

INTRODUCTION TO ORGANIC FOOD GARDENING



**Presented by Sustainable Food Center's
Grow Local Program**

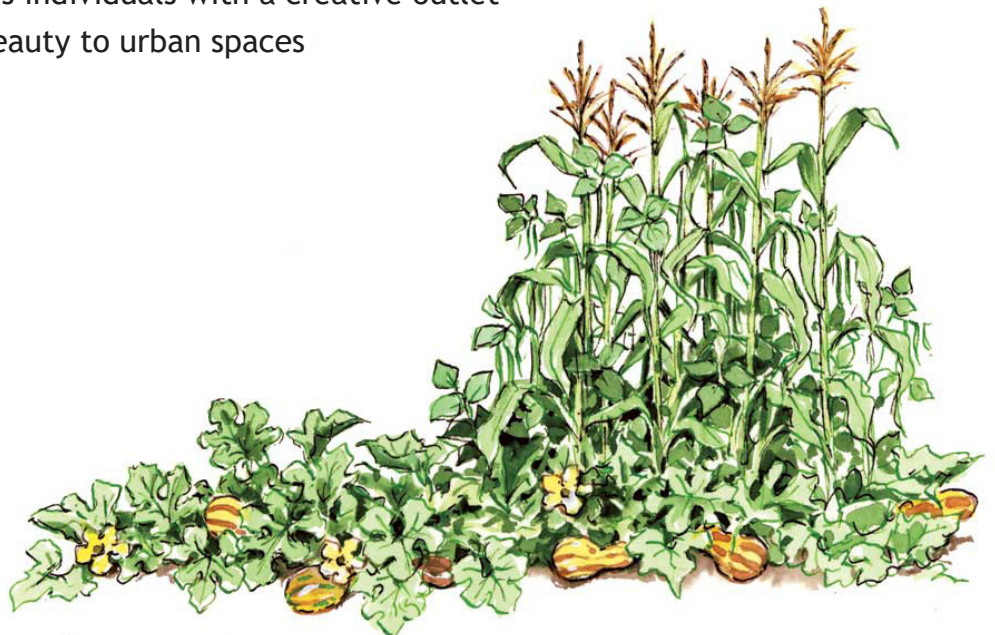
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WHY GARDEN?

There are many reasons to grow your own food:

- **Food security/food sovereignty:** Food gardeners can ensure that they have access to fresh, healthy vegetables that are free of pesticides, preservatives, and additives
- **Sustainability:** Food gardeners can produce food in environmentally sustainable ways by conserving water, gardening organically, and composting. In so doing, gardeners minimize their dependence on agribusinesses that use unsustainable agricultural practices.
- **Preserves biodiversity:** Agribusinesses are usually not interested in genetic diversity and plant only a few types of vegetables and fruits that transport well. By gardening, you ensure that a greater diversity of food plants is passed down to subsequent generations. You also protect and develop plant varieties that are suited to Central Texas' unique soils and climate.
- **Historical:** Humans have been growing food for thousands of years. By gardening, we ensure that this agricultural knowledge is passed on to subsequent generations.
- **Physical health:** Gardening provides a good source of exercise
- **Educational:** Adult and youth gardeners learn about soil, plants, compost, insects, weather patterns, and a host of other environmental phenomena
- **Financial savings:** Gardeners save money on grocery bills, and expert gardeners can even make money by selling vegetables, flowers, and herbs
- **Family-friendly:** Gardening is fun for children and offers families an enjoyable, meaningful activity to do together
- **Social outlet:** Food growing brings people together at school and community gardens, educational events, seed swaps, and harvest parties
- **Spiritual:** Gardening can provide a spiritual connection to nature
- **Mental health:** Gardening can ease stress, anxiety, and depression, and can help heal trauma
- **Artistic:** Gardening provides individuals with a creative outlet
- **Aesthetics:** Gardens add beauty to urban spaces
- **Gardening is fun!**



WHY GARDEN ORGANICALLY?



In the context of gardening, “organic” refers to materials derived directly from plants, animals, and minerals, without the use of synthetic chemicals.

Sustainable Food Center promotes organic gardening because it is environmentally safe and because vegetables and fruits grown organically taste better than their non-organic counterparts. They may also contain more vitamins and minerals, contributing to the health of individuals, families, and communities.

There are two types of inorganic materials that non-organic gardeners frequently use: artificial fertilizers and artificial pesticides. Artificial fertilizers consist of alien molecules, and plants have a limited ability to absorb the nutrients they contain. Excess nutrients leach out of the soil and into nearby waterways where they cause algal blooms, depriving other aquatic life of sunlight and oxygen. Artificial fertilizers also contain salts and, if used regularly, can build up salt in the soil, causing plants to wilt and die.

Artificial pesticides also pollute the earth. They easily become air- or waterborne, traveling hundreds of miles from their point of application. They contaminate distant waterways and may remain in the soil for decades. They do not distinguish between good and bad animals and instead harm all organisms they come into contact with, from bees and birds to fish, amphibians, and humans. Human exposure to pesticides in the field or on the fruits and vegetables that we eat can cause neurological problems, including memory loss, loss of coordination, and reduced visual ability. Other negative health effects include asthma, allergies, and skin disorders. Pesticide exposure is also linked with cancer, hormone disruption, reproductive problems, and fetal development problems.

Equally important is the fact that inorganic fertilizers and pesticides harm beneficial soil microbes, such as bacteria and fungi. These microbes are responsible for building the soil upon which plants depend to be able to absorb nutrients and fight pests and diseases. Consequently, gardeners who rely on inorganic gardening materials quickly find that their soil has degraded, their plants struggle to absorb nutrients, and their crops suffer from regular pest and disease outbreaks.

Fortunately, it is easy to garden organically. Some organic gardening practices, such as organic pest management, may be time-consuming in the short term. In the long run, however, organic gardeners spend less money on and time in the garden, for they help create thriving soil ecologies that do much of their gardening work for them.

GARDENING TOOLS

SHOVEL

Used for digging deep into the ground or moving materials. The longer the handle, the more leverage a shovel provides for difficult jobs. Pointed shovels are best for cutting through weeds and digging, while square-headed shovels are best for shoveling dirt and wood chips.



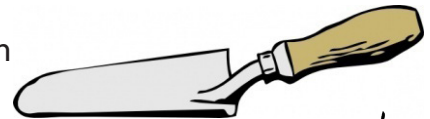
SPADING FORK

Useful for breaking up, loosening, and turning soil and compost, as well as shoveling wood chips. Typically has 3-4 metal prongs and a long wooden handle for leverage. Watch out for the sharp prongs.



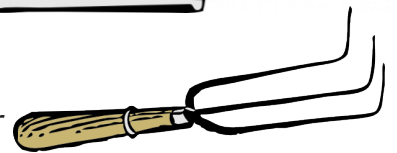
TROWEL

Used for small jobs, such as transplanting or removing weeds with shallow roots.



HAND CULTIVATOR

Used to remove small weeds, turn the top layer of soil, and dig rows for planting seeds.



HOE

Used for breaking up and weeding compact soil.



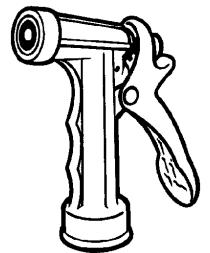
GARDENING GLOVES

Help keep your hands clean and protect them from ants and other biting insects, as well as rocks, twigs, and prickly plants.



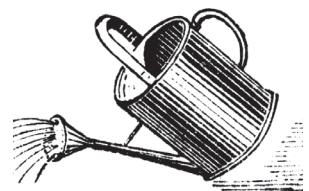
HOSE NOZZLE

Controls the intensity of the flow of water. By reducing the force of water from a hose, prevents damage to plants and disturbance of soil.



WATERING CAN

Choose a light-weight, sturdy watering can so that you can water seeds and individual plants by hand. Watering cans are also useful if you want to apply liquid fertilizers to plants.



While it might be tempting to purchase cheap tools, remember that you get what you pay for. Inexpensive tools may break quickly, requiring new purchases. We recommend investing in higher-quality, possibly more expensive tools, as this investment may save you money in the long run.

THE FOUR ELEMENTS



SUN

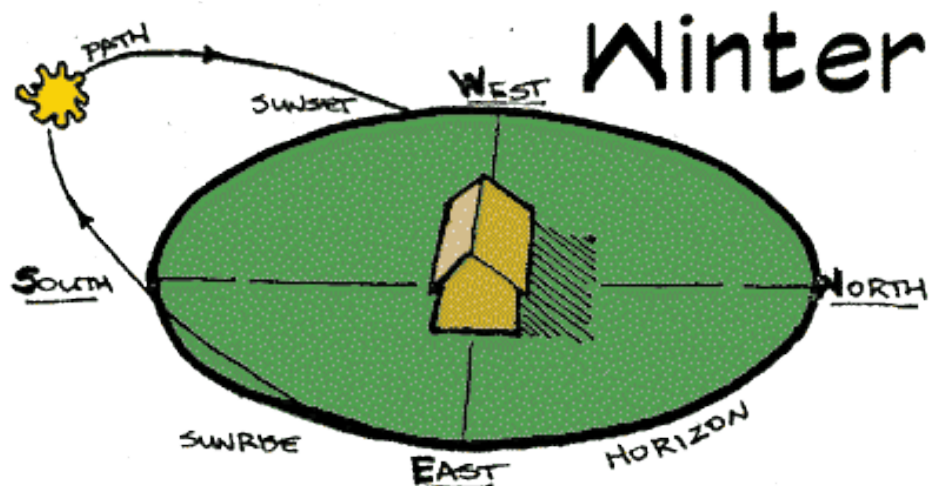
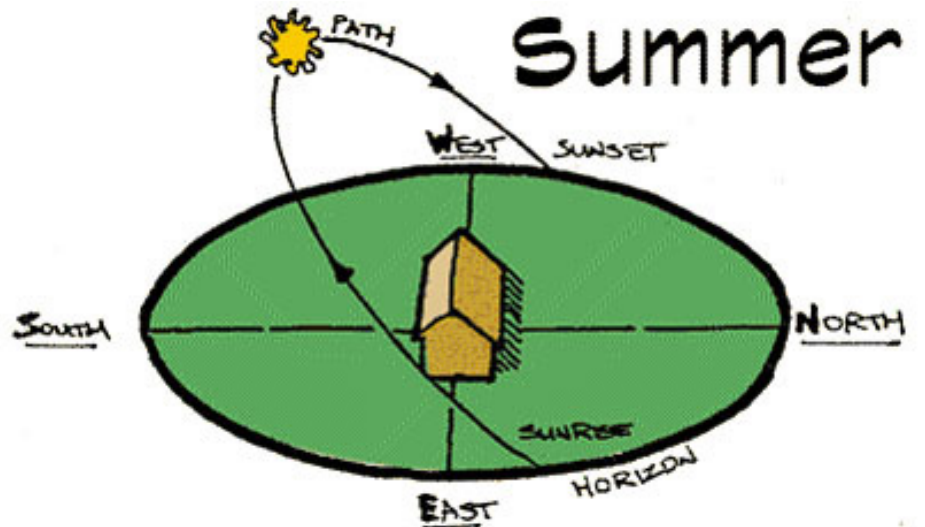
Sunlight is the primary source of food for almost all vegetation, and without enough of it, plants will not grow. Leafy cool-season vegetables (winter plants), such as lettuce, spinach, and kale, require a minimum of 6-8 hours of sunlight each day. Fruiting warm-weather plants (summer plants), such as tomatoes, eggplant, and cucumbers require at least 8-10 hours of sunlight each day.

Where is South?

Since Central Texas is located in the northern hemisphere, the sun passes through the southern half of the sky. It is therefore important that gardens have good southern exposure. Shadows change throughout the day and year. They also change when trees lose and regrow their leaves. To ensure that your garden receives adequate sunlight, observe potential garden locations throughout the day and consider how shadows will change from season to season.

Sun-Related Tips

- Since plants prefer morning sun, it is best to situate your garden so that it has full eastern exposure.
- During Central Texas summers, plants often receive too much sun and heat, causing them to yellow and wither despite frequent watering. You can protect your garden from the summer sun by providing it with dappled western shade. Sources of shade include trees and trellises that support heat-tolerant vines, such as trumpet or passion vines or hyacinth beans. You can also plant a row of sunflowers on the west side of your garden.
- Another option is to use shade cloth to protect your plants from the summer sun. Shade cloth is available at most gardening stores.

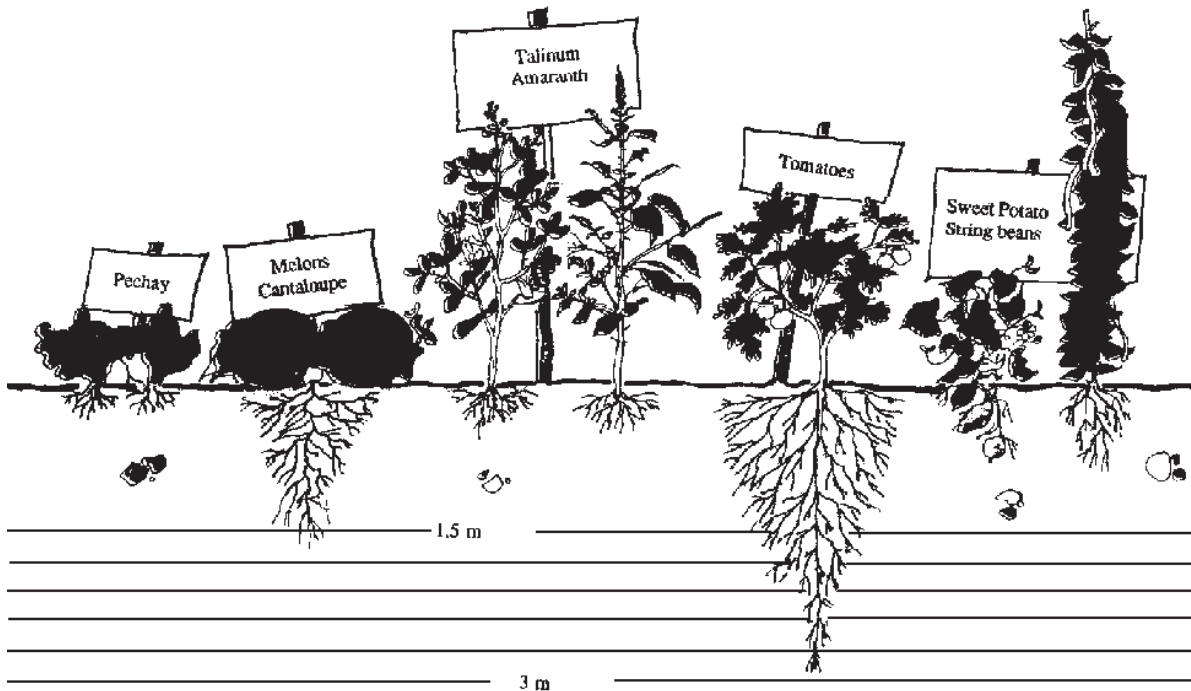


SOIL

Soil Functions

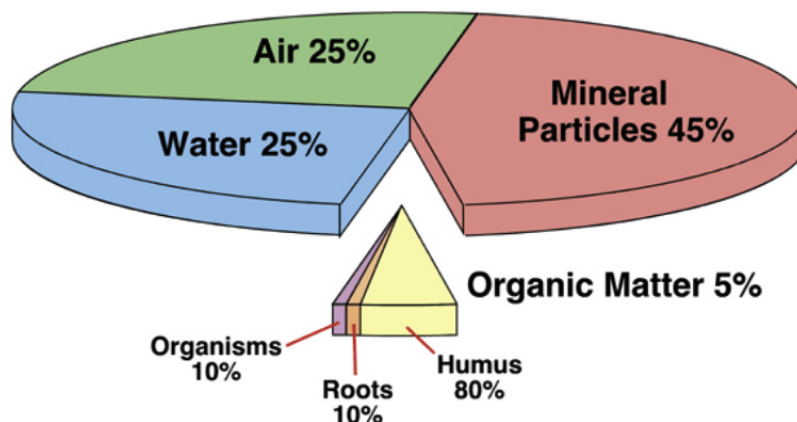
Soil provides plants with habitat in which to grow and reproduce. It stores the water, air, and nutrients necessary for plant growth and health. Soil also provides a habitat for millions of organisms upon which plants depend to access nutrients and fight diseases.

