

# Food Safety For School and Community Gardens:

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**A Handbook  
for Beginning  
and Veteran  
Garden  
Organizers**

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## Reducing Food Safety Risks in Community Gardens

Creating and maintaining community and school gardens has been identified as an effective strategy to increase healthy food awareness and consumption. Unfortunately, fresh fruits and vegetables have been linked to hundreds of outbreaks of foodborne illness in the U.S. since 1990. In commercial food production, employing a set of risk-reduction steps — known as good agricultural practices (GAPs) — has been pointed to by the U.S. Food and Drug Administration as one part of reducing risks from foodborne illness-causing pathogens.

The Centers for Disease Control and Prevention estimate that 48 million people are sickened with foodborne illness in the United States each year. While most people who become sick from foodborne illness recover quickly, an average of 128,000 hospitalizations and 3,000 associated deaths occur annually.

Contamination of gardens may not only come from biological contaminants (foodborne pathogens) but can also include physical contaminants, (metal, stones, or glass) and chemical contaminants (runoff from parking lots or pesticide drift).

Implementation of GAPs focuses primarily on commercial production, but the food safety principles throughout the GAPs guidelines are also applicable to community and school gardens. The steps presented in this guide are practical, rooted in science, and presented in a context suitable for passionate organizers and volunteers associated with school and community gardens.

# Food Safety In The Garden

There are four topics to think about as you design safety procedures for your garden.

1. Clean and sanitized hands.
2. Safe soil amendments.
3. Safe water.
4. Clean and sanitized surfaces.

The gardener should address each of these topics to effectively reduce risk.



**Bacteria and viruses cannot be easily washed off fresh produce, so limiting contamination is the best practice.**

By preventing the introduction of pathogens into the garden, risks of foodborne illness are minimized, increasing safety of the final products. Good agricultural practices are the basic environmental and operational conditions necessary for the production of the safest possible wholesome fruits and vegetables. The purpose of GAPs is to document practices that reduce the risks of microbial contamination of fruits and vegetables.

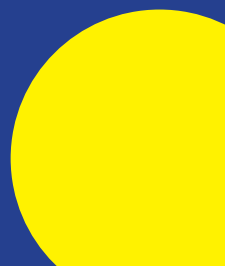
Using research-based knowledge from community members, extension agents, food scientists, state agencies, teachers, and students, this document compiles the best practices for garden management that can be posted online, given out in a classroom or volunteer training, or even laminated and kept in the garden itself.

Every garden is unique, so recommendations in this document will need to be adapted for each site. Special care should be taken when dealing with children, the elderly, and people who are immunocompromised because they are more susceptible to foodborne illnesses than healthy adults.

This handbook provides a blueprint and best practices for making a garden as safe as possible and provides tips on how to make established gardens safer. This information should be helpful whether you are just starting out, taking over a garden for someone else, or a long-time gardener.

This document outlines the recommended agricultural practices for food safety in gardens.

Best practices are indicated with **green** dots, minimum standards with **yellow** dots.





# Site Selection

## What's the Safety Risk?

It is important to know the history of the site where the garden is located. The site may have a history that includes flooding, animal crossings, chemicals and metals in the soil, and runoff, all of which could increase the potential for the foods grown there to become contaminated.

## What's the Best Way to Lower the Risk?

Selecting a site for the garden can be challenging. Soil composition, the history of the land, and access to clean water sources need to be considered. By knowing the land-use history, unforeseen problems are less likely to occur. The history of the site could divulge the potential for flooding or any past struggles with growing vegetables on the land, as well as provide insight into whether hazards exist in the soil.

For example, if the garden was once a parking lot or industrial site, a risk of contaminated soil may be likely. Neighboring industries might be a source of polluted runoff. A simple visual site assessment can enable an organizer to see animal tracks or whether the garden is in an area that is likely to flood.

Each site carries some food safety risks that the garden managers and coordinators should recognize and mitigate. With a land-use history, the proximity to other risks can be mitigated. It is often helpful to make a checklist of the risk factors so they can be monitored once the garden is in place.

Establishing a long-term lease or arrangement for a garden minimizes food safety risk over time because production practices can be documented. If a land arrangement is temporary, it is more difficult to establish good practices. A well-supported garden is more likely to have longevity. Before securing a site, organizers should research local laws and regulations regarding urban agriculture; there might be particular rules, especially regarding domestic livestock like hens and goats.

