

The background of the slide features a large, faint, circular seal of Rutgers University. The seal contains the text "RUTGERS UNIVERSITY" and "EST. 1823" around a central emblem.

# RUTGERS

New Jersey Agricultural  
Experiment Station

# Fresh Produce Safety

Meredith Melendez  
Agricultural Agent  
Rutgers Cooperative Extension  
of Mercer County

## HUNT FOR SOURCE OF BAD SPINACH CARRIES ON

The New York Times

PACKAGED SPINACH SALAD  
APPEARED FROM STORE SHELVES  
THE COUNTRY SATURDAY, AS I  
GATORS SEARCHED FOR THE  
OF BACTERIAL CONTAMINATION  
AS NOW SICKENED MORE TH  
PEOPLE. OFFICIALS SAID SAT  
HAT THE NUMBER OF PEOP  
CTED BY THE E. COLI OUT  
OW STOOD AT 102, UP FROM 9  
Y BEFORE. DR. DAVID ACHES  
CTOR OF FOOD SAFETY AT THE  
D. DRUG

## Lettuce Sus

AP

HEALTH OF  
WEDNESDAY  
ON LETTUCE  
LIKELY SUSPECT IN THE  
E. COLI OUTBREAK LINKED TO TACO  
BELL, THOUGH TRACING THE VEGETA-  
BLE'S SOURCE MAY PROVE DIFFICULT.  
THE OUTBREAK APPARENTLY HAS RUN  
ITS COURSE AFTER 71 CONFIRMED  
CASES OF THE DISEASE IN FIVE STATES,  
PRIMARILY NEW JERSEY, NEW YORK  
AND PENNSYLVANIA. OFFICIALS SAID  
INVESTIGATORS



## F.D.A. WARNS OF OUTBREAK AND NOT TO EAT BAG SPINACH

The New York Times

CONSUMERS SHOULD AVOID EATING  
FRESH BAGGED SPINACH AFTER AN  
OUTBREAK OF E. COLI IN EIGHT STATES

## Spinach Pulled From Stores Across U.S.

AP

SHOPPERS CHANGED  
BUYING HABITS  
AS SPINACH  
FROM  
BUYING  
WAS  
STORE  
TBREAK  
KILLED

THE SPINACH, GRO  
COULD HAVE BEEN  
THE FIELD OR DU  
ACCORDING TO TH  
EASE CONTROL AN  
ABOUT 74 PERCE  
MARKET SPINACH  
COMES FROM CALI  
TO

## fields of California

THE WORST WE'VE SEEN; SHE'S REALL  
D OFF.' " RHODES SAYS. "AND TH  
AS AFTER THEY HAD GIVEN ME MO  
HINE AND I WAS S  
RHODES WAS ONE  
STATES WHO HAV  
AUG. 23 IN A  
AT CI

