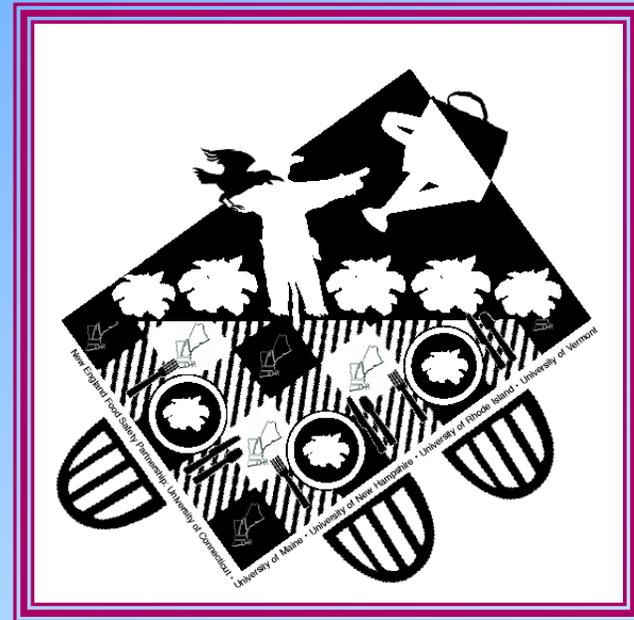


Food Safety and the Home Garden: From Garden to Table



Lori Pivarnik, PhD,
Coordinator, Food Safety Outreach/Research
April 14, 2015
Master Gardener Volunteer Training

Project Funded by CSREES/USDA. Project 2003-5111001713

Objective of Program

Since:

Microbiological safety hazards commercial vegetables is documented.

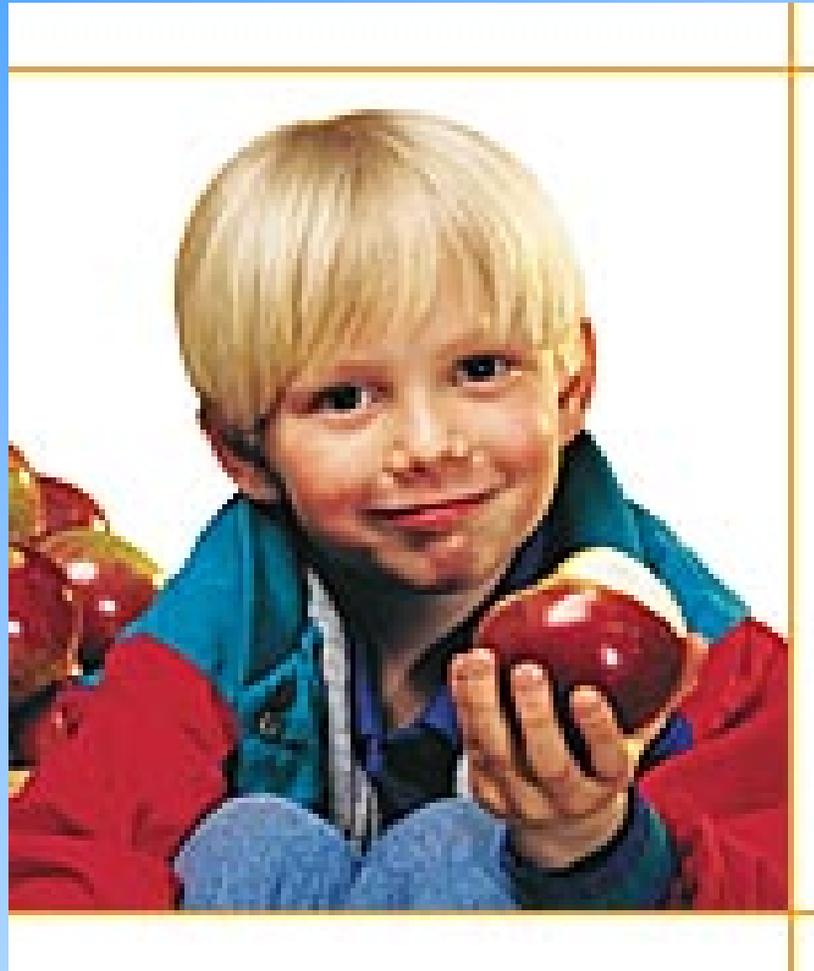
Educational programs for commercial producers – none for home gardeners.

Goal:

Help home gardeners apply “Good Agricultural Practices” or GAP to minimize microbial food safety hazards from “Garden To Table”.



What Are Good Agricultural Practices? Why Are They Important?



Good Agricultural Practices (GAP) Program for Commercial Growers

- **Water and Water Quality**
- **Manure and Biosolids**
- **Field Sanitation**
- **Worker Health and Hygiene**
- **Sanitary Facilities**
- **Packing Facility Sanitation**
- **Transportation**
- **Traceback**