Local Virginia Cooperative Extension agents are great resources for assistance on garden food safety issues.

The best practice is to obtain the history of the site from planning officials and determine whether the garden site is suitable.

If the history is unavailable, ask the community. Virginia Cooperative Extension agents and community members might be able to help.



# Soil: Pesticides and Fertilizer

## What's the Safety Risk?

Soils can be contaminated with heavy metals that can cause health complications. Testing the soil can ensure gardeners' safety.

## What's the Best Way to Lower the Risk?

Before the garden is built: The best practice is to have a soil test before the garden is built, testing for levels of plant nutrients and micronutrients, pH, and soil class. This information helps when deciding about soil amendments. Special tests for heavy metal presence and concentration could also be conducted.

If the garden is already in operation: A soil nutrient test can still be done, and it will give gardeners recommendations for soil amendments. Soil testing is provided through the Virginia Tech Soil Testing Lab for a nominal fee. More information can be found at [www.soiltest.vt.edu](http://www.soiltest.vt.edu). For additional assistance, contact your local Virginia Cooperative Extension office.

## Best Practices in Soil Testing

1. Take a soil sample a few months before landscaping, building beds, or planting.
2. Sample each section of the area you intend to garden. Sample the established growing areas (trees, shrubs) as well, but you only have to do this every three to four years.
3. Use clean equipment so the sample will not be contaminated.
4. Take samples from an appropriate depth of 4 to 6 inches.
5. Place samples from one unique area into a plastic bucket and mix thoroughly. You need approximately 1/2 pound for a soil test.
6. Label the box. You can obtain sample boxes and information sheets from your local Virginia Cooperative Extension office.
7. Mail the soil sample, paperwork, and payment to:  
Virginia Tech Soil Testing Lab  
145 Smyth Hall (0465)  
Blacksburg, VA 24061

## Soil Testing and Fertilizers

According to the U.S. Department of Agriculture, a soil test is essential prior to creating a garden. The test is used to (1) find out if the soil lacks adequate nutrients, (2) determine the necessary amount of fertilizer, (3) measure the pH, and (4) find out if lime or anything else is needed (and how much to apply).

Urban gardens should be tested for lead among other heavy metals because there is concern about transference of the lead into crops — especially those in which the stalks, stems, roots, and leaves are edible. Both community and school gardens often produce edible items and donate those crops to charitable organizations, depending on the local requirements, so it is pertinent to have the soil in a good state.

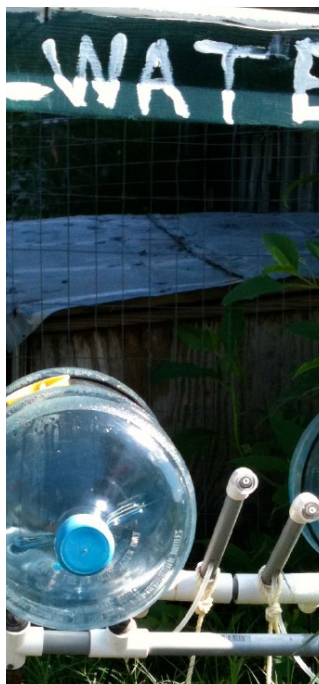
If soil amendments are necessary, there are many factors to consider:

- How long the amendment will last in the soil.
- Soil texture.
- Salinity and plant sensitivities to salts.
- Salt content.
- The pH of the amendment.

The second volume of Rodale's "Organic Gardening Basics" series is dedicated to soil and is full of suggestions for nonchemical fertilizers and soil amendments. Compost can be excellent for this purpose. It is necessary to ensure proper and complete composting before spreading on the garden; otherwise, pathogens may still be present. Soil amendments, pesticides, and any other chemicals should be kept away from children, and the instructions posted on the bag must always be followed. Soil amendments, even when organic, should not be overapplied.

## Pesticides

A number of community and school gardens practice pesticide-free methods. Gardeners who choose to use pesticides need to ensure they are locked and stored away from children and applied according to the instructions on the containers using clean water. Be careful not to overapply pesticides, herbicides, or fertilizers; any deviation from the labels could lead to environmental and safety impacts and is a violation of the law.



# Handwashing

## What's the Safety Risk?

Spreading potentially harmful microorganisms and cross-contamination.

The U.S. Centers for Disease Control and Prevention estimate that more than 50 percent of foodborne illnesses are linked to poor handwashing. In the garden, most tasks are performed by hand. Pathogens are easily spread through direct contact with hands, but it's easy to lower the risk.

