Produce Safety ALLIANCE

Bacteria, Viruses, Parasites: Key takeaways from past outbreaks to reduce food safety risks in caneberries

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Note: slides in this PPT without
in the upper left-hand corner come directly from the PSA Grower Training Manual (Bihn, E, G Wall, C Fisk, M Humiston, D Pahl, D Stoeckel, R Way, and K Woods. 2017. Produce Safety Alliance National Curriculum, Version 1.1. Produce Safety Alliance, Cornell University. 340 pages.) or PSA supplemental water slides (2019).

Overview

- Micro 101
- Outbreak examples and prevention tips:
  - Worker health and hygiene
  - Wildlife
  - Production water
  - Equipment surfaces

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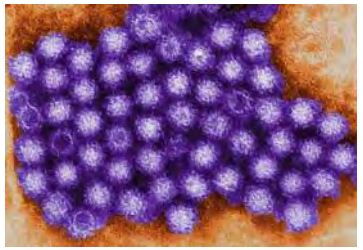
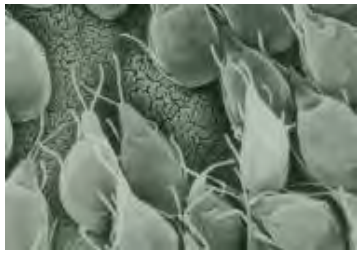
The biggest food safety hazards in fresh produce are pathogens

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





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Bacteria

- Bacteria are microorganisms that can <u>multiply both inside and outside of a host</u>
- Bacteria can multiply rapidly given the right conditions: food, temperature, moisture
  - If conditions are ideal, bacteria can multiply once every 20 minutes
- Good Agricultural Practices minimize situations that support bacterial survival and growth

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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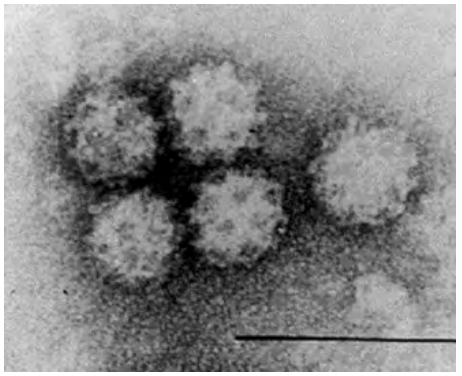
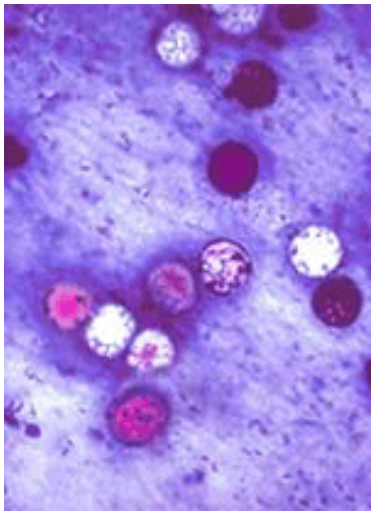
Viruses

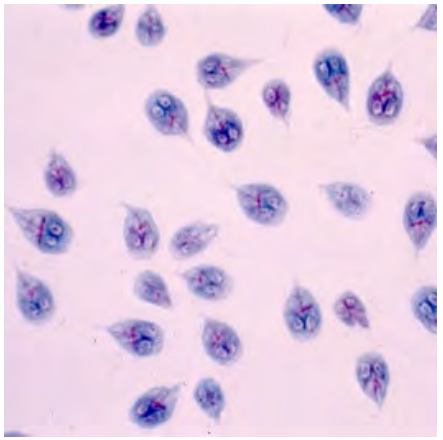


- Viruses are small particles that multiply only in a host, not in the environment or on produce
  - Can be very stable in the environment
- Contamination most often linked to an ill worker handling fresh produce (fecal-oral route) or contaminated water
  - Basic handwashing, proper restroom use, and illness reporting can help prevent the spread of viruses
- It only takes a few virus particles to make someone ill

