



# Harvest & Post-harvest

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## Food safety considerations

- Learn how to identify risk of contamination and how to minimize them
- Rodent control
- Worker training (hygiene, health, illness, or injury)
- Quality of the production and postharvest water
- Cleanliness of buildings, equipment, tools, and surfaces
- Pets
- Visitors
- Fertilizers (organic source)
- Provide equipment, training, policies, practices and facilities to minimize risks

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## Produce Safety Challenges

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



**YOU CANNOT SEE, SMELL, OR TASTE PATHOGENS**



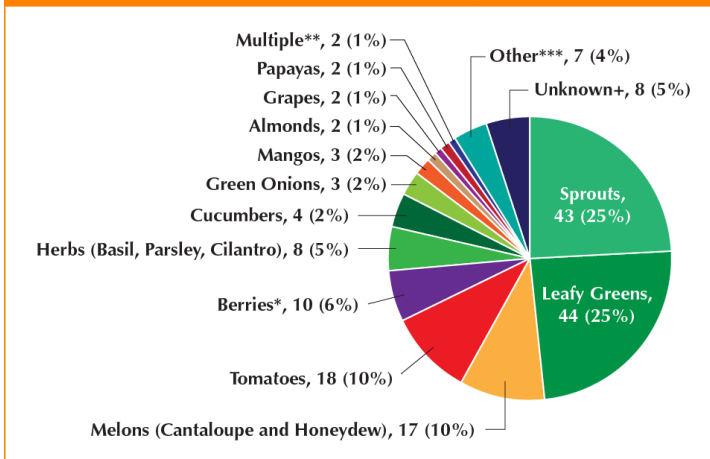
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## Outbreaks Associated with Produce

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*,  
*Toxoplasma gondii*



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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



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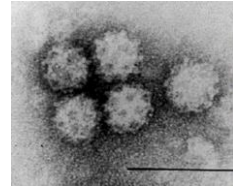
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## Viruses

- **Viruses** are small particles that multiply only in a host, not in the environment or on produce
- Contamination most often linked to an **ill worker handling fresh produce** (fecal-oral route) or contaminated water
- It only takes a few virus particles to make someone ill
- Can be very stable in the environment
- **Prevention** is the key to reducing viral contamination
- Limited options for effective sanitizers



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**NorCORE**  
Food Virology  
Collaborative for Outreach, Research & Education

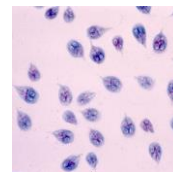
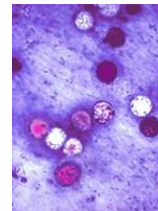
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## Parasites

- **Parasites** are protozoa or intestinal worms that can only multiply in a host animal or human
- Commonly transmitted by water
- Can be very stable in the environment; often not killed by chemical sanitizers
- Can survive in the body for long periods of time before ever causing signs of illness



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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 Curcubitacin toxin outbreak associated with squash).

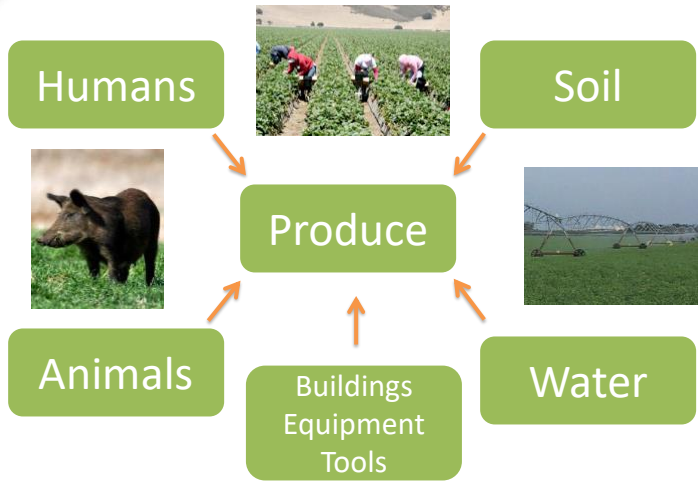


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## Contamination Sources



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## Pre-harvest checklist

- Health self-check: Do not harvest if you feel sick
- Inspect the production area for any suspected source of contamination
- Check that harvest containers and equipment are clean
- Did you wash your hands?
- Always wear clean clothes
- Avoid walking between the mushroom and basil containers: Start with basil and end with mushrooms
- Make sure **every surface** that touches produce is clean