Handwashing is essential to preventing foodborne illness because hands are the most commonly used utensils in food preparation. Wash hands after using the toilet, after touching garbage or compost, before and after treating a cut or wound, and whenever else hands might be dirty.

Washing hands with soap and water is the best way to reduce the number of microorganisms on them. If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60 percent alcohol. Alcohol-based hand sanitizers can quickly reduce the number of microorganisms on hands in some situations, but sanitizers alone do not eliminate all types of microorganisms, nor are they effective when hands are visibly dirty. Also, alcohol-based hand sanitizers are not effective in reducing norovirus, one of the most common foodborne illness-causing viruses.

If sanitizer is the only option, rub the product over all the surfaces of the hands and fingers until they are completely dry for best effects. Keep in mind: Hand sanitizer will not address norovirus risks.

If running water is not available, you will have to bring it with you. This could be as simple as a jug of potable water and a roll of paper towels. Many options are available for portable, temporary handwashing units – from homemade, low-cost sinks to costly commercial-grade units. The type of unit that is appropriate for your site will depend on your ingenuity, the number of people using it, and the resources available. Regardless of size, cost, or scale, all of these units consist of the same basic features: potable running water, soap, and single-use towels.

If you cannot bring water to the site, gardeners should wear disposable, single-use gloves while harvesting. It's acceptable to wear traditional gardening gloves while maintaining the garden, but they will not prevent the spread of pathogens when harvesting.

Be sure that gardeners of all ages are washing their hands properly. The best way to wash hands is to follow these steps:

1. First, scrub nails and fingertips with a brush full of soap. Rinse hands.
2. Wet hands with clean running water (warm or cold) and apply soap.
3. Rub hands together to make lather and scrub them well for 20 seconds. Scrub the backs of hands, between fingers, and under nails.
4. Rinse hands well under running water.
5. Dry hands using a single-use towel.

## What's the Best Way to Lower the Risk?

The best practice is to wash your hands with soap and clean running water and then dry them using a single-use towel.

If there is no running water available, wear disposable, single-use gloves while harvesting. If the task is maintenance-only, traditional gardening gloves are recommended.

# Water and Irrigation



## What's the Safety Risk?

Nonpotable water — water that is unsafe to drink because of contamination — can introduce pathogens into the garden.

Contaminated or untreated water is a frequent source of hepatitis A, *Giardia*, *Shigella*, and other pathogens.

If you wouldn't drink the water, do not apply it to the edible portion of your plants.

## What's the Best Way to Lower the Risk?

The best practice is to use a regulated, treated, water source. Water authorities employ filtration, chlorination, and testing to make sure it meets U.S. Environmental Protection Agency standards for drinking water.

If you are using or intend use another source, such as a well, have the water tested and make sure it is up to EPA standards before you use it for watering or washing things like hands, equipment, and food.

Ensuring the availability of safe water for irrigation minimizes the potential of microbial contamination of fruits and vegetables.

1. Begin by determining the source of the garden's water. Water can be easily contaminated by a number of biological and chemical hazards, including bacteria, viruses, domestic waste, nitrate nitrogen, combustion products from roadways, petroleum residues, and heavy metals. Without knowing the safety of your source, you could be introducing contaminants into your garden.

Frequently, the same municipal water source that services a school is used for irrigating its garden, but in a community garden, irrigation can be more complex.

Most public water systems provided by cities or other municipalities should be safe. The best practice is to obtain water test results from the water provider or have the water source tested at a reputable lab for coliform and generic *E. coli* — indicators of potential fecal contamination. An inexpensive test can be obtained from a single sample at the point of use (or end point), which can represent the entire system. Samples can be tested through the Virginia Household Water Quality Program through Virginia Cooperative Extension. These programs are offered in select counties across Virginia each year. Contact your local Extension agent to see if this is available in your area.

2. Avoid untreated, unregulated water sources such as rivers, streams, irrigation ditches, or ponds. The best practice is to use water that meet EPA guidelines and considered potable. However, if the garden is using a water source that is untreated, be sure to have the water tested regularly as described previously, including water captured from rain barrels and cisterns.



## Taking Responsibility for the Garden

If the garden manager who is typically in charge has left you to run things, don't panic. It will be OK. If you have questions about food safety that have been unanswered here, contact Lester Schonberger, Extension specialist at Virginia Tech, at [hlschon@vt.edu](mailto:hlschon@vt.edu).

