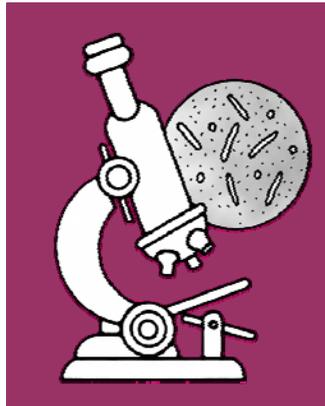


GARDEN TO TABLE: FIVE STEPS TO FOOD SAFE FRUIT AND VEGETABLE HOME GARDENING

Food Safety and Your Garden Produce

Increasingly, foodborne illness outbreaks are being traced to lettuce, tomatoes, cantaloupe and other fresh fruits and vegetables. The reason may simply be that we are eating more fruits and vegetables. And, we often eat them raw.

Foodborne illness can be caused by food safety hazards that can be from a biological, chemical or physical origin. Most food borne illness is caused by **biological food safety hazards**, including the bacteria, viruses, molds and parasites found on raw produce that is not carefully washed or prepared. Many of these can make you sick. The microorganisms that make you sick are called “**pathogens**.”



Bacteria can cause foodborne illness. Two examples are *Salmonella* and *Listeria*. While bacteria can be found in the water, soil or on plants, the source is usually people, animals or animal waste. Contaminated water, including the surface water (pond, stream) used in your garden, is a possible source of **viruses**. Hepatitis A is a virus that can be transmitted through food or water. Infected food handlers may also contaminate food with viruses. **Parasites** can be found in contaminated water or on the dirty hands of an infected food handler. They may be carried by wildlife as well. *Cyclospora cayetanensis* is a parasite that has been found on fresh produce.

These microorganisms are a natural part of the environment and can be a problem whether you choose to use organic or conventional gardening methods.

Many of us grew up thinking it was safe to simply cut or scrape away mold and eat the rest of the food. However, new research tells us that **molds** are not only unsightly--they often produce toxins or poisons that can make a person ill. Some are potentially cancer causing. Patulin is a mold toxin that can grow on fruit (especially apples), grains and cheese. Some people are very allergic to molds.

Though rare, **chemical food safety hazards** can contaminate food. Cleaning solutions, fertilizers, and pesticides can be food safety hazards. Heavy metals (lead) and other chemicals may be found in garden soil or well water.

Be sure to:

- Use pesticides and insecticides according to the directions for food crops. (1)

| Fruit/ Vegetable | Storage method/time | Tips |
|--|--|---|
| Melons (Watermelon, Honeydew, Cantaloupe) | At room temperature until ripe Refrigerator: 3 to 4 days for cut melon | For best flavor, store melons at room temperature until ripe. Store ripe, cut melon covered in the refrigerator. Wash rind before cutting. |
| Nectarines, Peaches, Pears | Refrigerator crisper: 5 days | Ripen the fruit at room temperature, and then refrigerate in plastic bags. Wash before eating. |
| Onions (Red, White, Yellow, Green) | Dry onions: Room temperature 2 to 4 weeks; green onions: Refrigerator crisper: 3 to 5 days | Store dry onions loosely in a mesh bag in a cool, dry well-ventilated place away from sunlight. Wash green onions carefully before eating. |
| Peas | Refrigerator: 2-3 days | The sugar in peas quickly begins to turn to starch even while under refrigeration, so eat quickly after harvesting. Store peas in perforated plastic bags. Wash before shelling. |
| Peppers | Refrigerator crisper: up to 2 weeks | Wipe clean and store in plastic bags. Wash before using. |
| Potatoes | Room temperature: 1 to 2 weeks | Store potatoes in a cool, dry, well-ventilated area away from light, which causes greening. Scrub well before cooking. |
| Summer squashes (zucchini, patty pan) | Refrigerator: 2-3 days | Wipe clean and store in plastic bags. Wash before using. |
| Tomatoes | Room temperature; once cut, refrigerator crisper: 2 to 3 days | Fresh ripe tomatoes should not be stored in the refrigerator. Refrigeration makes them tasteless and mealy. Wipe clean and store tomatoes at room temperature away from sunlight. Wash before eating. (Refrigerate only extra-ripe tomatoes you want to keep from ripening any further.) Store cut tomatoes in the refrigerator. |
| Winter squashes, pumpkins | Room temperature for curing; then cool, dry storage area for 3 to 6 months. | Most winter squash benefits from a curing stage; the exceptions are acorn, sweet dumpling and delicata. Wipe clean before curing. Curing is simply holding the squash at room temperature (about 70 degrees) for 10 to 20 days. After curing, transfer to a cool (45 to 50°F), dry place such as the basement or garage for long term storage. Do not allow them to freeze. The large hard rind winter squash can be stored up to six months under these conditions. Warmer temperatures result in a shorter storage time. Refrigeration is too humid for whole squash, and they will deteriorate quickly. The smaller acorn and butternut do not store as well, only up to 3 months. Store cut pieces of winter squash in the refrigerator. |

