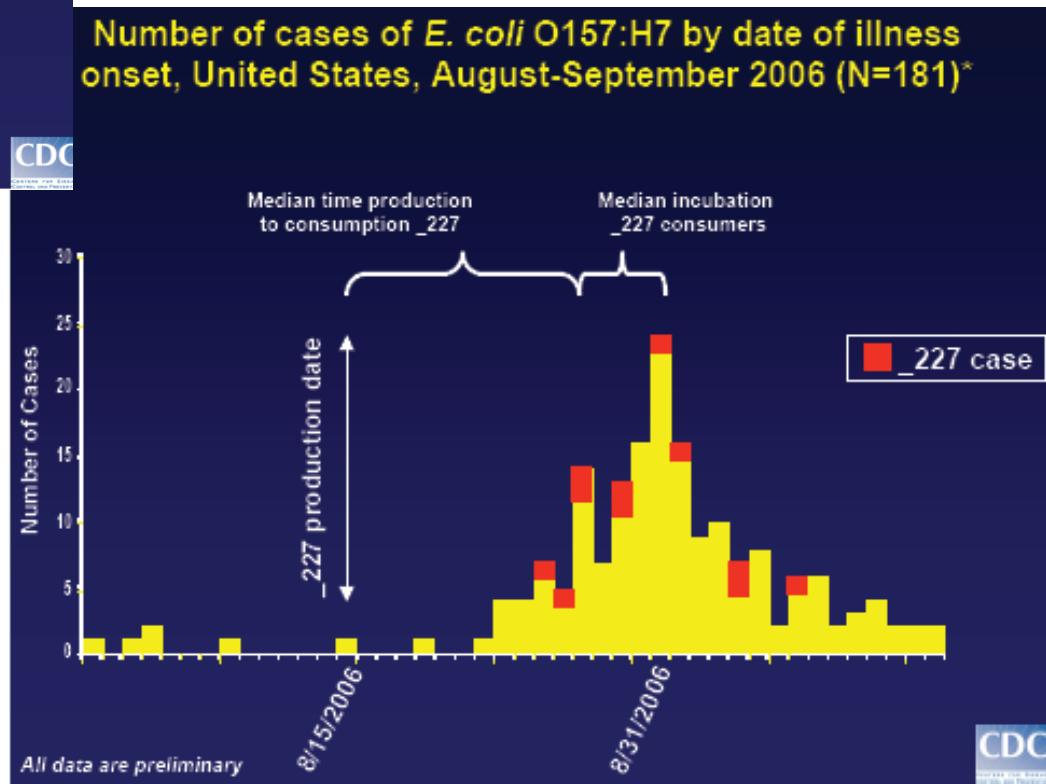
3 Deaths

26 States

5 Recalls

11 Bags from

Lot 227 test +



Will Microbiological Testing Assure Food Safety ?

- Safety Cannot Be Tested Into A Product
- Negative Tests Don’t Prove Absence
- What will you test for ?
- Micro Testing Can Be Used To Identify Abnormal Performance (places data in context)
- Focus On Process Not Product

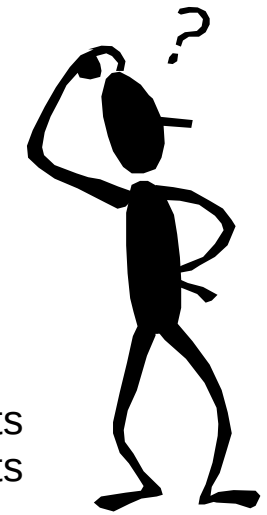
Random Sampling

Table 1. Probability of accepting a defective lot with indicated proportion of defective sample units

	Number of Sample Units			
% Defective	**15**	**30**	**60**	**100**
0.1	0.99	0.97	0.94	0.90
0.5	0.93	0.86	0.74	0.61
1	0.86	0.74	0.55	0.37
2	0.74	0.55	0.30	0.13
5	0.46	0.21	0.05	0.01