Parasites



- Parasites are protozoa or intestinal worms that can only multiply in a host animal or human
- Can be very stable in the environment
- Commonly transmitted through water contaminated with fecal material
- Can survive in the body for long periods of time without producing any symptoms
  - Symptoms may also come and go



Incubation Periods & Symptoms

Etiologic Agent	Incubation Period	Clinical Syndrome
E. coli O157:H7	1-10 days; usually 3-4 days	Diarrhea (often bloody), abdominal cramps (often severe), little or no fever
Listeria monocytogenes	2-6 wks	Diarrhea, abdominal cramps, fever; meningitis, neonatal sepsis
Hepatitis A	15-50 days; median: 28 days	Jaundice, dark urine, fatigue, anorexia, nausea
Norovirus	12-48 hrs median: 33 hrs	Diarrhea, vomiting, nausea, abdominal cramps, low-grade fever
Cyclospora cayetanensis	1-14 days; median: 7 days	Diarrhea, nausea, anorexia, weight loss, cramps, gas, fatigue, low-grade fever; may be relapsing or protracted
Cryptosporidium spp.	2-28 days; median: 7 days	Diarrhea, nausea, vomiting; fever

Outbreak (noun)

Two or more persons experience a similar illness resulting from the ingestion of a common food

Source: StateFoodSafety.com

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Foodborne illness outbreaks associated with caneberries

Form	Country of Origin	Pathogen	Year	Illnesses
Fresh raspberries	Guatemala	*Cyclospora cayetanensis*	1996, 1997, 1998	850, 1012, 192
Frozen raspberries	Scotland	Hepatitis A	1983, 1988	24, 5
Frozen raspberries	Poland	Norovirus	2005, 2009	973, 900
Fresh blackberries	Guatemala	*Cyclospora cayetanensis*	1999	104
Fresh blackberries	Not identified	Hepatitis A	2019	20

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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

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Freezing Does NOT Kill Viruses

- FDA reported three hepatitis A virus outbreaks and one norovirus outbreak linked to frozen berries in the United States from 1997 to 2016
- In 2019, FDA tested 339 domestic samples and 473 import samples of frozen berries and found hepatitis A virus in 5 samples and norovirus in 8 samples

Turn those frozen berries into the perfect purée to add to lemonade, sparkling wine, plain yogurt, or put on top of ice cream. Or to make the best berry margarita. 😉 All you need is frozen, thawed berries, a food processor and a fine-mesh strainer. #oregonberries

