

Practical Produce Safety

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Practices mostly commonly changed as a result of participating in a PPS workshop.

- **Handling / cleaning of harvest containers (90%)**
- **Employee training in produce safety (80%)**
- **Expanded produce safety plan (75%)**
- **Installed hand washing station (60%)**
- **Improved record keeping (55%)**
- **Switched to triple rinsing (40%)**

“Why a workshop on
food safety?”



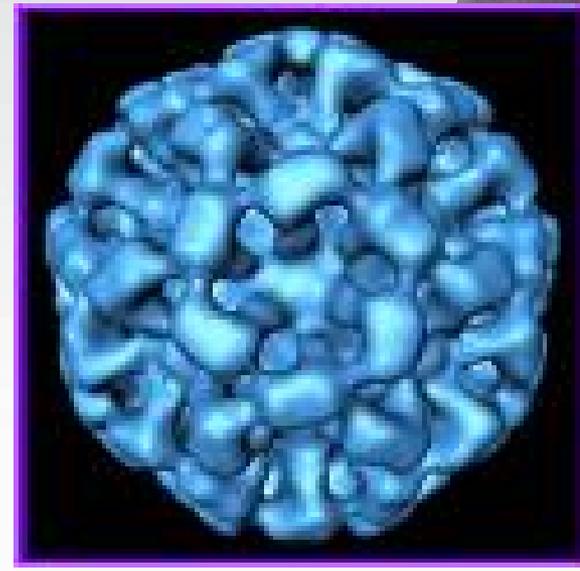
Campylobacter



Salmonella



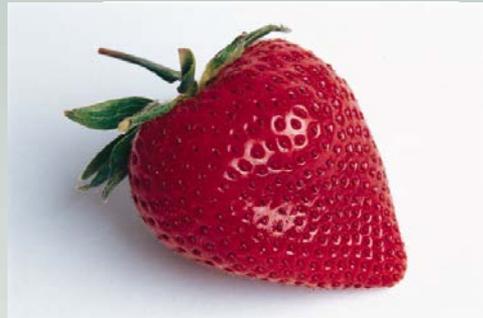
E. coli 0157



Norovirus /
Norwalk-like virus



Campylobacter



Salmonella



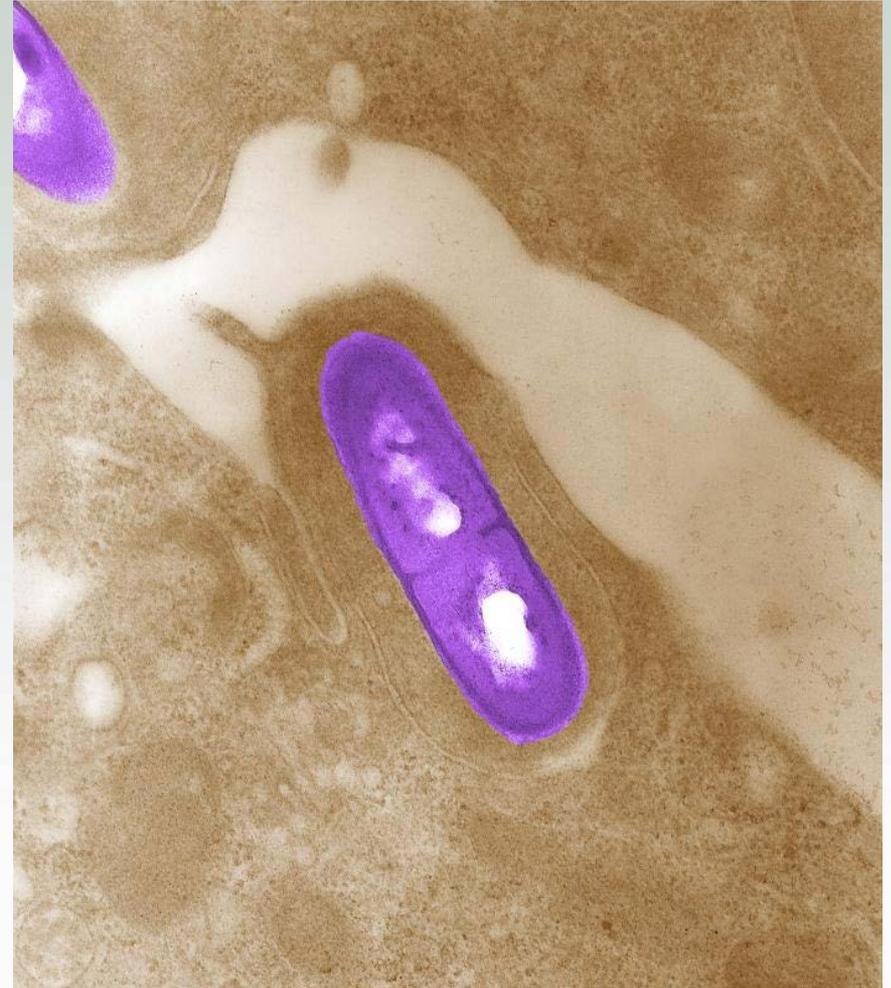
E. coli 0157



Norovirus /
Norwalk-like virus