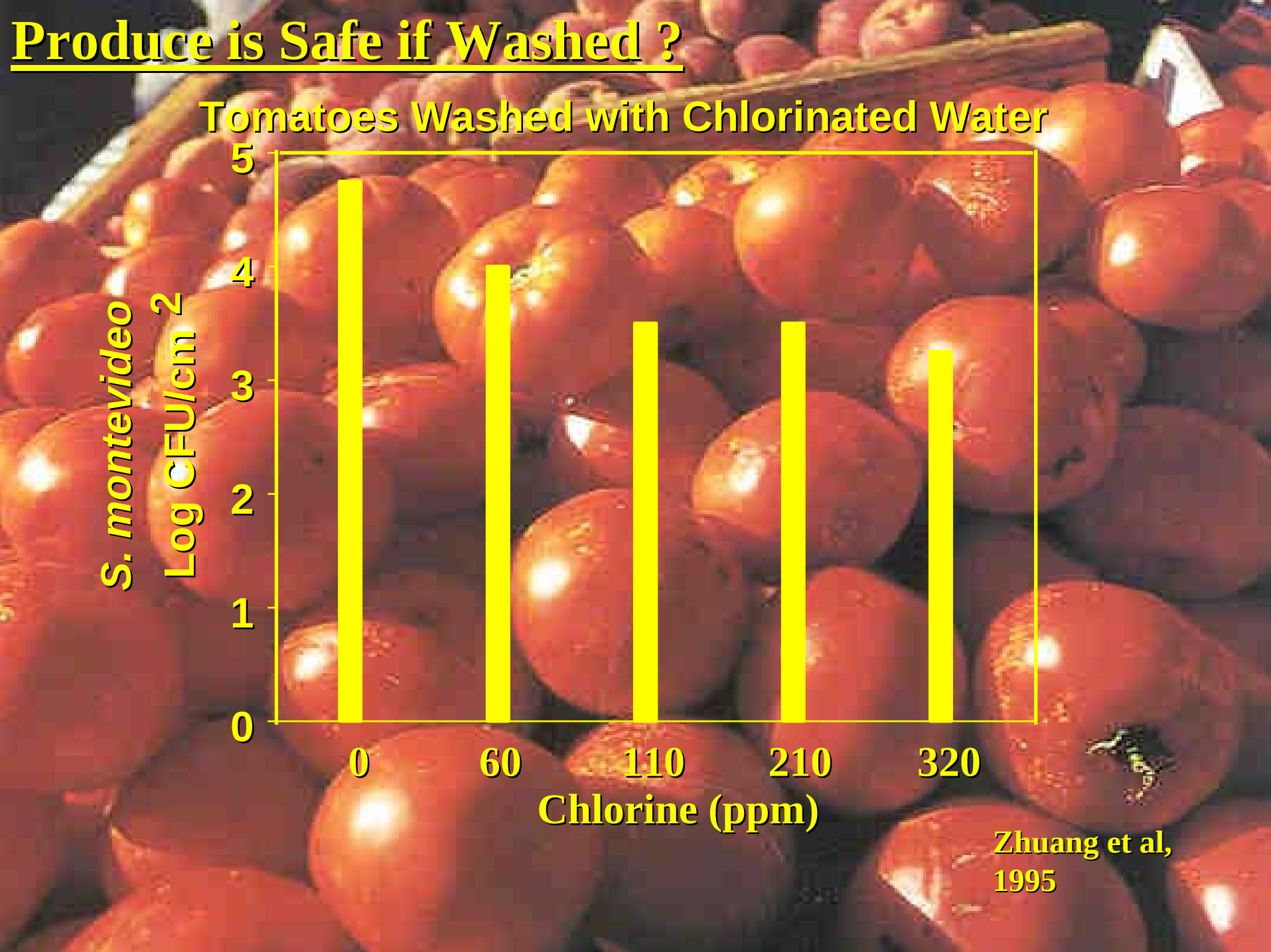
Adapted From: Microorganisms in Foods 7 - Microbiological Testing in Food Safety Management, 2002 International Commission on Microbiological Specifications for Foods (ICMSF) Kluwer Academic / Plenum Publishers NY, NY

Example 1
Defect Level: 0.5%
Samples Units Tested: 30
Analysis: 86% probability that all 30 samples will be found negative and the lot will be accepted.