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Contamination Sources

Humans

Soil

Produce

Animals

Buildings
Equipment
Tools

Water

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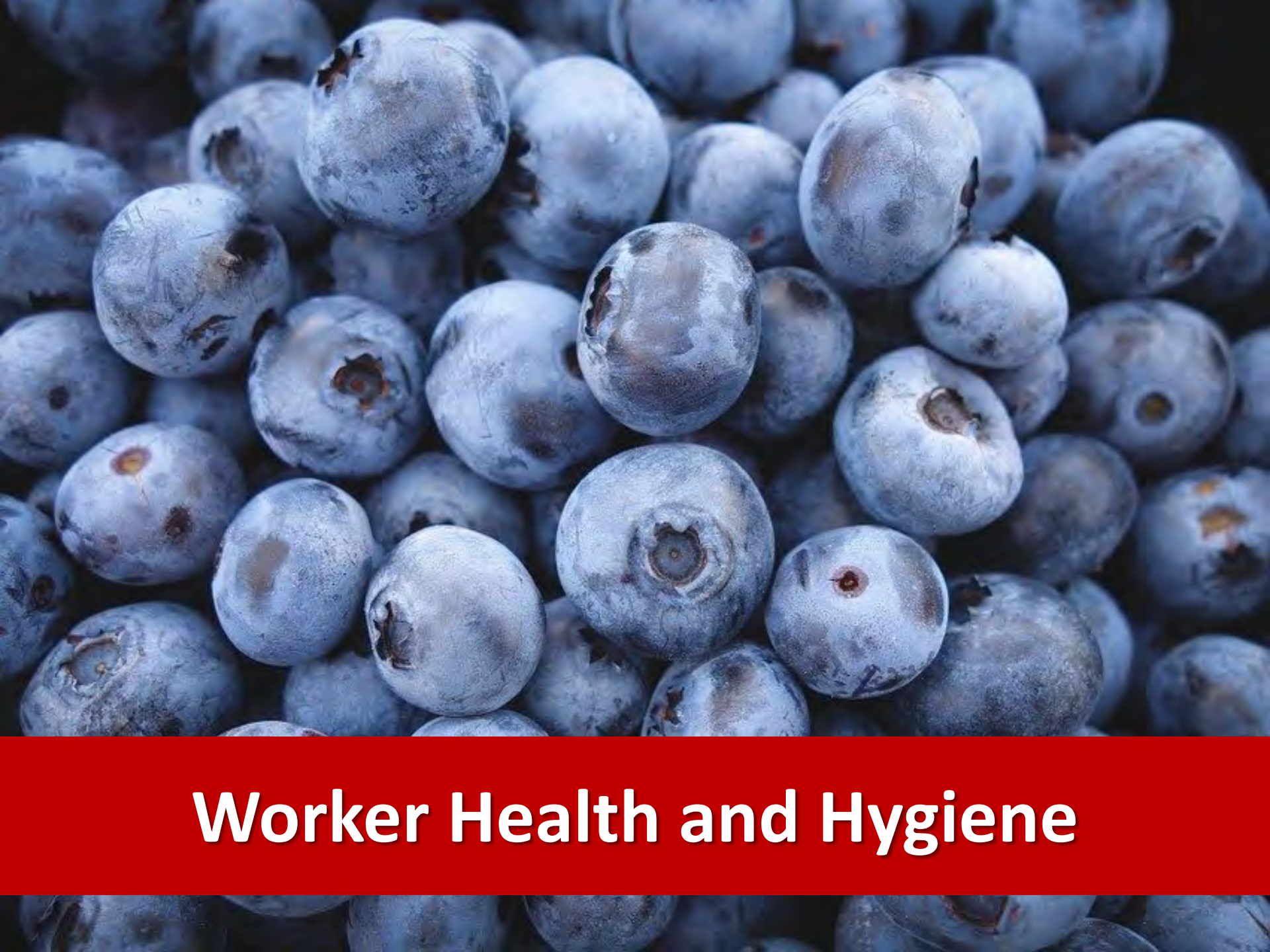

Worker Health and Hygiene

Waikato Blueberries, 2002

- Hepatitis A outbreak
- Illnesses: 81
- Hospitalizations: unknown
- Deaths: unknown

Contributing factors:

- Infected person present during harvest
- Inadequate handwashing facilities (no running water, soap, or hand towels)
- Bare hands picking (no gloves)

Worker Training Requirements

- Workers must have a combination of education, training, and experience to perform job assignments
- All workers who handle produce or touch food contact surfaces must receive training appropriate for their duties:
  - Upon hiring
  - At least once annually thereafter
- Training must be easily understood by those being trained
- Training must be documented

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Training Programs Must Include

- Principles of food hygiene and food safety
- Importance of health and hygiene for all personnel and visitors
  - Includes recognizing symptoms of injury or sickness that could contaminate produce or food contact surfaces
- Other training relevant to the worker's job
- How to report food safety concerns to supervisors

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Routes of Contamination

Feces

Clothing

Hands

Footwear

Tools & Equipment

Illness & Injury

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Key Worker Hygiene Practices

- Maintain personal cleanliness
- Avoid contact with animals other than working animals and take action to minimize likelihood of contamination of covered produce
- Wash hands thoroughly
- If using gloves, maintain in an intact and sanitary manner and replace when necessary
- Remove or cover hand jewelry that cannot be cleaned and sanitized when covered produce is manipulated by hand
- Do not eat, chew gum, or use tobacco products in the area used for a covered activity (drinking beverages is permitted in designated areas)

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Wash Your Hands Before Picking

- Handwashing sinks are located in the restrooms, at the field entrance, etc.
- Use of hand sanitizer is not a replacement for handwashing