Vegetable gardens require at least 12 inches (one foot) of soil. Ideally, they will have 24 inches (two feet) or more of soil.



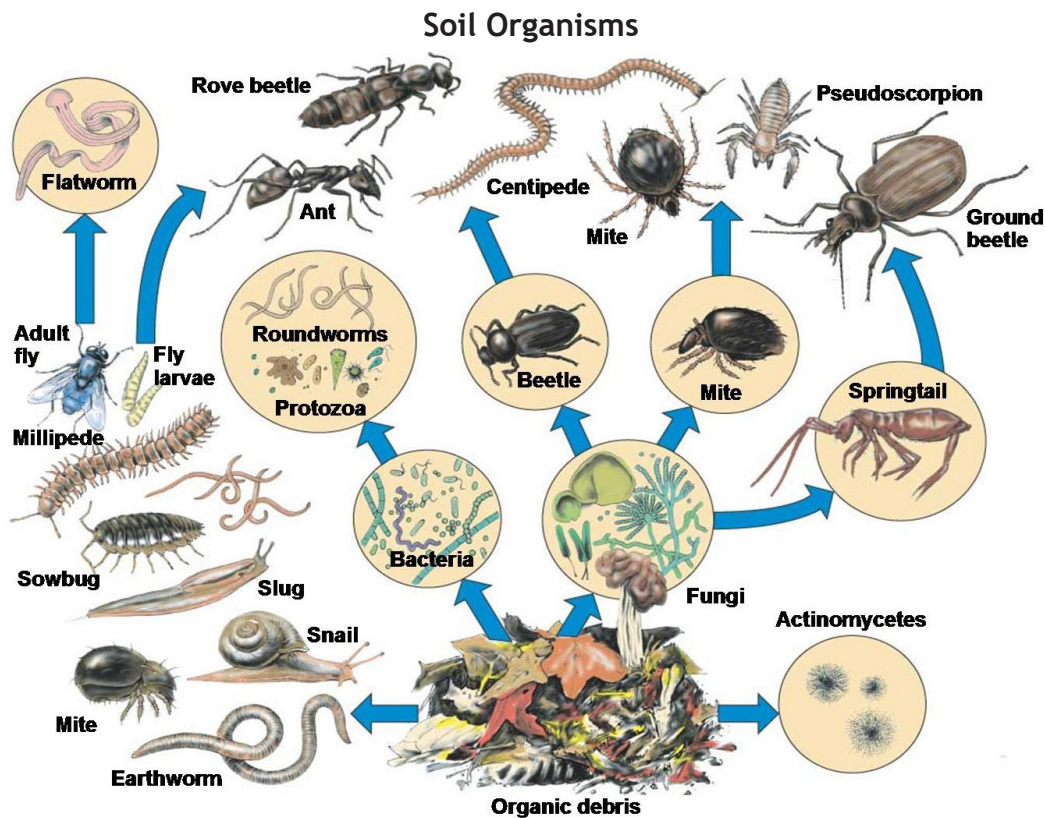
Soil Components

- Soil is made up of water, air, mineral particles, and organic matter
- Common **mineral particles** include gravel, sand, silt, and clay
- **Organic matter** refers to anything that is alive or was once living, including roots, branches, twigs, and humus. **Humus** refers to decomposed organic matter, or compost. **Organisms** refer to the bacteria, fungi, and animals, such as ants, beetles, and earthworms, that live in the soil.



Soil Biology

Healthy soil is teeming with millions of creatures, from microscopic bacteria to earthworms. These organisms build soil by digesting organic matter and generating compost and by binding compost and mineral particles together. Over time, this digestive work creates a unique soil structure that stores and cycles water, air, and nutrients, providing an ideal growing medium for plants.



Functions of Soil Organisms

- **Composters:** Soil organisms consume wood, leaves, and other organic materials and convert them into nutrient-rich compost
- **Nutrient absorption:** Many nutrients found in organic matter exist in forms not accessible to plants. As microbes consume organic materials, they change the chemical makeup of nutrients into forms that plants can absorb.
- **Water retention:** Bacteria exude sticky substances and fungi form webs. Together, these bind compost and mineral particles, creating a crumbly structure with pockets that absorb, store, and cycle water.
- **Aeration:** Soil's unique structure also stores and cycles air. In addition, when larger organisms like ants and earthworms move through the soil, they aerate it. This is called biological (as opposed to mechanical) tillage.
- **Nutrient retention:** Soil organisms lock up nutrients in their bodies, ensuring that nutrients do not wash away when it rains
- **Pest and disease prevention:** Healthy soils contain a diverse range of organisms that suppress pests and diseases by out-competing them
- **Purification:** Soil organisms break down many pollutants

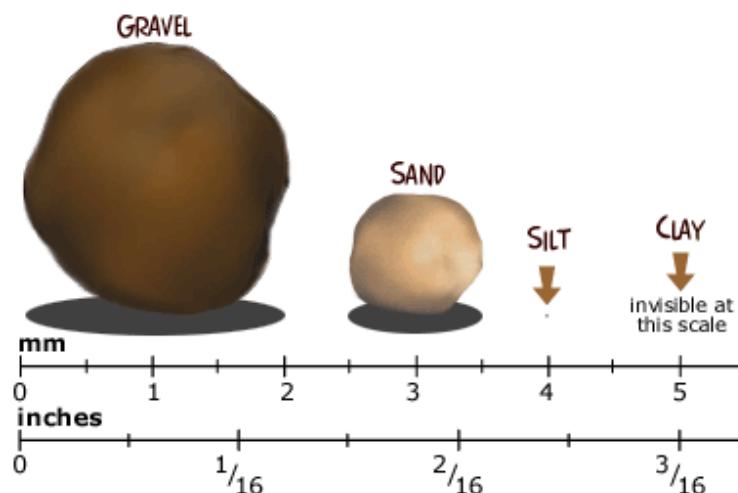
How to Build Soil Health

- **Garden organically:** Avoid inorganic pesticides and fertilizers, as they harm microbes
- **Add compost:** Fresh compost contains nutrients and millions of soil organisms. (Bagged compost is nutrient-rich, but because it has been sitting around for weeks or even months, it often contains very few microbes.) Start gardening with soil that contains $\frac{1}{3}$ -part compost. Before each planting season, amend your soil by covering your beds with a 3-inch layer of compost. Gently turn the compost into the soil, taking care to minimize disturbance of existing soil organisms.
- **Mulch:** When soil is exposed to the air, it dries out, causing organisms to die. Nutrients also evaporate into the atmosphere. To protect organisms and conserve water and nutrients, mulch your soil with organic matter, such as leaves or straw. As the mulch breaks down, it will add organic matter to the soil. It is best to avoid using coarse wood chips as mulch.
- **Avoid chlorinated water:** Municipal water systems are chlorinated to prevent water-borne diseases. However, chlorine also harms beneficial soil bacteria, the foundation of a diverse soil web. So does chloramine, another chemical found in tap water. Avoid using tap water by storing rainwater. You can also purchase a shower filter for your garden tap. Chlorine evaporates when exposed to air. You can leave water in an uncovered container for 24 hours before using it in your garden. To encourage chloramine to evaporate, throw a handful of soil into the water, as chloramine turns into chlorine when it interacts with organic matter.
- **Minimize mechanical tillage:** While mechanical tilling aerates soil, it harms soil organisms. If done frequently and over long periods of time, it degrades the soil. Fortunately, gardens that are tended regularly do not need to be mechanically tilled, as larger soil organisms till the soil for us.

Because new gardens do not have an established soil biology, their plants often experience inconsistent growth and low yields. Generally, it takes 3-5 years to establish your soil's biology. If you are working with a new garden, be patient and keep building your soil.

Mineral Particles

Minerals have different qualities that affect a soil's ability to absorb, retain, and release nutrients, water, and air. The mineral particles most commonly found in garden soil include sand, clay, and silt.



Sand particles are like plastic balls. When placed in a container, there is a lot of space between each ball. As a result, sandy soils tend not to compact and have good drainage. However, they do not store nutrients or water well.

Clay particles are like poker chips. When stacked together, there is little space between them. As a result, clay soils have a tendency to compact, causing poor drainage. However, clay soils store water and nutrients well. That said, clay also tends to “lock up” nutrients, requiring a thriving soil biology to make them accessible to plants.

Silt particles are found in rivers and creeks. They are larger than clay but smaller than sand and, therefore, share qualities of both.

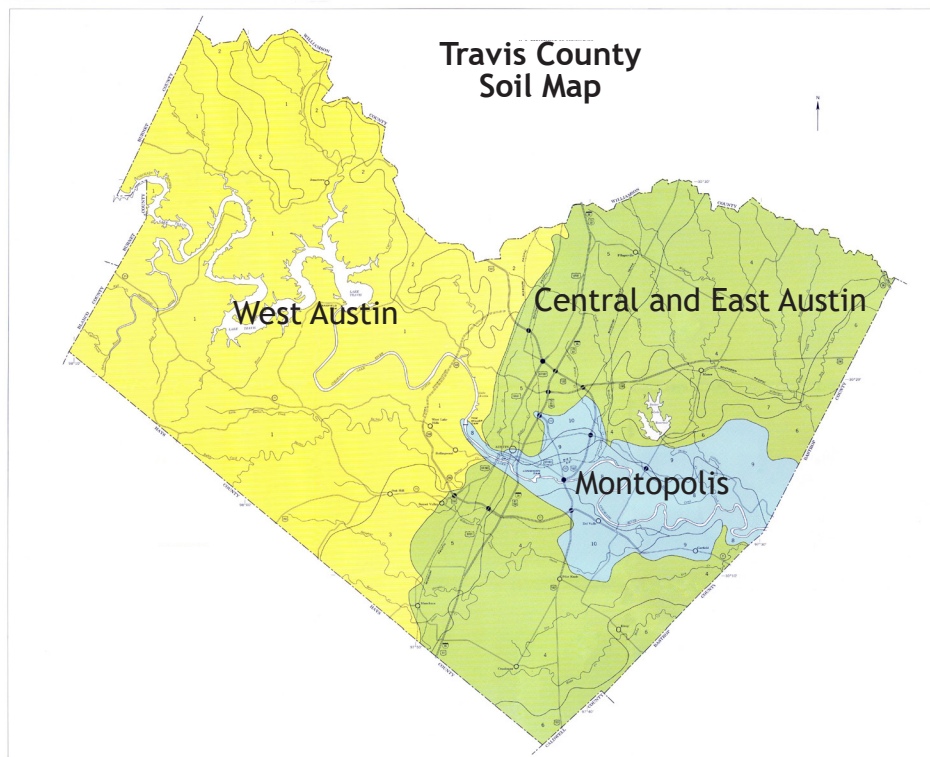
Mineral Component	Benefits	Drawbacks
Sand	Good drainage	Poor nutrient retention, dries out quickly
Clay	Good nutrient and water retention	Poor drainage, locks up nutrients, compacts easily
Silt	Good nutrient and water retention	Compacts easily

Ideal gardening soil consists of equal parts clay, sand, and silt. This is referred to as **loam**. Avoid purchasing “sandy loam” in stores, as this product is nutrient-poor and high in clay content.

Different parts of Austin have different soil profiles. East of Mopac Expressway, in the Blackland Prairies, the soil is generally deep and has a high clay content. West of Mopac, along the Edwards Plateau, the soil is shallow and contains more limestone. In the parts of Montopolis that sit in the historic floodplains of the Colorado River, the soil is silty.

Due to urban development, much of the city’s native soils have been removed and/or replaced.

To find out what kind of soil you have, dig into it. No matter what your soil profile, in order to improve your soil, amend your garden beds with organic matter, including compost and mulch.



WATER

Water Sources

Since Central Texas has a hot, semi-arid climate, gardens require frequent watering. Save time and energy by locating your beds near a water source. Gardeners can water with municipal water, rainwater, or well water.

Water Source	Benefits	Drawbacks
Municipal or tap water	Easy to access	Contains chlorine and chloramine, which harm soil organisms Strains water reservoirs
Rainwater	Does not contain chlorine or chloramine Reduces strain on aquifers Free	Can be costly to establish a catchment system (see page 44 for more about rainwater collection)
Well water	Does not contain chlorine or chloramine	Costly to dig a well Strains water reservoirs

Watering Frequency

Appropriate watering is crucial to successful vegetable gardening. Most vegetables prefer damp soil. If the soil is dry or wet for too long, plants will wither and eventually die. New food growers often over-water. Plants suffering from too much water wilt, much like plants suffering from dehydration. In turn, new gardeners water even more, exacerbating the problem. If you are unsure if your garden needs water, insert your finger into the soil at least three inches below the surface (make sure not to disturb plant roots). If the soil is dry, water. If it is wet or moist, wait a day or two.