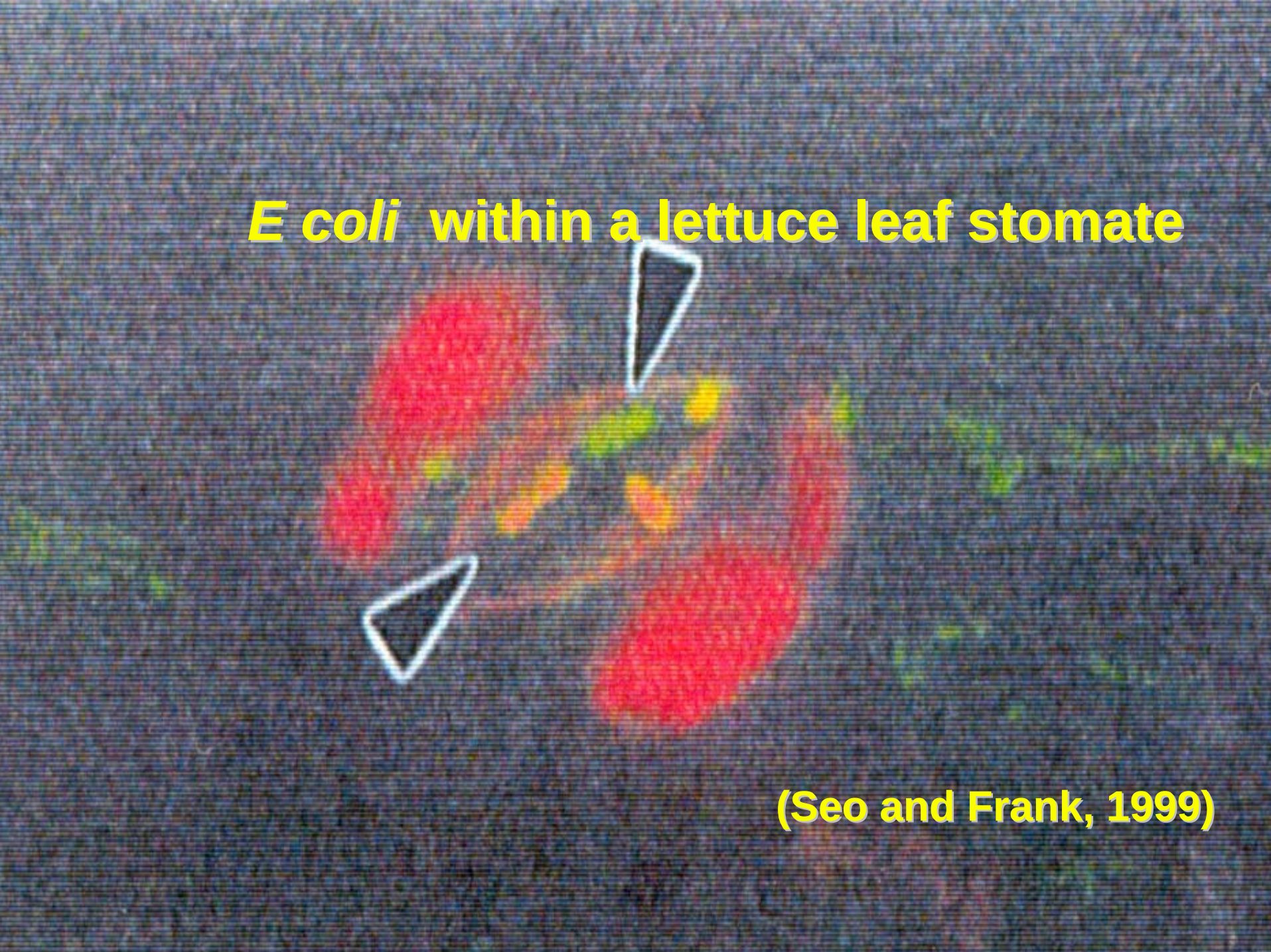


Example 2
Defect Level: 0.7%
Number of samples required to detect the defect with 95% probability: 428 sample units
Number of samples required to detect the defect with 90% probability: 329 sample units