FRESH PRODUCE STORAGE CHART

| Fruit/ Vegetable | Storage method/time | Tips |
|--|---|--|
| Apples | Room temperature: 1-2 days; refrigerator crisper: up to 1 month | Ripen apples at room temperature. Once ripe, store in plastic bags in the crisper. Wash before eating. |
| Asparagus | Refrigerator crisper: up to 3 days. | Once picked, asparagus loses quality quickly. Wrap the base of a bunch of asparagus with a moist paper towel, place in a plastic bag and store in the refrigerator. Wash before using. |
| Beans, green or yellow | Refrigerator crisper: up to 3 days | Store in plastic bags. Do not wash before storing. Wet beans will develop black spots and decay quickly. Wash before preparation. |
| Broccoli | Refrigerator crisper: 3 to 5 days | Store in loose, perforated plastic bags. Wash before using. |
| Beets, Carrots, Parsnips, Radish, Turnips | Refrigerator crisper: 1 to 2 weeks | Remove green tops and store vegetables in plastic bags. Trim the taproots from radishes before storing. Wash before using. |
| Berries (Blackberries, Raspberries, Strawberries, Blueberries) | Refrigerator crisper: 2-3 days | Before storing berries, remove any spoiled or crushed fruits. Store unwashed in plastic bags or containers. Do not remove green tops from strawberries before storing. Wash gently under cool running water before using. |
| Brussels sprouts | Refrigerator crisper: 1-2 days | The fresher the sprouts, the better the flavor. Remove outer leaves and store fresh sprouts in plastic bags. Wash before using. |
| Cabbage | Refrigerator for up to 2 weeks. | Store, after removing outer leaves, in perforated plastic bags. |
| Chard | Refrigerator crisper: 2-3 days. | Store leaves in plastic bags. The stalks can be stored longer if separated from the leaves. Wash before using. |
| Collards | Refrigerator crisper: 4-5 days | Collards store better than most greens. Wrap leaves in moist paper towels and place in sealed plastic bag. When ready to use wash thoroughly. Greens tend to have dirt and grit clinging to the leaves. |
| Corn | Refrigerator crisper: 1 to 2 days | For best flavor, use corn immediately. Corn in husks can be stored in plastic bags for 1 to 2 days. |
| Cucumbers | Refrigerator crisper: up to 1 week | Wipe clean and store in plastic bags. Do not store with apples or tomatoes. Wash before using. |
| Eggplant | Refrigerator: 1-2 days | Eggplants do not like cool temperatures so they do not store well. Harvest and use them immediately for best flavor. If you must store them, store in a plastic bag in the refrigerator. Be careful as it will soon develop soft brown spots and become bitter. Use while the stem and cap are still greenish and fresh-looking. |
| Herbs | Refrigerator crisper: 2 to 3 days | Herbs may be stored in plastic bags or place upright in a glass of water (stems down). Cover loosely with plastic bag. |
| Lettuce, spinach and other delicate greens | Refrigerator crisper: 5 to 7 days for lettuce; 1 to 2 days for greens | Discard outer or wilted leaves. Store in plastic bags in the refrigerator crisper. Wash before using. |

- Keep all garden and household chemicals in the original, labeled container. If you mix chemicals in another container, label before use. Clean the used container and throw it away.
- Check well water to be sure it does not contain chemical hazards, including lead.
- Check the soil for lead or other heavy metals before planning a new garden, particularly if you live on a busy street or industrial area.

When lead is a concern: If your garden is close to busy streets or highways, remove outer leaves of leafy crops, peel all root crops, and thoroughly wash the remaining produce in water containing vinegar (1 percent). In general, plants do not absorb lead, though in gardens with high-lead soils it is possible for some lead to be taken up. Higher concentrations are more likely to be found in leafy vegetables (e.g., lettuce) and on the surface of root crops (e.g., carrots). There is more concern about lead on the surface of unwashed produce than from uptake by the plant itself.

Food may also become contaminated as a result of a **physical food safety hazard**. Sometimes these hazards can result in injury. To prevent this from happening:

- Check for stones or slivers and burrs from wood or plastic harvest containers.
- Keep glass away from the garden.