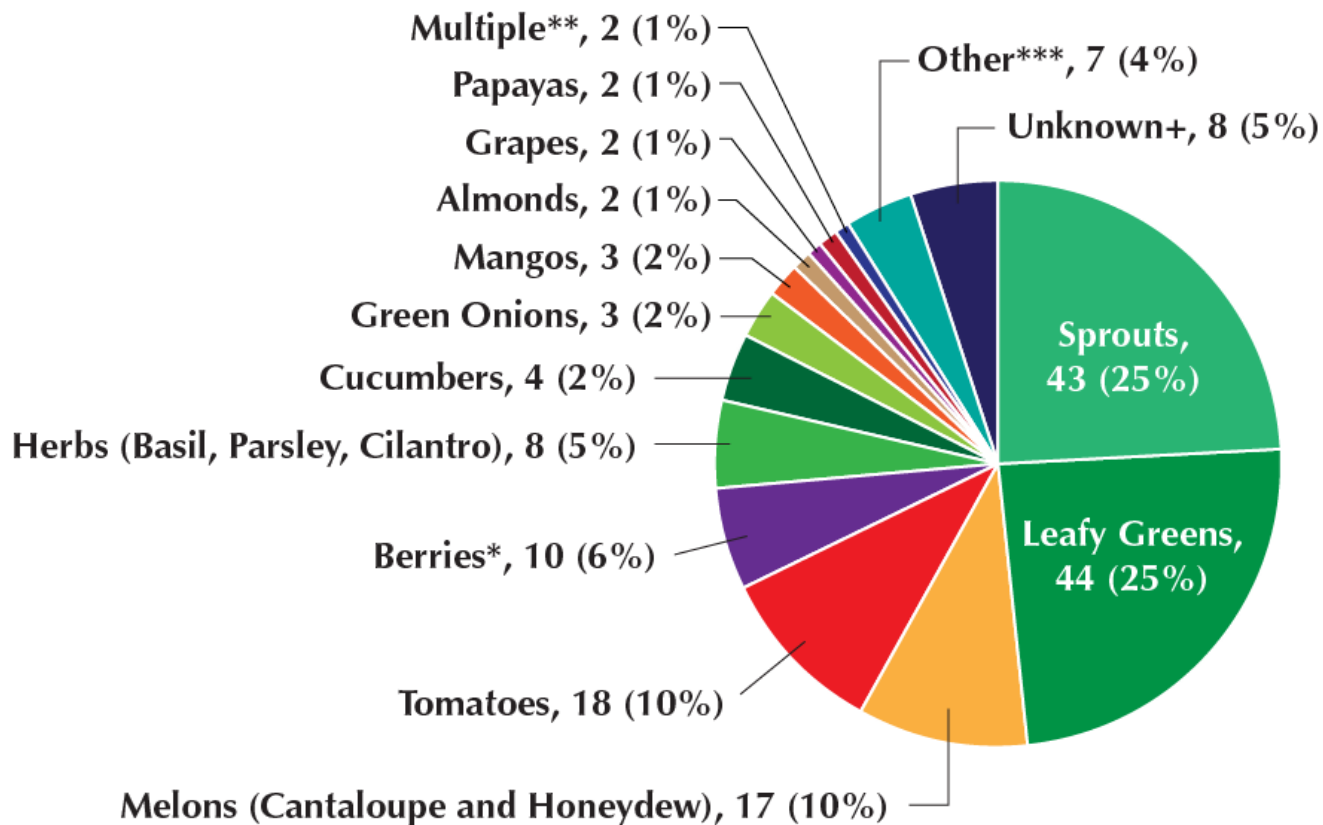
USA  
TODAY

THE VICTIMS MANY QUESTIONS ABOUT  
WHAT THEY ATE OVER THE PREVIOUS  
WEEKS BAGGED FRESH SPINACH  
THE ONLY FOOD THAT PATIENTS SO F  
HAD INTO THE HOSPITALS



# Outbreaks Associated with Produce

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

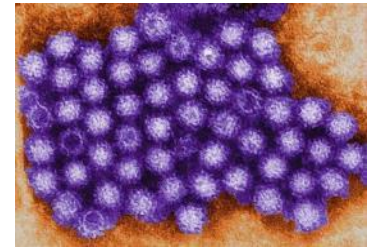






# Microorganisms of Concern in Fresh Produce

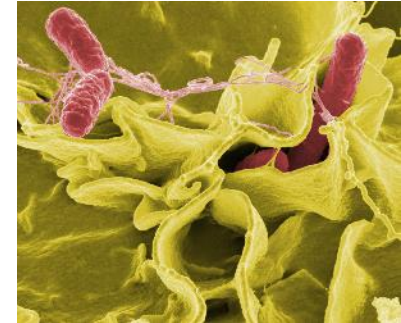
- Bacteria
  - *Salmonella*, toxigenic *E. coli*, *Shigella*, *Listeria monocytogenes*
- Viruses
  - Norovirus, Hepatitis A
- Parasites
  - *Giardia lamblia*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*