Produce is Safe if Washed ?



Zhuang et al, 1995

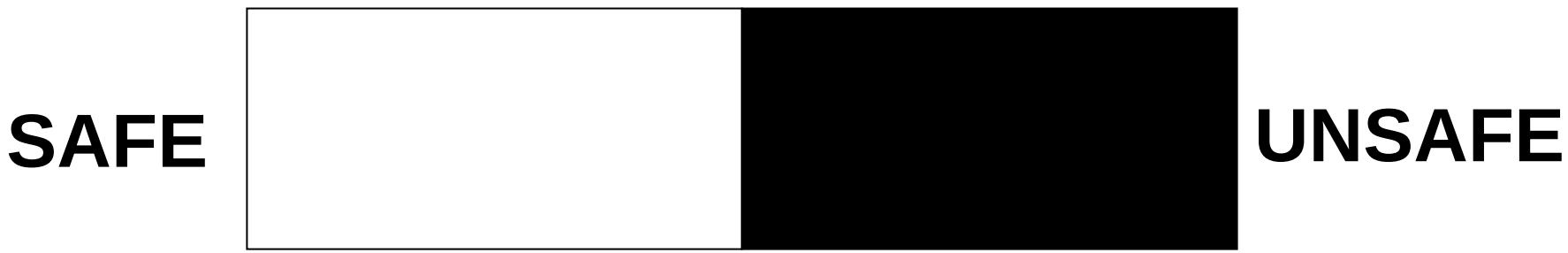

E coli within a lettuce leaf stomate
(Seo and Frank, 1999)