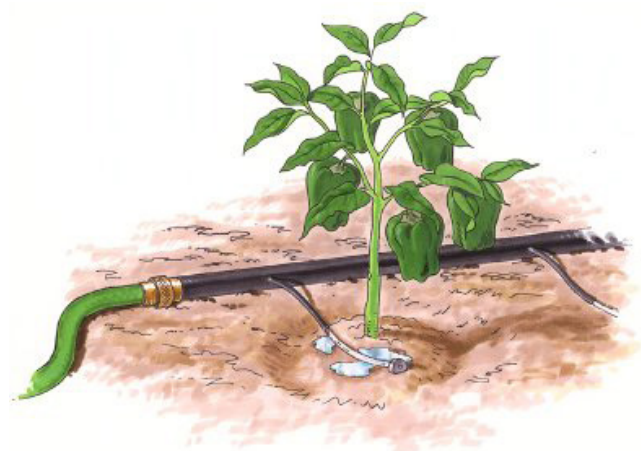
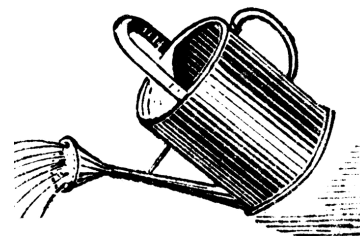
Seeds: As a general rule, unless it rains or the day is overcast and very humid, seeds should be watered lightly every 2-3 days during cold weather and every day during hot weather. To minimize disturbance of seeds and soil, when watering with a hose, use a nozzle or your thumb to break up the force of the water. Once plants have formed their first true set of leaves, water less often but more deeply. The first set of leaves on a plant, called cotyledons, are always undifferentiated, meaning they look the same on all plants. True leaves are unique to each plant and indicate that a plant has established a root structure.

Transplants: When transplanting seedlings, if the weather is warm, water every 1-2 days for at least a week. In cooler weather, water every three days. Once you see new growth, you know a plant is established, and you can treat it like other established plants in your garden. Fully grown plants should be watered less often but more deeply. This encourages roots to grow downward to where water is stored and where soil temperatures do not fluctuate as much.

These are general rules, as all plants have different water needs. Cabbage plants, for example, require regular watering, even in cool weather, while okra needs watering no more than once per week, even in the middle of the summer. Additionally, different soils hold different amounts of water. As your gardening skills develop, you will get a feel for when plants need to be watered.

Irrigation Methods

Hand watering with a hose or watering can is, technologically speaking, the simplest way to water a garden. It also maximizes control over which plants you water and how much. Keep in mind that, in the summer and during dry spells, hand watering can be time-consuming.



Drip irrigation involves placing soaker or drip hoses directly on the soil, reducing evaporation. If installed properly, drip irrigation systems can save time. They have a tendency to clog with built-up salts and minerals and therefore require cleaning at regular intervals.

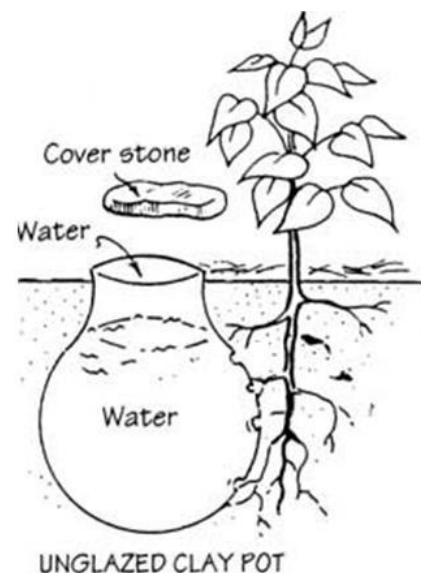
Ceramic pots (ollas) are permeable pots that slowly release water underground, reducing evaporation. They are a useful way to irrigate established plants, but should not be used to water seeds. They generally cost \$25-\$40, depending on their size. If this is outside

your budget, you can substitute ollas with glass or plastic bottles. Simply poke or drill small holes in the bottom of the bottles and bury them in the ground.

Water Conservation

Sustainable water use is a crucial part of sustainable food gardening and food security. As Central Texas' population has grown, water use has increased, causing reservoir levels to fall to often alarmingly low levels. To ensure that future generations have access to potable water, it is vital that we grow our food in water-wise ways. Some tips for conserving water in your garden include:

- **Build the soil:** Healthy, living soil holds more water than degraded soil
- **Practice appropriate watering:** Reduce evaporation by watering in the early morning or late evening. Remember to water the soil, not plant foliage.
- **Use drip irrigation/soaker hoses:** By delivering water directly to the soil, drip hoses reduce water lost through evaporation



- **Seek western shade:** Western shade protects gardens from the summer's hot evening sun, reducing water lost through evaporation
- **Put your garden to sleep during the summer:** As water use is greatest during summer, when plant yields tend to be low, consider putting your garden to sleep from mid- to late summer by covering your beds with a thick layer of mulch or by planting a summer cover crop, such as black-eyed, cream, or purple hull peas
- **Apply mulch:** Covering your garden with a 2-4-inch layer of mulch reduces evaporation from the soil, cutting down on watering needs. Mulching also suppresses weeds and builds the soil. Make sure to leave a little space between mulch and plant stems to prevent fungal infections.

Mulch options include:

- Leaves
- Pine needles
- Straw (avoid hay, as it contains seeds)
- Other fine, aged plant material (avoid coarse wood chips)

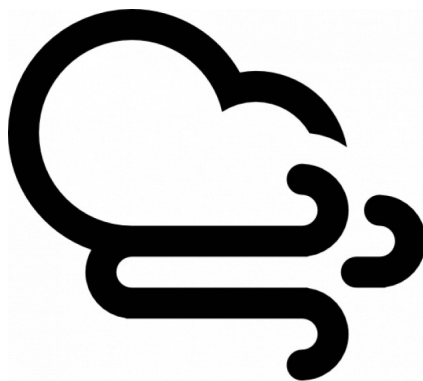


AIR

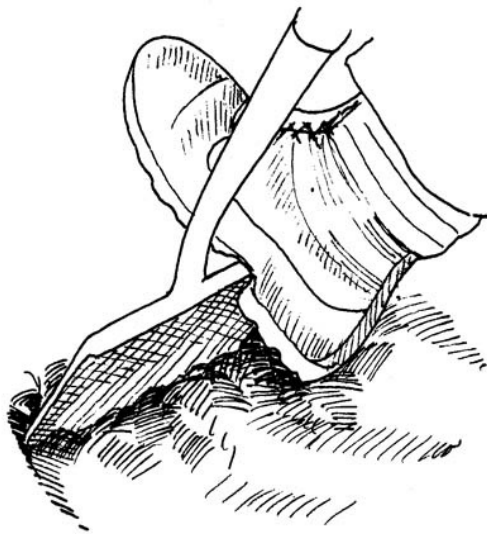
Plants require oxygen to grow. Ensure that your soil is aerated by:

- Double digging new garden beds (see page 17)
- Amending your soil with compost
- Adding earthworms to your beds
- Avoiding compacting the soil by not walking where you plant

Plants also benefit from air circulation above the ground, as air helps prevent fungal and pest infections. To ensure adequate air circulation, do not over-crowd your plants.



PREPARING GARDEN BEDS

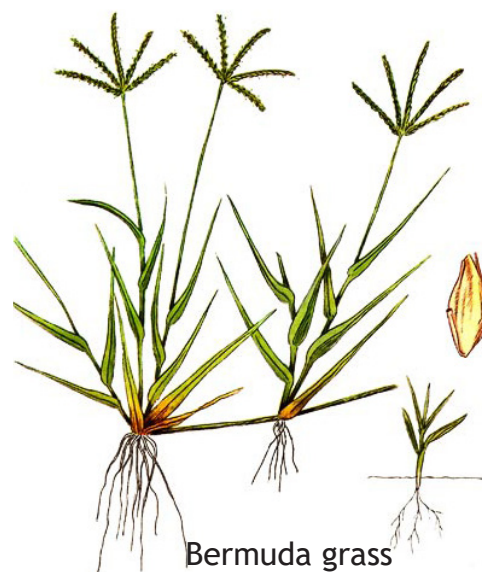


ESTABLISHING GARDEN BEDS

Some new gardeners are lucky enough to inherit beds that have already been cultivated. If you are one of these fortunate few, preparing your garden for planting is easier. Remove weeds. Cover beds with a 2-4-inch layer of compost and gently turn it into the existing soil. Break up large chunks of earth. Remove rocks and large twigs. Even out the surface so it is flat, then transplant or sow seeds.

Establishing a new garden or reviving a long-abandoned one is trickier. It often requires tilling to loosen existing soil or purchasing new soil if there is none on-site.

It is also important to weed your site thoroughly before planting. This is particularly important if your site contains Bermuda grass. If not removed properly, such grass will easily overgrow your bed. First, outline your garden. Next, if there is sod in the chosen area, cut the grass out using a hoe or mattock. Bermuda grass can regrow from a tiny root piece, so make sure to remove any and all roots that you find. Do not use a tiller, as this will break the roots into tiny pieces and turn them into the soil, making them difficult to remove. It is also recommended to weed a 1-foot pathway around the garden to act as a weed barrier. If you are feeling particularly diligent, you can set lumber, metal, or snugly fitted stone eight inches into the ground. While this is not required, it provides an additional physical barrier. Weeding will most likely be the most difficult part of preparing your new garden, but weeding properly can save you a great deal of time and energy in the future.



Last but not least, to ensure that you can easily reach all parts of your bed, it is recommended that beds not be wider than four feet. If you plan to garden with children, limit the width of your beds to 2-3 feet. Paths between beds should be at least 1.5 feet wide.

Each garden site is as different as is each gardener's vision. This means that there is no single way to establish or revive a garden. Some questions you might ask yourself are:

- Is there already a decent amount of soil on-site? If yes, what is the quality of the soil?
- Is the soil relatively dark and loose or is it pale and compacted?
- Is the area covered in weeds? If yes, what sort of weeds, and how difficult will they be to remove?
- Are you able to bend down to garden?
- Do you have children or pets that might disturb your beds?
- Do you prefer the tidy aesthetic of raised beds or the natural aesthetic of in-ground beds?
- How much money are you willing to spend?

The answers to these questions will determine whether you establish an in-ground garden, a raised bed garden, a container garden on a patio or balcony, or some combination of the three.

IN-GROUND BEDS

In-ground beds are ideal for sites that already have at least 12 inches of soil. Some of the benefits and drawbacks of in-ground beds are listed below.

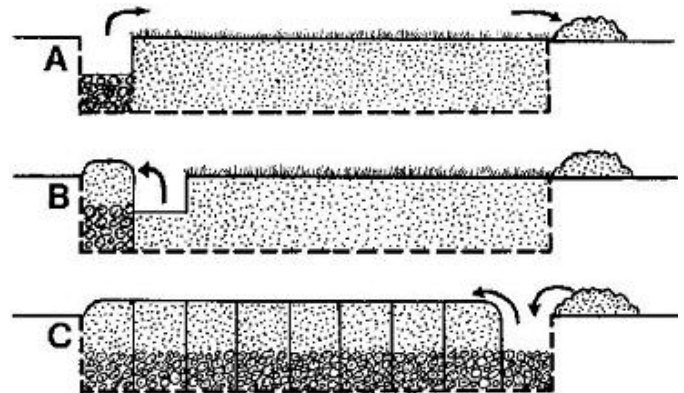
Benefits	Drawbacks
Fully exposed to surrounding soil biology	Often require extensive weeding to establish
Soil temperatures do not fluctuate as much as raised beds or container gardens	Often require large amounts of time and labor to loosen and amend existing soil
Soil tends not to dry out as quickly as raised beds and container gardens	More vulnerable to disturbance from children and pets
Relatively cheap to install	Require gardeners to bend down

Double Digging

New garden sites often have compact soil that needs to be loosened and amended in order to improve drainage, give roots room to grow, and ensure that plants have the nutrients they require. Double digging is a labor-intensive but simple, cheap way to prepare new beds for planting. **Note:** This is a technique for starting new beds. Once a bed has been double-dug, if it remains in production, it does not need to be double-dug again.

Instructions for double digging a garden bed:

- 1) Call 811 to ensure there are no utility lines where you plan to dig
- 2) Begin at one end of the garden and dig a trench across the bed's width. The trench should be one foot deep. Place the excavated dirt in a wheelbarrow or at the opposite end of the bed. Remove any grass or other weeds as you dig and discard them far away from your garden.
- 3) Work a spading fork into the floor of the trench and slowly rock the fork back and forth to loosen the soil another foot down
- 4) Dig another equal-sized trench next to the first, this time placing the excavated soil in the first trench. Use the spading fork to loosen the soil at the bottom of the second trench. Avoid stepping on the soil you have just loosened.
- 5) Repeat step 4 until you reach the end of the bed, then fill the last trench with the soil in the wheelbarrow
- 6) Add a 3-inch layer of compost to the bed and turn the compost into the soil. Break up large chunks of earth, remove any rocks, and smooth the beds over so that the soil is flat.
- 7) Plant!
- 8) Mulch your beds with leaves or straw



RAISED BEDS

Raised beds are ideal for sites with very little or very poor soil and for gardeners with physical disabilities. Additional benefits, as well as drawbacks, of raised beds are listed below.

Benefits	Drawbacks
Often require less time and labor to establish than in-ground beds	Can be relatively expensive to establish due to cost of siding and soil
Less vulnerable to disturbance from pets and children	Soil temperatures fluctuate more than in-ground beds
Do not require gardeners to bend down	Soil tends to dry out more quickly than in-ground beds
Tidy aesthetic	Limited exposure to surrounding soil biology

Siding

Raised beds can be made of wood, stone, pavers, bricks, or cinder blocks. Avoid using tires or pressure-treated wood, as they contain chemicals that leach into the soil. It is also best to avoid metal siding, as metal heats up during summer, raising soil temperatures and stressing plants. To build a simple, 4x4-foot wooden raised bed, see the instructions below.

Materials:

- Cardboard and newspaper (more is better)
- ½ cubic yard of good garden soil
- 2 2"x12"x8' lumber boards, cut in half
- 8 2½" nails
- Sandpaper

Construction:

1) Prepare the site: Choose a flat site or level the area. Next, use the cardboard and newspaper to create a weed barrier. Place 2-3 layers of cardboard over the bed's intended location and at least two feet outside of where the bed will be placed. Overlap the cardboard's edges by at least four inches. Cover edges with 2-3 layers of newspaper and seal by wetting the entire area. This "sheet mulching" provides a temporary weed barrier until the cardboard and newspaper break down.

