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New Jersey Agricultural Experiment Station

Fresh Produce Safety

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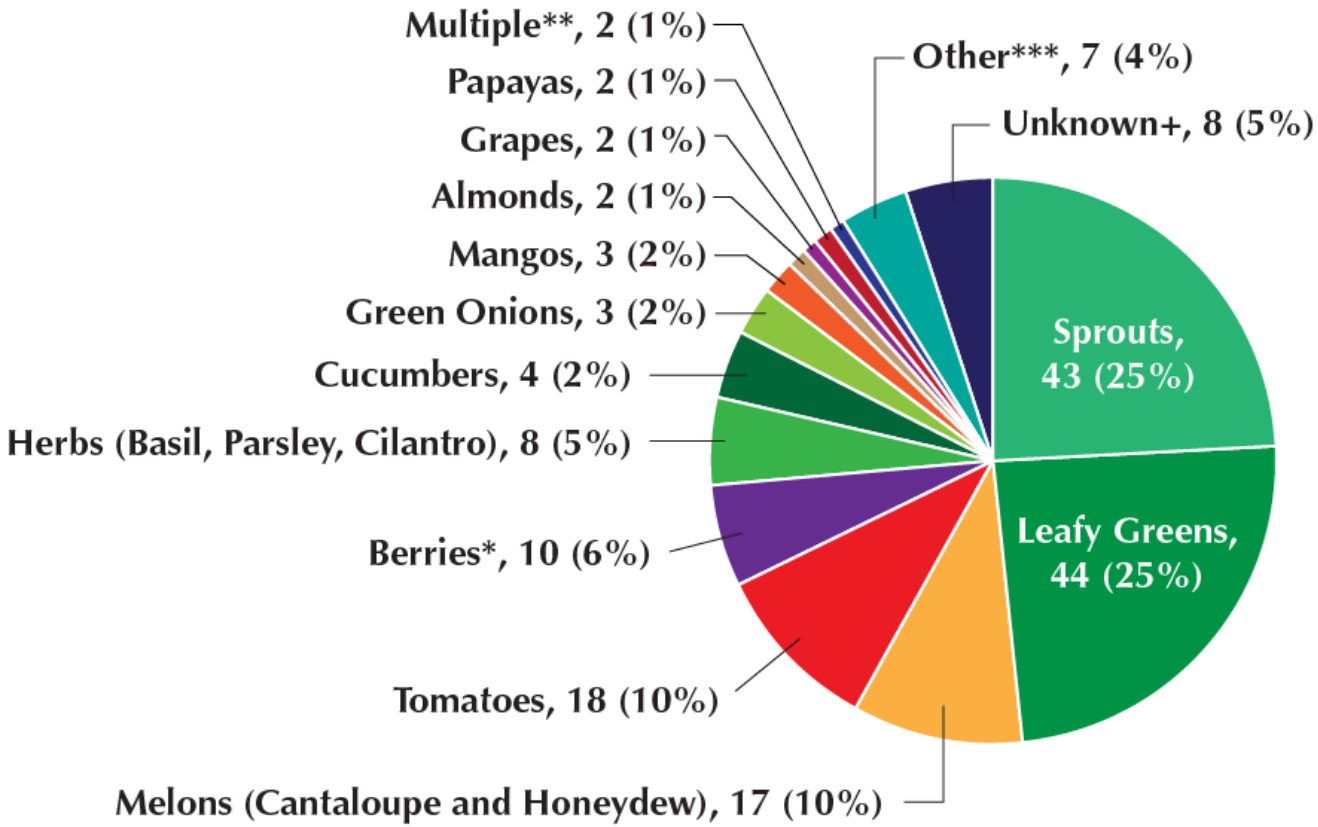
Outbreaks Associated with Produce

FDA Outbreaks Linked to Produce Contamination Likely Prior to Retail: 1996–2014



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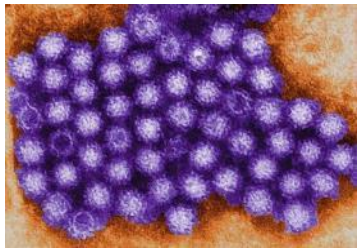
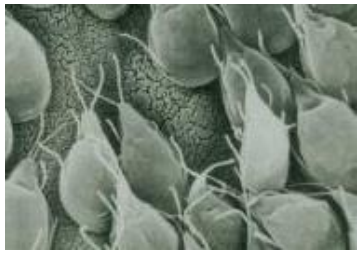
Microorganisms of Concern in Fresh Produce