Defining Safety

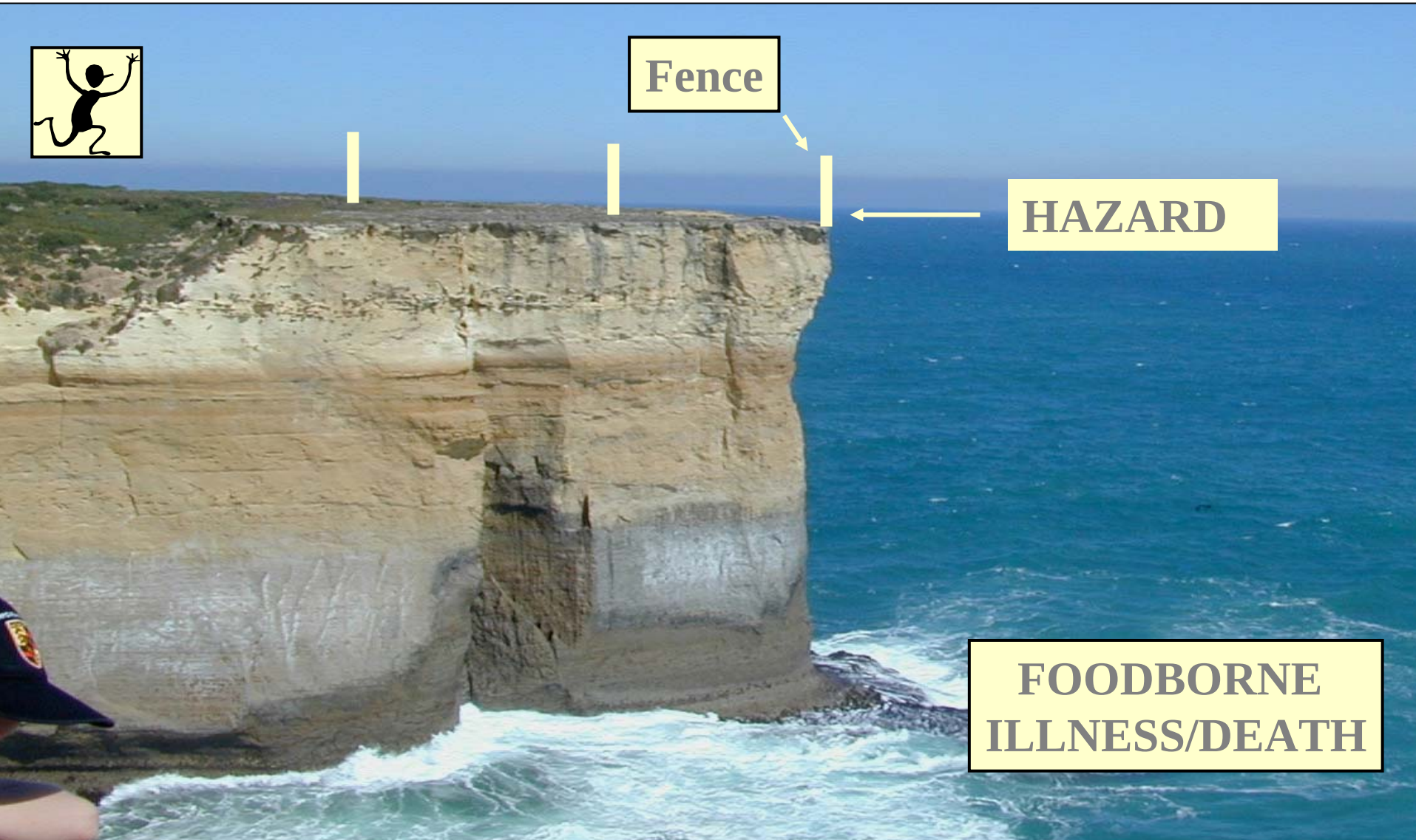
The goal of all food safety programs is: zero illnesses.

Food safety programs identify and manage risks (i.e. potential hazards).

Produce Food Safety = Prevention



Food Safety Programs Control, Reduce or Eliminate Hazards



Produce and Food Safety Concerns

Potential Contamination Sources

Field

Packing Shed

Cooler

Processing Plant

Distribution

Consumers

Good Agricultural Practices (GAPs)

- **GAPs USA = Food Safety (emphasis microbial)**
- **EurepGAP = Food Safety (emphasis pesticides)**
  Social Accountability
  Environmental Stewardship
  Sustainability
- **SQF, ISO, etc, etc, etc**

Produce Food Safety Program Components

GAPs (Voluntary)

GMPs

(Mandatory for Processors)

HACCP (Voluntary)