2) Assemble the bed: Sand the ends of the lumber boards to avoid splinters, then assemble the bed by laying the lumber boards together so that the crowns face inward and the boards are off-set. Nail the boards together and place the bed on top of the cardboard-covered area. Fill the bed with garden soil, mix in compost, mulch, and plant.



Tip for cheaply filling raised beds: If your raised bed is 24 inches high or taller, you can save money on soil by filling the bottom six inches of the bed with unfinished compost. First, place a layer of leaves, twigs, and branches at the bottom of the bed to trap air, then cover with a few inches of raw compost and a second layer of leaves and twigs. By the time plant roots reach the bottom of the bed, the compost will have broken down into soil.

CONTAINER GARDENING



Container gardens are ideal for small spaces with little to no soil, including balconies, courtyards, decks, and patios. They are also ideal for renters and individuals with limited mobility or limited time to care for a large landscape.

Types of Containers

There are two types of containers: porous and non-porous. Pots that are porous look more natural but can deteriorate quickly if consistently exposed to moisture and freezing temperatures. During winter months, they should be brought inside to prevent cracking. Non-porous containers have a longer lifespan and may be stored outdoors in the winter; however, they are often made of potentially harmful materials, such as plastic.

Types of Porous Containers	Types of Non-Porous Containers
Clay pots	Glazed pots
Wooden pots	Plastic pots
Pots made of pressed fiber, such as baskets	Metal pots

The cheapest way to establish a container garden is to recycle materials that are no longer in use, such as bathtubs, buckets, baskets, crates, dresser drawers, wheelbarrows, and sinks. Avoid tires and treated wood, as they will leach chemicals into the soil. We also recommend avoiding metal, as it will heat up in the summer and your soil will dry out more quickly.

If your containers are made of non-porous materials, make sure they have drainage holes so that your soil does not become water-logged. Two to four holes are recommended, depending on the size of your pot. If a container has no holes, drill some yourself.

Container Size

Vegetable plants do not grow well if their roots are restricted, so it is important to make sure your containers are large enough for the plants you want to grow. Most herbs grow well in 4-gallon (8-12-inch diameter) pots. Basil, chives, and cilantro can be grown in smaller, 3-gallon pots. See page 22 for a list of recommended container sizes for different types of vegetables.

Container Location

Place your containers where they will receive 6-10 hours of full sun each day. Soil is heavy, so move your containers into position before filling them.

Container Soil

Container soil must provide the water, nutrients, oxygen, and support that plants require. Garden soil tends to compact in containers, reducing the amount of water and oxygen available to plants. To keep your container soil from compacting, buy potting mix or make your own.

Potting Mix

Most potting mixtures do not actually contain soil. Instead, they contain three basic ingredients: peat moss, which retains moisture (we do not recommend using peat moss, as it is an unsustainable product); pine bark, which adds nutrients; and either perlite or vermiculite, which are lightweight volcanic rocks that are naturally filled with air and promote drainage. You can buy potting soil at any gardening store.

Do-It-Yourself Potting Soil

Garden soil can be used as a container medium, but it needs to be modified. Though it requires a little more work than buying potting mix, creating your own soil mixture can save you money. Garden soil mixtures can also help your plants by adding beneficial microorganisms and nutrients to your containers. Make your own potting soil by adding one part garden soil that has been amended with compost; one part shredded coconut husks, called coconut coir, in place of peat moss; and one part perlite, vermiculite, coarse builder's sand, or shredded leaves. Do not use fine beach sand or play sand.

Container soil can harbor pathogens, so many gardeners change the soil in their containers after each growing season. Other gardeners empty their containers after two growing seasons or if their plants are attacked by a disease or pest. How often you empty your containers is up to you.

Watering and Fertilizing Container Gardens

Containers hold a limited amount of soil. They therefore store less water and need to be watered more frequently than garden beds. Every time you water plants, the water carries away some of the nutrients in the soil. Consequently, container gardens also require more frequent fertilizing.

There are two types of fertilizers: slow- or timed-release fertilizers and water-soluble fertilizers. For environmental reasons, always use organic fertilizers. You can buy these at most local nurseries.

Slow-release fertilizers provide a steady supply of nutrients to plants over an extended period of time (usually months). They include compost as well as granular fertilizers. One or both of these may be added to your soil before you plant.

Water-soluble fertilizers release nutrients to plant roots immediately and for short periods of time. Depending on your plants' and soil's needs, you might never use water-soluble fertilizers, or you might water with fertilizer every 1-2 weeks. If you use water-soluble fertilizers, follow product directions for concentrations and frequency of application.



Different plants need different amounts of water and nutrients. It is best to grow plants with similar needs in the same container. Below are some recommended combinations of herbs and edible flowers.

Grow in relatively dry, poor soil	Require regular watering and rich soil
Calendula	Basil (in spring and summer)
Lavender	Chives
Oregano	Cilantro (in fall and winter)
Rosemary	Marjoram
Sage	Parsley
Thyme	Tarragon

Note: Since mint is an aggressive plant, is it best to grow it in its own container.

Vegetable Container Gardening Guide			
Vegetable Plant	Light Requirement	Minimum Container Size	Space Between Plants
Arugula	Full sun/partial shade	0.5 gallons	3-4 inches
Beans, Bush	Full sun	2 gallons	2-3 inches
Beans, Pole	Full sun	5 gallons	2-4 inches
Beets	Full sun/partial shade	0.5 gallons	2-3 inches
Broccoli	Full sun	5 gallons	12-18 inches
Cabbage	Full sun/partial shade	5 gallons	12-18 inches
Carrots	Full sun/partial shade	1 quart	2-3 inches
Chard, Swiss	Full sun/partial shade	0.5 gallons	4-6 inches
Collards	Full sun	5 gallons	5-7 inches
Cucumbers	Full sun	5 gallons	14-18 inches
Eggplant	Full sun	5 gallons	1 plant per container
Kale	Full sun/partial shade	5 gallons	10-15 inches
Lettuce, Leaf	Full sun/partial shade	0.5 gallons	4-6 inches
Onions, Green	Full sun/partial shade	0.5 gallons	2-3 inches
Peas, Snow	Full sun/partial shade	2-5 gallons	3-4 inches
Peas, Southern	Full sun/partial shade	2-5 gallons	3-4 inches
Peppers, Bell	Full sun	2 gallons	1 plant per container
Peppers, Hot	Full sun	5 gallons	1-2 plants per container
Radishes	Full sun/partial shade	1 pint	1 plant per container
Squash, Summer	Full sun	5 gallons	1 plant per container
Squash, Winter	Full sun	5 gallons	1 plant per container
Tomato	Full sun	5 gallons	1 plant per container
Tomato, Cherry	Full sun	1 gallon	1 plant per container
Turnips	Full sun	1 gallon	2-3 inches
Zucchini	Full sun	5 gallons	1 plant per container

PLANTING



PLANTING CALENDAR

Since different plants do well at different times of the year, it is important to consult a local planting calendar before sowing seeds or transplanting. Texas A&M AgriLife Extension Service has seasonal planting guides just for this purpose. See the guide for Travis County on the next page.

The guide includes average first and last frost dates. It is important to know these dates, as they will determine when you put plants that are not frost-resistant into your garden.

Note that the calendar recommends starting some plants from transplants instead of seeds. This is recommended because we have relatively short periods of mild weather in Central Texas. While established plants can handle freezes or hot weather, new plants cannot. Consequently, we have long **growing seasons** but relatively short **planting seasons**. By starting plants from seedlings instead of seeds, we can get a head start on the planting season, increasing our chances of success.

Annual plants complete their entire life cycle in one growing season. This means that, over the course of the growing season, a plant will grow from seed to adult, bolt, and die. Edible annuals include lettuce, spinach, radish, broccoli, cucumber, cilantro, basil, and corn.

Biennial plants complete their life cycle over the course of two growing seasons. Edible biennials include Brussels sprouts, parsley, chard, beet, cabbage, carrot, cauliflower, celery, collard, endive, kale, kohlrabi, leek, onion, parsnip, and turnip.

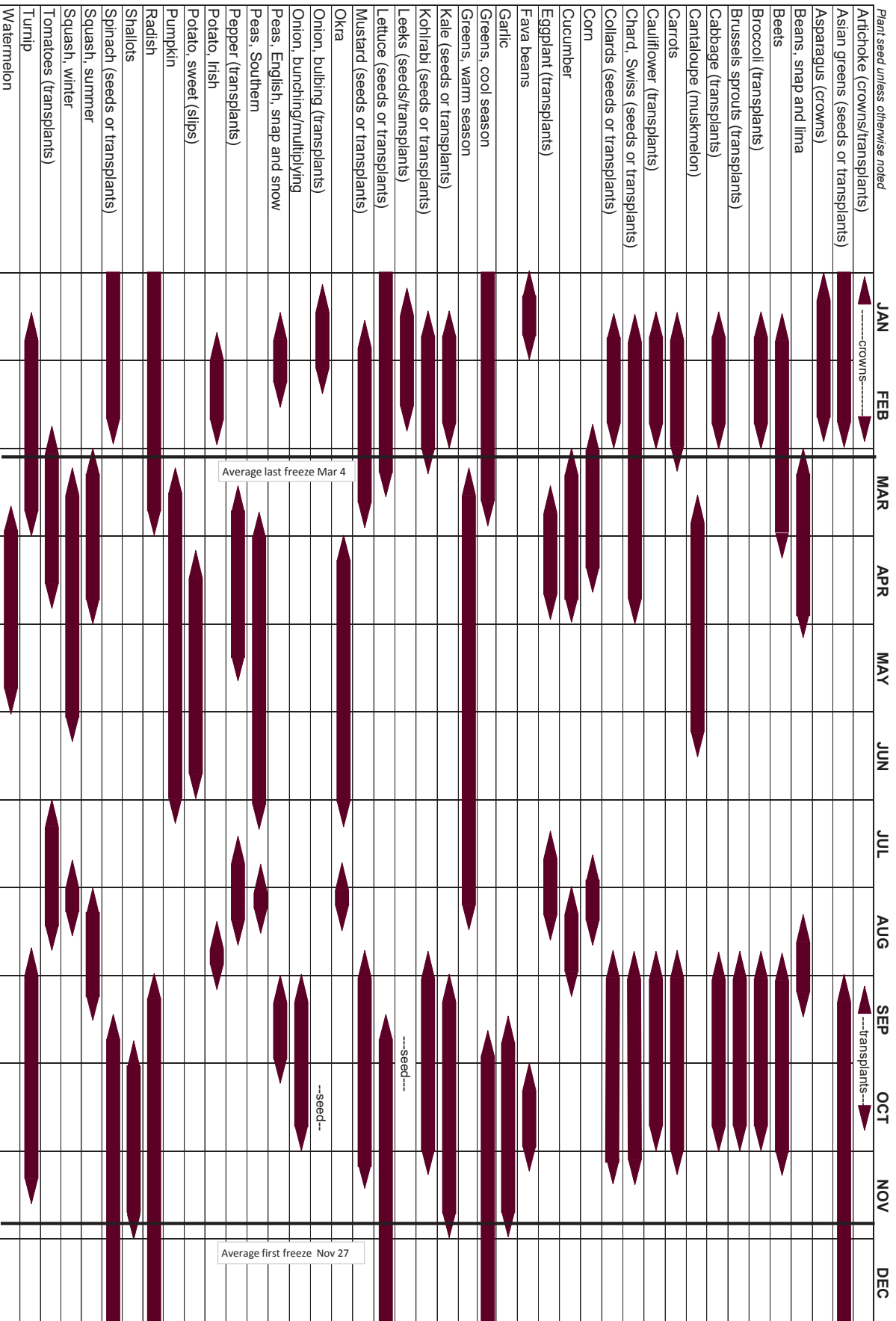
Perennial plants complete their life cycle over the course of three or more seasons. Edible perennials include herbs like rosemary, sage, lavender, fennel, oregano, thyme, and vegetables like artichokes, asparagus, rhubarb, fruit trees, and vines.

Whether plants are annual, biennial, or perennial varies from region to region. For example, tomatoes, which cannot withstand cold weather, are annual plants in Central Texas because they die off each winter. In tropical regions, tomato plants can live for years.

Companion planting is the practice of growing certain plants side by side because they benefit one another. Companion plants help each other grow by attracting beneficial insects and/or repelling garden pests, the natural chemicals produced by one plant improve the flavor and/or growth of another plant, or they have different nutrient needs or rooting depths and therefore do not compete with one another. See the companion planting chart on the back of your laminated planting calendar.

Vegetable Garden Planting Guide

Daphne Richards, County Extension Agent - Horticulture
Texas AgriLife Extension Service, Travis County, 1600-B Smith Road, Austin, TX 78721 512-854-9600



Plants grown in winter will benefit from protection during freezing weather
Plants grown in late summer will benefit from shade cover during establishment

Compiled by Patty G. Leander, Master Gardener Vegetable Specialist
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January 2015

PLANTING SEEDS

Some seeds, like carrots and radishes, are best planted in rows. Other seeds, like pumpkins and tomatoes, are best planted in individual holes. Still other seeds, like lettuce and parsley, can be broadcast over an entire area. As different seeds have different planting preferences, read the directions on seed packets carefully, and, if you can, ask an experienced gardener.

- 1) Read the seed packet. This will tell you how deep to plant seeds, how far apart, and how many seeds per hole.
- 2) Plant and water. Make sure to water with a watering can or a hose nozzle so you do not disturb the soil.
- 3) Keep your garden beds moist. When the weather is warm and dry, water every day until seeds have sprouted and formed true leaves.
- 4) If plants become crowded as they grow, thin them out by pinching the stem of excess plants at the soil line. Always choose the weakest, smallest plants to thin. It is better to have fewer healthier plants than too many plants that are unable to get enough nutrients and water to thrive. Thin plants repeatedly as they grow until the recommended spacing is achieved.

PLANTING SEEDLINGS

























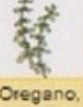




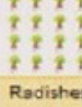


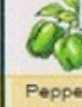















- 1) Water seedlings and garden beds
- 2) Loosen seedlings by squeezing their pots
- 3) Remove seedlings from their pots by holding the pots upside down and continuing to squeeze and tap them. If necessary, gently pull on the plant stem.
- 4) You may see roots growing in a circle around the root ball. These are called **bound roots**. They occur when a plant has limited growing space. Loosen bound roots by gently pulling them apart.