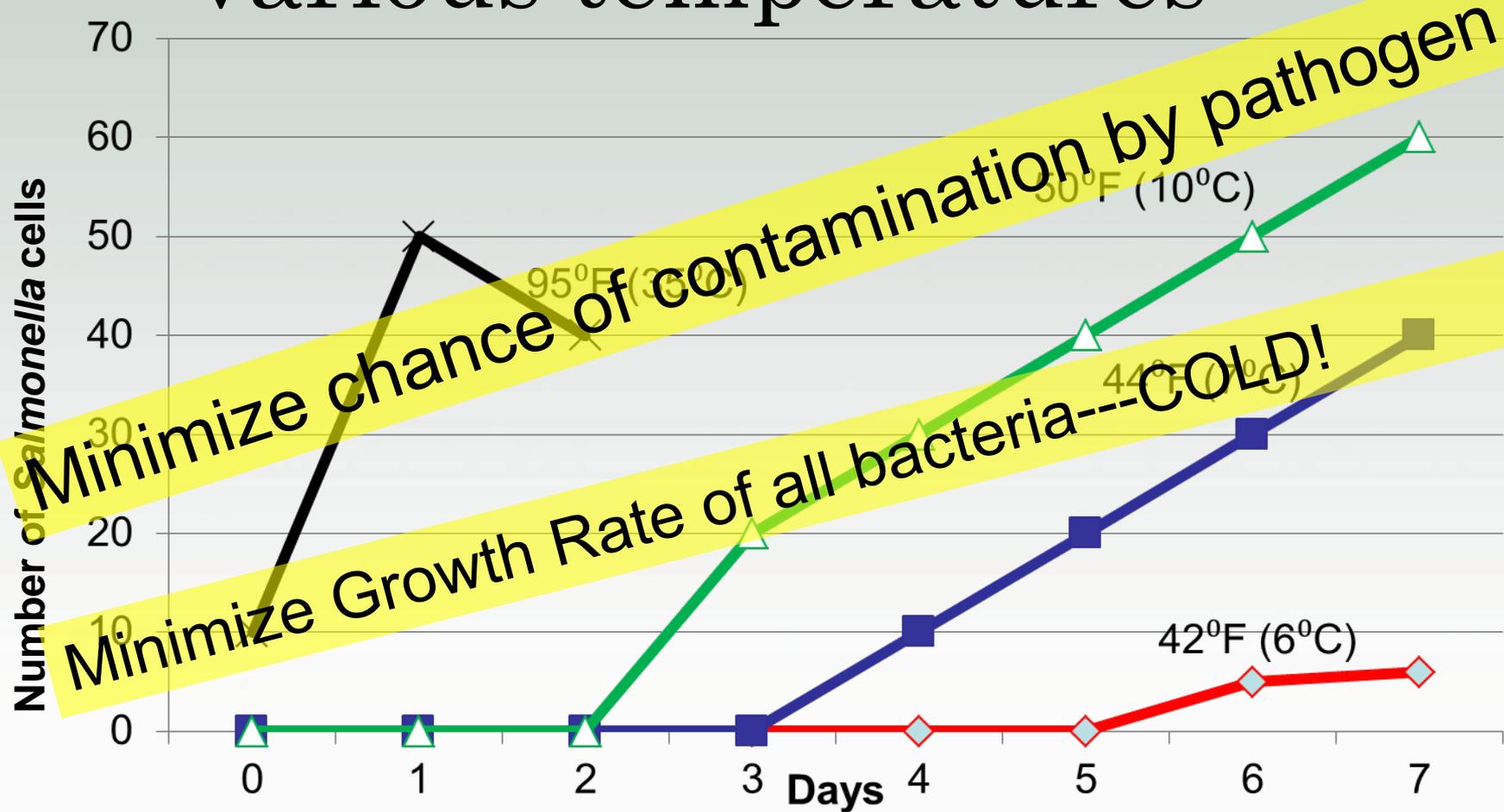
Thinking like a microbe.

- Moisture
- pH
- Nutrients
- Temperature
 - 40° - 141° = happy microbes
 - *Listeria* is an exception
- Time



Listeria in tissue. Photo courtesy of CDC.

Growth of *Salmonella* at various temperatures



Annual Burden of Foodborne Illness in the US: CDC Estimates

3,000

Deaths

128,000

Hospitalizations

48 Million Foodborne Illness

(1 in 6 Americans)

“Why is food safety suddenly such a big deal?”

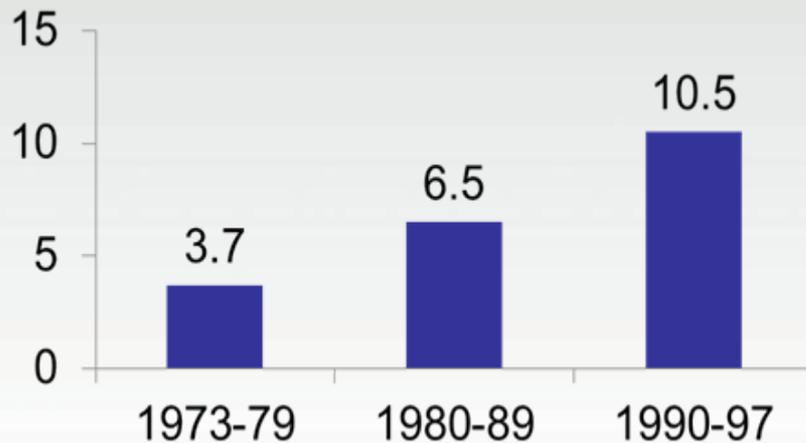
Outbreaks: Then & Now

- Then
 - Local outbreaks
 - Gross contamination
 - Mostly animal products
- Now
 - Multi-state outbreaks
 - Enhanced recognition
 - Additional food vehicles recognized



Why Produce-Related Food Borne Illnesses Increasing?