Uncontaminated water ensures a good quality harvest. Clean water is also needed for applying chemicals, irrigation, good hygiene and handwashing, and processing or washing the harvest.

## What About Using Rainwater for the Garden?

There is growing interest in collecting water in rain barrels or cisterns to use for watering gardens — especially during drought and in gardens without a nearby water source. Rain barrels and cisterns also effectively manage stormwater runoff, thereby minimizing soil erosion. In Virginia, a garden might be unable to meet irrigation demands with its rain barrel, but it is still an excellent way to supplement other water.

There are various factors that can affect the safety of the roof runoff. Climate, age of roof, materials used, air quality, slope of the roof, and even its temperature can all play a role in the safety of the water. Roofs with metal

surfaces have additional water safety considerations, including the coating used on the heavy metal surfaces and using nonmetal gutters and downspouts.

While harvesting rainwater in barrels can be fine for watering the plants, it must be tested for microorganisms and even heavy metals before gardeners should use it. These water samples can be tested through the Virginia Household Water Quality Program described previously.

- If the water comes back positive for pathogenic *E. coli*, that water should not touch edible crops.
- Many gardeners choose to use rainwater only for irrigating ornamental plantings due to its risky nature.
- It is necessary to check out state and local laws before you build a mechanism for rainwater collection; in some states, a permit is necessary for a cistern.

## Allergens and Garden Activities

Gardens are not all the same and neither are gardeners. Some have food allergies that are considered a major food safety issue. While it's rare that community gardens have activities in the gardens themselves, it's a good rule overall to not bring any products with allergens into the garden so as to prevent cross-contamination.

Keep activities with foods like peanut butter out of the garden. To be even safer and respectful of the fellow gardeners, do not grow crops of well-known allergens, such as peanuts or soybeans. Through the implementation of good agricultural practices, the garden can be a safe place.

## What Is the Best Way to Water?

Using drip irrigation or applying water at the base of plants is the best way to water in order to reduce soil and water splash on the edible portion of the plant, minimizing risk.

Drip irrigation is also more efficient than spray watering because it can be timed and rationed, but when it is impractical or cost-prohibitive, traditional hand watering is acceptable.



# Compost

## What's the Safety Risk?

Compost that has not been treated properly (typical requirement is for it to have registered above 130°F [130 degrees Fahrenheit] for at least five days) can be contaminated with pathogens. Additionally, the location of the compost bin can pose problems.

Organic matter should be fully composted before adding it to the garden or it will compete with the plants and their roots for the nitrogen in the soil. It is necessary to take the temperature of the compost, so a long-stemmed thermometer should be kept on hand. These thermometers are available in gardening stores as well as online.

Start the compost with shredded leaves, yard trimmings, and fruit and vegetable scraps — depending on what

## What's the Best Way to Lower the Risk?

The best practice is to put the bin as far downhill from the garden as possible. Use a long-stemmed thermometer to check that the compost has been above 130°F for at least five days before using it in the garden (or other specified time/temperature as recommended by the USDA or EPA).

If the compost bin is already in use, create barriers to keep the contents from getting into the garden until it is ready; pay careful attention to flooding. By properly managing air, moisture, and nutrients, the composting process can transform large quantities of organic material into compost in a relatively short time. The process should generate temperatures high enough and for the correct amount of time to kill pathogens such as *E. coli* and *Salmonella*.



material is available. The literature is diverse as to what has been deemed proper to compost; a variety of sources list leaves and lawn clippings, fruits and vegetables, eggshells, coffee grounds and filters, tea and tea bags, and hay and straw. Citrus rinds, corn stalks, and nutshells can be composted, but they take a much longer time to break down.

While animal manure has long been considered an acceptable material to compost (the EPA includes it on its list of safe materials), it is not recommended due to its strong connection to pathogens like *E. coli*. Extra steps must then be taken to guarantee the safety of the finished compost. These are not discussed in this document.

If compost from another source is allowed but gardeners want to maintain an organic garden, it is imperative to ask what kinds of materials are in the mixture.

The compost will need to be turned approximately once a week (or more frequently). Turning it too often prevents the compost from reaching effective temperatures to destroy microorganisms. Research also

Composting is the process of treating solid waste (manure or plants) for beneficial use and destroying pathogens and undesirable weed seed.



shows that composting can reduce your environmental impact, making it a great step to have in the gardening process. Do not leave food scraps lying on top of the pile; they will rot or mold and not break down into compost if you do not turn it. Scraps should be 2 inches or smaller.