5) Dig holes in the ground as deep as the seedlings' root balls and place seedlings so that the bottoms of their stems are level with the ground. Fill holes with soil. Press lightly around the base of the stem so plant roots have good contact with the soil. **Note:** Tomatoes are an exception. It is best to plant their root balls 1-2 inches below the soil line, as this encourages additional root growth.

6) Water seedlings deeply so that water soaks through the entire root ball. Continue watering every 2-3 days until the plants have taken root. Once you see new growth, you can water less frequently.

SQUARE FOOT GARDENING

 Garlic, (4)	 Okra, (1)	 Carrots, (16)	 Hot peppers, (1)	 Kale, (2)	 Kohlrabi, (4)	 Head Lettuces, (4)	 Leaf Lettuces, (16)	 Peas, (8)	 Peppers, (1)	 Potatoes, (2)	 Melons, (1)
 Dill, (9)	 Fennel, (2)	 Beans, (4)	 Beets, (9)	 Bok Choi, (1)	 Brussels Sprouts, (1)	 Cabbage, (1)	 Cauliflower, (1)	 Chives, (1)	 Corn, (2)	 Cucumbers, (2)	 Eggplants, (1)
 Oregano, (1)	 Parsley, (2)	 Parsnips, (9)	 Cilantro, (9)	 Rutabagas, (4)	 Radishes, (16)	 Rosemary, (1)	 Pumpkins, (1)	 Peppers, (1)	 Sage, (1)	 Basil, (2)	 Arugula, (16)
 Spinach, (9)	 Summer Squash, (1)	 Sweet Potatoes, (1)	 Swiss Chard, (2)	 Thyme, (2)	 Onions, (9)	 Turnips, (9)	 Winter Squash, (1)	 Swiss Chard, (2)	 Leeks, (6)	 Celery, (2)	 Calendula, (2)

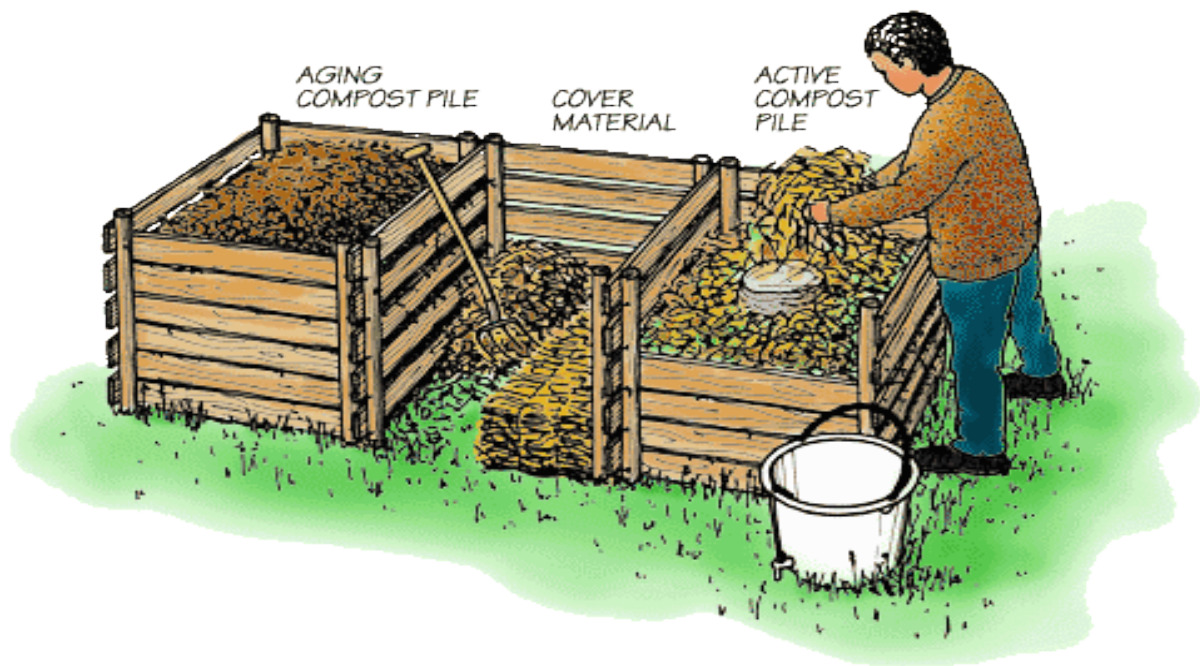
Square foot gardening helps maximize garden space. This technique is ideal for new gardeners, as it instructs gardeners how densely to plant their beds. The practice requires well-amended soil.

Use string and upholstery tacks to divide your beds into square feet and use square foot gardening charts to plant each foot as densely as possible.



You can also maximize your gardening space through **vertical gardening**. Trellises can be made out of wood, bamboo, metal, or plastic. Plants that thrive when grown on trellises include pole beans, peas, cucumbers, pumpkins, melons, and tomatoes.

COMPOST



Composting is a natural process whereby organisms consume organic matter and break it down into humus, a nutrient-rich, soil-like material. Contrary to popular belief, it is easy to compost. If built properly, a compost pile will not stink or attract (many) rodents.

Why Compost?

- Composting ensures that your garden has a steady supply of nutrients and soil microorganisms
- Composting reduces waste
- Composting reduces greenhouse emissions. Rotting food in landfills releases methane, a potent greenhouse gas, into the atmosphere.
- Composting saves money otherwise spent on store-bought soil and fertilizer
- Composting is fun and interesting, particularly for children

Frequently Asked Questions

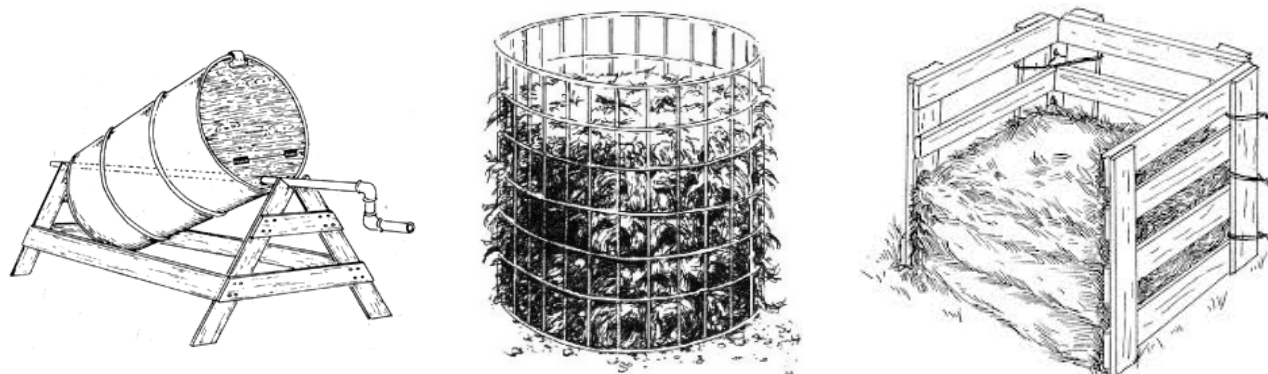
What do I need to compost?

In order to thrive, compost organisms require water, air, and a balance of nitrogen and carbon. Sources of nitrogen are called “green” or “wet” materials because they are often green and wet. Sources of carbon are called “brown” or “dry” materials because they are generally brown and dry. Avoid oils, meat, dairy products, cooked foods, bones, disease- or insect-ridden plants, yard trimmings with seeds or chemical pesticides, and pet and human manure. It is also best to avoid paper and cardboard that has been bleached, dyed, or waxed.

Nitrogen-Rich Materials	Carbon-Rich Materials
Vegetable and fruit scraps	Dry leaves and other dry yard scraps
Tea bags and coffee grounds	Branches and twigs
Fresh leaves and green yard scraps	Wood chips and sawdust
Manure	Shredded paper and cardboard
Urine	Cotton or wool rags and shirts
Hair	Nut shells

What type of compost system works best?

Compost systems come in all shapes and sizes. The simplest system consists of a pile on the ground. You can create a structure using wooden pallets, chicken wire, or stones. You can also compost inside a barrel; however, because the barrel is isolated from soil organisms, it is important to inoculate it with organisms by adding fresh compost.



Where should I place my compost pile?

Compost organisms do not require sun and will die if the pile dries out, so it is best to place compost piles in the shade and near a water source. Compost piles should also be located close to your garden so it is easy to move finished compost to your beds. Avoid placing piles directly against a building.

How do I build a compost pile?

Store your food scraps indoors in a small, covered container. When the container is full, empty it into your compost pile. Every time you empty food scraps into the compost, cover them with a thick layer of “brown,” carbon-rich materials so that none of the food scraps are visible. We recommend keeping a pile of leaves next to your compost pile so that it is easier to add brown materials. Make sure the pile is moist but not wet.



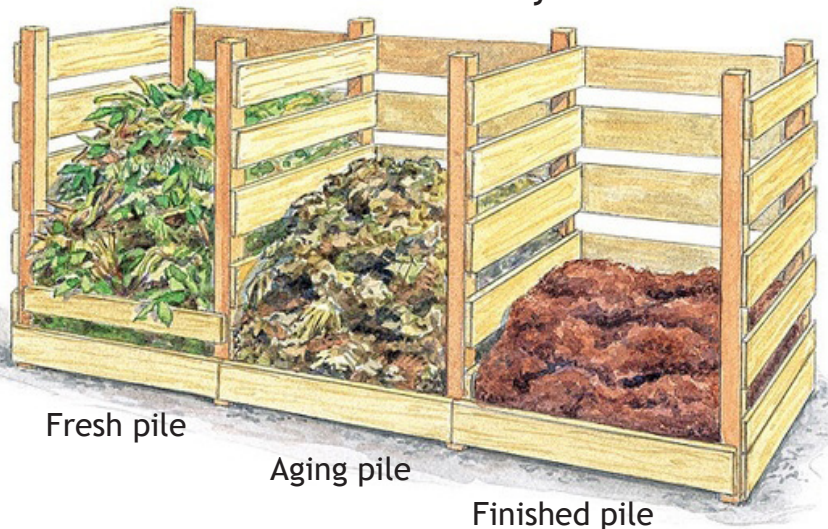
You can occasionally turn your compost to aerate it and speed up the composting process. However, if you add enough carbon, turning is not necessary. As the materials break down, the pile will get warm and might even produce steam. This means it is working, as the steam is being produced by millions of bacteria that are consuming your food scraps. Once you can no longer identify your food or yard scraps, your compost is ready.

How long does the composting process take?

Composting can take anywhere from 2-12 months, depending on the size of your pile, what you add to it, and how often you turn it. Some tips for speeding up the composting process include:

- Create a 3-bin system. This way, you can add fresh materials to one pile while another pile ages. The third pile is finished compost that you can use in your garden.

3-Bin System



- Cut your food and yard scraps into small pieces before adding them to the pile
- Build large piles of at least one cubic foot. This will create a habitat for a critical mass of compost organisms, accelerating the composting process.
- Do not let your compost pile dry out
- Turn your pile weekly or monthly
- Observe your pile until you figure out the best ratio of nitrogen to carbon

Troubleshooting Compost

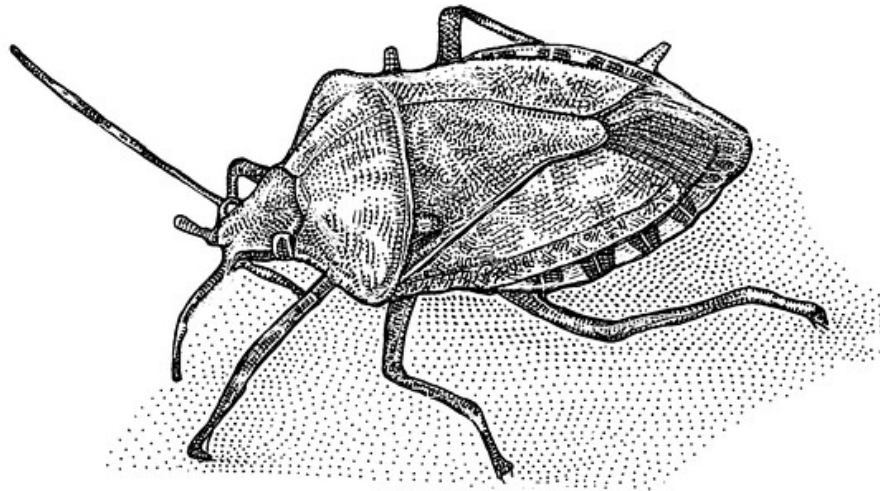
To prevent your pile from stinking and attracting pests, ensure that the outer layer of the pile is covered in brown materials. If your pile is not composting properly, your microorganisms are not getting the right combination of air, water, and nutrients they need.

Common Problems and Solutions		
Problem	Cause	Solution
Compost pile is not heating up	Not enough nitrogen (green/wet materials) or water	Add fresh lawn clippings, food scraps, tea bags, etc., and moisten with water
Compost pile stinks	Not enough carbon (brown/dry materials) or too wet	Add leaves, twigs, shredded paper, cardboard, etc., and reduce amount/frequency of watering
Compost is attracting rats or other pests	Too much nitrogen	Add carbon and ensure that the outer layer of the pile is covered in carbon
Compost is attracting cockroaches	Too much carbon	Add nitrogen

Composting Tips

- Leave cardboard outside where it will be rained on before adding it to the pile. Once the cardboard has gotten wet, it will be easier to tear into small pieces.
- Keep a second container, such as a waste bucket, indoors to store household brown waste, such as unbleached paper towels and toilet paper rolls. Empty this container into your compost pile along with your food scraps.
- Gather free mulch and brown composting materials. Each fall, gather bags of leaves from sidewalks around town. Before taking any leaves, look inside the bags to ensure they are not full of weeds. Keep the leaves bagged and store beside your home, in a shed, or in a garage.

DISEASE AND PEST MANAGEMENT



Diseases and pests are part of nature and will be present in any garden, even if only minimally. Indeed, a gardener's adage recommends that food gardeners grow at least three of every plant: one to go to seed, one to eat, and one for the pests to eat. There are, however, a number of ways to minimize the occurrence of diseases and pests. The best way to prevent diseases and pests is to keep your plants healthy by growing them in nutrient-rich, well-drained soil and by watering them appropriately. More targeted practices can be broken down into **biological**, **cultural**, **mechanical**, and **chemical control**. Collectively, these practices are known as **integrated pest management**.

