

Is Produce Safe? Microbial Risks from Fresh Produce

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Why are we hearing more about food safety?

- Mass production of food
- Global supplies/inspection holes
- Changing demographics
- Risk management/consumer knowledge
- Emerging pathogens



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Produce can cause illness

- 1990 – 2004 over 31,000 cases of foodborne illness attributed to produce:

Food product	% of contribution
– Salad greens/lettuce	36%
– Fruits/berries/melons	17%
– Vegetables sprouts	29%
– Home canned	3%
– Processed retail	15%

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Is this a lot?

- Consider that CDC estimates 76 million cases of FBI EACH YEAR
- 32,000 *reported* cases over 14 years from produce related foods
- So not really thought of as concern

BUT

What happened in 2006?

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What causes these FBI?

- Microbiological hazards are considered the biggest risk to the food industry.

HAZARDS



Chemical
Physical
Biological

- Microorganisms are important because:
cause loss of shelf life and product quality
major cause of food borne illness

How do they get on the produce?

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What are sources of contamination?

- **Environmental sources** of contamination
- **Handling/human sources** of contamination
- These sources may have a variety of pathogenic microbes associated with them.
- Can't see with naked eye
- Microorganisms are small and living
- They include bacteria, viruses, yeasts, molds, and parasites.



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Environmental Contamination

- Prior land use
- Adjacent land use
- Field slope and drainage
- Soil properties
- Water quality and practices
- Crop inputs and soil fertility management
- Animal control
- Equipment/containers (pre-and post-harvest)
- Pest control



Producer Control Points

- Field Selection
 - Soil, water source, animals, drift and runoff from adjacent fields, land use history...
 - Manure source; Age
 - Water source; Quality; Irrigation method
 - Wild/domesticated animal controls
- Land preparation/Practices
 - Fertilization
 - Planting
 - Irrigation
 - Pest control



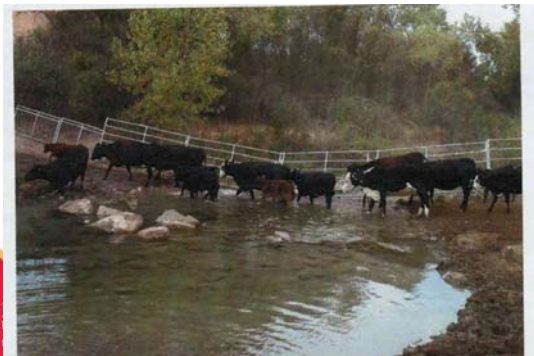
It may make a difference where the field is sited



Sample Type	
●	cattle (15 samples)
●	wild pig (7 samples)
●	water (2 samples)
●	soil (2 samples)



Grazing Patterns and Runoff Contaminate Water Sources

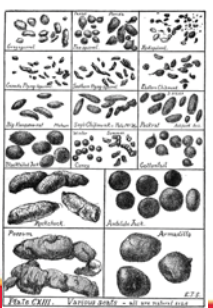


Human Contamination

1. Worker hygiene
2. Post harvesting processing practices
3. Temperature control
4. Facilities control
5. Wash water




Fresh Produce Growers and Packers ARE Food Handlers !!!



- Feces contamination
 - Wild animal
 - Domesticated animal
 - Humans


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In consideration of feces

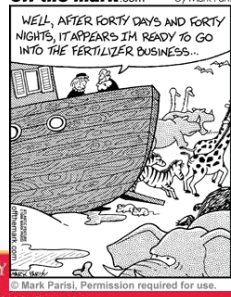
- Pathogen populations in animal feces
 - Potentially huge numbers - dilution factor helps
 - Direct contamination
- Treatment/storage/processing of manure
 - Green vs aged vs composted
- Biological activity/type of soil manure is applied to
 - Higher activity may inactivate pathogens quicker
 - Specific types of soil bind pathogens
- Timing and location of manure application
 - Pre or during germination
 - Weather and Harvest schedule

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Noah probably had gastroenteritis

off the mark.com by Mark Paris



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Pathogens found animal manure


Bacteria	Manure	Compost/Soil Survival
• <i>Salmonella</i>	P, R, S, I, W	56 – 180 days
• <i>E. coli</i> O157:H7	R, S, I, W	up to 230 days
• <i>Campylobacter</i>	P, C, I, W	unknown
• <i>Listeria</i>	S, C, W	

Parasites

- *Cryptosporidium* R, S 12 weeks
- *Giardia* R, S, W 7 weeks

• Key: P - poultry; R – ruminants (deer, cattle); S – swine; I – insects; W – wild animals other than ruminants

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Is Organic Safer?

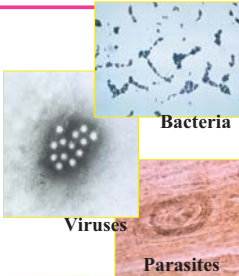
- Not really
- In compost and manure survival of major pathogenic bacteria ranges 10 – 70 days, depending upon the steeping temperature.
- Parasites survive for at least as long.