Personal Hygiene- Five Steps to Food Safe Gardening

Because foodborne illness can often be traced back to the people who handle food, it is important to use good personal hygiene habits when harvesting or preparing produce for storage or eating. For example:



- ✓ After working in the garden always wash your hands well with soap and warm water. Use a nail brush to clean soil from under fingernails. Dry with a paper towel.
- ✓ Change out of clothes and shoes soiled with garden dirt and debris before going into the kitchen.
- ✓ Ask a family member or friend to pick your produce if you're sick – especially if you have diarrhea. Or, wash your hands and use clean disposable plastic gloves to pick produce. Hands with infected cuts or sores can also contaminate produce as you harvest. Cover cuts or sores with a clean bandage and disposable gloves. [Gloves will also protect a cut on your hand from infection by microorganisms in the soil or on the produce].
- ✓ Always wash your hands *before* you prepare fruits and vegetables for a meal or snack.

Follow the five simple steps listed here and reduce the risk of someone suffering a food borne illness after eating produce from your home garden

STEP 1-PREPARING THE GARDEN FOR PLANTING

Location

We usually make decisions about garden location based on sun exposure, soil type and moisture and convenience. Consider food safety too. Locate vegetable gardens away from manure piles, well caps, garbage cans, septic systems and areas where wildlife or farm animals roam.



Compost

Compost is the natural breakdown product of leaves, stems, manures and other organic materials. Pathogens can be found in decaying organic matter. A well managed compost pile (of at least 27 cubic feet) can generate enough heat to destroy pathogens. To be effective, your compost must reach a temperature of at least 131°F for 15 days – turn at least 5 times. If your compost pile is smaller than this, or, if you do not manage it properly, pathogens and weed seeds can survive. You need to turn the pile regularly so the entire pile can get properly aerated, and all contents of the pile will get to the middle where heat is generated and proper temperature can be maintained. Include ingredients that will break down. Coffee grounds and grass clippings (do not use if treated with pesticides or herbicides) can help to produce more heat. If time/temperature is not monitored and met or you are just unsure, the recommendation is to apply compost in late fall – after harvest.

The best way to know if your compost is getting hot enough to kill pathogens is to check the temperature with a compost thermometer. You can buy one at a garden supply store. If you cannot measure the temperature of your pile or if you are unable to turn and manage it regularly, then treat your compost like uncomposted manure and spread it in the garden late in the fall.

Even though commercial composters use horse and dairy manures in their “recipes”, home gardeners should not use any animal waste, including pet waste. Animal waste may contain pathogens that might not be destroyed during the compost process. You should also not put meat scraps or dairy product waste into your compost bin. These too can carry pathogens and attract animals to your pile.

STEP 2- MAINTAINING THE GARDEN

Protection from wild animals/household pets

Any animal can be the source of pathogens. During the growing and harvesting season, keep cats, dogs and other pets out of the garden. Wild animals can be a bigger problem.

(3)

Be sure to wash your hands (as well as the knife and cutting surface) before preparing any ready-to-eat foods such as salad, fresh fruit or a sandwich. If you have leftover produce that has been cut, sliced or cooked, store it in clean, air-tight containers in the refrigerator at 40°F or less.

PRESERVING FRESH GARDEN PRODUCE



Canning, freezing or drying fruits and vegetables allows you to enjoy the fruits (or vegetables) of your labor all winter long. If you choose to preserve the produce from your garden, it is essential to know how to do it safely. Choose and follow recipes and methods that are tested by a United States Department of Agriculture (USDA) endorsed source such as Cooperative Extension.

For more information, processing times, and recipes for canning, freezing and drying, please contact your local Cooperative Extension office or visit the following web sites:

1. The National Center for Home Food Preservation offers tested recipes and procedures.
<http://www.uga.edu/nchfp/index.html>
2. The USDA Complete Guide to Home Canning
http://nchfp.uga.edu/publications/publications_usda.html
3. Ball Canning
<http://www.freshpreserving.com/home.aspx>

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(8)

Some fresh produce (onions, potatoes, tomatoes) is of better quality when not refrigerated. Storage areas should be clean and dry. Fruits and vegetables stored at room temperature should be in a cool, dry, pest-free, well-ventilated area separate from household chemicals. All stored produce should be checked regularly for signs of spoilage such as mold and slime. If spoiled, toss it out.

Check the chart at the end of this brochure for specific fruit and vegetable storage recommendations

STEP 5-PREPARING AND SERVING FRESH GARDEN PRODUCE

We eat almost all fresh fruit and vegetables raw. Therefore, as we cannot rely on the heat of cooking to destroy pathogens that might be on lettuce or tomatoes, it is important to prepare raw produce with food safety in mind.