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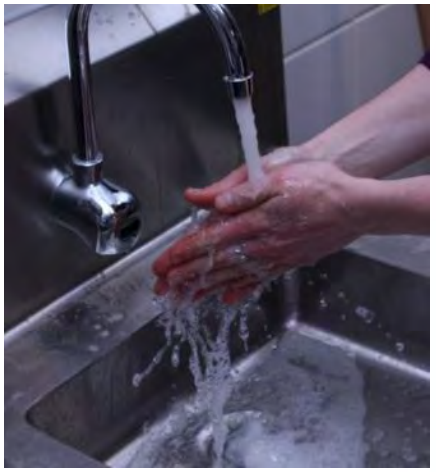
Proper Handwashing



1. **Wet hands** with water
2. **Apply soap and lather.** Be sure to wash the front and backs of hands as well as in between the fingers. Rub hands together for AT LEAST 20 seconds
3. **Rinse** hands thoroughly with clean water
4. **Dry** with a paper towel (turn off faucet with used towel)
5. **Throw** the paper towel in a trash can

Antibacterial hand sanitizers CANNOT replace handwashing

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Did you wash your hands?

Stop the spread of germs and be healthy.

WET Wet hands under warm water.

WASH Wash hands with soap for 20 seconds.

RINSE Rinse under warm water.

DRY Dry hands. Turn off water with paper towel.

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AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER Services provided on a nondiscriminatory basis.

POR FAVOR, LÁVESE LAS MANOS FRECUENTEMENTE

ANTES Y DESPUÉS DE:
- TRABAJAR
- USAR EL BAÑO
- MANIPULAR FRUTAS Y VERDURAS
- COMER Y BEBER
- FUMAR

BEFORE AND AFTER:
- WORK
- USING THE TOILET
- HANDLING FRUITS AND VEGETABLES
- EATING AND DRINKING
- SMOKING

PLEASE WASH YOUR HANDS OFTEN!

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Toilet & Handwashing Facilities

- Provide a sufficient number of toilets and sinks to meet worker and visitors' needs
  - OSHA requires one facility per 20 workers within ¼ mile of the working area
- Facilities must be fully serviced on a regular schedule
- Toilet and handwashing facilities must be well stocked
- Facilities should be monitored every day when in use

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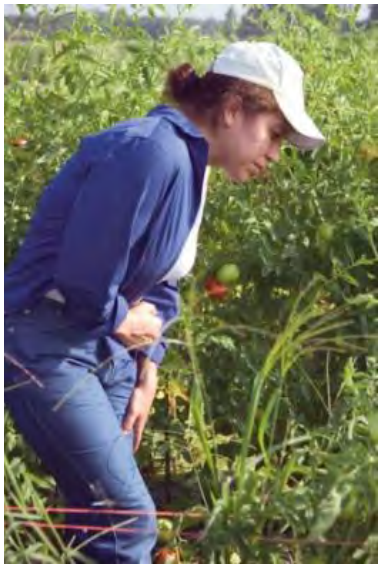
Worker Illness

- Workers who are sick or show signs of illness can contaminate fresh produce
- Ill workers must not handle fresh produce
- Symptoms of illness can include:
  - Nausea
  - Vomiting
  - Diarrhea
  - Fever
  - Jaundice



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No Eating, Drinking, Chewing Gum, or Smoking in the Fields

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Wildlife

Jaquith Strawberry Farm, 2011

- *E. coli* O157:57 outbreak
- Illnesses: 16 reported
- Hospitalizations: 7
- Deaths: 1

Contributing factors:

- Deer feces in production field with outbreak strain

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Wildlife, Domesticated Animals, and Working Animals

- Growing areas must be assessed for evidence of potential animal contamination
  - Observation of animals
  - Animal excreta
  - Crop destruction

- If significant evidence of contamination is found, evaluate whether produce can be harvested
- Take steps to ensure that contaminated produce can be identified and not harvested