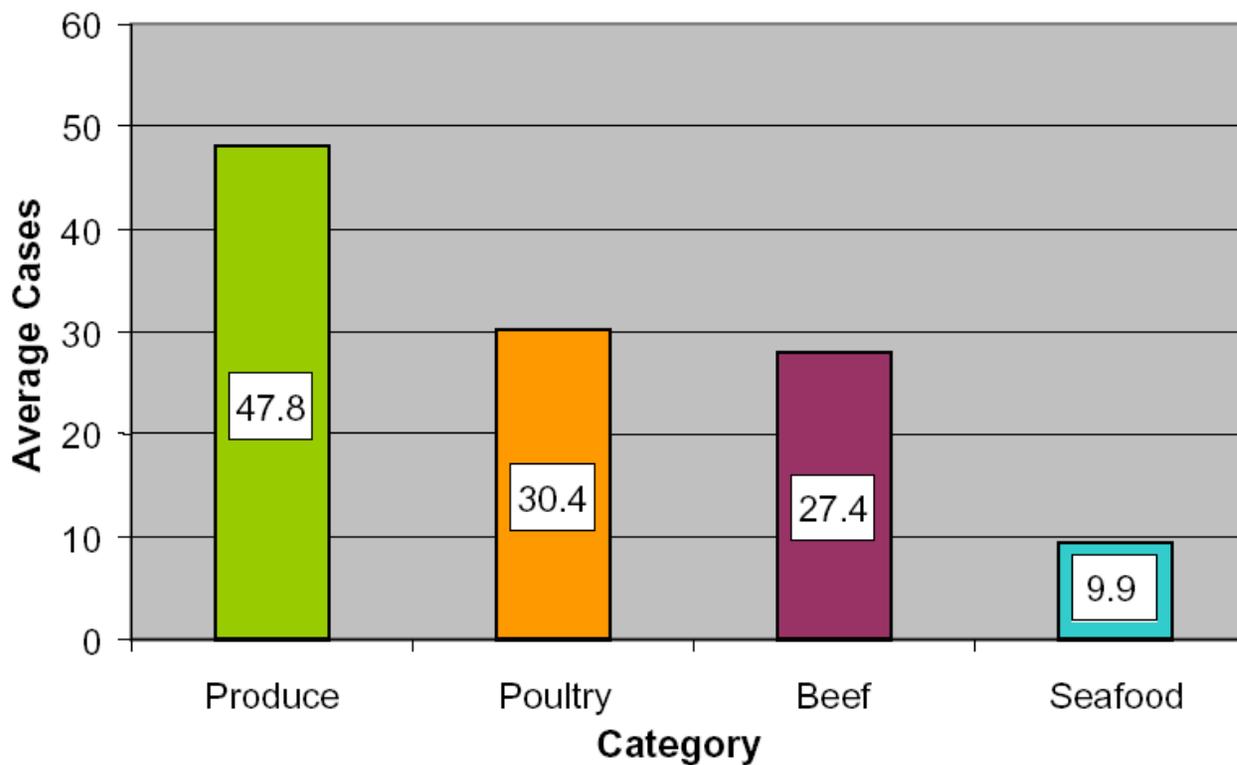


Produce Safety Concerns: Why now?

- Consumption of fresh produce steadily increasing.
- Increases in the number of produce associated with foodborne disease outbreaks in the U.S.
- A variety of fruits and vegetables implicated--domestic and imported



FIGURE 3. AVERAGE CASES PER OUTBREAK BY FOOD CATEGORY 1990-2005



Caroline Smith Dewaal and Farida Bhuiya. 2007. Presented at IAFP. Center for Science in the Public Interest

Produce Concerns

2006: Food commodities associated with largest illness numbers:

- Poultry (21%), **Leafy vegetables (17%)**, fruits or nuts (16%)

Produce Concerns: 1998-2008

	Leafy Greens	Dairy	Poultry	Beef	Eggs	Pork
Rank	1	2	4	6	7	8
% Outbreaks	22.3	13.8	9.8	6.6	6.0	5.4

#3 (fruits, nuts); #5 (vine related); #12 (fish)- out of 17 commodities

All produce commodities accounted for 46% of illnesses; meat-poultry accounted for most deaths 29% (with poultry at 19%) and produce 23%.

Produce Concerns

So What Does This Have To Do with Home Gardening?



Good Agricultural Practices and the Home Gardener

- **Adapt** to Home Gardeners - many issues same
 - Water safety
 - Domestic/Wild animals
 - Use of compost
 - Use of manure
 - Personal hygiene/sanitation
 - Post-harvest handling and temperature control
- **Goal:** reduce microbial **risks** in fresh fruits and vegetables — making produce safer.
- **Prevent** foodborne illness
- **Integrate** food safety into gardening practices

Foodborne Illness and the Consumer

- 2008: 31% US households (est. 36 million) participated in food gardening. Vegetables, fruit, berries, herbs
 - 2.8 Billion dollars
- 2009 : 19% increase over 2008
- Why grow?
 - Taste, Quality, Food bills
 - They know it is safe
- Underreporting of foodborne outbreaks with estimated 50% of all foodborne illnesses from exposure pathogens at home
- **Consumers not likely to consider food from own homes as the source of illness**



1. Butterfield, BW. 2009. Impact of Home and Community Gardening in America.
2. Doyle, MP and others. 2000 Dairy , Food and Environ. Sanitation. 20(5):330-337.
3. Redmond, EC and Griffith, CJ. 2003. J. Food Protection. 66(1):130-161.

What do we need know?

Is there a lack of food safety knowledge related to produce grown by home gardeners?



What Did We Do First?

The Survey

- ✓ 5,000 surveys mailed to households of fruit and vegetable gardeners in NE. Over 800 answered and returned.
- ✓ Assessed food safety knowledge of and attitudes regarding growing and handling of produce by home gardeners.
- ✓ 66 questions on food safety topics for all aspects of gardening and post-harvest handling



Survey Results

- ✓ Survey results showed key food safety areas that gardeners need more information about to minimize the risk of foodborne illness:
 - proper composting and manure application, maintaining water safety, and post-harvest handling.
- ✓ Results indicated lack of food safety knowledge among home gardeners regardless of location, age, education and income.



Potential Sources of Contamination for Home-grown Produce

- Soil
- Water
- Manure/Compost
- Wild and Domestic Animals
- Personal Hygiene/Sanitation
- Containers
- Wash and Rinse Water/Inadequate drying
- Post-harvest handling and temperature control



Structured Interviews: Some Results

Purpose:

- A “follow-up” to the regional survey.
- To probe key food safety topics to better understand why there is a lack of knowledge.
- On-site interviews with gardeners
 - 94 interviews done
 - 5 NE states (18-20/state)



Structured Interviews Results: Overall Food Safety

- Many home gardeners did not understand that contamination from harmful bacteria could come from a variety of sources in their garden.
- Chemicals viewed as the bigger problem.



Structured Interviews Results:

Overall Food Safety

- “Disconnect” between the realization that bacteria could be on produce and the source (e.g. soil). Indications that concerns about food safety less since produce from their gardens.
- Produce safety with chemical contamination a prevailing theme – must shift priority.



Structured Interview Results:

Soil Preparation and Compost/Manure Application

- Many composted but did not use temperature to determine completion
- Of those that used fresh manure, only a minority knew proper application/harvesting timeframe.