Research on composting mostly focuses on its environmental impact and chemical composition. In an attempt to understand the fate of pesticides during composting, researchers were unable to claim that pesticides would break down entirely but explain that pesticide residues in typical composting feedstocks do not appear to be a concern.

If purchasing compost, obtain it from a reputable source that can guarantee that proper steps have been taken. If there is a question regarding pesticide carryover in the compost, do not use it for fresh fruit and vegetable gardens.

## Safe Compost Location

A major concern is in keeping unfinished compost out of the garden. There are many kinds of compost containers – from manufactured tumblers to aerated plastic bins to those made from pallets. Tumblers decrease the chance for the components to get into the garden during a rainstorm because they are fully enclosed, but they are costlier than other receptacles.

The compost bin should be on a flat surface not too near the garden. While there are no official regulations as to how far away the bin should be, place it as far from the garden as possible. If the property is on a slope, the compost should be downhill from the garden. The gardeners should consider where the contents of the compost bin might go in the event that it is full, it rains, or the bin overflows before the compost is ready for use. Place the bins away from the fence line to help keep rats away from it.

Vermiculture (composting with worms) presents the same issues as other compost with respect to placement.

**Adequate moisture is necessary for microbial activity. The compost should be damp but not soggy. Add water ONLY if you could squeeze the compost with your hand and not see any moisture, much like a damp sponge.**

In-depth instructions for composting, as well as the materials to include, are available in Virginia Cooperative Extension publication 426-703, “Making Compost From Yard Waste” (<https://www.pubs.ext.vt.edu/426/426-703/426-703.html>). Additionally, the EPA has great information about composting ([www.epa.gov](http://www.epa.gov)).

## Uh-Oh! The Compost Is in the Wrong Place

If the compost has already been built but is in an imperfect location, there are remedies. If the area floods regularly, you should find a way to divert the compost from the garden, like a trench or a French drain. The local Virginia Cooperative Extension agent would be an excellent resource for such garden design details.



# Garden Design and Animals

## What's the Safety Risk?

Animal feces can bring pathogenic *E. coli*, *Campylobacter*, *Shigella*, and *Salmonella*, among other foodborne, illness-causing microorganisms.

## What's the Best Way to Lower the Risk?

The best practice is to use a fence to keep out animals like deer. Electric fences keep out many kinds of pests but are more expensive.

If a fence is out of the question, repellents and sprays can be used to keep out known pests, be it rabbits, deer, or birds. Maintain records and attempt to prevent them from entering the garden.

## What to Consider When You Think About Garden Design

When designing the garden, consider ways to keep animals — both domestic and wild — out. Animals can cause a problem by eating plants, fruits, and vegetables and can be the source of foodborne, illness-causing contamination. Animal manure is a major source of foodborne, illness-causing pathogens (*Salmonella*, *Campylobacter*, *E. coli*, *Cryptosporidium*) and keeping animals — from deer to birds — out of the garden is the best way to prevent such an event.

Just because the animals are not visiting the garden during the harvest does not mean they are not in the garden. Take precaution. Even domestic pets, like dogs, should be kept out of the garden because they can carry and shed pathogens like *Salmonella*. While scarecrows are considered to be helpful, they will only keep out birds.

For detailed problems and solutions for all kinds of pests, see

- “Complete Guide to Pest Control With and Without Chemicals,” 2nd ed., by George W. Ware.
- “Common Sense Pest Control,” by William Olkowski.

Deer droppings have been the source of pathogenic *E. coli* outbreaks — specifically on small farms. A tall fence is likely the best way to keep out deer, but opossums, chipmunks, squirrels, and raccoons are much more difficult to exclude. Given the opportunity, birds will nest, leaving their droppings in the garden. Take steps to keep them from residing nearby by trimming overhanging branches and making it an unattractive place for birds to nest.

Keeping the compost bin covered and well-maintained is another good measure to keep pests out of your garden. If animal tracks or droppings are found, organizers should figure out the kind of animal that left them and take steps to keep them out. Tracks are particularly helpful because following them can provide you with an idea of how the animal has entered the garden. Virginia Cooperative Extension agents can also help with this. You can use modern repellants and sprays in the mitigation of various pests, as well as trapping.