Prune and Trellis to Keep Fruit Up Off the Ground

Training Workers to Identify and Reduce Risks at Harvest

- Evaluate contamination risks before and during harvest such as significant animal activity, presence of fecal matter, damaged crops, or extensive animal tracks
- Never harvest produce destined for the fresh market that is visibly contaminated with feces
- Never harvest dropped covered produce (covered produce that drops to the ground before harvest)
- Only use clean harvest and packing containers

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Dust as a Source of Pathogens

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Production Water

Guatemalan raspberries, 1996

- *Cyclospora* outbreak
- Illnesses: 978
- Hospitalizations: 22
- Deaths: 0

Contributing factors:

- Pesticide sprays mixed with contaminated water from improperly constructed or maintained wells near deep pit latrines or sewage pits
  - Wells are particularly vulnerable to contamination during rainy season (e.g., from surface water runoff)

Helpful FSMA Produce Safety Rule Definitions

- **Agricultural water** must be safe and of adequate sanitary quality for its intended use
  - **Agricultural water** means water used in covered activities on covered produce where water is intended to, or is likely to, contact covered produce or food contact surfaces
  - **Covered produce** means produce that is subject to the requirements of the Produce Safety Rule and refers to the harvestable or harvested part of the crop

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Evaluating Risks Related to Production Water

Three main impact points for produce safety risks related to production water are:

1. Production water source and quality
   - Public water supply, ground water, surface water
   - Testing frequency and sampling location
2. Application method
   - Water that does not contact the harvestable portion
   - Water that contacts the harvestable portion of the crop
3. Timing of application
   - At planting or close to harvest

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Water Sources

In practice, which of these water sources would be more variable in quality?

Ground water

Surface water

Public water supply

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Methods of Irrigation

- Overhead (sprinkler)
  - Higher risk: A direct water application method resulting in contact with produce

- Flood (surface, furrow)
  - May avoid direct contact with produce
  - Consider risk of contact with contaminated soil during harvest or from splash
- Drip (trickle, subsurface, micro, under canopy)
  - Lower risk: Produce generally not in direct contact (except root crops), reduces foliar diseases, improves water use efficiency

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Is This Agricultural Water?

Blackberries

Pesticide Application

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Pesticide Sprays

- Pesticides do NOT destroy human pathogens
- Should understand quality of water used to mix pesticides (or use potable water)
- Be sure to train workers how to mix tanks for pesticide sprays

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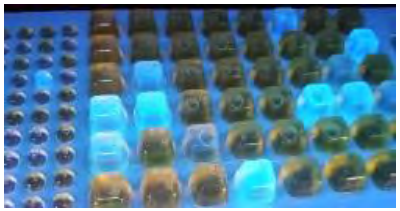
Water Compliance Date Extension: What growers should do now

- Continue water testing
  - To understand water quality
  - To meet buyer and audit requirements
- Develop water management strategies
  - To identify and reduce risks
  - Example: Surveys of water sources
- Understand quality by testing … especially if you have never tested
  - For generic *E. coli*
  - Before using agricultural water
  - During frequent use periods



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Equipment Surfaces

Jensen Farms, 2011

- 28 state outbreak of *Listeria monocytogenes* infections (listeriosis)
- Illnesses: 147
- Hospitalizations: 143
- Deaths: 33

Contributing factors:

- Pools of water on packinghouse floor
- Old, hard-to-clean equipment

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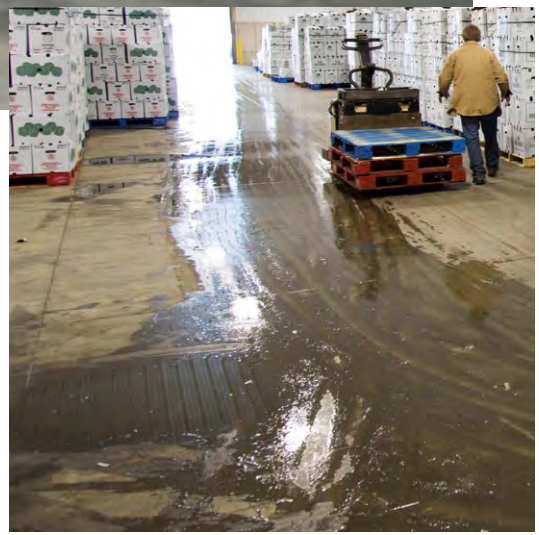
Avoid Standing Water



