Good Agricultural Practices

Farm to Table Food Safety for Colorado Producers

PART 2: Minimizing Risks During Production

Irrigation Water and Manure Management
Presenters & Agenda

• Speakers:
  
  Marisa Bunning  
  Assistant Professor and Extension Specialist - Food Safety

  Gretchen Wall  
  Graduate Research Assistant

  Department of Food Science & Human Nutrition  
  Colorado State University

• Topics:
  
  - Site Selection
  - Manure & Pathogen Survival
  - Composting Manure
  - Application & Timing
  - Water Contamination Routes
  - Irrigation Sources & Testing

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Review of Webinars

March 16
• General On-Farm Food Safety
• Regulatory Landscape
• 3rd Party Audits
• Worker Hygiene and Health

March 30
• Post-Harvest Operations
• Packing Shed Sanitation
• Pest Management
• Cooling and Wash Water
• Transportation
• Traceback

Recordings posted on:
http://farmtotable.colostate.edu/gap-ghp.aspx
Risk Reduction

- **Prevention** is the key to reducing microbial contamination of fruits and vegetables *before* it occurs.

- Current technologies **cannot** eliminate all potential food safety hazards associated with fresh produce eaten raw.

"WHAT’LL IT BE — ONE LARGE RISK OR SEVERAL SMALL ONES?"
Sanitation in the Field

• Site Selection
  - Land History
  - Livestock Operations
  - Worker Facilities
  - Availability of Safe Water Source
Sanitation in the Field

• Production Practices
  - Manure Management
  - Manure Application
  - Irrigation Practices
  - Water Testing
  - Harvest & Post-Harvest Operations

Photo credit: Frank Stonaker
Animal Exclusion

- Keep livestock away from irrigation water sources (direct deposition)
- Harvest workers should be trained to leave any fruit or vegetable that has been contaminated (visibly) with or in close proximity to animal feces
- Visitors, U-Pick customers, family, and friends should be instructed to leave their pets at home
- Keep deer, birds, raccoons, and household pets out as much as possible
Manure as a Source of Contamination

• Why should we be concerned?
  - Pathogens can survive in soil for long periods of time
  - Fruits and vegetables may come in direct contact with soil
  - Many farm animals shed harmful pathogens naturally
    - Cattle: *Escherichia coli* O157:H7
    - Sheep: *Listeria monocytogenes*
    - Poultry: *Campylobacter*
Survival of *E. coli* O157:H7 in Soil

Crop Selection

• **Root Crops:**
  - Edible portion in direct contact with soil/manure/water

• **Above Ground Crops:**
  - Tomatoes, peppers, etc.
  - Contamination may occur post-harvest via workers, packing house, handling

• **Leafy Greens:**
  - Irrigation method
  - Large surface area
  - Minimally processed (bagged greens)

• **Tree Fruit:**
  - Risk low, avoid fruit on ground

• **Grain/Forage Crops:**
  - No major risk
Manure Types

- Types of Manure
  - Green manure
  - Raw manure
  - Composted manure
  - Incompletely composted manure
Composting and Microbial Reduction

• **Benefits of Manure Application**
  - Improved soil structure
  - Increased uptake of nutrients by plants
  - Improved water absorption and retention

• **Benefits of Manure Composting**
  - Reduction of weed seeds
  - Substantial reduction of pathogenic microorganisms

• **How does it work?**
  - **Active Treatments**
    - Expose harmful bacteria to consistent lethal conditions
      - ie. Proper composting
  - **Passive Treatments**
    - Longer ‘aging’ time, not a consistent method to reduce pathogens, **not** to be confused with composting
Guidelines for Composting Manures

Cornell Food Safety Begins on the Farm Guidelines
- Pile achieves high temperatures between 130°F and 160°F for at least 5 days
- Compost pile is aerated and turned several times

National Organic Standards
- Composted plant and animal materials must be produced through a process that:
  1. Established an initial C:N ratio between 25:1 and 40:1
  2. Maintained a temperature of between 131°F and 170°F for 3 days using an in-vessel or static aerated pile system
  3. Maintained at a temperature between 131°F and 170°F for 15 days using a windrow composting system, during which period, materials must be turned 5 times
Handling of Manure & Compost

• Manure storage and treatment sites should be situated as far as practical from fresh produce production and handling areas.