# 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



# 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).



# Produce Safety Challenges

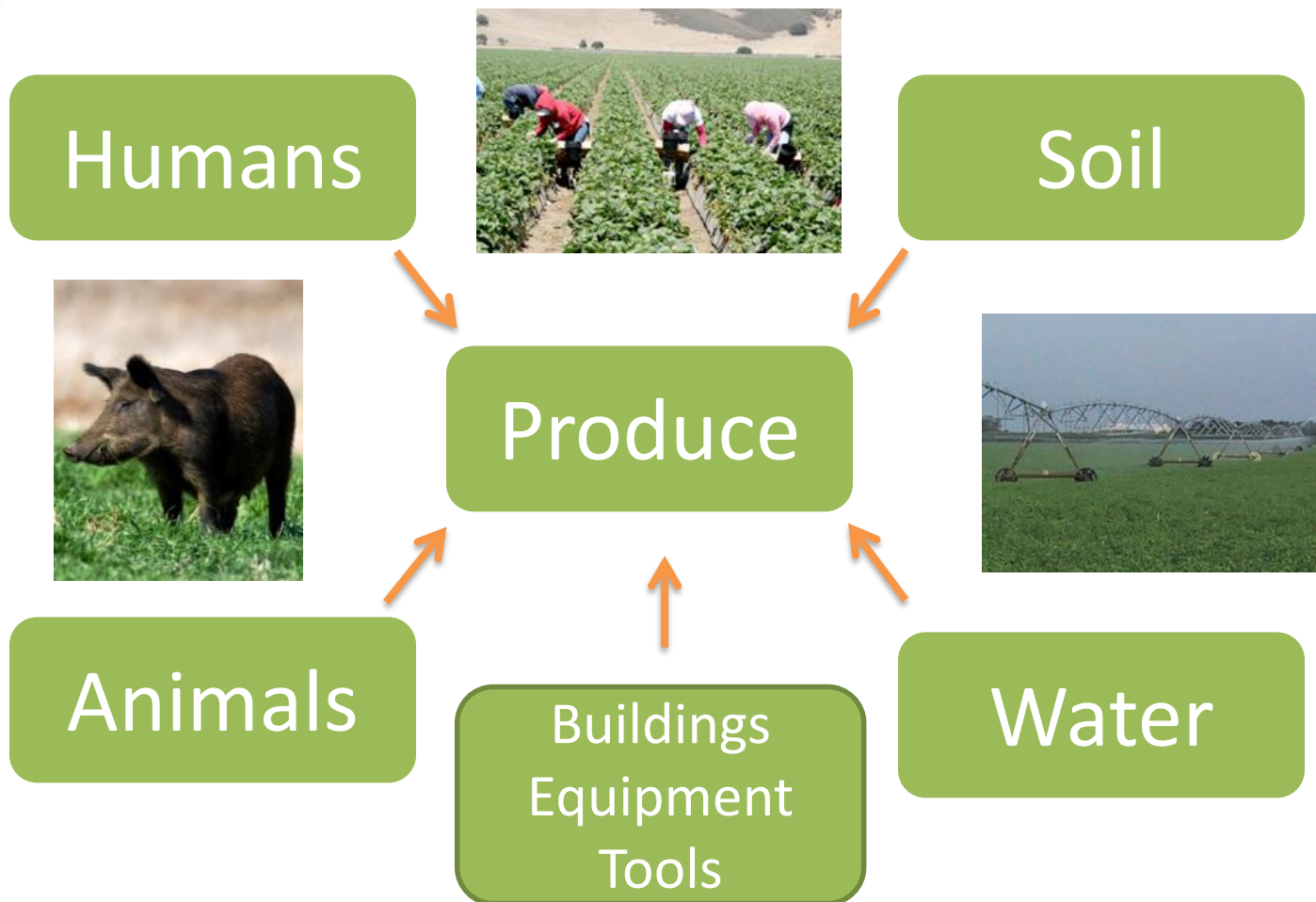
- Fresh produce is often consumed raw (i.e., not cooked)
- Microbial contamination on produce is extremely difficult to remove once present
  - Natural openings, stem scars, bruises, cuts
  - Rough surfaces, folds, netting
- Contamination is often sporadic
- Bacteria can multiply on produce surfaces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







# Contamination Sources





# 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





# 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





# 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



# 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)







# 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

The image shows two sample recordkeeping forms. The top form is titled "Worker Training Log" and includes fields for Name of operation, Trainer, Location, Training material, Employee name, and Employee signature. The bottom form is titled "Sample Illness/Injury Reporting Log" and includes a table with columns for Date, Name of employee, and a section for reporting illness or injury. The table has multiple rows for data entry. Below the table, there is a section for "Reviewed by:" and a date field.



RUTGERS

New Jersey Agricultural  
Experiment Station



# Questions?

Photo: Meredith Melendez