Always wash your hands first. Rinse fresh fruits and vegetables under cool, running, clean water (even if they were washed before storage). Even if you do not plan to eat the skin or rind, wash the produce. Rub or brush firm-skinned fruits and vegetables under running water. Wash delicate berries and greens by placing them in a colander or strainer and rinsing with a gentle stream of water or use a kitchen sink sprayer. Shake, and then turn the colander while spraying. Cut away any bruised or damaged areas with a clean

knife. Never use soap or detergent to wash fresh fruits or vegetables. They may be absorbed through the skin and are not approved for this use. Bleach or a bleach solution is not recommended for rinsing produce in the home kitchen. Soap and bleach solutions may affect flavor and are not safe to ingest.

Avoid cross-contamination when preparing fruits and vegetables. **Cross-contamination** occurs when a clean work surface such as a cutting board or utensil (paring knife) or uncontaminated food is contaminated by dirty work surfaces, utensils, hands or food. This can happen when, after handling raw meat, fish or poultry, eggs or raw unwashed vegetables, you continue to prepare ready-to-eat foods without washing your hands or the utensils, cutting boards or dishes that were used to prepare the raw foods. For added protection kitchen sanitizers can be used on cutting boards and countertops.

Do not allow piles of decaying plant matter to collect in the garden (unless it is in the compost bin). Eliminate nesting and hiding places for rats and mice by minimizing vegetation at the edges. Do not feed wild animals, even birds, near your garden. Fencing and/or noise deterrents may help discourage other wild animals.

Water source

Whether you use a garden hose, a watering can or a drip irrigation system, your water source could contaminate your garden produce with pathogens. To prevent this from happening, be familiar with the quality and safety of the water source(s) you use in your garden.



Potable water is water that is clean and safe to drink. Public water supplies are monitored and treated for contaminants.

Pathogens are more likely to be found in *surface water* (lakes, ponds, rivers and streams). These water sources are non-potable. Surface water can be polluted by human sewage or animal waste, fertilizers and pesticides from lawns and farm fields, or chemicals from industry.

Ground water (which is the source for *well water*) is less likely to have microbial contaminants than surface water. However, if a well is your water source, you need to take a little more care to be sure that it is providing you with safe, clean water. Well water originates as rain and snowmelt and filters through the ground. As it soaks through the soil, the water can pick up contaminants that might be on or in the ground. These contaminants can include agricultural chemicals or pathogens such as *E. coli* O157:H7 or *Cryptosporidium parvum*.

Wise management of well water. Test your well water. Private wells are not regulated by any local, state or federal agency. Homeowners should conduct a standard water test at least once a year to determine if their well water meets the standards of the Environmental Protection Agency (EPA). Current drinking water standards are available at: <http://www.epa.gov/safewater/mcl.html>. A standard water test will tell you if your water supply contains “fecal coliforms” and “generic” *E.coli*. The presence of these organisms indicates your well is contaminated with bacteria. A more extensive test will tell you the extent of the problem. When levels exceed health standards, you should take steps to correct the situation.

Test whenever you notice a change in color, odor or taste of your drinking water. Have your samples tested by a state approved laboratory. For more information on water testing contact your Cooperative Extension water quality program in your state or your local or state health department.

Know your well type. Dug (or shallow) wells pose the highest risk of drinking water contamination because they are poorly protected from surface water. All other types of wells, including those constructed by a combination of jetting and driving, are drilled wells. Drilled and/or artesian wells are deeper wells and are more protected from surface contamination.

Keep contaminants away. Keep potential pollutants as far away as possible from your well. Inspect your septic system every one to three years and pump as needed. Never dispose of hazardous materials in or near the septic system. Do not allow runoff from a road, driveway or rooftop to collect around the well. Keep the area around the well clear and free of debris. Keep pet waste, dog runs and livestock away from the well. Avoid mixing or using pesticides, fertilizers, herbicides, oils, fuels and other pollutants near the well.

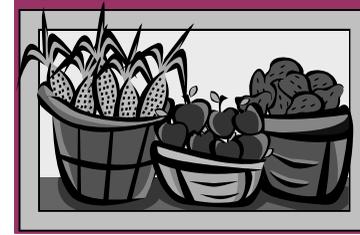
Maintain your well. Every spring, inspect your *well casing*, looking for holes or cracks at the surface, or down the inside of the casing with a flashlight. If you can move the casing around by pushing against it, you may have a problem with your well casing's ability to keep out contaminants.