- Bacteria
  - *Salmonella,* toxigenic *E. coli, Shigella, Listeria monocytogenes*
- Viruses
  - Norovirus, Hepatitis A
- Parasites
  - *Giardia lamblia*, *Cryptosporidium parvum, Cyclospora cayetanensis*





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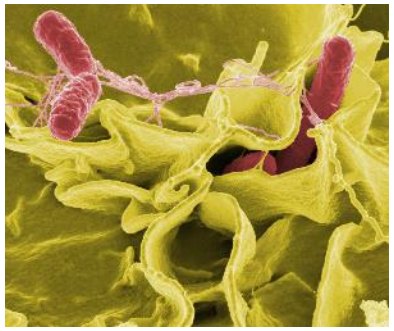
Bacteria in the Farm Environment



- Bacteria are microorganisms that can multiply both inside and outside of a host
- Bacteria include pathogens such as *E. coli* O157:H7, *Salmonella*, and *Listeria monocytogenes*
- Bacteria can multiply rapidly given the right conditions: water, food, and the proper temperature
- Good Agricultural Practices can reduce risks by minimizing situations that support bacterial survival and growth

Bacteria

- If conditions are ideal, bacteria can multiply once every 20 minutes
- It is unlikely you'll ever start with just ONE bacterium
- Some pathogens can make people sick with a dose of 10 cells or less
- What conditions are optimal?
  - Food source
  - Moisture
  - Right temperature

Time	# of Bacteria
20 min	2
40 min	4
1 hour	8
80 min	16
100 min	32
2 hours	64
4 hours	4096
6 hours	262,144
8 hours	16,777,216

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Health Impacts by Pathogen Type

FDA Outbreaks Linked to Produce by Pathogen Types: 1996–2014

Pathogen Type	Outbreaks (% of total)	Illnesses (% of total)	Hospitalizations (% of total)	Deaths
Bacterial	148 (85.55)	11,377 (66.28)	1,844 (89.21)	65
Parasitic	21 (12.14)	4,786 (27.88)	67 (3.24)	0
Viral	3 (1.73)	993 (5.79)	156 (7.55)	3
Total	173*	17,164	2,067	68

*The total also includes chemical hazards not identified in this table (e.g., a Curcurbitacin toxin outbreak associated with squash).

Produce Safety Challenges

- Fresh produce is often consumed raw (i.e., not cooked)
- Microbial contamination on produce is extremely difficult to remove once present
  - Natural openings, stem scars, bruises, cuts
  - Rough surfaces, folds, netting
- Contamination is often sporadic
- Bacteria can multiply on produce surfaces and in fruit wounds, provided the right conditions are present

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Contamination Sources

Humans

Soil

Produce

Animals

Buildings
Equipment
Tools

Water

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How Contamination Is Spread

- **Humans**

  Workers can spread pathogens to produce because they directly handle fruits and vegetables.

  – Improper health and hygiene practices
    - Lack of adequate training and handwashing practices
    - Lack of or inadequate toilet facilities

  – Illness or injury
    - Working while sick
    - Injuries that result in blood contacting fresh produce

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How Contamination Is Spread

- **Animals**

  Domesticated and wild animals can carry and transmit human pathogens to produce.

  – Field intrusion may result in direct fecal contamination of crops and fields
  – Animal feeding, rooting, and movement through fields may spread contamination
  – Animals can contaminate water sources used for produce production
  – Manure runoff can contaminate fields, water sources, and crops

How Contamination Is Spread

- **Water**

  Water can carry and spread human pathogens, contaminating entire fields or large amounts of produce.

  – Production water
    - Irrigation, crop sprays, frost protection
  – Postharvest water
    - Fluming, cooling, washing, waxing, cleaning
  – Unexpected events
    - Flooding, runoff

How Contamination Is Spread

- **Soil Amendments**

  Raw manure and other soil amendments can be a source of contamination if not properly handled and applied.

  - Application too close to harvest
  - Improper/incomplete treatment
  - Improper storage
  - Runoff
  - Wind spread
  - Cross-contamination due to improper sanitation procedures

How Contamination Is Spread

- **Surfaces, equipment, tools, and buildings**

  Any unclean surface that contacts produce can harbor pathogens and serve as a source of contamination.