Number of Produce-Associated Outbreaks

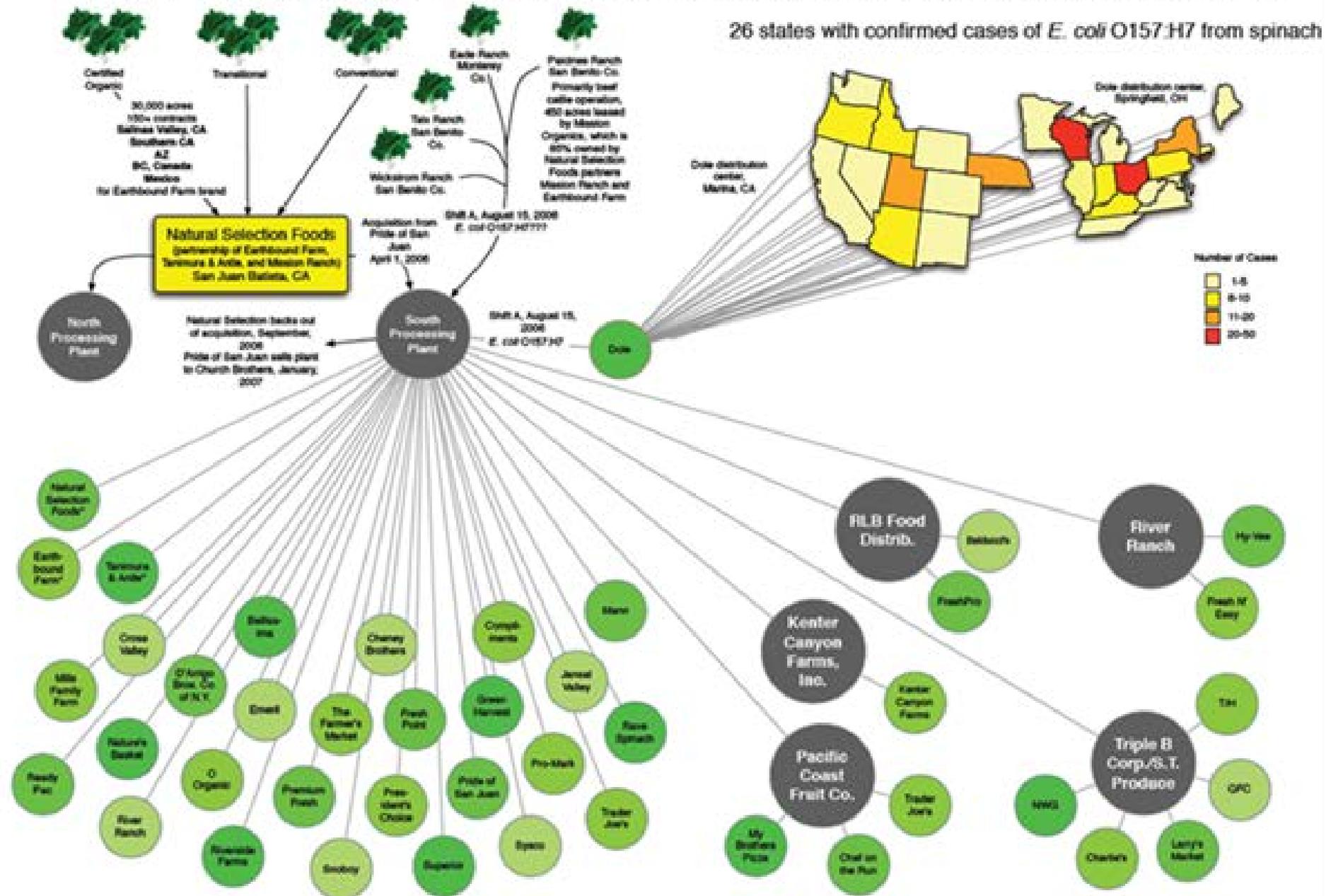


- More people eating raw produce: 24% increase in produce consumption 1970-1997
- More virulent pathogens: E. coli 0157:H7

Source: Wesley Kline, PhD Rutgers Cooperative Extension of Cumberland County, 2009

The 2006 *E. coli* outbreak in Natural Selection Foods' bagged spinach commodity chain

26 states with confirmed cases of *E. coli* O157:H7 from spinach



Recalled bagged spinach brands
*Brands with ownership ties to Natural Selection Foods

Recalled brands with spinach ingredients

Trends in public health

- Changing Microbes
 - Microbes mix and mutate
 - Low numbers of microbes needed to cause disease
- Changing demographics
 - Aging population
 - More people with compromised immune systems





“If someone got sick from food from my farm I would know it.”

Yes and no....

Yes...

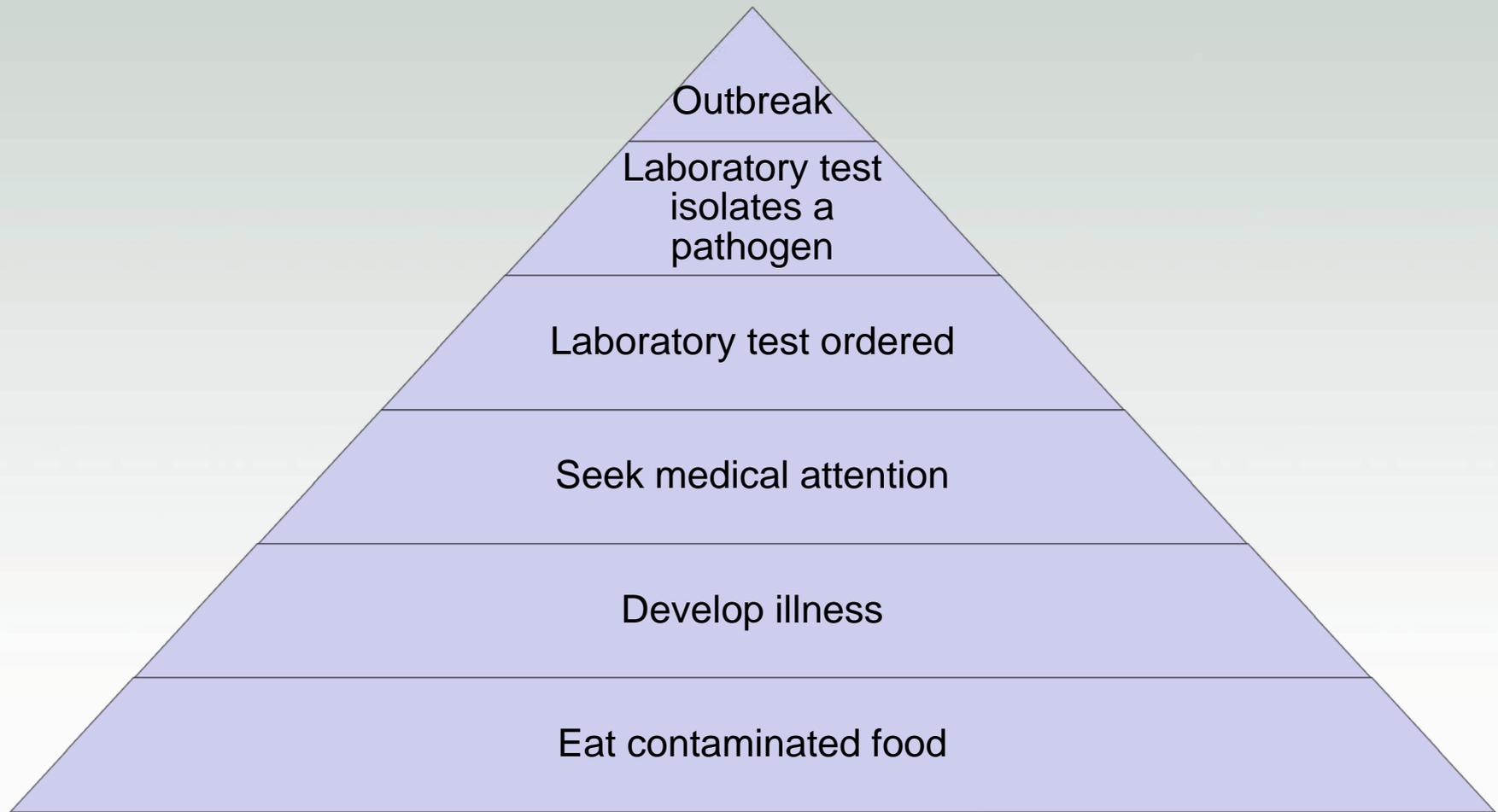
- You probably have a relationship with many of the people who eat your food, or at least they know where to find you!