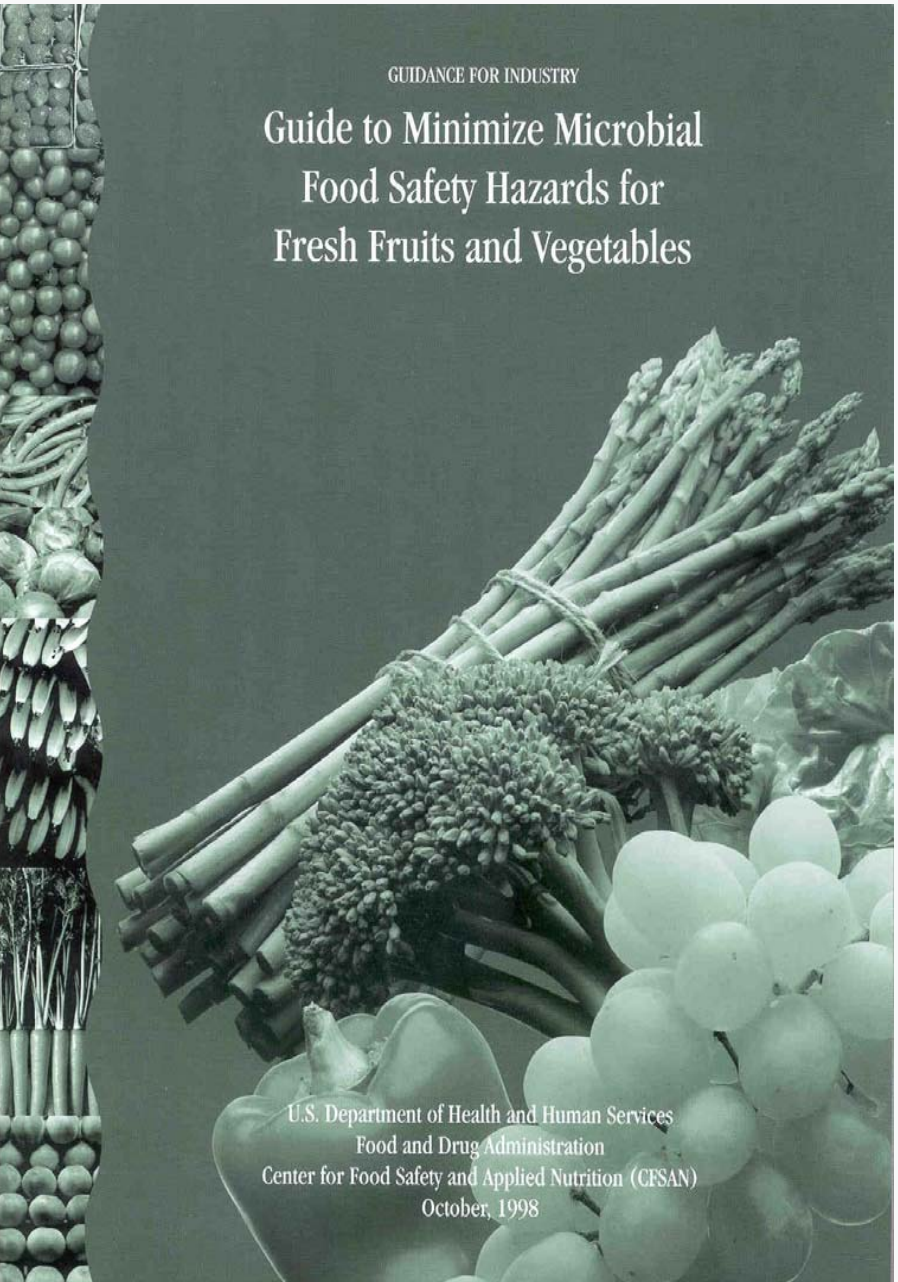
Customer Audits

Third Party Audits

Good Agricultural Practices (GAPs)

- No Kill Steps
- Washing will NOT Eliminate Hazards
- Cross Contamination Potential

Good Agricultural Practices (GAPs)



Ranch History

Adjacent Land Usage

Fertilizer Usage

Pesticide Usage

Water Supply

Employee Hygiene

Harvest Practices

Packing House Operations

Practices, Possibilities and Controls

Practices

- Important to understand current practices.
- Practices are rapidly and ever changing.
- Many variations.

Possibilities

- Practices determine the risk profile.