- Make an effort to reduce standing water in equipment and on the floor
- Standing water can support the growth and persistence of pathogens such as *L. monocytogenes* and splash onto produce and equipment

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Best Case Scenario: Sanitary Design of Equipment

- Food contact surfaces should be:
  - Non-toxic, non-absorbent
  - Durable, able to withstand corrosion
  - Able to be easily cleaned and sanitized

- Equipment should be designed and installed to facilitate cleaning and sanitizing
  - Easy access to equipment and adjacent spaces
  - Able to remove or access brushes, rollers, and nozzles for cleaning and sanitizing

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Best Case Is Not Always Possible

- **Many farms have old or wooden equipment that is not easy to clean or sanitize. All hope is not lost!**
  - Most things can be cleaned, even old equipment!
  - Keep equipment clean (sanitize when necessary)
  - Establish cleaning schedules that reduce contamination risks and prevent biofilm formation
  - Air dry wooden surfaces after washing
  - Equipment and tools that cannot be maintained or cleaned properly may need to be discarded
  - Be sure <u>new</u> equipment and buildings are designed to be easily cleaned and sanitized

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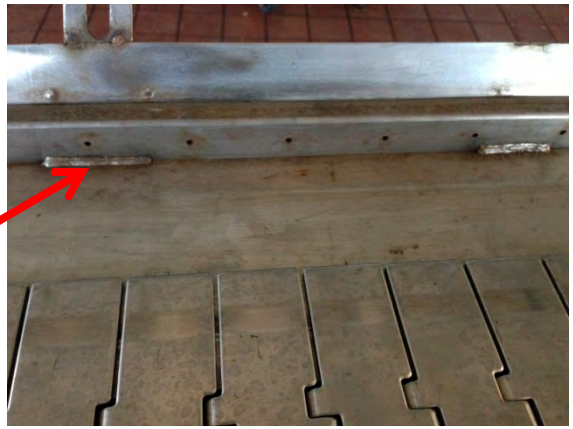
Retrofitting Equipment

- Make sure changes or modifications to equipment will not result in an increased risk of contamination
- Use materials that can be cleaned and sanitized
  - No carpet or materials that cannot be cleaned or do not dry
- Consider consulting technical assistance resources or a sanitation expert if using the equipment for a new purpose or for which it was not designed
- When possible, invest in the right equipment rather than modifying



Post-manufacturing welds are not easy to clean and may become a source of contamination

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Zone 1: Direct Food Contact Surfaces

- Biggest concern because if contaminated, could result in cross-contamination of the produce
- Includes harvest/storage bins, workers' hands, conveyors, belts, brushes, rollers, sorting tables, racks, and utensils
- Initial efforts should be focused on Zone 1 since it has the most immediate impact on safety
  - Clean and, when necessary and appropriate, sanitize

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Hand-Picked, Field-Packed

- Picking directly into clamshells reduces the surfaces the fruit contact
- Requires worker training and attention to detail so only high quality, uncontaminated fruit get picked

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Summary

- If given the right conditions, bacteria can multiply outside a host
  - Humans, wildlife, production water, equipment surfaces
- Viruses and parasites only multiply in a host
  - Humans; commonly transmitted through water
- Fresh and frozen berries have no kill step – prevention is key
  - Practices to implement?

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Practices to Reduce Food Safety Risks

1. Wash hands
2. Don’t work when sick
3. Don’t harvest poopy fruit
4. Don’t harvest dropped produce
5. Keep fruit up off the ground
6. Use drip irrigation
7. Use clean water to mix pesticide sprays
8. Avoid standing water in packing areas and coolers
9. If using heritage or repurposed equipment, make sure it can be adequately cleaned and, if necessary, sanitized
10. Clean and sanitize food contact surfaces

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