Structured Interview Results: Planting/Growing

Organic gardening

- Many respondents considered themselves organic gardeners.
- Why?
 - ✓ Safer, no chemical
 - ✓ Tastier, healthier.
- Did not connect microbial issues with organically grown produce.



Structured Interview Results: Planting/Growing

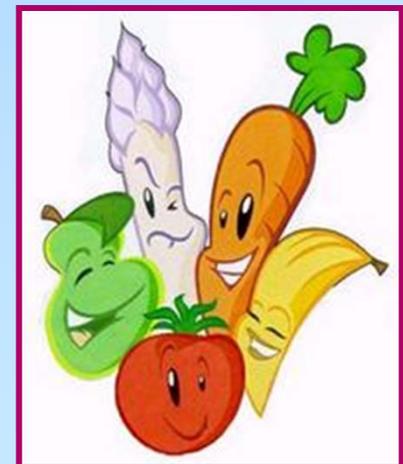
Water Safety

- Many respondents considered well water safer than municipal.
- Majority do not view water a source of disease-causing bacteria.
- Most did not know about back-flow protectors



Structured Interview Results: Other Issues

- Room temperature vs. refrigerator storage
- Soil is dirt – does not contain bacteria
- Eating unwashed produce
- Safe preservation techniques



Food Safety Review



You won't spot unsafe food by using your senses



From: <http://lancaster.unl.edu/food/pizza.shtml>

Foodborne illness: How you get sick from food 5 Steps

Illness



Ingestion



Mishandling ?

Contamination



Food



Foodborne Illness Symptoms

- Nausea
- Vomiting
- Diarrhea
- Headache
- Fever



A “tiny taste” will not protect you ...

... as few as **10 –100 bacteria**
could make you sick!

Foodborne Illness: People at Greatest Risk



Infants & Children
Pregnant women



Elderly



**People with weakened
immune systems**



Foodborne Illness: Dangers

- **Cases:** 48 million per year
- **Hospital:** 128,000 per year
- **Deaths:** 3,000 per year
- **Cost:** \$Billions



Why is this so hard to find? Why don't you know?

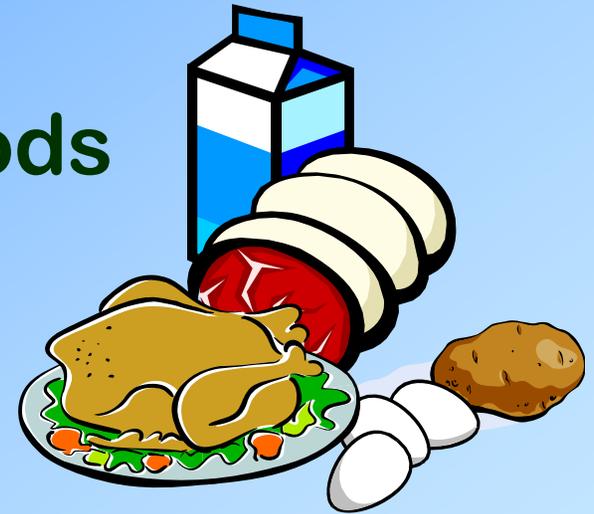
- **The Food that Made You Ill Is Probably Not the Last Food that You Ate**

Incubation Period

- Norovirus 12-48 hours
 - Salmonella 6 to 72 hours
 - E. coli O157:H7 1 to 10 days
 - Listeria 3 to 70 days
- **You might not get ill – or enough to notice**

Foodborne Illness: Most likely sources

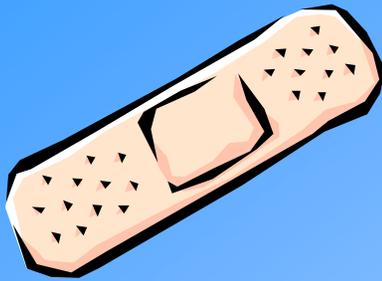
- Potentially Hazardous Foods



- Ready to Eat Foods

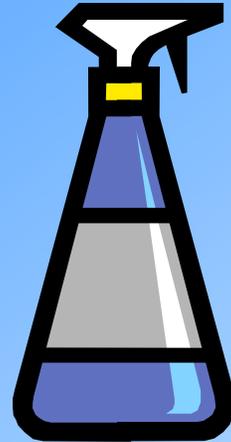


Food Safety Hazards: 3 Types of Contamination



Physical

Plastic
Glass
Metal
Wood
Bandages
Jewelry and other
personal items



Chemical

Allergens
Pesticides
Sanitizers
Lubricants



Biological

Parasites
Viruses
Bacteria

Chemical Food Safety Hazards

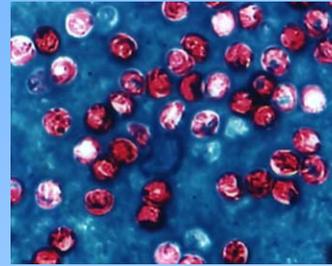
- Use pesticides according to manufacturer's directions
- Keep chemicals in original labeled containers
- Check well water for chemical hazards
- Toxins from mold
 - e.g. patulin in apples



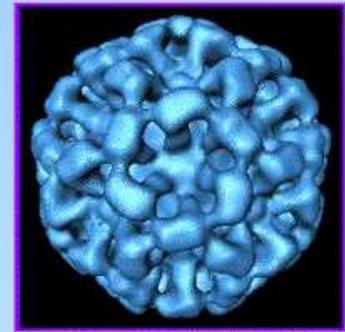
Biological Food Safety Hazards

What are the differences?

- Parasites
- Viruses
- Bacteria



Cryptosporidium parvum



Norwalk virus



Salmonella spp.