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## Pre-harvest checklist

- Check for signs of animal intrusion
- Check rodent traps
- Flag areas suspected of animal intrusion and avoid harvesting that area
- Do not pick dropped produce
- Bruised or damaged produce will have shorter shelf life and is a food safety risk
- Avoid harvesting mushrooms and basil at the same time
- **Wash** and **disinfect** packing area and harvest equipment when switching between mushroom and basil

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## Reduce Risks in All Packing Areas

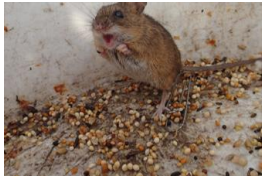
Keep it clean    Proper hygiene facilities & break areas for workers



Pest management

Avoid standing water

Keep it organized



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## Packing area design

### Wash Line & Packing Shed Design for Food Safety

Robert Hadad CCE: Cornell Vegetable Program WNY Regional Vegetable Specialist rgh26@cornell.edu



**Aim to keep every step clean:**

- Worker hygiene
- Pre-harvest inspections and steps

**Segregate mushroom and basil harvest:**

- Space: separate equipment and packing space \$\$
- Time: separate hours with cleaning and sanitizing steps in between

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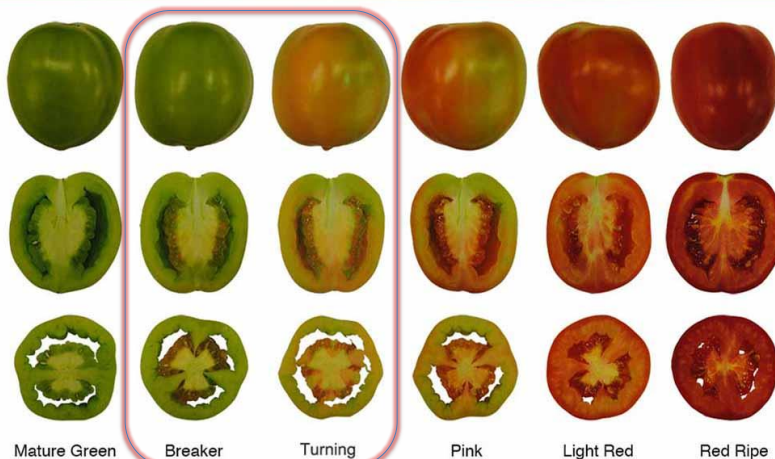
## Harvest

- Lettuce:
  - Loose leaves
  - Live plants: prevent water and roots from touching the plants
- Basil:
  - Single cut and Live plants
  - Loose leaves
  - Multiple harvests: cut 3 inches above the ground level and repeat for 3 cycles
- Tomato:
  - Between breaker and turning
  - Free from decay, damage, and sunscald

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## Tomato harvest and post harvest

### Six Ripening Stages of Tomatoes



Source: Organic Farming and Gardening School

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## Ideal storage conditions

- Cold moist: 32-40°F and 95-100% humidity
  - Leafy greens, salad crops, cole crops
- Warm moist: 55-60°F and 85-95% humidity
  - Potatoes, tomatoes, and basil
- Mushrooms: 35-45°F in non-waxed paper bags or cardboards. **DO NOT WASH!** Use a brush to clean. **DO NOT BLOW THROUGH YOUR MOUTH!**