  – For example, not having an established schedule for cleaning or sanitizing food contact surfaces, including tools

  Facility management can also impact risks

  – Areas outside buildings that are not kept mowed or clean can serve as pest harborage areas

  – Standing water or debris present in the packinghouse can become a source of cross-contamination

Steps Towards Produce Safety

1. Assess Produce Safety Risks
2. Implement Practices
3. Monitor Practices
4. Use Corrective Actions
5. Keep Records

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Assessing Risks

- **Assess your farm practices**
  - Location of farm, fields, and adjacent land activities that may represent risks to the crops you grow
  - Fecal contamination risk from domesticated or wild animals
  - Use of water and manure in crop production
  - Farmer training programs and hygiene facilities
  - Practices used to grow, harvest, pack, or hold produce and the tools and equipment
  - Typical and atypical (e.g., flooding) situations

Implementing Practices to Reduce Risks

- Focus on preventing contamination
  - Cannot reliably remove contamination
- Address risks most likely to have the biggest impact on produce safety first
- May require modification of current practices
- May require capital investment
- You may already be doing the right thing!
- Ask for help and seek training if you are unsure

Standard Operating Procedures (SOPs)

- **A written document defining how to complete a specific food safety practice.**
- **SOPs include:**
  1. Step-by-step instructions to ensure that even a person who has never done a practice before can complete the practice correctly by following the instructions
  2. Location and name of any supplies needed to complete the practice
  3. When and how often the practice should be completed
  4. What records are needed/necessary

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Monitoring

- Performed on a schedule or during a specific activity
- Allows you to verify practices are being completed properly
- Helps identify problems before they impact safety
  - Frequent high generic *E.coli* counts in water test results
  - Evidence of animal intrusion and fecal contamination
  - Improper cleaning and sanitation practices resulting in dirty equipment and tools

Corrective Actions

- Can be established in advance
  - Negative consequences for workers not following practices
  - Plans for a spilled portable toilet
- Fix problems that are identified during monitoring
  - Restocking toilet and handwashing facilities
  - Retraining supervisors and farm workers
- May require short and long term planning
  - Establishing sanitation programs (short term)
  - Replacing equipment (long term)

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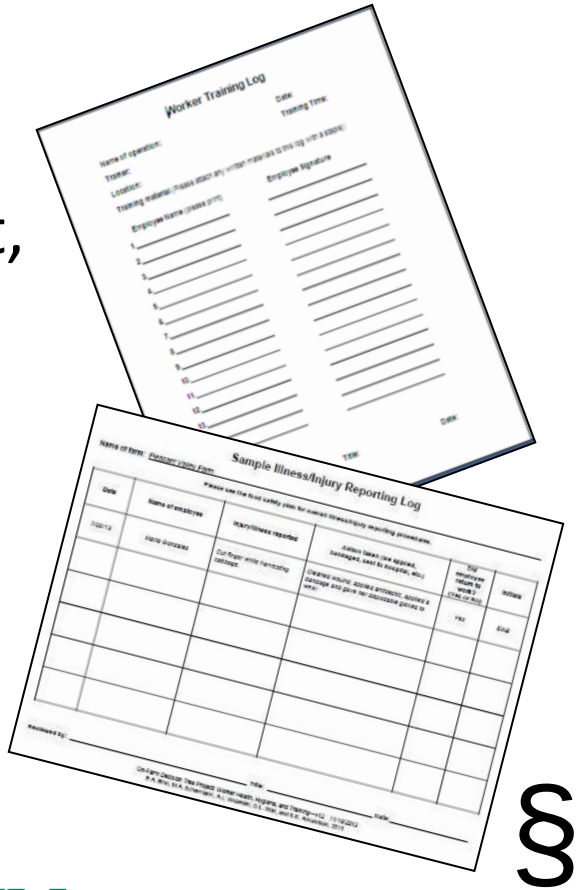
Recordkeeping

- Recordkeeping includes documenting practices, monitoring, and corrective actions
- There are many templates available
- Recordkeeping should be convenient, or else it will not get done
- Records must be signed and dated after they are reviewed
- Keep all records for at least 2 years



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Questions?

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