Sources of Biological Contamination

- Animals (wild and domestic, and manure)



- People



- Environment



Source of harmful bacteria/viruses in fruits/vegetables

Animal/human intestinal tract

- *Salmonella*
- *E.coli O157:H7*

Human

- *Shigella*
- *Hepatitis A virus*
- *Norovirus*
- *Staphylococcus*

Environment

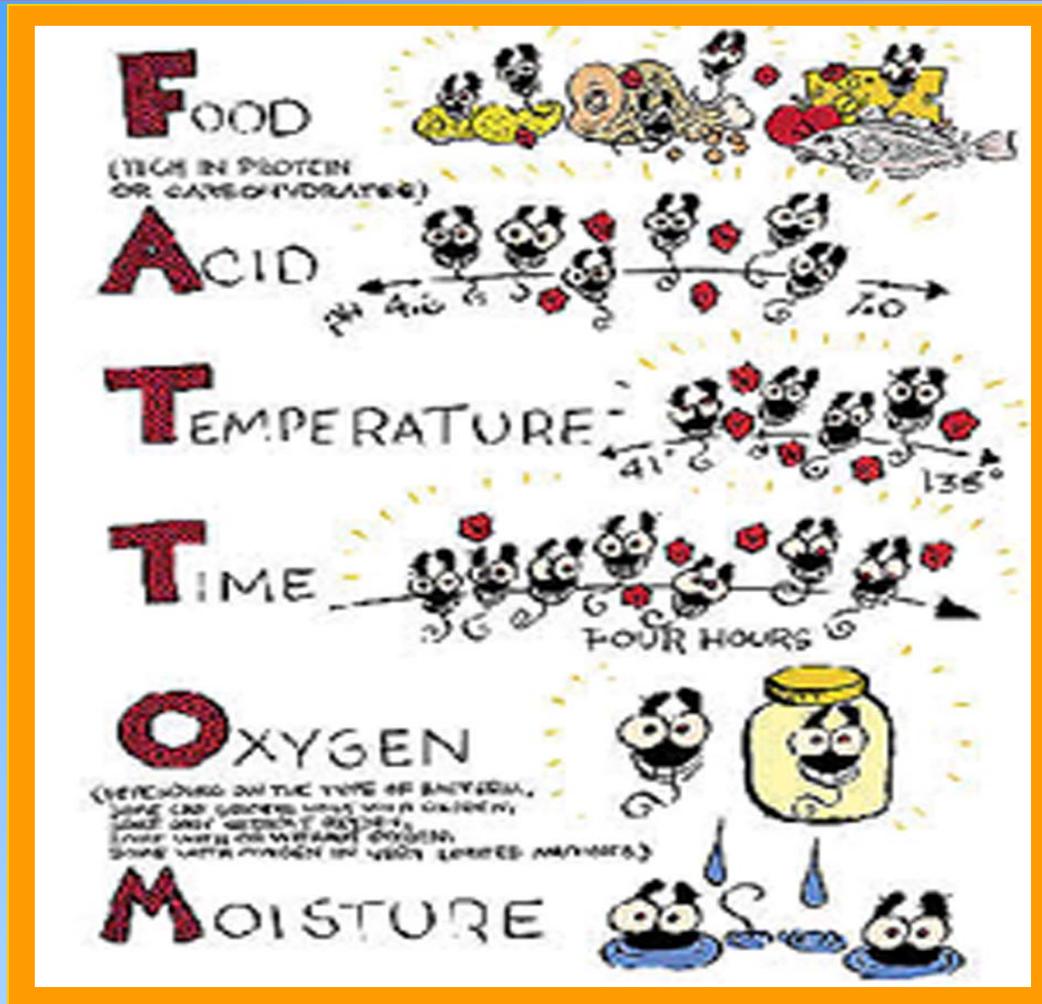
- *Listeria*
- *Clostridium*
- *E.coli O157:H7*

Water

- Most of the above

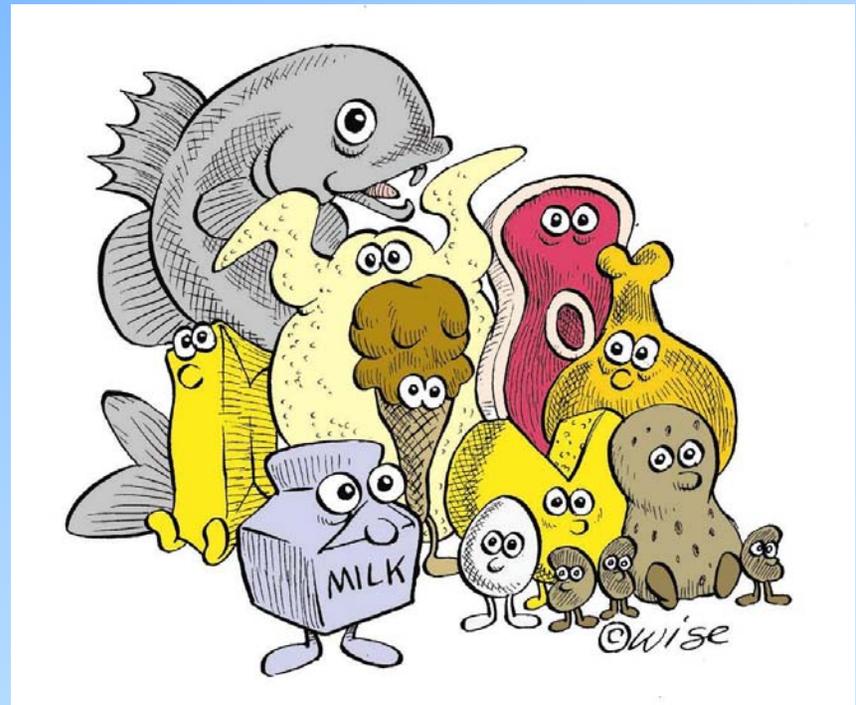


What do bacteria need to grow?