Biological Control

Biological control refers to the cultivation of a diverse web of soil organisms that out-compete diseases and pests. Create thriving soil webs by:

- Amending your soil with compost
- Providing a habitat for beneficial insects and other animals that eat pests
- Not killing beneficial insects
- Spraying your plants with compost tea (see page 42)

What is a beneficial insect?

Beneficial insects support gardens by eating pests, pollinating plants, aerating the soil, and forming part of a larger garden ecology that supports plant health. See the following pages for examples of common beneficial insects.

How can I attract beneficial insects to my garden?

To attract beneficial insects to your garden, provide them with a habitat by cultivating colorful, fragrant flowers, ground covers, and shrubs. Ladybugs and praying mantises like angelica, marigolds, and yarrow. You can also attract beneficial insects by leaving umbelliferous plants (e.g. dill, parsley, fennel, carrots, and cilantro) in your garden long enough to flower. **Note:** Unless you are saving seed, it is not recommended to leave Brassicas plants (e.g. cabbage, broccoli, cauliflower, kale) in your garden, as older Brassicas tend to attract aphids and other pests.

During the summer, it is helpful to leave a shallow dish of water near your garden. This will deter larger animals, like squirrels, from eating your melons since they often bite into unripe fruit rinds looking for water. By leaving a dish of water in your garden, you will also attract larger animals that eat pests, including lizards, turtles, frogs, and birds.

Last but not least, do not kill beneficial insects! If you are checking for pests and find unfamiliar insects on your plants, be they adult insects, pupae, larvae, or eggs, educate yourself about what kind of bug you have found before disturbing it. If it is a beneficial insect, leave it alone!

Common Beneficial Insects

Praying mantises are generalist predators and will eat any insects they find.

Adult Praying Mantis



Praying Mantis Eggs

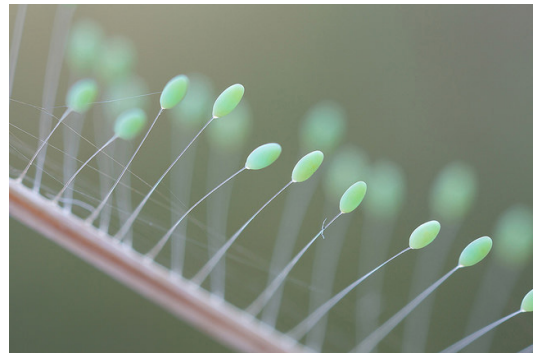


Green lacewings are voracious predators. Nicknamed “aphid lions,” they devour aphids and other garden pests by the dozen.

Adult Lacewing



Lacewing Eggs



Braconid wasps are parasitic insects that prey on a number of garden pests, including hornworms. Females lay their eggs underneath the skin of hornworms. When the eggs hatch, they feed on the worm, eating it alive.

Adult Braconid Wasp



Braconid Wasp Eggs



Ground beetle larvae develop in the soil and prey on slugs, root maggots, cutworms, and other pests that live in and on the soil. A few species venture up plant stems and hunt for caterpillars or insect eggs.

Adult Ground Beetle



Ground Beetle Larva



Painted lady butterfly caterpillars feed mainly on thistle and do minimal damage to vegetables. Swallowtail caterpillars eat dill, fennel, and parsley. However, because these plants grow quickly, the caterpillars do minimal damage.

Painted Lady Butterfly Caterpillars



Swallowtail Caterpillars



Mechanical Control

Mechanical control refers to the management of pests using physical means, including:

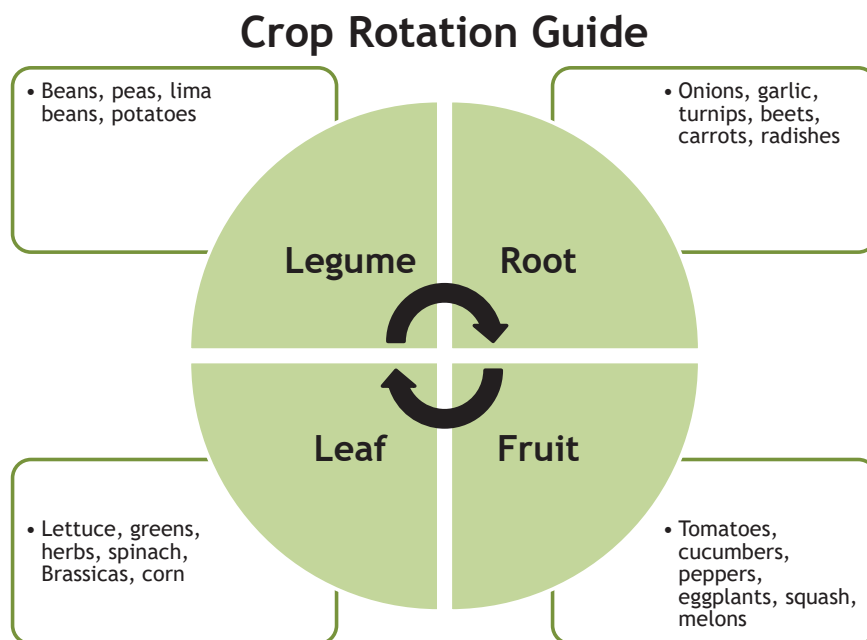
- Removing pests by hand. The best time to check for pests is in the early morning or late evening, as insects often hide during the day.
- Using a strong spray of water to dislodge pests from stems and leaves
- Using row covers, nets, and fences. This can also protect your crops from larger pests, such as birds and squirrels. **Note:** Row covers keep pests away from your plants, along with beneficial insects, including pollinators.



Cultural Control

Cultural control refers to cultivation practices that reduce the occurrence of pests and diseases. These practices include:

- Intersperse pest-prone plants like cabbage and tomato with pungent plants like onion, cilantro, and basil
- Reduce pest habitat by removing dead plant debris and weeds
- Rotate your crops every season or every other season (see guide below)
- Grow “trap plants” near your garden to attract and trap pests. These include milkweed, which attracts aphids and monarch butterflies.
- Minimize fungal infections by avoiding overhead watering. Remember to water the soil and do not over-water.
- Do not overcrowd plants
- Choose pest- and disease-resistant plant varieties, as well as locally appropriate varieties



Chemical Control

Chemical control refers to the use of pesticides. Though less harmful than artificial pesticides, organic pesticides do not distinguish between good and bad insects and should be used sparingly. You can buy organic pesticides at gardening stores or use homemade organic pesticides (see the following recipes). Read product labels carefully and make sure the label says “OMRI Listed.” This means it has undergone an independent review by the Organic Materials Review Institute (OMRI) and is allowed for use in organic cultivation.

Organic Pesticide Recipes

Baking soda: Baking soda makes an excellent fungicide for black spot, powdery mildew, brown patch, and other fungal problems. Mix at the rate of four teaspoons per gallon of water. Add one teaspoon of liquid soap or vegetable oil. Potassium bicarbonate is also effective and better for the soil.

Garlic spray: Six cloves mixed into one gallon of water will give you a weak spray. This may be sufficient for preventative measures. For a stronger spray, use up to two full bulbs of garlic pureed into ½ cup of water. Crush your garlic and put it into a medium-sized bowl. Cover with boiling water and let it steep overnight. Strain before you put it into a spray bottle so the garlic pieces do not clog the nozzle. To repel a wider variety of pests, add a tablespoon of crushed hot pepper or a hot pepper sauce to the water while the garlic steeps. Add a tablespoon of liquid soap or vegetable oil to the mixture, which coats larvae and eggs and smothers them.

Citrus oil spray: Fill a container half-full with citrus peels or pulp. Orange is best. Fill the remainder of the container with water. Let mixture sit in a cool place for a week. Strain. Use one cup of the concentrate per gallon of spray. **Note:** Commercial orange oil is more potent than homemade orange oil and can burn plants. Use it at a rate of less than two ounces per gallon of water and always mix it with molasses and compost tea.

Safety Tips for Using Organic Pesticides

- Always label any homemade garden spray that you intend to store
- Store out of reach of children and pets
- Only spray on days that are not windy to minimize the risk of spraying yourself

Common Vegetable Garden Pests

Cabbage loopers chew large, irregular holes in Brassicas, including cabbage, broccoli, cauliflower, kale, and Brussels sprouts. They are most active in warm weather.

You can prevent looper attacks by checking under the leaves and on the stems of plants and picking off any eggs or larvae before an outbreak starts. Check for adult cabbage loopers in the morning or on overcast days, as they tend to hide once the sun is out. Cabbage looper larvae are also easy targets for predators. In particular, parsley, dill, fennel, coriander/cilantro, and sweet alyssum attract the kinds of insects and other animals that prey on these worms.

Adult Cabbage Loopers



Cabbage Looper Eggs



Also known as plant lice, **aphids** are small, sap-sucking insects that live on stems and the undersides of leaves. They are most common during warm weather and can be avoided entirely during cold months. Crowded plants are more susceptible to aphid infestations, so make sure your crops have adequate space. If you have a small infestation, wipe the aphids off with your fingers or a soft cloth, or spray the leaves with a strong jet of water. Check again every day or two and repeat until you stop seeing the insects. If you have a large infestation, try pepper or garlic sprays, or remove the affected plants from your garden.



Leaf-footed bugs commonly infest tomatoes but feed on almost any plant. Weeds provide them with a food source during winter and spring when fruits are not available. Try to eliminate weed-ridden areas near your garden or keep them mowed. At regular intervals, examine your garden for all stages of the pest and hand-pick them off plants. The insects may be hidden inside dense foliage layers or fruit clusters, so look closely. Natural predators of leaf-footed bugs include birds, spiders, and assassin bugs.



Cutworms are caterpillars that eat almost all vegetable plants but are especially fond of tomatoes and peppers. Different species range in color from gray and pink to green and black. They can be solid, spotted, or striped, and tend to curl up when not on the move.

Cutworms do the most damage early in the spring gardening season, when they emerge from hibernation. They chew through the base of plant stems and often cut off the plant from underneath the soil. In most cases, the entire plant is destroyed.

To control cutworms, patrol your garden during dusk and evening hours or on cloudy days, when the caterpillars feed. You can also make plant collars by placing a 4-inch piece of cardboard around each plant stem. This helps prevent cutworms from reaching tender stems, especially right at transplanting. The moths prefer to lay eggs in high grass and weeds, so make sure your garden remains tidy.





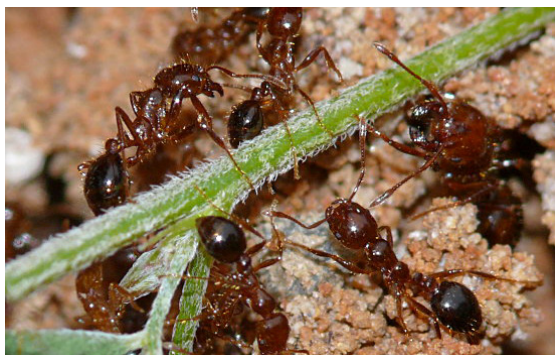
If your squash plants suddenly wilt and have holes in their stems, you likely have **squash vine borers**, a moth whose larvae feed off squash stems. This pest is so common in Central Texas that many gardeners choose not to grow summer or winter squash, as they are particularly susceptible to borers. If you are determined to grow summer or winter squash, you can guard against squash vine borers using the steps below:

- Sow your squash early in the summer and do not plant squash in the same beds for two consecutive years, as borers overwinter in cocoons in the soil
- Protect your squash plants with row covers, which prevent moths from laying eggs
- Plant fennel, dill, and cilantro near your squash and let these plants flower. This will attract parasitic wasps, which feed off borers.
- If you catch borers very early, you can remove them. Slit the lower stem lengthwise with a sharp knife, remove the larvae by hand, then cover the slit with moist soil to promote the formation of secondary roots.
- You can also control the presence of borer cocoons in the soil by introducing chickens into your garden. Make sure to protect the plants you want to keep, as chickens will quickly eat whatever plant foliage they can access.



Tomato hornworms eat tomatoes, peppers, eggplants, and potatoes. They can grow up to five inches long. Since they are relatively large, the easiest way to get rid of hornworms is to pick them off plants. However, if you see a hornworm covered with white egg sacs, leave it be, as the eggs belong to a Braconid wasp. Let the eggs hatch and you will have an army of wasps ready to defend your garden against all types of pests. You can

also control hornworm populations by interspersing your plants with marigolds.



Imported fire ants prefer poor, sandy, and disturbed soils. They are active in warm weather and are particularly fond of okra, sunflowers, eggplants, and black-eyed peas. Once established, their colonies are almost impossible to eliminate, but there are ways of keeping the ants out of your garden. First and foremost, build your soil. Disturb mounds by shooting them with strong sprays of water. You can also use a shovel to move them, but work quickly,

as the ants will swarm up the shovel to your hands. If bothered enough, the ants will relocate. You can also try molasses and citrus oil sprays, granular fire ant killer (spinosad or diatomaceous earth), adding beneficial nematodes to the soil, and tossing cornmeal over the mounds.

Common Garden Diseases

The best ways to prevent garden diseases are:

- Do not over- or under-water
- Grow your plants in well-amended soil
- Build your soil biology by adding compost, mulching, and gardening organically. In so doing, you will ensure that beneficial microbes out-compete pathogens.



Powdery mildew is a common disease on many vegetables, fruits, and flowers. A fungal infection, it is characterized by a powdery white to gray fungal growth on leaves, stems, and heads. It can affect the flavor of melon and squash and reduce their yields. Woody species, such as grapes and fruit vines, are more seriously affected: new growth is often disturbed, causing young fruit to develop rough skin.

Contrary to popular belief, powdery mildew does not require free water to establish and grow. The fungus prefers warm temperatures and shady conditions and is sensitive to extreme heat and direct sunlight. In most cases, cultural practices will adequately control powdery mildew. These practices include:

- Select powdery mildew-resistant varieties
- Plant in full sunlight in a well-drained area
- Do not crowd plants. Airflow and ventilation will discourage mildew growth.
- Powdery mildew thrives where high rates of nitrogen have been used. Excess nitrogen promotes tender leaf formation, causing dense stands that are more susceptible to infections. Avoid over-fertilizing and fertilize using compost, which slowly releases nutrients as plants need them.
- Prune infected plants to get rid of infected parts and increase airflow. If infections are severe, remove entire plants.
- Disinfect pruning tools in a solution of one part white vinegar to four parts water after each cut

Organic sprays can also be used on plants that have been infected. Baking soda, in particular, increases the surface pH of the leaf, making it unsuitable for the growth of powdery mildew spores. Be sure to spray the undersides of leaves as well as the upper surfaces.



