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Food Safety from Garden to Plate

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Objectives

- Participants will learn
 - how to prepare and maintain a garden.
 - harvesting food safety tips.
 - how to handle produce after it is picked.
 - how to safely prepare fresh produce.
 - fresh produce storage tips.




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Have You Ever Thought?

- You impact the quality and safety of the fresh produce that you eat, give or sell to others!
- Ask yourself if the produce you harvest, prepare and handle is something that you would accept from someone else or buy from another source.


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Examples of Produce Involved in Foodborne Outbreaks

Rank	Food	Pathogen	Outbreaks	Associated Illnesses	Illnesses per Outbreak
1	Greens-Based Salad	Norovirus	144	5,353	37.2
2	Lettuce	Norovirus	30	1,025	34.2
3	Spouts	Salmonella	24	1,875	78.1
4	"Fruit"	Norovirus	22	1,656	74.4
5	Greens-Based Salad	Salmonella	20	1,033	51.7
6	Melon	Salmonella	16	1,137	71.1
7	Mushrooms	Chemicals/Toxins	16	82	5.1
8	Greens-Based Salad	E. coli	15	791	52.7
9	Lettuce	E. coli	14	382	27.3
10	Potato	Salmonella	14	206	14.7

PRODUCE outbreaks from 1990-2005, Outbreak Alert, 2008

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1998-2007 Produce Outbreaks

5 commodity groups make up >75 percent of produce related outbreaks

Commodity	% Produce Outbreaks
Lettuce/leafy greens	31%
Tomatoes	18%
Cantaloupe	13%
Herbs (basil, parsley)	8%
Berries	8%
Total % of 5 top commodities	78%

Data provided by Jack Guzewich, FDA
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What does this have to do with home gardeners?

- Increase in US households growing vegetables
- Under reporting of food borne illness
- Estimated 50% of food borne illness occurs from exposure to pathogens at home
- Consumers not likely to consider food from own homes as a source of illness
- Survey shows lack of food safety knowledge for home gardeners

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Commercial or Home Gardeners

- **Home Gardens - many issues the same**
 - Water safety
 - Domestic/Wild animals
 - Use of compost
 - Use of manure
 - Personal hygiene/sanitation
 - Post-harvest handling
 - Temperature control



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Food Safety Review

If a food looks, tastes and smells perfectly normal is it safe to eat?


- a. Yes
- b. No
- c. Try and see
- d. Maybe and maybe not
- e. Do not know

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B. No. You won't spot unsafe food by using your senses



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A "tiny taste" will not protect you.
... as few as **10-100 bacteria** could make you sick!



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Food Safety Hazards: 3 Types of Contamination

		
Physical	Chemical	Biological
Plastic Glass Metal Wood Bandages Jewelry and other personal items	Allergens Pesticides Sanitizers Lubricants	Parasites Viruses Bacteria

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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: patulin in apples



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Biological Food Safety Hazards

What are the differences?

- Parasites
- Viruses
- Bacteria



Cryptosporidium parvum



Norwalk virus



Salmonella spp.

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Sources of Biological Contamination

- Animals (wild and domestic, and manure)
- People
- Environment






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Where Do They Come From?

- Bacteria** - Greatest number of foodborne illnesses
Escherichia coli O157:H7 and *Salmonella*
- Virus** - *Norovirus* #1 cause of produce-related illnesses
- Parasite** - *Cyptosporidium parvum* and *Cyclospora cayatanensis* clearly linked to consumption of fresh produce or fresh-squeezed juice



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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






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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

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Personal hygiene

- Wash your hands with hot water and soap for at least 20 seconds after working in the garden, using the bathroom, **before and after** handling fresh produce, and **before** preparing fruits and vegetables.
- Be aware of illness symptoms. If ill, especially diarrhea, have someone else do the gardening. 
- Avoid touching your mouth, lips, eyes, face, or hair when harvesting, handling, or preparing produce.
- Cover open cuts and sores.


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Preparing garden for planting: Use of Manure

While animal manure can provide nutrients, it can also be a source human pathogens.

Fresh manure not recommended for use, however.....