No...

- Most people blame the meal they consumed immediately prior to getting sick
 - Only the case with toxins and environmental contaminants
 - Typically takes days to weeks for illness to develop
- Many cases of foodborne illness go unrecognized

Necessary steps for outbreak recognition





“Food safety is only a concern for big agriculture”

Yes and no...

Yes...

- Products are co-mingled and processed (such as ready-to-eat) increasing the potential for cross contamination
- Longer storage and transportation increase the opportunity for improper handling
- Outbreaks usually large

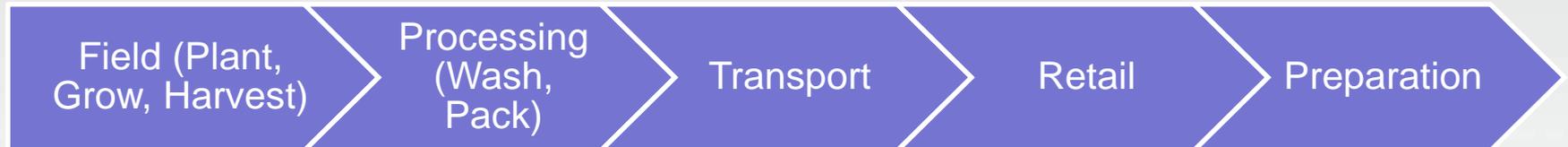
No...

- Basic on-farm good agricultural practices apply to all farms regardless of size



Everyone from Farm to Fork is Responsible for Food Safety

For produce eaten fresh, there is no microbe-killing (heat) step. (i.e., no opportunity for corrective action).



Points Most Susceptible to Contamination

Everyone from Farm to Fork is Responsible for Food Safety

For produce eaten fresh, there is no microbe-killing (heat) step. (i.e., no opportunity for corrective action).



Points Most Susceptible to Contamination

We're here to
help you with
your food
safety plan!

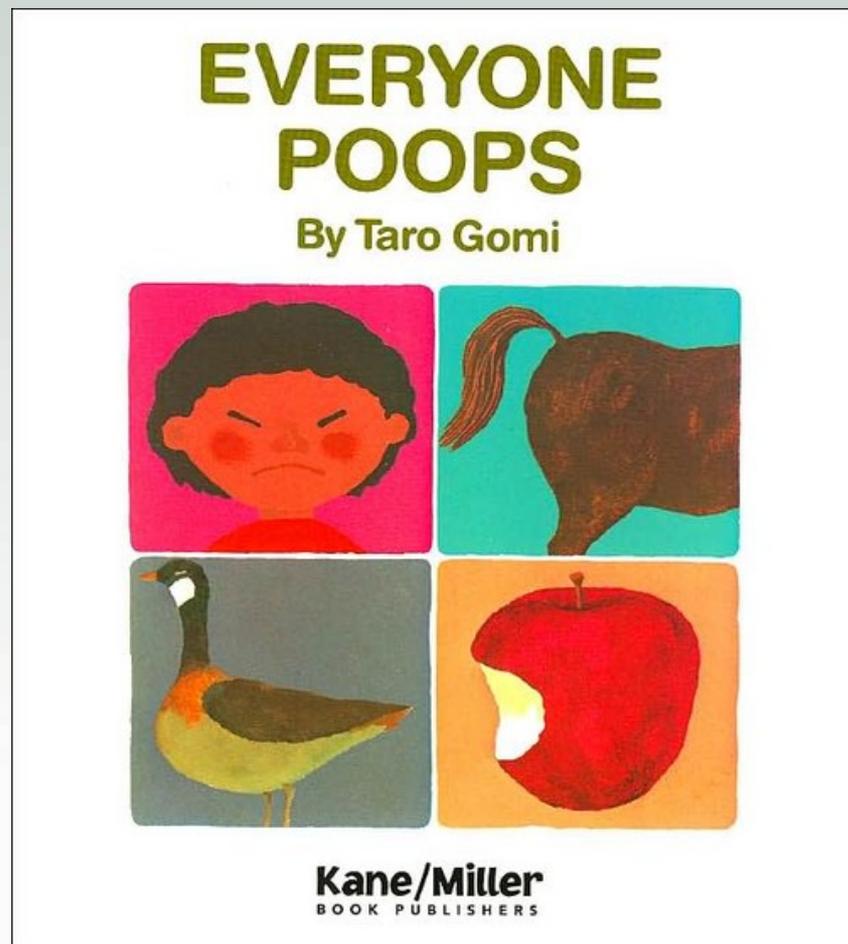


5 Routes of Microbial Contamination

- Agricultural water
- Biological soil amendments of animal origin
- Worker health and hygiene
- Equipment, tools, buildings and sanitation
- Domesticated and wild animals

