Good Agricultural Practices for Food Safety: Water Quality

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Water is the Major Source of Contamination for Fresh Fruits and Vegetables

Pathogens Found in Water Include:

- *Escherichia coli*
- *Salmonella spp.*
- *Cryptosporidium parvum*
- *Cyclospora cayetanensis*
Best Practices for Water Use

• Describe the water system
• Perform a sanitary survey
• Use water of appropriate microbial quality
• Test water close to point of use
• Keep records of testing and results

Purdue Extension Safewater Site
https://engineering.purdue.edu/SafeWater/

University of Illinois Extension Water Quality
http://www.wq.illinois.edu/uie-wq.html/
Contamination

Human or animal feces is the most common source of contamination in water

Prevent contamination by proper
  Personal hygiene
  Livestock management
  Manure management
Surface Water

- Most likely to be contaminated
- Run-off or wind-disperal from animal facilities or compost operations
- Improperly treated sewage
- Wildlife
Indiana Surface Waters Not Meeting Standards in 2006

Based on IDEM 303d list for 2006. In the majority of cases E. coli is the problem. Does not show ALL waters with excessive E. coli.

http://tinyurl.com/impaired-streams
Protecting Surface Water

- Keep livestock out of water sources and drainages to water
- If manure is used, apply it away from surface water
- Manage manure storage and compost to avoid run-off
- Upgrade sewage systems
Wells

- Less likely to be contaminated
- Contamination can enter at the well-head
  - Uncapped or improperly capped wells most risky
  - Damaged wellhead or casing risky

Image and reference: Indiana Farmstead Assessment: Drinking Water Well
www.extension.purdue.edu/waterquality/resources/surveys/factsheets/farmassess1.htm
Protecting Wells

- Don’t mix pesticides or other chemicals near the well
- Don’t apply raw manure within 100 ft. of wellhead (200 ft. if slope > 6%)
- Use backflow prevention fittings when applying ag chemicals through irrigation system
- Retire and properly cap abandoned or unused wells
- Keep livestock away from active recharge area
- Inspect wells annually

Sealed Well
Managing the Wellhead Protection Area
https://engineering.purdue.edu/SafeWater/wellhead/manage.htm
Municipal Water Systems

• Least likely to be contaminated
• Legally must be potable
• Request copies of water quality tests at least annually
Water Uses

- Irrigation
- Pesticide application
- Frost protection
- Postharvest
Irrigation

Water contacting edible portion of crop near harvest poses the greatest risk

• Drip Irrigation
  – Lower risk of crop contamination
  – Does not usually wet edible portion of crop
  – High water use efficiency

• Overhead Irrigation
  – Higher risk of crop contamination
  – Wets edible portion of crop
Measuring Water Quality: Microbiological Tests

- Tests are used to track water quality, not for daily monitoring
- Records of test dates and results are important to establish patterns
- Change in pattern may indicate a problem
Microbial Tests

Presence of indicator organisms means there may be a problem with fecal contamination.

Indicator organisms:
- Total coliform
- Fecal coliform

**Generic E. coli**
- Reported as MPN/100 ml
- Most Probable Number per 100 milliliters of sample

Generic E. coli is the preferred indicator organism for GAPs.
Microbial Standards for Irrigation Water

No specific federal standards at this time

“water…is not contaminated with animal or human feces and is of sufficient microbial quality for its intended purpose”

FDA Guide to Minimize Microbial Food Safety Hazards of Tomatoes; Draft Guidance

Industry standards are based on:

- EPA drinking water standards or
- EPA recreational water standards

Industry standards vary with commodity
Pesticide Application and Frost Protection

Water used to apply pesticides or other materials to crop should meet the same standards as irrigation water.