If the manure or droppings do not provide enough information to identify the pest, consult a reference guide or contact your local Extension agent for assistance. Always exclude fresh fruits and vegetables that may have been directly contaminated with manure and keep them away from the rest of the harvest to avoid cross-contamination.

Rodale's “Ultimate Encyclopedia of Organic Gardening” provides detailed, easy-to-read, nonchemical practices concerning deer, mice, squirrels, moles, rabbits, skunks, and birds, among other creatures. The Rodale Organic Gardening Basics series has informative individual, pamphlet-like documents on soil and composting.



# Sanitation and Tools

## What's the Safety Risk?

### Cross-contamination

While many gardeners use their hands for harvesting, some may use scissors, knives, and other tools to remove fruits and vegetables from plants. If there happens to be a pathogen on the crops and the scissors go unwashed, the contamination may be passed on to the next vegetable it touches. If a site lacks a kitchen or sink facility, the garden coordinator or manager might need to designate a person to wash and sanitize the tools at home. Clean tools and containers should be stored in a place where animals cannot get to them, such as a locked shed.

## The Harvest

The containers for the harvest should be washed and sanitized regularly. Use containers that will not cross-contaminate the fruits and vegetables. Do not reuse plastic bags or harvest into wooden boxes or unwashed

buckets. Containers should be protected while in storage so they cannot be contaminated between uses. Clean off as much dirt and debris as possible while still in the field so as to reduce the risk inside.

For immediate consumption: In school gardens, it is very common to eat fruits and vegetables right after they are harvested. All harvested items should be washed and/or processed in a space with clean and sanitized work surfaces, utensils, and hands. If linked to a school or institution, a good relationship with cafeteria staff, for example, can lead to help with food preparation — or even just permission to wash the harvest in the kitchen.

For later consumption: In community gardens, the gardeners are most likely going to take the produce home or donate it to a nonprofit organization. The lowest-risk “best practice” in terms of contamination is

## What's the Best Way to Lower the Risk?

The best practice is to wear single-use gloves and/or use clean, sanitized tools when harvesting produce. Put your harvest into clean, sanitized containers.

Equally as effective is to wash and sanitize your hands before harvesting and again if they become contaminated. Put your harvest into single-use bags.

Pathogens can hang around on equipment for days.

Wash and sanitize tools using a bleach solution of 50 to 200 parts per million or about 1 teaspoon to 1 tablespoon of bleach per gallon of water).



to wait to wash the harvest until it is time to be consumed. The harvest should be stored in a cool, pest-free area in separate containers (or new plastic bags) for each crop, away from any household chemicals. However, it must be washed before eating.

## Volunteer Management

- **Regularly remind everyone of the safety procedures.**
- **Prepare an orientation.** When there are new volunteers, students, or gardeners, explain the procedures before they get started. By starting with handwashing on the first day, volunteers will likely continue to wash with each visit.
- **Consider the differences.** People learn in different ways. For example, some people are better at hands-on learning while others are auditory learners.
- **Explain why.** The best way to make sure food safety procedures are enacted is to explain why they must be done. Explain the history and the mission of the safety plan.
- **Make it easy.** It should be easy for volunteers to follow procedures and obtain answers to any questions. Post the standard operating procedures throughout the garden so everyone can see them. Also, create an accessible binder or notebook containing the procedures so volunteers and gardeners have a reference manual of sorts to use when the garden manager is not there.
- **Set the standard.** The garden managers and coordinators must show their commitment to the procedures. If they wash their hands, others are likely to do so also.

It is completely acceptable to tell the gardeners that the rules are required. Safety rules are much like government regulations. GAPs guidelines require farms to post signs and provide training. A garden is much like a small farm and similar measures should be taken to stay safe.

A great garden is chock-full of capable gardeners — smart, hard-working people who spend their free time in the soil. Everyone in the garden should follow food safety guidance, which includes staying home when sick.