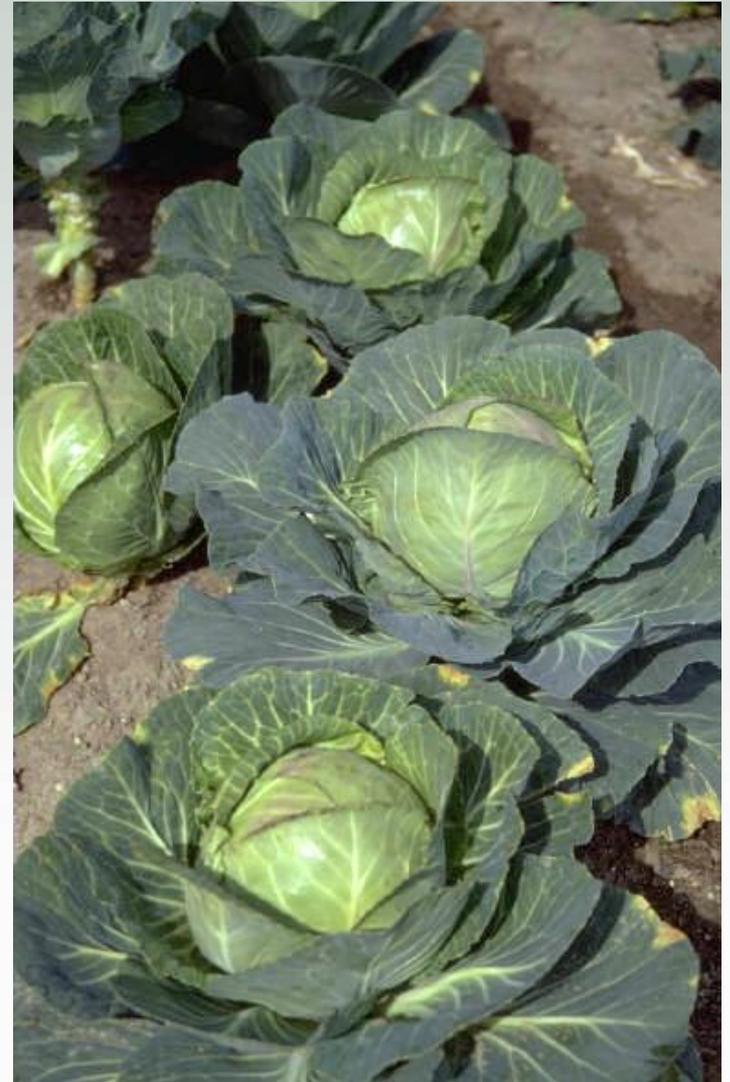
It's all about poop!

- Animal & human
 - Soil
 - Water
 - Contact surfaces
 - Hands



Cultivation: Contamination Sources

- Soil
 - Amendments (manure)
 - Prior contamination
 - Weather conditions (flooding)
- Water
 - Irrigation, applications
- Animals
 - Wildlife or domestic
- Humans
 - Workers and visitors



Land History: Any contamination?

- Prior use of land
 - Agricultural
 - Non-agricultural (e.g. dump site)
- Potential contaminants
 - Persistent chemicals
 - Carcass & manure



Cultivation: Soil Amendments



Best Practices

- Locate animals, manure and manure-based compost downslope or in a depression
- Use berms & buffer strips to protect crops from runoff
- Manure-based compost should heat to at least 131⁰F for at least 3 days

Cultivation: Soil Amendments



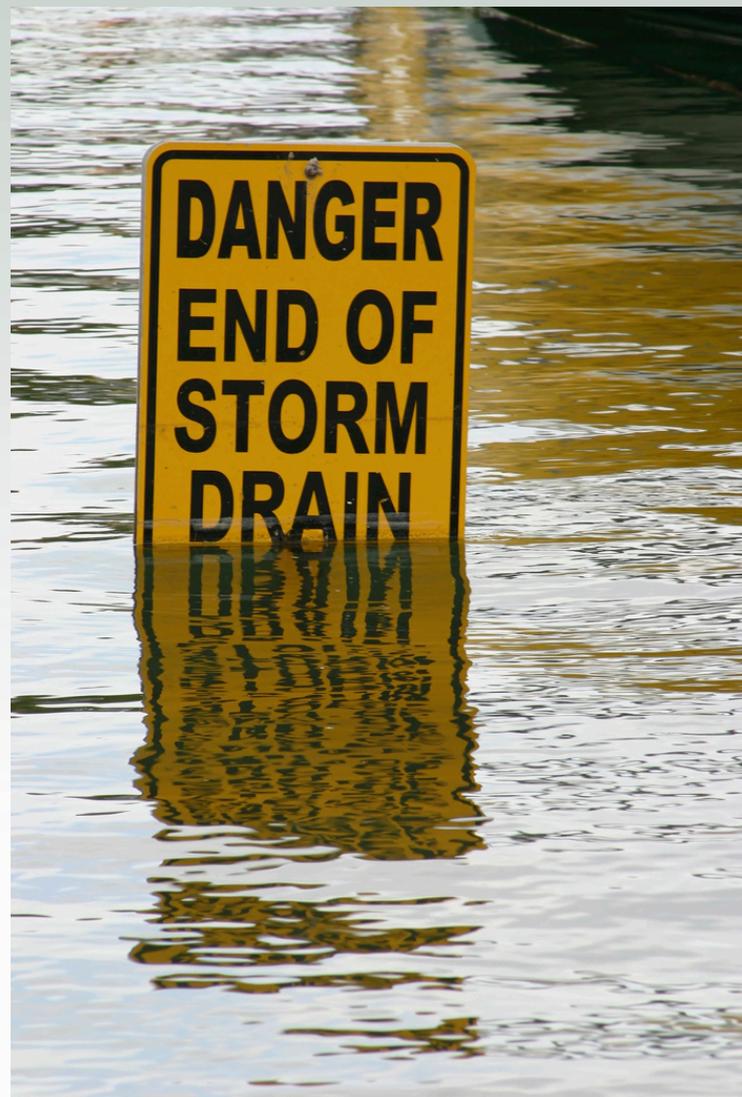
Best Practices

- Monitor composting process, temperature and turning
- Allow 120 days between application of raw manure or presence of livestock and harvest
- Watch out for recontamination!

Cultivation: Flooding

Best Practices

- Know areas on farm prone to flooding
- Plant lower risk crops in areas prone to flooding
 - e.g. corn, not lettuce
 - Inedible cash crops
- Construct berms and other physical barriers between water source and crop land



Cultivation: Water



Best Practices

- Keep livestock away from irrigation water sources
- Know your water quality:
Regular Water testing
 - Water quality should be appropriate for use

Water, water, everywhere.....



- Used for multiple on-farm purposes
 - Quality must match use
- Common source of microbial contamination
 - Promotes growth
 - Cross contamination
- Necessary for on-farm hygiene
 - Produce and people!