To prevent contaminants from flowing down the inside of the well casing, be sure you have a tight-fitting, vermin-proof *well cap*. The cap should be installed so that it cannot be removed by children and so bugs and water cannot get in. It should have a screened vent that allows air into the well.

Backflow Prevention

Backflow occurs when contaminated water gets drawn into or flows back into a clean water supply. This can happen when you fill pesticide sprayers or other chemical containers using a hose attached to an outside faucet. A hose sitting in water mixed with chemicals can lead to contamination of a clean water source. (If there is a change in water pressure, this contaminated water can be “sucked” back into the potable water supply.) Backflow devices prevent these chemicals from being drawn into the household water supply if there is a drop in water pressure. You can purchase a “hose bib” backflow prevention device at your local hardware or plumbing supply store. It is best to use backflow prevention devices on all outside faucets with hose connections. You might want to consider contacting a plumber to install a backflow prevention device in your outside faucets. Some towns may have building codes that require these. (5)

STEP 3-HARVESTING GARDEN PRODUCE



When harvesting, use a clean, food-grade container. A **food-grade** container is made from materials designed specifically to safely hold food. Garbage bags, trash cans, and any containers that originally held chemicals such as household cleaners or pesticides are not food-grade.

Remember the rules of personal hygiene when picking produce. Use clean gloves that have not been used to stir compost or pull weeds or clean hands.

After the produce has been harvested, shake or rub off any excess garden soil or debris before bringing it into the kitchen.

STEP 4-STORING GARDEN PRODUCE

To wash, or not to wash? Even the experts disagree when giving advice on washing garden produce. Some tell you not to wash before storage, and some will tell you to wash off any garden dirt before bringing produce into the home. At issue is this: if you bring in fresh produce loaded with garden dirt, you may also bring pathogenic microorganisms into your kitchen. However, if you wash your produce before storage, it may mold and rot more quickly. If you choose to wash fruits and vegetables before storing, be sure to dry them **thoroughly** with a clean paper towel.

The temperature of the wash water can affect the safety of some fruits and vegetables. If the water is much colder than the produce, pathogens may be pulled into fruits or vegetables through the stem or blossom end. So, when washing produce fresh from the warm outdoors, the rinse water should not be more than 10 degrees colder than the produce. If you are washing refrigerated produce, use cold water.

If you choose to store without washing, shake, rub or brush off any garden dirt with a paper towel or soft brush while still outside. Never wash berries until you are ready to eat them. Store fresh produce in plastic bags or containers so they don't contaminate other foods in the refrigerator. Keep fruit and vegetable bins clean.

Fruits and vegetables needing refrigeration can be stored at 40° F or less. If your refrigerator has a fruit and vegetable bin, use that, but be sure to store fresh produce away from (above) raw meats, poultry or fish. (6)

RESOURCES IN YOUR STATE

URI Cooperative Extension Food Safety Education Program
<http://web.uri.edu/foodsafety>

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URI Cooperative Extension Gardening/Food Safety Hotline
1-800-448-1011

URI Water Quality Program
<http://web.uri.edu/cels/water-quality-programs>

Rhode Island Department of Health
<http://www.health.ri.gov/foodprotection/>
<http://www.health.ri.gov/find/labs/privatewelltesting>

Office of Water Quality
<http://www.health.ri.gov/programs/drinkingwaterquality/index.php>

References:

- <http://www.urbanext.uiuc.edu/veggies/index.html>
Watch Your Garden Grow: A guide to growing, storing and preparing vegetables, University of Illinois Extension
- <http://www.extension.umn.edu/garden/yard-garden/vegetables/harvesting-and-storing-home-garden-vegetables/>. Harvesting and Storing Home Garden Vegetables, University of Minnesota Extension Service
- http://www.foodsafety.wisc.edu/assets/pdf_Files/safe_handling_produce.pdf ; Safe handling of Fresh Fruits and Vegetables
http://repository.tamu.edu/bitstream/handle/1969.1/87212/pdf_1902.pdf. ; Safe Storage of Fresh Fruits and Vegetables. Texas Cooperative Extension System, Texas A&M University System.
- <http://ucfoodsafety.ucdavis.edu/files/26396.pdf>,
<http://www.foodsafety.gov/keep/types/fruits/tipsfreshprodsafety.html>,
<http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/UCM174142.pdf> Safe Handling of Raw Produce and Fresh-Squeezed Fruit and Vegetable Juices, FDA.

Garden to Table

Five Steps to Food Safe Fruit and Vegetable Home Gardening



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