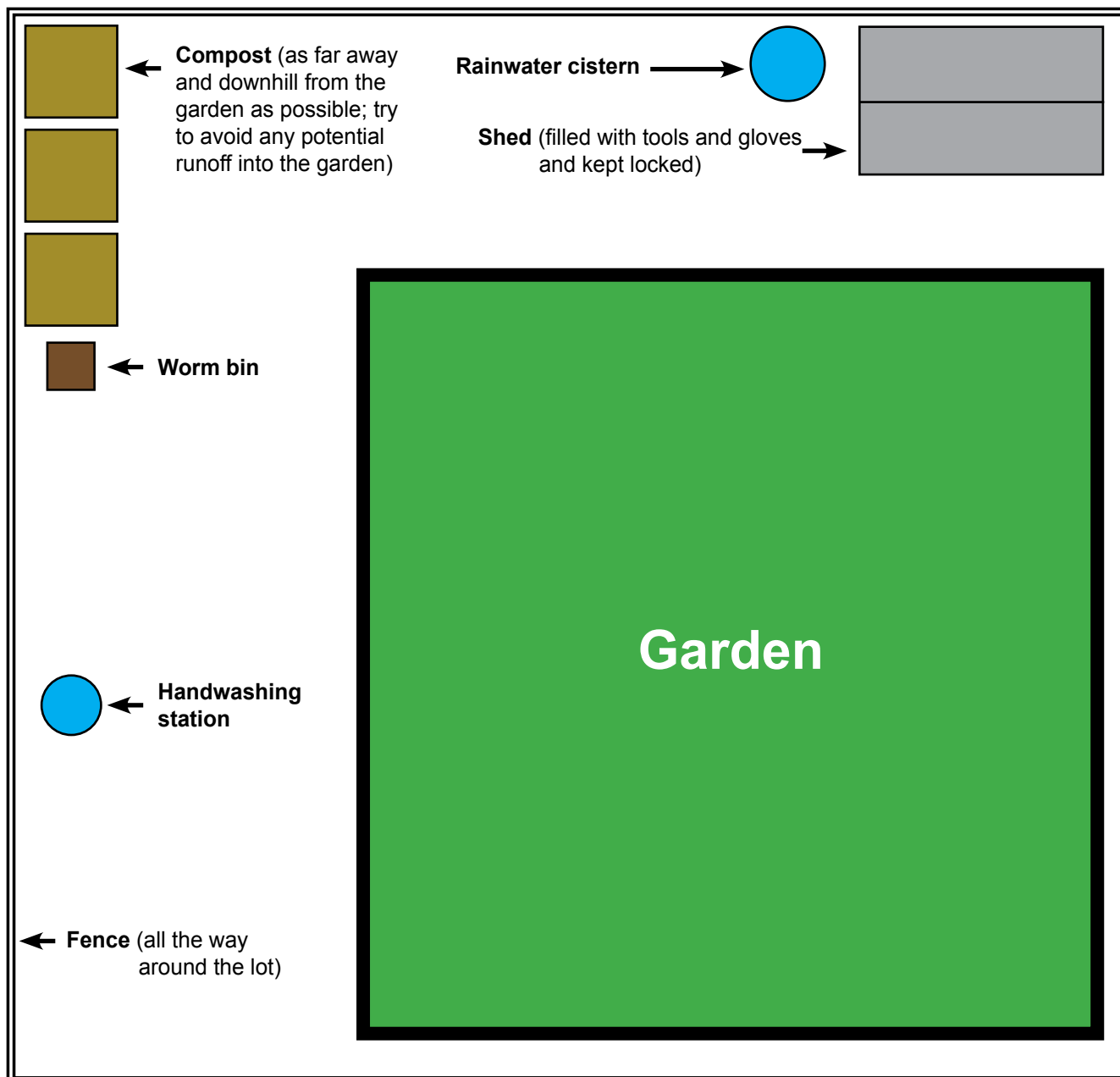
## Remember:

- Clean hands.
- Clean water.
- Clean soil.
- Clean surfaces.



# Sample Community Garden Map

**Remember:** It's OK if your garden is different as long as safety mechanisms are in order.



Virginia Cooperative Extension offers a self-check list to help produce growers and gardeners assess their food safety practices. “Enhancing the Safety of Locally Grown Produce: Farm Self-Help Form” is available at [https://www.pubs.ext.vt.edu/content/pubs\\_ext\\_vt\\_edu/en/FST/FST-35/FST-35NP.html](https://www.pubs.ext.vt.edu/content/pubs_ext_vt_edu/en/FST/FST-35/FST-35NP.html).

# Frequently Asked Questions

Q. Does it matter if the beds are raised or if the crops are in the ground?

A. In terms of general food safety, your garden should be designed in whatever way makes sense for you. However, if the potential for flooding exists, raised beds are preferable. They would be more likely to be kept out of stagnant water and less likely for compost or animal excrement to be swept into them.