The same is true for water used for frost protection.
Sampling Water Sources used for Irrigation

Surface water
   Yearly before use
   Regularly during use (monthly)
   As needed

Well water
   Yearly

Municipal water
   Yearly (obtain tests from water company)
Sampling Water Sources

• Contact lab before sampling
  – Confirm tests available: Generic E. coli MPN
  – Request sampling instructions
  – Obtain containers
  – Request shipping information

• Create chain of custody forms to document who took the sample, time of sample collection, time of delivery to the lab
Indiana Certified Microbiology Drinking Water Laboratories

www.in.gov/isdh/22450.htm
When Water Source Doesn’t Meet the Grade

- Is it an on-going or repeated problem?
- Well treatment
  - Chlorine treatment of well. See IDEM recommendations
- Surface water treatment
  - Chlorine treatment before irrigation
Chlorine Treatment of Irrigation Water

- Dosatron injector
- Accu-tab dosing system
Sanitizer Uses are Regulated by EPA

• The label is the law
  – Uses
  – Methods
  – Rates
  – Precautions
  – Disposal
Postharvest Water Uses

- Washing
- Hydrocooling
- Ice
- Flumes
- Dump tanks
- Hydration
Postharvest Water Quality

All water that contacts the crop after harvest should meet EPA standards for microbial quality of drinking water (standards for potable water) at the start of the process.

<table>
<thead>
<tr>
<th>Generic <em>E. coli</em> Test</th>
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<tbody>
<tr>
<td>negative</td>
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<tr>
<td>or below detection limit</td>
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We don’t always control the water…

- Flood waters may contain sewage, chemicals, heavy metals, and pathogens
- FDA considers food contacted by flood water to be “adulterated” and not fit for human consumption

“Flooding is the flowing or overflowing of a field with water outside a grower’s control” FDA Guidance Evaluating the Safety of Flood-affected Food Crops for Human Consumption.

“Pooled water that is not reasonably likely to cause contamination of the edible portions of fresh produce is not considered flooding.” FDA Guidance Evaluating the Safety of Flood-affected Food Crops for Human Consumption.
Flood Waters Contact Edible Portion of Crop

- Do not harvest for food
- Manage so that the contaminated crop does not contaminate unaffected crops

Flooding In or Near Crop
Flood Waters do NOT Contact Edible Portion

“Evaluate on a case-by-case basis for likelihood of contamination”

Consider testing for:

- Mycotoxins
- Heavy metals
- Pathogens
- Pesticides
- PCBs
- Other contaminants

Get technical advice

Prevent cross contamination between flooded and non-flooded areas

- Document extent of flooding with photos and markers in field
- Clean equipment after use in flooded area
- Avoid travelling through flooded area on way to crop
- Wear boots, gloves when working in flooded areas
- Don’t harvest near flooded area (30-ft.)
Flooded Before Crop is Planted

- Consider field history and crop selection
- Consider time between the flooding, planting and harvest (LGMA recommends 60 days before planting)
- Consider source of flood (drainage ditch, river, etc.) and potential for human pathogens
- Allow soils to dry; rework before planting
- Maybe: sample soil for microorganisms

Describe Water on Your Farm

• Water movement onto farm
• Water sources
• Facilities
• Equipment
Sanitary Survey

- Run-off from surrounding areas
- Flooding
- Liquid manure applications
- Water Sources
  - Potential upstream sources of contamination
  - Point-source contamination
  - Non-point-source contamination
    - run-off
    - tile drains
Pay Attention to Water Distribution Systems

• Irrigation system parts
  – How are they stored when not in use?
  – If contaminated, how can they be cleaned?
  – Potential for contamination while in use?

• Plumbing connections
  – No cross-connections in plumbing system
  – Backflow prevention devices in place
  – No dead-end or unused lines
Pay Attention to Water Storage

- Water reservoirs or storage tanks
  - Nurse tanks for pesticide applicators
  - Tanks for handwashing water
  - Cisterns for rainwater collection
Water Recordkeeping

- Documentation and summary of survey
- Potable water for workers (water test)
- Source and method for irrigation
- Procedure and test results for irrigation and spray water
- Test results for postharvest water
- Procedure and records for packing line water temperature and treatments
- Procedure and records for cleaning of water contact surfaces
- Potable water for ice and cooling (test)
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Questions?

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