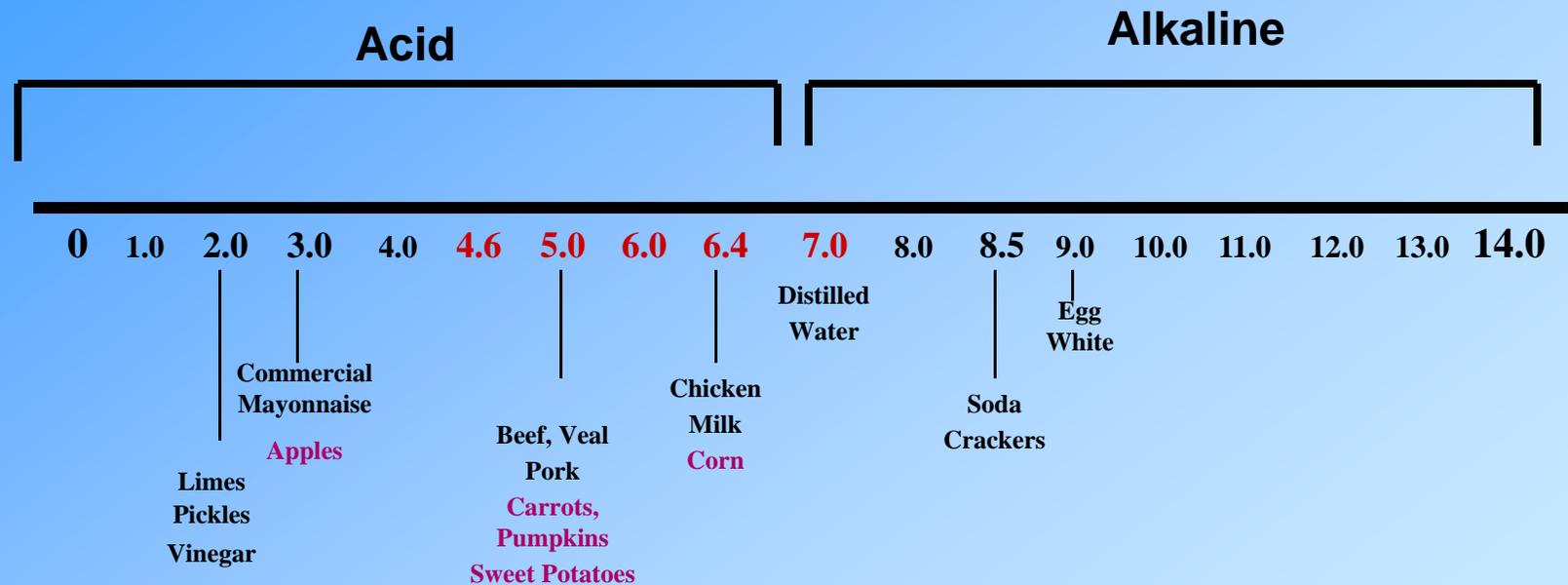


To Grow, Bacteria Need: Food

- ✓ High in protein or carbohydrates
- ✓ High in moisture
- ✓ Low in acidity

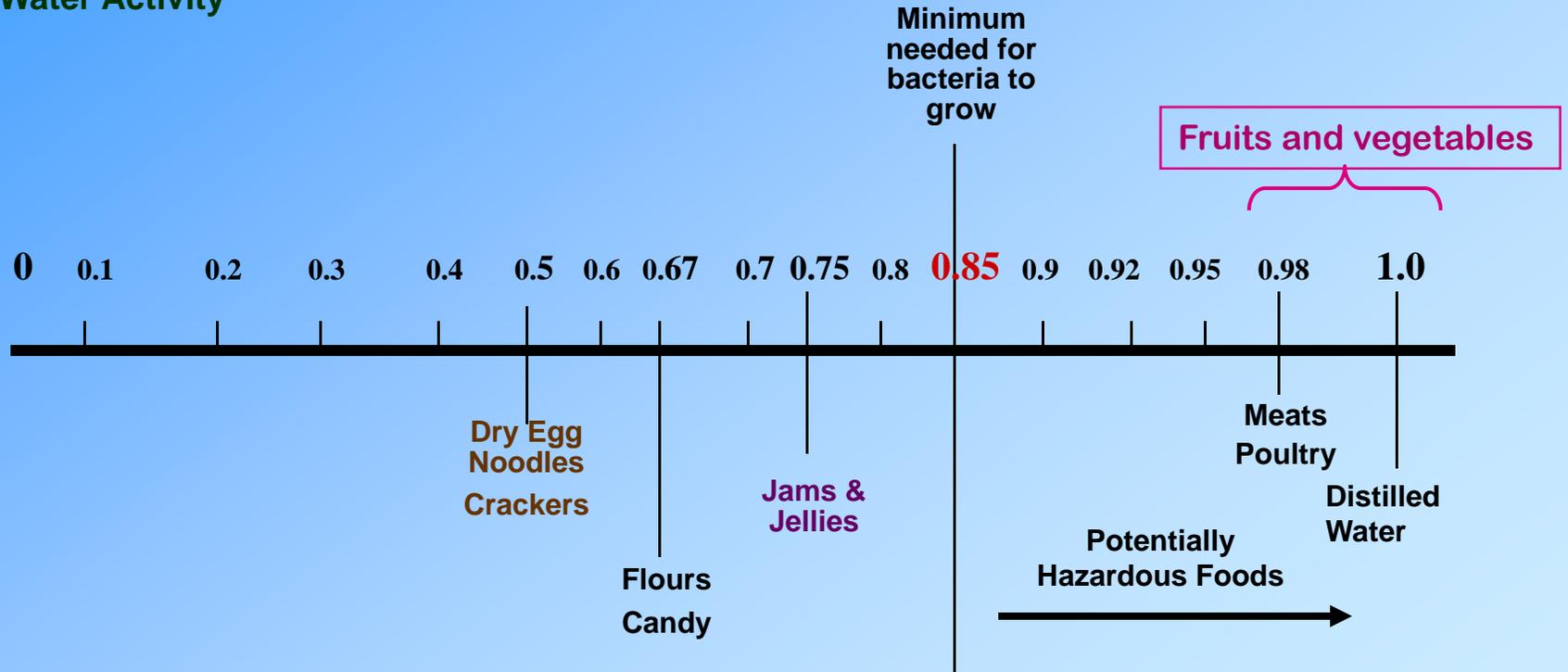


To Grow, Bacteria Need: Certain pH (Acidity)