Taking a Water Sample



- Follow lab instructions (amount, timing, etc)
- Sample on low flow day (surface water)
 - Under conditions in which you would normally irrigate
 - Not after heavy rain
- Sampling
 - Potable water: tap
 - Surface water: pump valve or from body of water

Water Testing: Frequency

Type of Water Source	Testing Recommendation
Municipal / Public	Not required
Well Water (drilled, dug, driven point wells)	1 time/yr Beginning of season
Surface (ponds, rivers, streams, lakes, springs)	At least 3 times per year** <ul style="list-style-type: none">• Start of the season• At peak use• Prior to harvest

Water Testing: Interpreting Results

Water Use	Tests	Standards
Pre-harvest: Irrigation, frost protection, chemical or fertilizer application	E. coli	235 CFU / 100 ml *
Potable water for drinking, hand washing, crop washing & rinsing, and post-harvest applications	Total coliform	0 CFU / 100 ml
	E. coli	0 CFU / 100 ml
	Nitrate	10 mg/L (NO ₃ -N)

*Above 235 CFU / 100ml, consider the following steps:

- Repeat testing
- Modify practices (call Extension to consult)

Cultivation: Irrigation

Best Practice

- Drip Irrigation



Not as safe

- Overhead spray



Modifying Practices Based on Water Tests

- Alter irrigation methods
 - Drip or drip under plastic
 - Trench Furrow
 - Overhead
 - Consider type of crop
 - Lettuce vs. corn
 - Maximize drying time between irrigation and harvest

Cultivation: Wildlife and Domestic Animals



Best Practices

- Cover or fence crops
- Use deterrents
 - Owl eyes, pie pans, etc
- Hunting & traps
- Avoid harvesting produce near animal feces
- Restrict domestic animals from fields (including U-pick) and production areas

Cultivation: Minimizing Animal Contamination and Crop Damage



E. Coli 0157:H7 in Strawberries

- Distributed to roadside stands and farmers markets
- Outbreak: 15 ill, 7 hospitalized, 1 death
- Environmental samples found *E. coli* identical to outbreak strain
- Deer suspected as source of contamination



Harvest: Keep it Clean!

Best Practices

- Keep harvest containers off the ground
- Avoid stacking soiled harvest containers on top of clean containers & produce



Harvest: Keep it cool!

Best Practices

- Harvest early
- Cover outdoor wash / pack areas for shade
- Cool to remove field heat, then *keep* cool



Harvest: Containers & Equipment

Best Practices

- Clean and/or sanitize harvest containers regularly
- Stack and store containers in covered area
- Maintain container of bleach solution to sterilize hand tools



Post-harvest: Washing

Best Practices

- Use potable water only for washing
- Change water often
- Double or triple rinse greens
- Add sanitizer*
 - Monitor pH & disinfectant levels
 - Adjust as needed



**Reduced
Microbial Load =
longer shelf life +
safer produce**

Post-harvest: Surfaces

Best Practices

- Non-porous surfaces
- Screens and/or mesh
- Regular schedules for cleaning and sanitizing work surfaces and equipment
- Well-drained, cleanable floors



Post-harvest: Storage

Best Practices

- Store produce at optimal temperature for product
 - Monitor temp daily
- Avoid condensate
 - Dripping coolers
 - Avoid wet over dry goods
- Minimize time between harvest and sale (72 hrs)
 - First in, first out policy
- Wash cooler walls & floor regularly or as needed



Post-harvest: Pests Control

Best Practices

- Maintain a pest control program in processing and storage area
 - Keep grounds around food storage areas mowed & free of debris
 - Empty trash often
 - Locate compost away from stored produce
 - Remember to check the traps!



Old Barn Considerations



Transporting Produce

Best Practices

- Clean or sanitize transport vehicles especially after transporting:
 - Livestock
 - Meat
 - Manure or compost
 - Chemicals
- Cover produce during transport



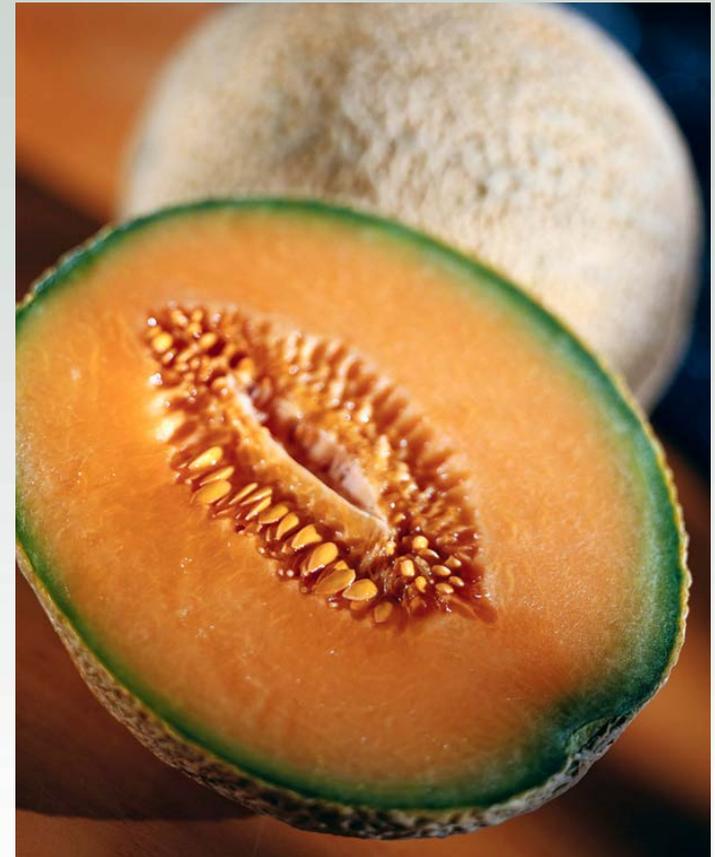
Listeria in Cantaloupe

- Outbreak
 - 146 ill, 29 deaths, 1 miscarriage from 28 states
- Environmental Assessment
 - *Listeria* found on fruit, processing line, packing area and cold storage



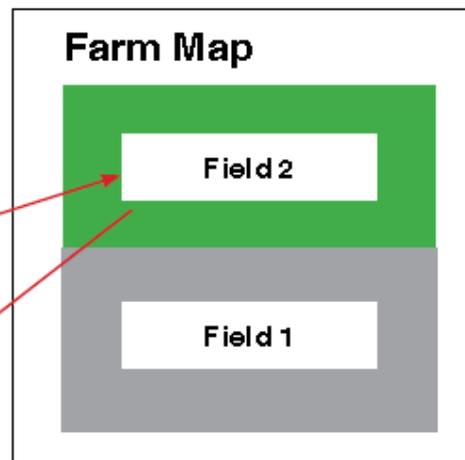
Listeria in Cantaloupe (cont.)