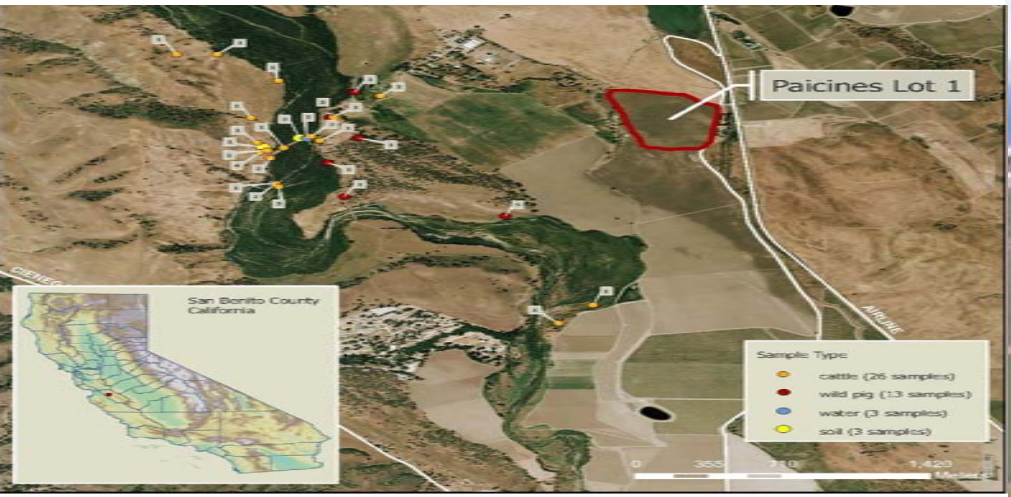
Controls

Problem solving is needed.

- Problem definition (identify need)
- Constraints,
- Alternative Solutions,
- Analysis,
- Decision,
- Iterate

Production & Harvest

Practices: Site Selection & Adjacent Land Use



Production & Harvest

Possibilities: Site Selection & Adjacent Land Use

Site Selection

- ❖ Range Land
- ❖ Crop Production
  Land that has been Grazed
- ❖ Flooded Ground

Adjacent Land

- ❖ Forest
- ❖ Riparian Environment
- ❖ Farm Land
- ❖ Urban Interface
- ❖ Composting Operations
- ❖ Sewage Treatment Facilities

1. What are the significant human pathogen reservoirs.
2. What are the vectors of human pathogen transfer to produce.
3. Environmental affects on survival or growth of human pathogens.
4. Survival and growth requirements for human pathogens on produce.
5. Effective microbial sampling schemes and interventions.

Production & Harvest

Controls: Site Selection Flooded Ground

- **Harvest Distance From Flooding**
- **Verification**
- **Formerly Flooded Ground**
  - Production Practices To Reduce Risks
  - Time Interval
  - Micro Testing to Validate Process

Production & Harvest

Controls: Adjacent Land Use

Potential Contamination Source

Proximate Safe Distance

Mitigation Measures / Risk Factors

Risk Factors

- Composting Operations
- CAFO's
- Compost On Adjacent Farms
- Grazing Lands
- Leach Fields
- Fallow Areas (Woods, etc.)

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Production & Harvest

Practices: Site Preparation

Production & Harvest

Possibilities: Site Preparation

- Field-to-field farm machinery pathogen transference?
- Variables affecting effective treatment of animal manure containing soil amendments?
- Water of appropriate microbial quality for emergence and soil preparation?

1. What are the significant human pathogen reservoirs.
2. What are the vectors of human pathogens transfer to produce.
3. Environmental affecting survival or growth of human pathogens.
4. Survival and growth requirements for human pathogens on produce.
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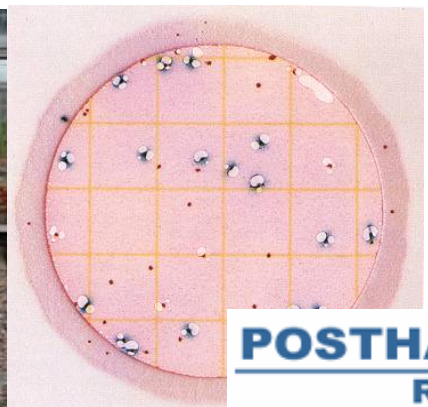
Production & Harvest

Controls: Site Preparation – Soil Amendments

- Physical, Chemical or Biological Treatment
- Output Micro Testing to Verify Process
- Application Interval



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Production & Harvest

Practices: Production



WATER



Production & Harvest

Possibilities: Production

- Water of appropriate microbial quality for irrigation?
- What factors effect pathogen persistence and growth in irrigation water?
- How effectively are pathogens transferred by water uses?
- Does the irrigation method used alter pathogen transference risk?
- If pathogens are transferred to produce what environmental factors and production practice effect survival and growth of human pathogens?
- Root uptake? Contaminated seed?