To Grow, Bacteria Need: Moisture

Water Activity



To Grow, Bacteria Need: The Right Temperature

“Danger Zone”

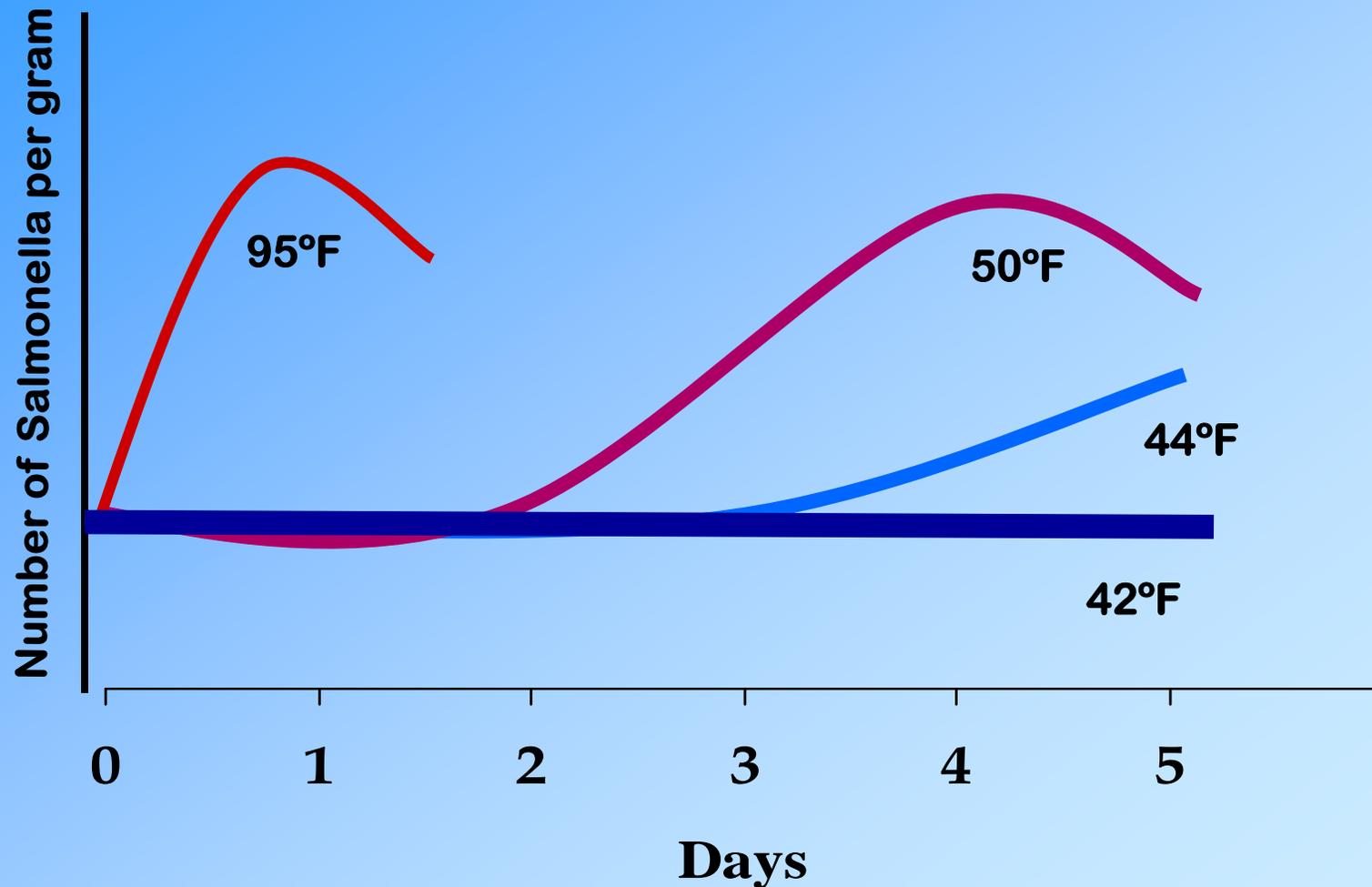
140 ° F



40 ° F



The effects of time and temperature on bacterial growth:



Potential Sources of Contamination for Home-grown Produce

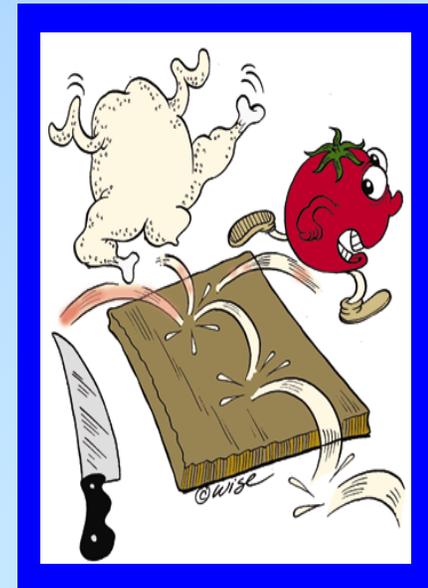
- Soil
- Water
- Manure/Compost
- Wild and Domestic Animals
- Personal Hygiene/Sanitation
- Containers
- Wash and Rinse Water/Inadequate drying
- Post-harvest handling and temperature control



Copyright © International Association for Food Protection

Key Food Safety Principles for Home-grown Fruits and Vegetables

- Practice safe soil preparation prior to planting
- Practice safe garden maintenance during planting and growing of fruits/vegetables
- Practice safe harvest and post-harvest handling including:
 - ✓ Good personal hygiene
 - ✓ Time and temperature control
 - ✓ Cross-contamination prevention



Five Steps to Food Safe Home Gardening

- **Step 1** - Preparing the garden for planting
- **Step 2** - Maintaining the garden (planting/growing)
- **Step 3** - Harvesting garden produce
- **Step 4** - Storing garden produce
- **Step 5** – Preparing and serving garden produce



Personal hygiene

Important at all steps

- Proper handwashing - after working in the garden, using the bathroom, *before* preparing fruits and vegetables
- Awareness of illness symptoms. If ill, especially diarrhea, have someone else do the gardening.
- Covering of open cuts and sores - bandages, gloves



Copyright © International Association for Food Protection

Preparing garden for planting: Use of Manure

Not recommended

Why not?