• Store manure at least 150-200 feet from water sources- including wells and streams.

• Consider barriers or physical containment to minimize contamination from run-off, leaching, or wind.

• Minimize recontamination of finished compost
Guidelines for Application of Raw Manure

• **National GAPs Program:**
  - 120 days for all crops prior to harvest
  - 2 weeks prior to planting

• **National Organic Standards:**
  - 120 days for crops with the edible portion below the soil
  - 90 days for crops whose edible portion does not come in direct contact with the soil
  - Fall application very feasible for Colorado
    If the 120-day waiting period is not feasible, such as for short season crops like lettuce or leafy greens, apply only properly composted manure
Water Contamination Routes

- Storm Water
- Septic Tank Leakage
- Agricultural Run Off
- Well Head Impacts
- Land Application
- Contaminated Water
- Wildlife
Sources of Water

**Surface Water**
- Greatest Risk
- Permanent, Cyclical, Intermittent

**Ground Water**
- Moderate Risk
- Well & Septic Maintenance

**Municipal Water**
- Low Risk
- Test Annually
Irrigation Method

- Overhead, Sprinkler
- Surface, Flood, Furrow
- Drip, Trickle
Microbial Testing of Water Sources

• Test municipal water annually
• Test surface water 3x/season
  - Planting
  - Peak Use
  - Harvest
• Records are to be kept on file for 2 years
Bacterial Indicators

Total Coliform

Fecal Coliform

E. Coli (Generic)

Pathogenic Bacteria
(E. coli O157:H7, Salmonella)
Irrigation Water Quality Standards

- No universally accepted standard for maximum microbial levels in irrigation water.

- EPA National Recreational Water Standards
  - 126 CFU *E. coli* /100 ml sample

- CO Recreational Water Standards
  - 126 CFU *E. coli* /100 ml sample or 200 fecal coliforms CFU/100 ml sample

- CA Leafy Greens Marketing Agreement
  - 126 CFU *E. coli* / 100 ml sample
Solutions to Contaminated Water

- **Locate**
  - Source of Contamination

- **Repair**
  - Structures that support water sources

- **Identify**
  - Alternate water sources if contamination is present
What’s Wrong With This Picture?

1- Surface Water Source for Irrigation
2- Overhead Irrigation Piping
3- Unmanaged Forest
4- Compost Heap
5- Vegetable Wash Station
6- Fruit Orchard

Resources

USDA Audit Check List
http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5050869

National Good Agricultural Practices Network for Education and Training, Cornell University
http://www.gaps.cornell.edu/

On-Farm Composting Handbook
http://www.nraes.org/nra_order.taf?_function=detail&pr_booknum=nraes-54

Northern Plains and Mountains Regional Water Program
http://region8water.colostate.edu/index.shtml

Small Acreage Management – Water Guidelines
http://www.ext.colostate.edu/sam/water.html

Colorado Department of Health Certified Water Labs
http://www.cdphe.state.co.us/lr/certification/sdwlist.pdf
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  - Traacy Vanderpool, Fruit & Vegetable Section Chief

- **Colorado State Extension**
  - Adrian Card, Boulder Extension Agent
  - Ruth Willson, Extension Technology
Contacts

• Dr. Marisa Bunning
  Assistant Professor and Extension Specialist, Food Safety
  970-491-7180
  mbunning@cahs.colostate.edu

• Tracy Vanderpool
  Fruit and Vegetable Section Chief, CO Dept. of Ag
  719-852-4749
  Tracy.Vanderpool@ag.state.co.us

• Adrian Card
  Colorado State University Extension, Boulder County
  303-678-6383
  acard@bouldercounty.org

• Gretchen Wall
  Graduate Research Assistant
  724-777-1113
  Gretchen.Wall@colostate.edu