Downy mildew is also caused by a fungal infection on plant leaves. It is most common on cucumber and cantaloupe, though all Cucurbits are susceptible. Infected leaves generally die but may remain erect while the edges of the leaf blades curl inward. Usually, leaves near the center of a hill or row are infected first. The infected area spreads outward, causing defoliation, stunted growth, and poor fruit development.

Downy mildew fungus is easily carried by wind currents, rain splash, farm implements, and the hands and clothes of farmworkers. Unlike powdery mildew, it requires humidity to flourish. Therefore, downy mildew is most aggressive when heavy dews, fog, and frequent rains occur.

Since this disease is carried to most fields on light winds, crop rotation and sanitation have a limited effect on the incidence of downy mildew. Effective cultural management practices include:

- Select growing sites with full sunlight, good drainage, and low humidity
- Water the soil, not the leaves of the plant
- If detected early, disease spread might be slowed somewhat by removing and destroying infected plants and by taking care not to transport the disease by hand or on infected tools and equipment

Root rot is often caused by fungi in the soil and occurs when plants are grown in waterlogged or drought conditions. If major roots or the crown are affected by root rot, the entire plant can wilt and die rapidly. If only the small “feeder” rootlets are affected, the plant may decline slowly and appear sickly and unproductive. Sick or damaged roots may be present only on part of a plant’s root system, resulting in a one-sided appearance of symptoms on leaves and stems. The first symptom of poor root health is usually dull foliage color. Sometimes leaves turn yellow and wilt. These changes may occur quickly or may take months to develop.

Management strategies include improving soil drainage and use of proper planting techniques. Planting holes should be large enough to accommodate roots without crowding. Before planting, loosen some of the roots on the root ball to encourage root growth into the surrounding soil. Mulch the soil surface lightly to reduce the likelihood of heat and moisture stress. Treatments that may help infected plants include:

- Avoid over-watering
- Remove some soil or mulch to expose the base of the plant so it can dry, but do not expose roots
- Do not fertilize plants during hot, dry weather

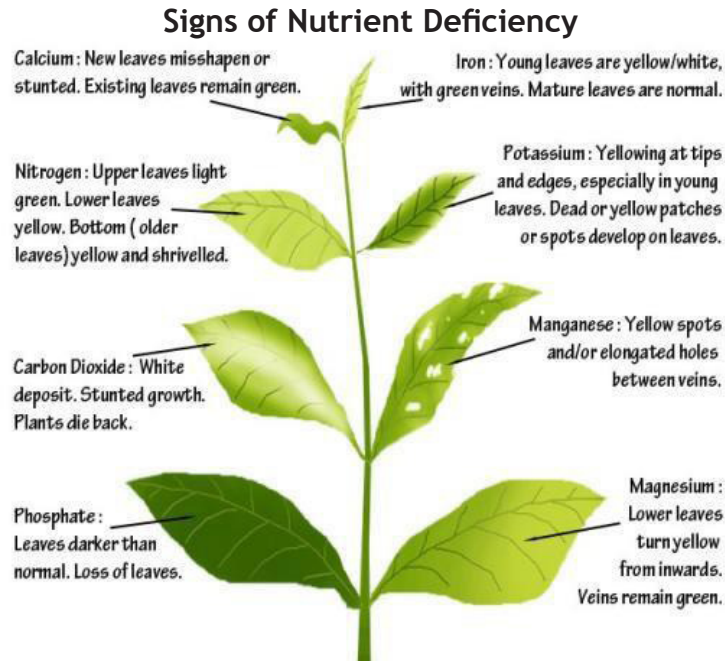
Damping off refers to a handful of fungal diseases, including several root rots and molds, that cause seedlings to die. Seedlings may start to grow and then wither, break off, or collapse. You may see some gradual discoloring or it may happen very suddenly. Often, it appears that the seedling has been pinched off at the soil line. Damping off can be prevented by sowing seeds in a sterilized growing medium, although fungal spores may still be introduced to the medium, either on the seeds, in the water, or on the wind.



You can also prevent the disease by not overcrowding seedlings, ensuring better air circulation and adequate sunlight; and by not over-watering them. To reduce pathogen survival, remove and discard diseased plants. Organic sprays have proven effective when used on infected plants, including garlic and chamomile sprays. The latter consists of a strong brew of chamomile tea.

Disease vs. Nutrient Deficiency

It is easy to confuse plant diseases with nutrient deficiencies. To prevent this confusion, see the guide below for signs of common nutrient deficiencies. Remember, because new gardens do not have an established soil biology, plants will often struggle to absorb nutrients. You can respond to nutrient deficiencies by regularly top-dressing with compost, spraying foliage with compost tea, and applying organic liquid fertilizers.



Compost Tea

In addition to containing nutrients, compost and compost teas are full of microorganisms that control diseases by out-competing them. By applying compost to the soil, you can prevent and mitigate diseases. You also boost plants' resistance to pests. Compost tea is best used on plants already affected by disease.

Materials:

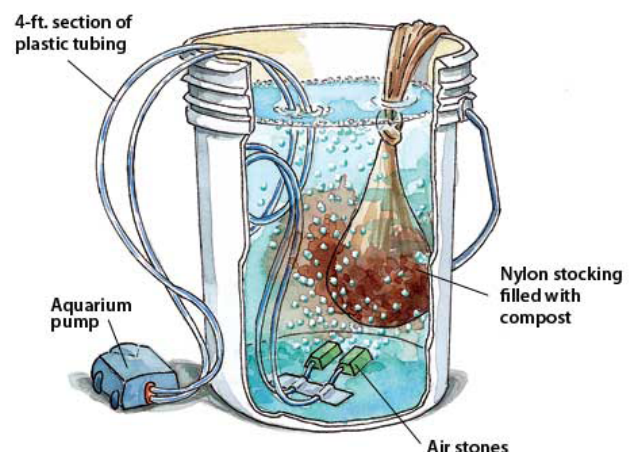
- 4-5 cups of finished compost
- Water (if possible, chlorine-free)
- 5-gallon bucket
- Small aquarium pump
- ¼ cup molasses
- Nylon stockings
- Duct tape

1) Fill nylon stockings with compost and tie them closed.

2) Fill bucket with water, add molasses, then suspend the nylon stockings inside. Hook up aquarium pump.

3) Duct tape the tubing to the bottom of the bucket so the pump does not float. Run the pump for 24-36 hours. When the tea turns coffee-brown, it is ready to use. Spray tea directly onto plant foliage.

4) Compost tea does not store well, so the sooner you apply it, the better.



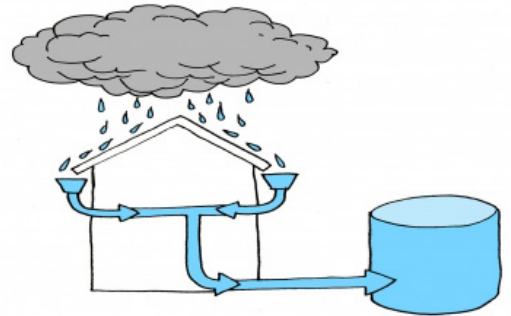
ADDITIONAL GARDENING TOPICS



RAINWATER COLLECTION

Why Collect Rainwater?

- Tap water contains chlorine and other anti-bacterial agents that harm soil organisms, slowing plant development. Rainwater does not contain these chemicals.
- Rain captures nitrogen from the air and deposits it in the soil
- Seeds watered with rain have a higher germination rate than seeds watered with tap water
- Long-term financial savings
- Conserves water



Rainwater Calculations

To determine how much rainwater you can capture from a given area, use the following equation:

$$\text{Gallons of rainwater collected} = \text{Catchment area (ft}^2\text{)} \times \text{amount of rain (in)} \times \text{conversion factor (0.63)}$$

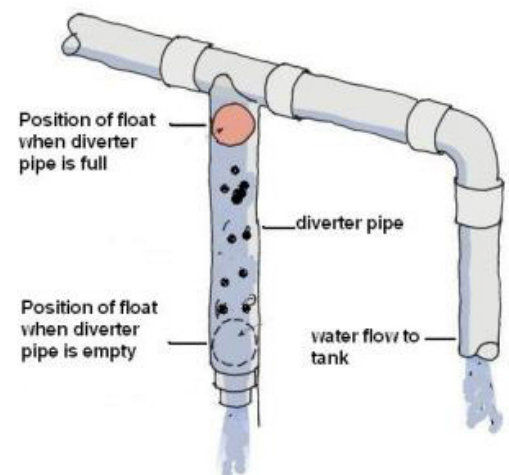
Amount of water captured from a 1000 ft² roof

Rainfall	Gallons of water captured
1 inch	630
2 inches	1260
32 inches (Austin's annual precipitation)	20,160

Storing Rainwater in Tanks

- Rainwater tanks can be made of plastic, concrete, fiberglass, or steel
- Water is heavy. One gallon of water weighs 8.345 pounds; when full, a 1000-gallon tank will weigh 8345 pounds, or almost half a ton. Make sure that whatever foundation you place your tanks on can bear the weight without cracking.
- Tanks should be elevated so that gravity provides water pressure through a hose. If it is not possible to elevate tanks, you will need a pump.
- Tanks should be sealed to avoid creating mosquito habitat
- Plan for overflow
- Place screens over your gutters or clean your gutters at regular intervals
- Integrate a first flush diverter system to prevent the first 5-6 gallons of water, which may be contaminated with animal droppings, leaves, and other residues, from entering the tank

First Flush Diverter System

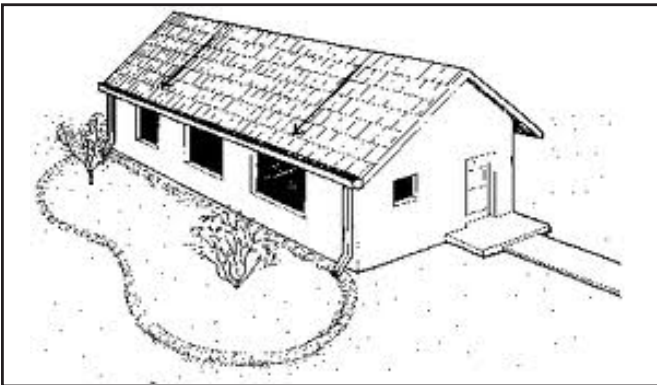


- If collecting rainwater off uncoated lead flashings, treated timber, or bitumen-based roofing, do not use this rain to water your garden, as it contains chemicals that are harmful to human health when ingested
- Tanks should be opaque and a dark color to prevent sunlight from reaching stored water and causing algal blooms. Ideally, tanks should also be located in a shady spot.

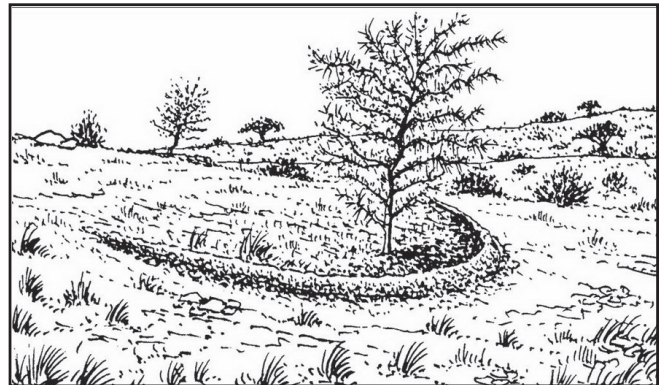
Storing Rainwater in the Ground

You can also store rain in the ground using berms, swales, and rain gardens. Berms are long, narrow mounds of dirt that enclose an area, trapping water inside. Swales are low-lying tracts of land where water settles and percolates into the ground. They can be created by building berms perpendicular to a slope.

Berm



Berm and Swale



Rain gardens are dug 6-8 inches into the ground, causing rain to flow into the beds. They are also ideal for low-lying areas that are prone to flooding. Since rain gardens often capture run-off from roads, and because this run-off is contaminated with metals and salts, such gardens are usually planted with non-edible plants. Ideally, they are landscaped using native and naturalized plants that can handle both dry and saturated soils.

Successful rainwater harvesting requires knowledge of how rain flows over the land. Before constructing berms, swales, or rain gardens, go outside when it is raining and observe.



REGULAR GARDEN CARE

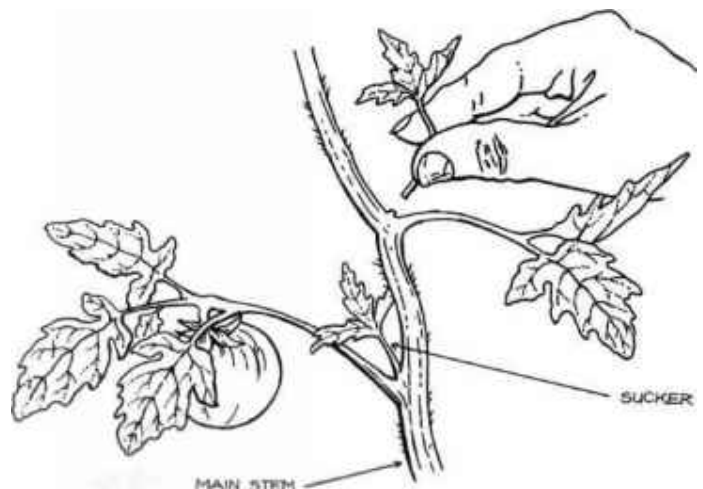
The saying “out of sight, out of mind” holds true for gardening. To ensure that you do not forget to water, weed, or harvest, install your garden where you will see it and keep the beds close together. Also, start small. Gardening takes time; instead of starting big and losing control of the whole garden, start small and expand slowly.

Successful food gardeners incorporate garden observation and care into their daily rituals. They may start their morning with a meander through their garden beds, poking their fingers into the soil or lifting a leaf here and there to check for pests or to see if fruit is hiding beneath the foliage. They may drink their coffee or tea at a table just next to the garden, where they can watch bees and butterflies flying from flower to flower and jot down observations in their garden journals. Alternatively, they may tend their gardens in the evening, after temperatures have cooled and all their other work is done. Whatever the case, even the most seasoned food growers visit their gardens almost daily, for regular visits enable gardeners to note patterns, catch problems early, and determine what work needs to be done.

Regular gardening tasks include watering and spot weeding. Other regular tasks vary from season to season. After a garden has been newly planted, and unless it rains, Central Texas gardeners generally water their beds every day or every 2-3 days, depending on the season. If weeds appear here and there, gardeners will spot-weed with a hand trowel, being careful not to disturb areas that have been planted. Apart from these small tasks, there is not much to do except wait for seeds to germinate and for transplants to grow.