Q. I've got hens, and I've heard they carry Salmonella. How do I stop that from impacting the garden?

A. If there are hens at your garden, there are quite a few things to consider. First, they must be kept in an enclosed area separate from the garden. Like the compost, the coop and hen area should be downhill from the garden for similar reasons. It should be difficult for chicken excrement to get into the garden, which also might mean having separate footwear for those entering into the area with the hens.

Q. We intend to preserve the harvest. What is the risk?

A. Any sort of preservation – from drying to canning – has its own risks, and participants in those activities should take precautions for other food safety issues, like botulism. For information on how to safely preserve the harvest, refer to the following Virginia Cooperative Extension publications:

- “Boiling Water Bath Canning” – <https://www.pubs.ext.vt.edu/348/348-594/348-594.html>
- “Freezing Fruits and Vegetables” – <https://www.pubs.ext.vt.edu/348/348-596/348-596.html>
- “Pressure Canning” – <https://www.pubs.ext.vt.edu/348/348-585/348-585.html>
- “Using Dehydration to Preserve Fruits, Vegetables, and Meats” – <https://www.pubs.ext.vt.edu/348/348-597/348-597.html>





Following are some key words and names of microorganisms used throughout this document.

# Glossary

**Bacteria** – Single-cell microorganisms without distinct nuclei or organized cell structures.

***Campylobacter*** – Bacteria that is often linked to animal production, especially poultry. Most people who become ill from *Campylobacter* get diarrhea, cramping, abdominal pain, and fever within two to five days after exposure to the organism.

**Contamination** – The unintended presence of potentially harmful substances in food, including microorganisms, chemicals, and physical objects.

**Control measure** – Any action or activity that can be used to prevent, eliminate, or reduce an identified hazard.

**Cross-contamination** – The transfer of harmful substances or disease-causing microorganisms to food by hands, food-contact surfaces, sponges, cloth towels, and utensils that touch raw food, are not cleaned, and then touch ready-to-eat foods. Cross-contamination can also occur when raw food, chemical containers, or soil amendments touch ready-to-eat foods.

***Cryptosporidium*** – A microscopic parasite that causes the diarrheal disease cryptosporidiosis. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection. *Cryptosporidium* is one of the most frequent causes of waterborne disease among humans in the United States.

***E. coli*** – A large and diverse group of bacteria. Although most strains of *E. coli* are harmless, others can make you sick. Some kinds of *E. coli* can cause serious illness marked with bloody diarrhea and abdominal cramps.

**Foodborne illness** – Sickness resulting from the consumption of foods or beverages contaminated with disease-causing microorganisms, chemicals, or other harmful substances.

**Hazard** – A biological, physical, or chemical property that may cause a food to be unsafe for human consumption.

**Hepatitis A** – A contagious liver disease that results from infection with the hepatitis A virus. It can range in severity from a mild illness lasting a few weeks to a severe illness lasting several months.

***Listeria*** – Bacteria that in some cases cause a serious disease called listeriosis. The disease primarily affects older adults, pregnant women, newborns, and adults with weakened immune systems. A person with listeriosis usually has fever and muscle aches, sometimes preceded by diarrhea or other gastrointestinal symptoms. Almost everyone diagnosed with listeriosis has an “invasive” infection, where the bacteria spread beyond the gastrointestinal tract.

**Microorganism** – A form of life that can be seen only with a microscope; includes bacteria, viruses, yeasts, and single-celled animals.

**Norovirus** – The most common organism causing symptoms of acute gastroenteritis, such as diarrhea, vomiting, and stomach pain. Norovirus is the official genus name for the group of viruses previously described as “Norwalk-like viruses.” Noroviruses spread quickly from person to person, through contaminated food or water, and by touching contaminated surfaces.

**Pathogen** – A microorganism (bacterium, parasite, virus) that causes disease.

**Personal hygiene** – Individual cleanliness and habits.

**pH** – The measure of the acidity of a product.

**Risk** – An estimate of the likely occurrence of a hazard.

*Salmonella* – Bacteria that may cause a serious disease. Most people infected with *Salmonella* develop diarrhea, fever, and abdominal cramps within 12 to 72 hours of infection. The illness usually lasts four to seven days, and most people recover without treatment. However, in some cases, the diarrhea may be so severe that the patient needs to be hospitalized.

*Shigella* – An infectious disease caused by a group of bacteria called *Shigella*. Most who are infected with *Shigella* develop diarrhea, fever, and stomach cramps, beginning a day or two after they are exposed to the bacteria.

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