While animal manure can provide nutrients, it can also be a source human pathogens (Listeria, Salmonella, E. coli 0157:H7)



Preparing Garden for Planting: Manure



If used, be aware:

- Best if thoroughly composted
- Apply fresh manure in the late fall, after harvest
- If using fresh manure prior to growing season
 - ✓ Spread two weeks before planting
 - ✓ NO harvesting 120 days after application
- Thoroughly incorporate into soil – NO side dressing
- Do not touch edible crop – survival!
- Keep animals out!



Compost/Manure Application

2013 Study Concludes: Need to be aware of hazards associated with using raw manure to fertilize home gardens.

- **Salmonella isolated from manure – horses, wild turkeys.**
- **Salmonella isolated from garden soil – horse manure source?**
- **Viable Salmonella persisted for 210 days**
- **Education of public of potential safety hazards using raw manure**

Preparing Garden for Planting: Compost

- **Properly** managed compost produce a **safe** product
- Materials used for a compost contain pathogens.
- Animal waste or meat/dairy scraps should not be added - higher pathogens and odor
 - **Certain animal waste** (poultry, horse, goat) used with caution
 - **No manure from carnivorous animals** (dog, cat)

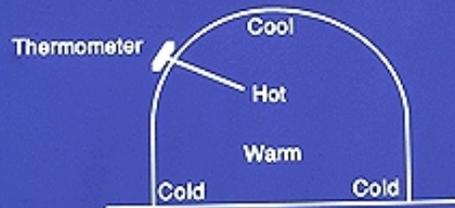


Preparing Garden for Planting: Compost

- Pathogens can be destroyed if the compost reaches a temperature of at least 131°F for 15 days, turning at least 5X – takes a long time.
- All contents of pile to middle – heat generated, proper temperature maintained
 - **Turning regularly aerates**
 - Selects “breakdown” microorganisms
 - Generates heat to destroy pathogens
 - Produces fertile soil amendment.
- Unsure time/temperature, apply in fall after harvest for next planting season.

Temperature of Compost

TEMPERATURE PROFILE OF A COMPOST PILE



Maintaining the Garden: Water Safety

- Water can be the source of a variety of pathogens.
- Produce related outbreaks (*Salmonella*, *Giardia*, *E. coli* 0157:H7, *Cyclospora*) have been attributed to the use of contaminated water for irrigation or produce washing.
- Be familiar with water sources used for the garden.



Maintaining the Garden: Water Safety



- **Municipal or public water systems**
 - Lowest risk.
 - Meets EPA water standards.
- **Private wells** from ground water
 - Tested annually for safety, less likely to contaminate produce than surface.
 - No regulation.
- **Surface water** (lakes, ponds or streams)
 - Most risk - more possible microbial contaminants.
 - Runoff : fertilizers, chemical sewage/animal waste.

Maintaining the Garden: Water Safety



Only potable/clean water should have contact with the edible portion of the crop close to or at harvest and post-harvest handling.

This water is clean and safe to drink.

Maintaining the Garden: Water Safety by Testing



Where can you go to get water tested?

- RIDOH water testing
- Private, certified testing labs
- <http://www.uri.edu/ce/wq/has/PDFs/Standards.pdf>
- www.health.ri.gov/labs - certified labs
 - private well testing
 - analytical



Maintaining the Garden:

Water Safety - Protecting well water

- **Location, location!!** – Local/state regulations, away from pollution sources
- Well clear of debris
- Well casing - are there cracks or holes?
- Well cap – pest proof, screened vents, tamper proof
- Well age - older wells may have problems, examined by expert
- Well type - drilled wells vs. dug (shallow) wells
- Well depth - deeper wells are more protected
- **Test, test, test !!! 1-2 times/year. Coliforms or generic E.coli indicates contamination.**



Maintaining the Garden: Water Safety - Protecting Water

Backflow Prevention

Occurs when contaminated water (non-potable) gets drawn into or flows back into clean water (potable) supply resulting in:

- **Back-siphonage** - a loss of water pressure (negative water pressure) anywhere in the water supply system.
- **Back-pressure** water source pressure greater than the supply source



Maintaining the Garden: Water Safety - Backflow prevention

- Look where potable and non-potable water are connected (cross-connections)
 - Disconnect sprayers or chemical containers from a hose attached to an outside faucet
- Purchase backflow prevention devices
 - Hardware store, plumbing supply
 - Hose bib for end of hose
 - Consult plumber, check building codes.

Examples of Hose Bibs



Maintaining the Garden: Wild and Domestic Animals

Animals are a source of pathogens

- Keep pets out of garden
- Wild animals - how?
 - ✓ Minimize vegetation around gardens - nesting places for animals
 - ✓ Fencing, noise for deterrents
 - ✓ Contact garden shop - new ideas
 - ✓ Contact University Extension



Maintaining the Garden: Organic Gardening

- Microbial food safety is an issue whether a gardener uses organic or conventional gardening methods
- Microorganisms are in the environment - air, soil or water
- Steps to a food safe home garden must still be followed.



Harvesting Garden Produce

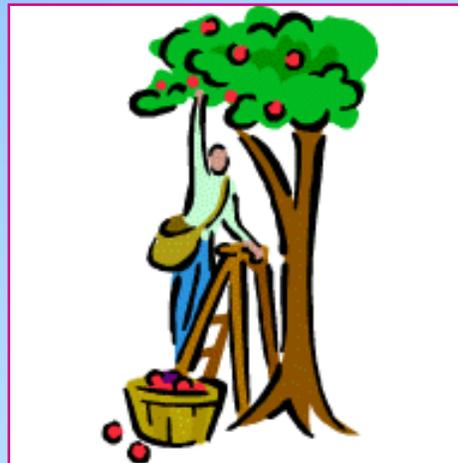
Humans are major source of disease transmission in food.