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Preparing Garden for Planting: Manure

If used, be aware:

Best if manure **thoroughly** composted

- Apply fresh manure in the late fall, after harvest
- If using fresh manure just prior to growing season
 - ✓ Spread **two weeks** before planting
 - ✓ **NO** harvesting until **120 days** after application
- Incorporate into soil – **NO** side-dressing
- Avoid root or leafy crops the year of manure application

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Pathogens associated with animal manure

Bacteria	Manure found	Compost/Soil Survival
<i>Salmonella</i>	A, R, S, I, W	56 – 180 days
<i>E. coli O157:H7</i>	R, S, I, W	up to 230 days
<i>Campylobacter</i>	A, C, I, W	unknown
<i>Listeria</i>	S, C, W	

Parasites	Manure found	Compost/Soil Survival
<i>Cryptosporidium</i>	R, S	12 weeks
<i>Giardia</i>	R, S, W	7 weeks
<i>Cyclospora</i>	A?,	?

Key: A - avian; R – ruminants (deer, cattle); S – swine; I – insects; W – wild animals other than ruminants

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A word on infectious dose

Infectious dose is the number of organisms required to make an individual ill.

At risk individuals require fewer – EPIC population

Examples:

Norovirus	10 – 1000 viruses	shed billions/gram
<i>E. coli O157:H7</i>	100 or so	
<i>Salmonella</i>	100 to millions	
<i>Campylobacter</i>	75 in milk	
<i>Listeria</i>	100s	pregnant and infants
Parasites	1 to 10 cysts	

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Preparing Garden for Planting: Compost

Properly managed compost can produce a safe product



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Preparing Garden for Planting: Compost

Pathogens can be present in compost materials with more in animal waste and meat/dairy scraps.

What should you do?

- **Animal waste or meat/dairy scraps:** should not be used
- **Temperature:** should be at least **130°F for 3 days** to destroy pathogens
- **Size:** at least **27 cubic feet** - smaller needs more attention to get heat
- **Turn:** turn pile regularly to aerate





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Maintaining the Garden: Water Safety


- Water can be a source of a variety of pathogens.
- Know the source of water used for your garden.




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Maintaining the Garden: Water Safety




- Municipal or public water** systems - best source and lowest risk of water for any use
- Surface water** (lakes, ponds or streams) more likely to have microbial contaminants
- Private wells** from ground water - safe if tested annually
- Use **only clean, potable/drinkable** water to water or wash produce close to or at harvest and during post-harvest handling


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Maintaining the Garden: Water Safety - Protecting well water

- Keep away from pollution sources
- Check well casing, cap, age, type, depth
- Test 1-2 times/year**




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Maintaining the Garden: Water Safety - Protecting Water

Backflow – What is it?
Occurs when contaminated water (non-potable) gets drawn into or flows back into clean water (potable) supply

Example: Back Siphoning




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Maintaining the Garden: Water Safety - Protecting Water


Backflow Prevention:


- **Disconnect** sprayers or chemical containers from a hose attached to an outside faucet after use
- **Purchase** backflow prevention devices
 - Hardware store, plumbing supply
 - Hose bib for end of hose
 - Consult plumber, check building codes

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Examples of Hose Bibs




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Maintaining the Garden: Wild and Domestic Animals

Animals are a source of pathogens


- Keep pets out of garden
- Deter wild animals
 - ✓ Minimize vegetation around gardens
 - ✓ Deterrents - fencing, noise
 - ✓ New ideas - garden shops
 - ✓ Call Extension for help




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Spinach Outbreak



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Maintaining the Garden: Organic Gardening

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



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Five Steps to Food Safe Home Gardening

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Harvesting Garden Produce

Humans are major source of disease transmission in food

- Personal hygiene – washing, covering wounds
- Change, wash dirty clothes/shoes after working in the garden
- Harvest using clean, food-grade containers




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Harvest Containers

- Sanitation is Key!
 - Use food-grade containers.
 - Do not use containers that held chemicals, cleaning agents or pesticides.
 - Sanitize containers after harvest.
 - Dunk containers in clean hot water.
 - Dunk in 10% bleach solution.
 - Rinse in clean, hot water. Allow to air dry.
 - Use clean paper bags as a one-use product only!

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Small Harvesting Equipment


- Keep knives and pruners sharp!
- Sanitize knives and pruners after each harvesting session with 10% bleach solution.
- Keep wheelbarrows and garden carts clean.
- Do not allow produce to rot in wheelbarrows or carts.
- Keep vehicle beds clean and use clean containers to move freshly picked produce.
- Park carts and vehicles away from possible animal contamination!

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Fresh Produce Harvesting


- Gently handle produce during harvest when picking or digging to reduce damage.
- Damaged produce can provide cracks bruises or breaks for soil, manure, and bacteria to enter.
- Damaged produce also has a shortened shelf life and is less appealing to potential consumers.


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Fresh Produce Harvesting

- A natural break point forms at the junction of the stem and the stalk when produce is mature. Harvesters should grasp the product firmly but gently and pull upward as illustrated below.