Most seeds will sprout and form their first true leaves within 3-4 weeks, and most seedlings will establish themselves within two weeks. At this point, gardeners can water less, but there are other regular tasks to do. If it is not too late in the planting season, and if gardeners have a large enough space, they might do another round of planting to ensure a longer harvest period. This is known as **succession planting**.

Gardeners may prune their tomato plants by removing **suckers**, resulting in less unwieldy plants. They may also decide to let the suckers grow. Additionally, carrots need to be thinned as they grow; tomatoes need to be caged, the earlier the better so as not to puncture a root; and trellises need to be placed alongside pole beans, peas, and other climbing vegetables.



If seedlings do not seem to be growing, or if they are growing slowly, a gardener may try to stimulate root growth by watering with seaweed or fish emulsions. If plants are growing but appear yellow or spotty, they may be struggling to absorb nutrients from the soil. If this is the case, a gardener may top-dress or side-dress beds by mulching them with a layer of compost. Side dressing is a way of amending a garden without damaging the roots of established plants. Side-dress your garden by laying compost on top of the soil alongside the plants and simply leave it to sit or gently turn it into the soil with a trowel or hand cultivator.

As the season progresses, leafy plants will grow large enough to yield a harvest, and fruiting plants will begin to flower. At this point, plants need be watered only 2-3 times per week, but they must be watered more deeply. If need be, gardeners may top-dress their beds again, ensuring that plants have all the nutrients they need throughout the growing season. They may find that the mulch laid over the garden a month ago has broken down and the beds need to be re-mulched with leaves, bark, or straw. If some plants have died, gardeners may replant in the open spaces.

Before a freeze, saturate your soil with water. At all times, regulate soil temperatures by mulching your garden beds. To protect your rain barrels from hard freezes, place them adjacent to a building, preferably on the south or west side. If expecting a hard freeze, undo fittings and hoses and store indoors. If your barrels are small, empty them and set them upside down.



Wise gardeners will also check their plants for pests before they notice any damage. Ideally, they will search for pests early in the morning or on cloudy days. If they notice a fungal infection, they may cut back infected foliage and perhaps thin their plants a bit more. If they see snails on their greens, they may search their garden for any stones or bricks that are providing the snails with habitat. Squirrels and birds love tomatoes, melons, and other fruit, so in the spring, gardeners may place netting over their beds before these plants bear fruit.

About 3-4 months after germinating, most plants are ready to harvest. Since adult plants produce rapidly, visit your vegetable garden every day or two to harvest, or you might miss your chance. When harvesting greens, it is best to pick the entire leaf and stem and to harvest the oldest outermost leaves first. It is also important to leave enough foliage on plants so that they can continue to photosynthesize and grow. Onions, carrots, and beets are ready to harvest when you see the roots sticking out of the soil. Potatoes and garlic are ready to harvest when their tops brown and wilt. Fruit, including tomatoes, eggplants, cucumbers, and melons, is ready to harvest when it breaks away from the stem easily. If you have to tug at a fruit, leave it a few more days. Okra should be harvested regularly, for once the pods are larger than two inches, they become too fibrous to eat.

Towards the end of the season, most plants will start to die. Fruiting plants will stop producing new fruit, and their foliage will brown and dry. Leafy annual plants will produce flowers and seed. Likewise, any remaining heads of broccoli, cauliflower, or cabbage will break apart and sprout long stalks that quickly form small yellow flowers. As plants bolt, or produce flowers then seeds, their leaves become bitter and they change shape and texture. To produce seed, plants must pull large amounts of nitrogen from the soil. Additionally, old plants can be pest-prone. In order to conserve nitrogen and avoid pests, gardeners may decide to remove bolting plants from their gardens.

On the other hand, flowers attract beneficial insects, so gardeners may let one or two bolting plants complete their life cycles. Other gardeners might decide to save seed from particularly tasty and hardy plants, in which case they will leave these plants in their garden until the seeds have matured and dried.

Whatever gardeners decide, they will eventually clear their garden beds of old plants and once again prepare them for planting, taking advantage of the bare beds to do a thorough weeding and amend the soil with compost. Central Texas winters are ideal for growing cool-weather crops, and if the weather is cool, gardeners may decide to replant their beds right away. In the summer, they might put their beds to sleep by clearing them and covering them with a thick layer of mulch, or they might plant their beds with a cover crop. When fall arrives, they will cut the cover crop into the soil, where it will act as a green manure.

If gardeners find themselves with down-time between seasons, they may turn their compost piles, install drip hose lines, and reflect on their successes and mistakes. Did one type of lettuce bolt early, while another type thrived? Were kale plants too crowded, resulting in an infestation of aphids? Did the tomatoes get tied up too late, causing the plants' limbs to break? Were carrot seeds sown too densely, making thinning a never-ending chore?

As a new food grower, such reflections will help you develop your gardening skills, as well as an intuitive sense of regular gardening chores. Throughout the process, if you continue to build your soil, amending it with compost and mulch, gardening will become easier and easier. Soon, the tomato, lettuce, and parsley seeds that fell of their own accord into your beds will produce "volunteers." Tiny chive plants will develop into onion patches. Pests and weeds will always be present, but with an hour or less of maintenance here and there, they will be easier to control. Before you know it, with only a little work, your food garden will produce regular and bountiful harvests that you and your family, friends, neighbors, and coworkers can enjoy.



GARDENING RESOURCES

Local Nurseries and Garden-Related Stores	Bulk Soil, Compost, and Mulch Suppliers
<p>Barton Springs Nursery 3601 Bee Caves Rd., Austin, TX 78746 (512) 328-6655 www.bartonspringsnursery.net</p>	<p>Daniel's Stone and Landscaping Supplies 12015 W Hwy. 290, Austin, TX 78737 (512) 288-8488 www.danielstoneandlandscaping.com</p>
<p>Breed & Co. 718 W 29th St., Austin, TX 78705 (512) 474-6679 Sells hardware and garden materials.</p>	<p>Gardenville 4001 Ranch Rd. 620 S, Bee Cave, TX 78738 (512) 219-5311</p>
<p>Callahan's General Store 501 S Hwy. 183, Austin, TX 78741 (512) 385-3452 www.callahansgeneralstore.com Local farm, ranch, and gardening supply store.</p>	<p>3606 FM 1327, Creedmoor, TX 78610 (512) 329-4900</p> <p>250 W.L. Walden Dr., Georgetown, TX 78626 (512) 930-8282 www.garden-ville.com</p>
<p>Gabriel Valley Farms 440 Old Hwy. 29 E, Georgetown, TX 78626 (512) 930-0923 www.gabrielvalleyfarms.com Wholesale nursery specializing in organics.</p>	<p>Geo Growers 12002 W Hwy. 290, Austin, TX 78737 (512) 288-4405 www.geogrowers.net</p>
<p>The Great Outdoors Nursery & Landscaping 2730 S Congress Ave., Austin, TX 78704 (512) 448-2992 www.gonursery.com</p>	<p>Kinser Ranch 10701 Kinser Ln., Austin, TX 78736 (512) 477-9025 www.firewoodandmulchaustintx.com</p>
<p>Natural Gardener 8648 Old Bee Caves Rd., Austin, TX 78735 (512) 288-6113 www.naturalgardeneraustin.com</p>	<p>Organics By Gosh 13602 FM 969, Austin, TX 78724 (512) 276-1211 www.organicsbygosh.com</p>
<p>Shoal Creek Nursery 2710 Hancock Dr., Austin, TX 78731 (512) 458-5909 www.shoalcreeknursery.com</p>	<p>Rock n Dirt Yard 14605 I-35 Frontage Rd., Buda, TX 78610 (512) 461-7607 www.rockndirtyard.com</p>
<p>Texas Metal Tanks 16299 Fitzhugh Rd., Dripping Springs, TX 78620 (512) 565-0875 www.texasmetaltanks.com Rainwater tank vendor and installer.</p>	<p>Whittlesey Landscape Supplies 3219 S I-35, Round Rock, TX 78664 (512) 989-7625</p> <p>629 Dalton Ln., Austin, TX 78742 (512) 385-0732 www.989rock.com</p>

Free and Low-Cost Gardening Materials

Austin Parks Foundation - Tools

Has a tool warehouse with hundreds of hand tools that may be borrowed for approved park improvement projects year-round by volunteer groups and park adopters.

Phone: (512) 477-1566

www.austinparks.org/tools-for-park-projects

Austin Resource Recovery Recycle & Reuse Drop-Off Center - Mulch

Free mulch available for pickup. You must load the mulch yourself.

Address: 2514 Business Center Dr., Austin, TX 78744

Hours: Monday-Friday 9am-5pm, Saturday 7am-12pm

Phone: (512) 974-4343

www.austintexas.gov/dropoff

Habitat for Humanity ReStore - Building Supplies

Address: 500 W Ben White Blvd., Austin, TX 78704

Hours: Monday-Saturday 9am-8pm, Sunday 11am-6pm

www.austinhabitat.org/restore

Keep Austin Beautiful - Compost, Mulch, Native Plants, Seeds, Tools

Has a Tool Shack that lends tools for community-driven beautification, improvement, and maintenance projects. Supplies are available on a first-come, first-served basis, so reserve at least two weeks in advance. Also hosts biannual resource giveaway days, during which they distribute free compost, mulch, native plants, and seeds.

Phone: (512) 391-0617

Email: resources@keepaustinbeautiful.org

www.keepaustinbeautiful.org/resource-request-form

P&R Tree Service - Mulch

Wood chip availability depends on the arborist's tree pruning and removal jobs. In order to deliver, arborists need enough space to maneuver a large truck.

Phone: (512) 806-0274 or (512) 775-2248

Spread the Harvest - Compost, Transplants, Seeds, Fertilizer

Sustainable Food Center's Spread the Harvest project offers members access to free seeds and organic fertilizer. Twice per year, participants may also receive plants and compost. Low-income and school gardeners may apply. After joining, participants may pick up seeds and fertilizer at SFC's office Monday-Friday 9am-5pm.

Address: 2921 E 17th St., Building C, Austin, TX 78702

Phone: (512) 220-1083

Email: mia@sustainablefoodcenter.org

TreeFolks NeighborWoods - Fruit and Native Trees

TreeFolks grows Central Texas urban forests through tree planting, education, and community partnerships. The NeighborWoods program gives away thousands of saplings at events October-March.

Phone: (512) 443-5323

Email: admin@treefolks.org

www.treefolks.org

Gardening Education Resources

Austin Organic Gardeners

Information on organic gardening techniques. Monthly meetings with guest speakers.

www.austinorganicgardeners.org

Austin Permaculture Guild

Hosts multiple Permaculture Design Courses per year.

www.austinperm.com/education/courses

City of Austin Grow Green Program

Gardening education program that promotes sustainable landscaping practices. Produces the “Native and Adapted Plant Guide for Central Texas.”

www.austintexas.gov/departments/grow-green

Dirt Doctor Howard Garrett

Information on organic gardening in Texas, including pictures, an interactive forum, books for sale, and links to organic gardening sources near you.

www.dirtdoctor.com

National Center for Appropriate Technology ATTRA Sustainable Agriculture Information Service

Provides information and assistance to individuals involved in sustainable agriculture.

Phone: 1-800-346-9140

Email: askanag@ncat.org

www.attra.ncat.org

National Gardening Association

Regional and national gardening information for home, community, and school gardens.

www.garden.org

The Natural Gardener

Organic nursery that holds free gardening classes throughout the year. Info Desk provides free professional consultation and diagnosis of plant problems.

Phone: (512) 288-6113

www.tngaustin.com/events

Organic Materials Review Institute (OMRI)

Nonprofit that conducts independent reviews of products (fertilizers, pesticides, etc.) intended for use in certified organic production and processing. Search their online database for listed products.
www.omri.org

Texas A&M AgriLife Extension Service

- Extension education overview for Travis County: Provides a high level of expertise in horticulture and other service areas. travis-tx.tamu.edu/horticulture
- Workshop and event calendar for Travis County: www.aggie-horticulture.tamu.edu/travis/local-extension-resources/calendar-2
- **Extension Horticulture Hotline for Travis County:** Staffed by Travis County Master Gardener volunteers, who provide free gardening advice year-round. Provides up-to-date, research-based advice from Extension and free publications. Hours: Monday-Friday 9am-5pm. Phone: (512) 854-9600. Email: travismg@ag.tamu.edu. www.aggie-horticulture.tamu.edu/travis/get-help
- **Plant Answers:** Searchable database of information on plants, from vegetables to roses. www.aggie-horticulture.tamu.edu/plantanswers/index.html

Texas Organic Farmers and Gardeners Association

Information on organic gardening, lawn care, insects, home remedies, and food and farming in Texas.
www.tofga.org

Other Gardening and Garden-Related Organizations

Central Texas School Garden Network (CTSGN)

Website and listserv for anyone affiliated with school gardens in Central Texas (parents, teachers, organizations, or community members). Used to share information and resources.
groups.google.com/forum/#!forum/centraltxschoolgardennetwork

Coalition of Austin Community Gardens (CACG)

Website includes a map of and basic information about most community gardens in the Austin area.
www.communitygardensaustin.org

Compost Coalition

Works to keep organic materials out of landfills and return nutrients back to the soil by connecting those producing “waste” with those that can use it. Also coordinates Ground to Ground, a city-wide campaign that diverts coffee grounds from landfills. Any resident can pick up free post-brew grounds.
www.compostcoalition.com

Green Corn Project

Grassroots, volunteer-run organization that installs organic food gardens for older adults, low-income households, people with disabilities, elementary schools, community centers, and shelters in underserved areas of Austin.
www.greencornproject.org

Lady Bird Johnson Wildflower Center

Botanical garden dedicated to native plants. Specializes in sustainable use and conservation of native wildflowers, plants, and landscapes.

www.wildflower.org

One World Permaculture

Provides individuals and organizations with permaculture education, consultation, design, installation, and maintenance services.

www.facebook.com/OneWorldPermaculture

Urban Patchwork

Nonprofit neighborhood farm network. Works with neighbors to turn unused yard space into farmland that provides fresh, organically grown produce and eggs to residents near each neighborhood farm.

www.urbanpatchwork.org

Urban Roots

Youth development organization that uses sustainable agriculture to transform the lives of young people and increase access to healthy food in Austin.

www.urbanrootsatx.org

Yard to Market Coop

Manages farm stands at local farmers' markets where backyard gardeners can sell produce.

www.yardtomarket.coop