What are the significant human pathogen reservoirs.
What are the vectors of human pathogens transfer to produce.
Environmental affecting survival or growth of human pathogens.
Survival and growth requirements for human pathogens on produce.
Effective microbial sampling schemes and interventions.

Production & Harvest

Controls: Production - Water

- Water Use: Production (Contact, Non Contact)
  Postharvest
- Microbial Action Levels Based on Safe and Sanitary Intended Use
- Testing Frequency Based on Source Variability
- Microbial Indicators Used To Measure System Performance (generic *E. coli*)
- Decision Tree Based Actions

Production & Harvest

Controls: Production - Water

- **Stop Using the Water Source**
- **Perform a Sanitary Survey**
- **Take Corrective Actions**
- **If Water Has Been Used for Crop Production**
  test produce for pathogens (*E.coli* O157:H7, *Salmonella*)

Production & Harvest

Practices: Harvest





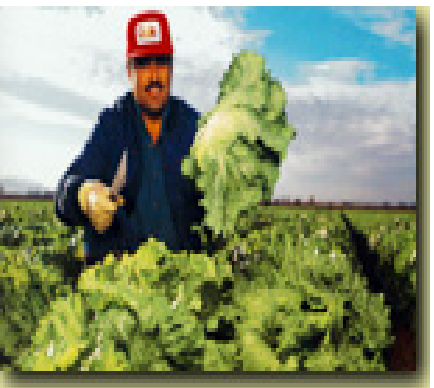





Production & Harvest

Possibilities: Harvest

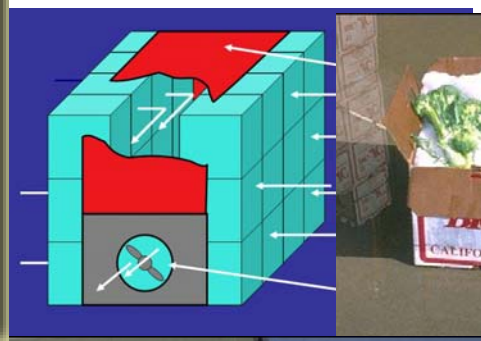
- Pathogen reservoirs: workers, adjacent land, animal feces?
- How effectively are human pathogens transferred to produce by worker, food contact surface the environment?
- What factors can effect human pathogens survival and growth on produce during/after harvest operations?
- If human pathogens are transferred to produce at harvest what environmental factors and handling practices effect survival and growth?



What are the significant human pathogen reservoirs.
What are the vectors of human pathogens transfer to produce.
Environmental affecting survival or growth of human pathogens.
Survival and growth requirements for human pathogens on produce.
Effective microbial sampling schemes and interventions.

Postharvest Operations

Practices: Postharvest Cooling



Postharvest Operations

Possibilities: Postharvest Cooling

- What are the sources and vectors of pathogens in the postharvest environment?
- How well can human pathogens persist or grow in this environment?
- What factors can effect human pathogens survival and growth on produce during/after postharvest operations?
- If human pathogens are transferred to produce at harvest what environmental factors and handling practices effect survival and growth?

1. What are the significant human pathogen reservoirs.
2. What are the vectors of human pathogens transfer to LLG.
3. Environmental affecting survival or growth of human pathogens.
4. Survival and growth requirements for human pathogens on LLG.
5. Effective microbial sampling schemes and interventions.

Additional GAPs Resources

UC: http://ucgaps.ucdavis.edu

Cornell: www.gaps.cornell.edu/

Summary

Meet Market / Buyers Needs By Use of:

- Innovative Postharvest Technologies
- Sustainable Practices
- Food Safety Programs

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