- Always practice personal hygiene - wash hands before and after harvest.
- Avoid picking or use single-use gloves when ill or when there is a wound.
- Harvest using clean, food-grade containers. Don't leave damaged produce in them.



Harvesting Garden Produce

- **Change/wash dirty clothes/shoes after working in the garden**
- **Though tempting to eat what has just been harvested, properly wash all fruits and vegetables prior to eating**



Post-harvest handling: Storage/Washing

Keys to storage and safety/quality:

- Different fruits/vegetables need different storage conditions
- Temperature and humidity key to long term storage
 - Cool/dry - 50-70 °F and 60% RH
 - Cold/dry - 32-40 °F and 65% RH
 - Cold/moist - 32-40 °F and 95% RH
- Home refrigerators generally cold and dry (40 °F 50-60% RH)
- Some conditions hard to maintain in typical home
- 25% decrease in shelf-life with every 10 F increase above optimum.

Post-harvest Handling: Storage/Washing

Keys to storage and safety/quality:

- **Ripen** some produce before refrigeration e.g. apples, tomatoes, melons.
- **Store** certain produce in cool, dry, well ventilated, clean places e.g. onions, potatoes.
- **Store** produce **above** meat, poultry, fish - avoid **cross-contamination** by separation.
 - Contamination of food by **harmful bacteria** from other food, “food-contact” surfaces, or people.
 - Important for produce – ready-to-eat



Post-harvest Handling: Storage/Washing

Keys to storage and safety/quality (con't):

- **Look** for signs of spoilage - throw out
- **Refrigerate** raw pre-cut or cooked produce in covered containers
- **See chart**



Post-harvest Handling: Storage/Washing

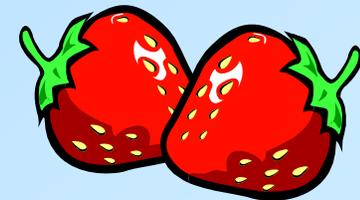
To Wash or Not to Wash :
That is the Question?

Should home gardeners
wash produce after
harvest and
before storage ?



Post-harvest Handling: Storage/Washing

- If wash before storage you must **thoroughly** dry to prevent spoilage and mold growth
- If do not wash before storage, shake, rub, brush dirt off. Refrigerate in clean, plastic bags to prevent contamination other foods. Perforated bags may be better.
- Some produce should not be washed before refrigerated storage (e.g. berries)
- See chart
- **Always** wash just prior to eating



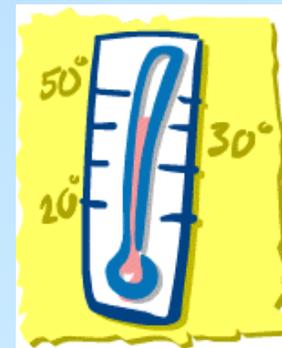
Post-harvest Handling: Storage/Washing

- Temperature of wash water can impact safety of some fruits and vegetables
- Water much colder than the produce may cause pathogens to be absorbed through the stem or blossom end
- Wash water should not be more than 10°F degrees colder than the produce.



tomatoes
peppers

potatoes
apples



Post-harvest Handling: Preparing/Serving/Preserving

- Practice good personal hygiene and wash hands before preparation
- **Always** wash produce in cool, clean running water just before eating or preparing
 - Removes remaining filth and bacteria
 - Pesticides are not the target - follow directions for application and harvest time.



Post-harvest Handling: Preparing/Serving/Preserving

- **Do not** use soap or detergent
- **Bleach not recommended for home use** - household bleach not approved for food
- **Wash/scrub the skin/rind with brush-**
bacteria on the outside
can be transferred to the
inside, edible portion
when produce is cut
or peeled



Post-harvest Handling: Preparing/Serving/Preserving

- Cut away bruised or damaged areas - higher probability of bacteria or mold contamination
- Avoid cross-contamination when preparing - clean work area and utensils.
 - Raw and to be cooked
- If cooked, store leftovers in refrigerator in covered container



Preservation

National Center for Home Preservation:

<http://www.uga.edu/nchfp/index.html>

Home Food Preservation:

USDA Complete Guide to Home Canning

http://www.csrees.usda.gov/newsroom/news/2011news/home_canning_guide.html

Home Canning (Ball/Kerr)

<http://www.freshperserving.com/home.aspx>

URI Food Safety Website

<http://web.uri.edu/foodsafety/foodPreservation/>



Browser address bar: <http://web.uri.edu/foodsafety/>

Navigation: HOME | LINKS | CONTACT US

UNIVERSITY OF RHODE ISLAND FOOD SAFETY EDUCATION

College of the Environment and Life Sciences

[URI Homepage](#)

- Commercial Growers of Fruits & Vegetables
- Consumers
- Educators
- Food Service Industry
- School Policy Makers
- Seafood Processors
- Volunteer Food Service Worker Training
- Food Preservation
- Garden to Table Outreach Program
- Food Safety for Home Gardeners
- RCCI Curriculum Package
- Food Safety Conferences

WELCOME TO THE URI FOOD SAFETY EDUCATION SITE

Cooperative Extension
Department of Nutrition and Food Sciences
College of the Environment and Life Sciences



University of Rhode Island
FOOD SAFETY EDUCATION

We have a variety of information and publications available for everyone from consumers to food service employees. Please navigate through our site using the links on the left, and don't hesitate to contact us for more information.

 **Questions? Comments?**
Our experts are here to help you. Call our Hotline, 1-800-448-1011, Monday-Thursday, 9 a.m. - 2 p.m.

Educational Programs and Trainings Offered:

- RI Good Agricultural Practices(RI GAP)
- Home Garden GAP
- Seafood HACCP
- Meat and Poultry HACCP
- Food safety training for teachers of transition and special education students
- Home Food Preservation workshops
- Food safety training for Residential Child Care Institutions
- Food safety training for volunteer foodservice workers
- Produce safety training for school foodservice directors

THINK BIG  WE DO

Copyright © 2014 University of Rhode Island.
A-Z - Directory - Contact Us - Alerts - Jump to top

<http://web.uri.edu/foodsafety>

Questions ???