- Introduction
 - Field, truck, used equipment
- Spread
 - Pooled water on floor near equipment and walkways
 - Facility and equipment not easily cleaned
- Growth
 - No pre-cooling step before cold storage → condensation



Traceability: One step forward, one step back

Step 1. Map all production fields or greenhouses, and assign numbers to identify specific growing areas.



Step 2. Using a labeling gun, mark all produce packages with the date and location of harvest.

Tomatoes
L & J Farms
1 Bumpy Rd, Honolulu 96822
808-000-0000
Grown in Hawai'i, USA

031109-2

TOTAL NET WT 16 oz (1 lb)

L & J Farms

1 Bumpy Road
Honolulu, HI 96822
Phone : [808-000-0000]
Fax: [000-000-0000]

INVOICE

DATE: 3/12/2000
INVOICE #: [123450]
Customer ID: [123]

BILL TO: [Name]
[Company Name]
[Street Address]
[City, State ZIP]

SHIP TO (if different): [Name]
[Company Name]
[Street Address]
[City, State ZIP]

ITEM #	DESCRIPTION	QTY	UNIT PRICE	TOTAL
P1	Papaya (31109_1)	15	1.24	18.00
T2	Tomatoes (31109_2)	200	0.35	70.00

Step 3. Put the harvest date and location ID on each invoice

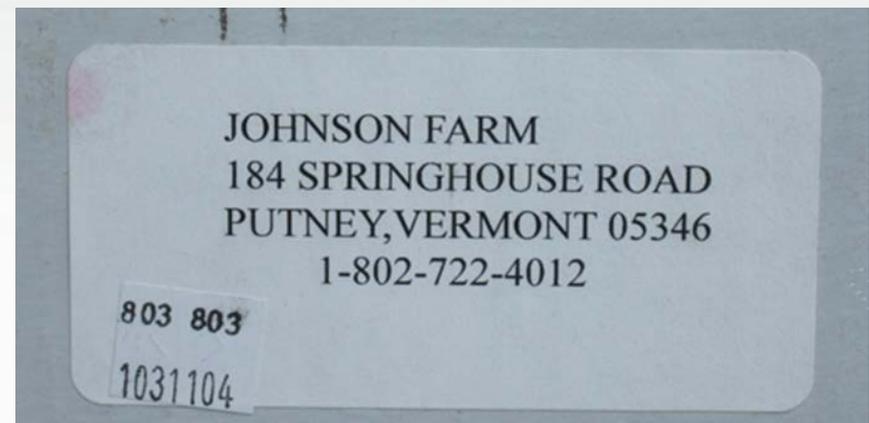
Tracking Produce

Best Practices

- Label containers for wholesale buyers
 - Farm name
 - Farm address / phone
 - Date of harvest / sale
 - Lot / field number
- Use of invoices combined with harvest log
 - Ability to trace lot / box of produce to harvest date and field



Label gun for pack codes



Pre-printed labels with farm name, address & phone

Recordkeeping for Produce Safety

Best Practices

- Water Tests
- Dates of raw manure application or livestock rotations
- Compost
 - Temp, turning
- Cleaning schedules
- Cooler temp monitoring
- Harvest / packing logs
- Wholesale invoices



Employee training

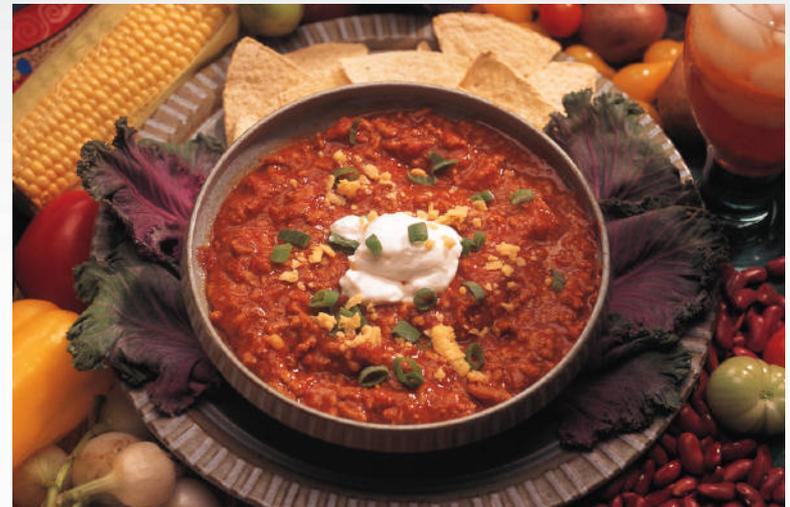


Humans hands are always a potential source of contamination



Hepatitis A in Green Onions

- 2003 outbreak in PA
 - 601 patients
 - 124 hospitalizations
 - 3 deaths
 - 13/69 workers ill
- Grown in Mexico
 - Nucleic acid sequence identical and similar to Hepatitis A among travelers to Mexico



Worker Health and Hygiene

- Accessible toilet and hand-washing facilities
 - In field or accessible by vehicle
- First aid
 - Multiple accessible first-aid kits
 - Gloves over bandages



Worker Health and Hygiene

- Encourage proper hand washing
 - Running water
 - Cold is ok
 - Soap
 - Liquid or bar
 - Antimicrobial soap not necessary
 - Single use paper towels
 - Signs



Worker Health and Hygiene

Sneeze in progress
showing a plume of
salivary droplets – yuck!



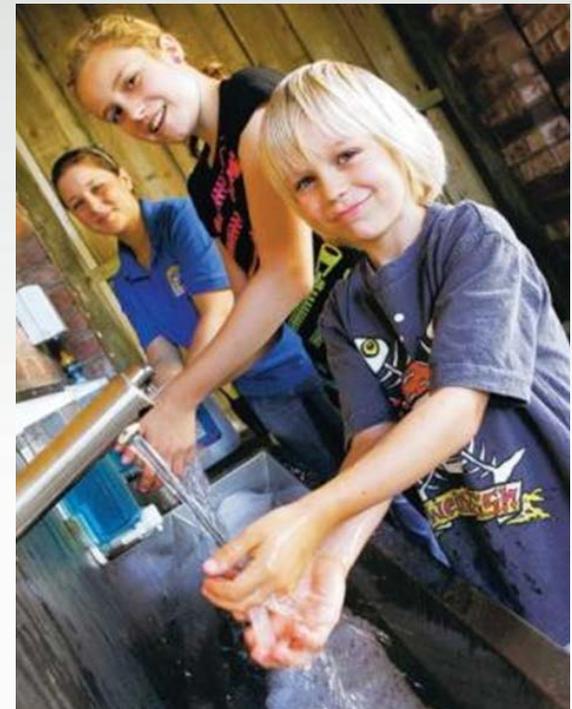
Photo courtesy of CDC.