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Harvesting Garden Produce

- Dispose of damaged fruit
- **Don't** eat directly from the garden! Properly wash all fruits and vegetables prior to eating




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


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Post-harvest Handling: Storage/Washing

Should you wash produce **after** harvest and **before** storage ?

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





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Post-harvest Handling: Storage/Washing

- Washing before storage requires **thorough** drying to prevent spoilage and mold growth. Store in clean bins or containers.
- Not washing before storage - shake, rub, brush dirt off. Refrigerate in clean, plastic bags.
- Some produce should not be washed before refrigerated storage (e.g. berries).
- Refrigerated fruits and vegetables should be stored at 40 degrees Fahrenheit or less.
- **Always** wash just prior to eating.





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Post-harvest Handling: Washing

- Very cold water may cause pathogens to be absorbed into the produce through stem or blossom end
- Wash water should not be more than **10 degrees** colder than the produce.
- Always use a continuous stream of water when rinsing produce.
- **Do not** use soap to wash produce.



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Do Not Do This!

Dye Infiltration in Cantaloupe



Photo courtesy of Dr. Michele Smith, FDACFSM

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How long will fruit last?

- **Approximate Shelf Refrigerated Shelf Lives**
- Apples (until ripe) 1 Month
- Citrus 2-6 Weeks
- Grapes 1-3 Weeks
- Melons (most varieties) 1 Week
- Peaches and Nectarines 2-3 Weeks
- Pears (Mature, Not Fully Ripe) 1-3 Months
- Pineapple (Ripe) 1 Week
- Berries* 2-3 Days

* From University of Rhode Island Extension
Food Storage – Julie Albrecht – UNL Extension

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How long will vegetables last?

- **Approximate Shelf Refrigerated Shelf Lives**
- Asparagus 2-3 Days
- Broccoli 3-5 Days
- Green Peas 3-5 Days
- Green Onions 3-5 Days
- Lima Beans 3-5 Days
- Rhubarb 3-5 Days
- Greens 3-5 Days
- Summer Squash 3-5 Days
- Mushrooms 3-5 Days

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How long will vegetables last?

- **Approximate Shelf Refrigerated Shelf Lives**
- Cabbage 1 Week
- Cauliflower 1 Week
- Celery 1 Week
- Cucumber 1 Week
- Snap Beans 1 Week
- Lettuce 1 Week
- Peppers 1 Week
- Tomatoes 1 Week

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How long will vegetables last?

- **Approximate Shelf Refrigerated Shelf Lives**
 - Carrots 2 Weeks
 - Beets 2 Weeks
 - Parsnips 2 Weeks
 - Radishes 2 Weeks
 - Turnips 2 Weeks
 - Corn 1 DAY


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How long will vegetables last?

- **Approximate Shelf Refrigerated Shelf Lives**
 - White Potatoes* 1 Week
 - Sweet Potatoes* 1 Week
 - Winter Squash* 1 Week
 - Rutabagas* 1 Week
 - Dry Onions* 1 Week


* Several Months at 50-60 Degrees Fahrenheit

Food Storage – Julie Albrecht – UNL Extension
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Post-harvest Handling: Preparing


- Practice good personal hygiene - wash hands before preparation
- Sanitize countertops and surfaces before starting
- Use only clean knives and other food equipment
- Avoid cross-contamination: if possible use a cutting board designated for produce


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Post-harvest Handling: Preparing

- Wash produce in clean running water just before eating or preparing - do not dunk in a container of water (use correct temperature of water)
- Do not use soap or detergent
- Bleach not recommended for home use
- Wash/scrub the skin/rind with brush
- Cut or remove bruised or damaged areas



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Produce Storage and Safety

- Store cut, sliced or cooked produce in clean, airtight containers in refrigeration at or below 40 degrees Fahrenheit.
- Use fresh and prepared produce quickly to enjoy product quality and freshness.
- Do not stack food container tightly together in the refrigerator to allow air circulation.

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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



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Questions??

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Resources

- “Garden to Table” 5 Steps to Food Safety Fruit and Vegetable Home Gardening New England Food Safety Partnership USDA Funded Project – 2003-5111001713
- Farm Food Safety Training With GAPs – University of Nebraska-Lincoln Extension
- Five Steps to Food Safe Fruit and Vegetable Home Gardening – University of Rhode Island Extension
- Food Safety in the School Garden – University of Maryland Extension
- Food Storage – University of Nebraska-Lincoln Extension
- Small Scale Post Harvesting Practices – University of California-Davis Extension

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