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Microbes That Cause Foodborne Illness

- **Bacteria** – Single-celled organisms that live independently.
- **Viruses** - small particles that live and replicate in a host.
- **Parasites** - intestinal worms or protozoa that live in a host animal or human.



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Good Microorganisms

- Add them to foods or they are there naturally.
- They ferment foods to preserve them and/or create unique flavors and textures.
- Examples: cheese, yogurt, sour cream, bread, sauerkraut and pickles.



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Bad (spoilage) Microorganisms

- Change foods and cause them to “go bad” or spoil.
- Molds and yeasts from fungi family
- Examples: Discolored, mushy, or fuzzy vegetables; sour milk; slimy meat.



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Ugly Microorganisms

Disease Causing

- Illness can range from mild to life-threatening
- Examples include foods contaminated with *Salmonella* and *E. coli* O157:H7.
- Common signs and symptoms include nausea, vomiting, and diarrhea.



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Microorganisms that cause...

Food spoilage -

- Affect aroma, texture and/or appearance of food

Foodborne illness -

- May or may not affect sensory characteristics of the food

Only laboratory testing can tell if harmful microorganisms or toxins are present –

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Problems Harmful Microbes

- Some people are more vulnerable to foodborne illness:
 - Young children or elderly people.
 - Immuno-compromised individuals.



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Harmful Microorganisms of Concern in Fresh Produce

Bacteria

- *Salmonella* species
- *E. coli* O157:H7
- *Shigella* species
- *Bacillus cereus*
- *Listeria monocytogenes*

Viruses

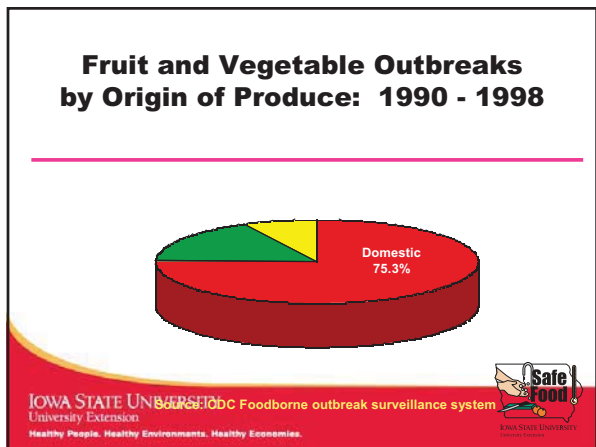
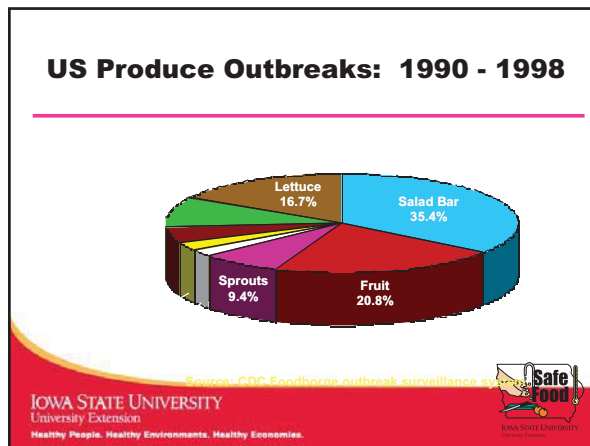
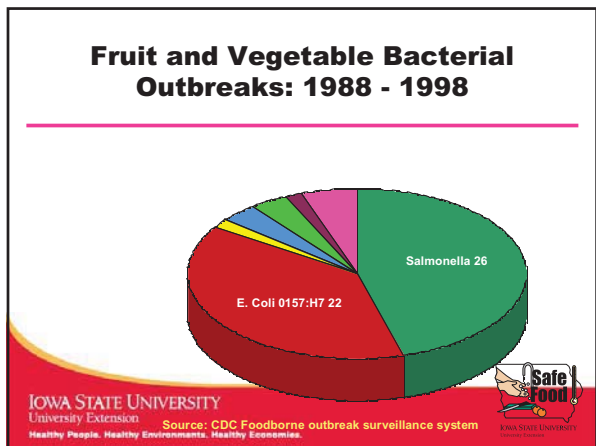
- *Hepatitis A virus*
- Norovirus

Parasites

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

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Bacteria Are Found Everywhere

- In air, soil, and water
- In intestines of animals & humans
- On skins of fruits & vegetables
- On raw meat, poultry, & seafood
- On shells of nuts
- On insects & rodents
- On hand, skin, hair, & clothing of people

Where Microbial Pathogens Live

Common in soils...	Residents human and animal intestinal tracts
<i>Listeria mono.</i>	<i>Salmonella</i> species
<i>Bacillus cereus</i>	<i>E. coli</i> O157:H7
<i>Clostridium botulinum</i>	<i>Shigella</i> species
<i>Clostridium perfringens</i>	<i>Campylobacter jejuni</i>
	Viruses and parasites

To grow, bacteria need:

- **Moisture**, found in most foods, including fruits and vegetables.
- **Nutrients**, provided most foods (protein, carbs)
- **Warmth**, especially room temperature 41°-135°F
- Time