Worker Health

- Establish sick policy
- Find non-food contact work if:
 - Gastrointestinal symptoms: nausea, vomiting, diarrhea
 - Jaundice (yellowing of eyes and skin)
 - Fever
 - Respiratory symptoms if unable to contain secretions

Visitors (CSAs, U-Picks)

- Request no dogs in production or packing areas
- Post informational signs as needed
- Encourage visitors to wash hands after touching livestock and before handling produce



Want more info?

The screenshot shows a web browser window displaying the website for the UVM Center for Sustainable Agriculture. The browser's address bar shows the URL www.uvm.edu/~susagctr/?Page=gapresources.html. The website header includes the University of Vermont logo and navigation links such as "ABOUT UVM", "ADMISSIONS", "ACADEMICS", "STUDENT LIFE", "RESEARCH", "ATHLETICS", "OFFICES", and "OUTREACH". A prominent banner for "UVM Center for Sustainable Agriculture" is visible, along with a search bar and an "APPLY TO UVM" button. The main content area is titled "PRODUCE SAFETY AND GAPS RESOURCES" and "PRACTICAL FOOD SAFETY RESOURCES", featuring a list of resources including the Cedar Circle Farm Safety Manual, Practical Food Safety Webinar, and various posters and guidelines. A sidebar on the left provides navigation options like "UVM Home", "College of Agriculture and Life Sciences", and "UVM Extension". A right sidebar contains "Center News & Events" and "Quick Links". The browser's developer tools and status bar are also visible at the bottom.

Center for Sustainable Agriculture : University of Vermont - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Center for Sustainable Agriculture : Univ... +

www.uvm.edu/~susagctr/?Page=gapresources.html

Mozilla%20Firefox.Ink Most Visited Getting Started Latest Headlines Consultants Farm Food Safety Food System Research...

DrawPlus center for sustainable a Go DrawPlus You 1:23 15 41% California... CB G

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PRODUCE SAFETY AND GAPS RESOURCES

PRACTICAL FOOD SAFETY RESOURCES

- Cedar Circle Farm Safety Manual:** An excellent example of an on-farm food safety plan for a diversified farm
- Practical Food Safety Webinar**
- "How to Wash Hands" Poster**
- "When to Wash Hands" Poster**
- Why Triple Rinse?**
- Water Quality Testing Guidelines**
- Assessing the History of Your Farm for Your Food Safety Plan**
- Using Manure and Compost with Food Safety in Mind**

Center News & Events

- December Pasture Calendar
- Vermont Youth Ag. IDA Program Launched to Help Youth Save and Learn about the Business of Farming
- Community Supported Farm Finance Featured in Burlington Free Press
- Carol Delaney's Goat Guide is Here

Quick Links

- Contact us:
- Resources

Sustainable Agriculture News And Events

- Hay & Slage Availability (via Agriview)
- 2012 Vermont Organics Recycling Summit
- USDA Seeks Woman and

Web Console Inspect Debugger More Tools

zotero

Extension Cost Tool

	Capital Cost	Annual Cost	First Year Total Cost					
General	\$ 1,560	\$ 980	\$ 2,540					
Part 1	\$ 500	\$ 48	\$ 548					
Part 2	\$ 500	\$ 174	\$ 674					
RECORDS		\$ 1,440	\$ 1,440	** estimate for maintaining records: .3hr/day x 240 days x \$20/hr				
TOTAL	\$ 2,560	\$ 2,642	\$ 5,202					
GENERAL SECTION		NEEDS			COST (\$)			
Criteria	Description	Documentation	Description of Needed Purchases	Labor need	Up-Front Cost	Annual Labor	Annual Material	Annual Total
PART 2-Field Harvest and Packing								
2.1	Pre-Harvest Assessment/Analysis	Y	NA	.17 HRWK X 32WKS X \$20	\$ 109			\$ - \$ -
2.2	Field Sanitation Units Completed	NA	NA	NA				\$ - \$ -
2.3	Toilet available	N	NA	NA				\$ - \$ -
2.4	Filed Sanitation units placed	NA	NA	NA				\$ - \$ -
2.5	Response plan for Sanitation	SOP	DONE					\$ - \$ -
2.6	Harvest containers cleaned	Y-ALREADY	SANATIZER-PERIOD	3 x 1 HOURS	\$ 500	\$ 30		\$ 30 \$ 530
2.7	Hand harvest tools (knives, etc.)	Y	NA	.08 HRWK X 40WKS X \$11	\$ 35			\$ 35 \$ 35
2.8	Damaged containers fixed	N	???	???				\$ - \$ -
2.9	Harvesting equipment in good condition	N	Already doing it	???				\$ - \$ -
2.10	Glass on Field Equipment cleaned	N	???	???				\$ - \$ -
2.11	Plan for glass breaking in field	SOP	NA	NA				\$ - \$ -
2.12	Plan for various field contamination	SOP	NA	NA				\$ - \$ -
2.13	Remove dangerous/toxic items	SOP	NA	NA				\$ - \$ -
2.14	Produce container policy	SOP	NA	NA				\$ - \$ -
2.15	Post-harvest water is microbially safe	RECORD	NA-DO NOT REUSE	NA				\$ - \$ -
2.16	Remove excess dirt/mud from containers	N	NA	NA				\$ - \$ -
2.17	Transportation Equipment Clean	N	ALREADY DOING IT?					\$ - \$ -
2.18	Cover produce during transport	SOP	ALREADY DOING IT?	NA				\$ - \$ -
2.19	New/clean field pack containers	Y	INCLUDED ABOVE	INCLUDED ABOVE				\$ - \$ -
2.20	Field pack containers well-stocked	N	INCLUDED ABOVE	INCLUDED ABOVE				\$ - \$ -
2.21	Product ID for traceability	Y	HARVEST MAP-INCLUDED ABOVE					\$ - \$ -

That's it folks!