



*Fort Bend County Master Gardeners*

A GUIDE TO  
School Garden  
Projects





## TABLE OF CONTENTS

Introduction .....	3
Gardening Benefits.....	5
Before You Begin.....	7
Garden Planning Worksheet ...	8
Cylinder Garden.....	9
Container Garden .....	12
Raised Bed Garden .....	14
After You Plant.....	17
Beneficial Insects .....	19
Butterfly Garden .....	20
Appendix.....	27

# Introduction

**A GUIDE TO SCHOOL GARDEN PROJECTS WAS WRITTEN BY TEXAS MASTER GARDENERS** for educators and volunteer leaders who wish to establish gardens in a school setting for youth education.

This guide will empower you with information about starting either an edible garden or a butterfly garden. The scale of your project will influence the recommended garden model. We're here to help your school garden project flourish! First, let's introduce you to some educational resources and programs in our community and beyond.

## *Texas Master Gardener Program*

The Texas Master Gardener Program is a volunteer development program offered by Texas A&M AgriLife Extension, designed to increase the availability of horticultural information and improve the quality of life through horticultural projects. Program objectives are implemented by trained local volunteers, known as Master Gardeners. They assist Extension by:



- advising on school garden projects,
- answering requests for horticultural information,
- establishing and maintaining demonstration gardens,
- working with special audiences in the community, and
- designing and implementing community improvement projects, as well as coordinating Master Gardener projects.

## Fort Bend County Master Gardeners

Before being certified as a Master Gardener, Fort Bend County Master Gardener (FBMG) volunteers complete 50 hours of classroom training and 50 hours of volunteer service within the first year. During each subsequent year, they recertify by receiving additional training and providing volunteer service. For more information, visit [fbmg.org](http://fbmg.org).

### FBMG SCHOOL GARDENS INITIATIVE

Fort Bend Master Gardeners serve as a resource to Fort Bend 4-H Program Administrators in school garden projects. Master Gardeners may:

- provide advice on garden location, construction, plant materials, mulching, fertilization, pest and disease identification and control,
- be present when students are working in the garden to give advice, and
- facilitate brief lessons on relevant topics based on what's happening in the garden.

Master Gardeners do not perform the work of building and maintaining the garden, leaving those tasks to the students as a key component of the learning experience.

## Fort Bend County 4-H Youth Development

4-H is the youth development program of Texas A&M AgriLife Extension that focuses on the needs, concerns, and interests of youth (ages 5–18). Its aim is to help youth develop a positive self-concept, rational social behavior,

knowledge and problem solving capabilities through planned individual projects, meetings, group activities, and participation in different events. For more information, visit [agrilife.org/ftbend4h](http://agrilife.org/ftbend4h).

## Junior Master Gardener Program

The Junior Master Gardener program (JMG) is an international youth gardening program of the University Cooperative Extension network. JMG engages children in novel, “hands-on” group and individual learning experiences that provide a love of gardening, develop an appreciation for the environment, and cultivate the mind. Its curriculum supports the garden through lesson plans which are aligned with the state’s teaching standards. Teachers and youth group coordinators may wish to implement JMG to further enhance the school garden experience. For more information, visit [JMGkids.us](http://JMGkids.us) where you will find valuable resources for teachers under “Learn, Grow, Eat & Go!”



## COMMUNITY RESOURCES



*Fort Bend County Master Gardeners*  
281-633-7041 or 281-633-7068  
[FortBendmg@ag.tamu.edu](mailto:FortBendmg@ag.tamu.edu)  
[fbmg.org](http://fbmg.org)



*Fort Bend County Extension*  
281-342-3034  
[fort-bend-tx@tamu.edu](mailto:fort-bend-tx@tamu.edu)  
[fortbend.agrilife.org](http://fortbend.agrilife.org)



*Fort Bend County 4-H Youth Development*  
281-342-3034  
[fort-bend-tx@tamu.edu](mailto:fort-bend-tx@tamu.edu)  
[agrilife.org/ftbend4h](http://agrilife.org/ftbend4h)



*Junior Master Gardener National Office*  
Texas A&M University  
979-845-8565  
[jmgkids.us](http://jmgkids.us)

# Gardening Benefits for Students



*Students benefit from their efforts by enjoying plants individually and together with their class.*

**THERE ARE SEVERAL BENEFITS TO STUDENTS WHO PARTICIPATE IN SCHOOL GARDEN PROJECTS, INCLUDING:**

## *Individual Responsibility and Ownership*

Students are actively responsible for bringing about and nurturing plant life by following a structured process. They prepare the soil, plant the seeds, provide nourishment, inspect for pest and disease issues, clean, monitor progress, and maintain data regarding the plants. Upon completion of the project, they are able to benefit from their efforts by enjoying the plants individually and together with their class.

## *Direction and Planning*

Students begin the project by establishing the goals and objectives which they hope to accomplish. They implement these goals and objectives by planning the location of the garden and the plants within it, establishing a feeding schedule, monitoring their progress, and remaining focused on them throughout the project.

## *Observation, Data Gathering, and Journal Skills*

Students regularly record in their journals their observations regarding the plant's growth, the existence of beneficial and potentially harmful insects, the effect of different weather patterns, and the maturity of the plant as a food source.

## *Value of Organized Effort*

The individual student's efforts are seen in the context of the entire garden and appreciated as a whole—the student takes pride both in individual and the collective efforts of the entire class. The final outcome is the enjoyment of a salad or other product which is greater than the sum of the individual parts.



### *Respect for Others*

Students must follow the directions of the teacher/ advisor, work together with fellow students, help and receive help from others, learn from the successes and failures of others, and benefit from the efforts of the entire class in a cooperative manner.

### *Accountability*

By regularly reporting to the class their observations and data, students are held accountable for the success or failure of their plant.

### *Teamwork*

Students divide roles and responsibilities according to their interests/ abilities, such as weeding, watering, and required activities. Two students work together and realize the benefits of cooperation.

### *Experimentation and Risk-Taking*

Students can see the direct results of watering versus not watering a plant, fertilizing versus not fertilizing, playing music as opposed to no music; they can learn from their mistakes and experiment with different techniques for supporting plant life.

*Students work together and realize  
the benefits of cooperation.*

### *Learning from Failure*

Given the realities of plant life in a school setting wherein some plants die, others are vandalized, or some might be defective and not grow, students learn to adjust to momentary failure or disappointment and start over to achieve success.

### *Recognition and Rewards*

Students recognize those who supported the project by writing thank you letters, describing their activities and results. They are rewarded by the success of the vegetable garden when they bring home their produce or consume the salad. They are rewarded by the success of a butterfly garden in enhancing wildlife diversity.

Source:  
Harris County Texas A&M AgriLife Extension's Cylinder Gardening for Young Gardeners on the Move Teacher's Guide

# Before You Begin

## Choose a Garden Model

Three garden models are featured in this guide: cylinder garden, container garden, and raised bed garden. The models range from simple to advanced, providing an option for any situation. Instruction is provided for both edible gardens and butterfly gardens suitable for southeast Texas.

## Purpose

Define the reasons you want to create a school garden by asking: *what are the benefits to the school and students?* Decide on the teaching objective: edible garden or butterfly garden.

## Funding

Consider funding sources. Your costs will vary depending on which garden model you select.

## School Rules

Understand any special requirements imposed by the school or school district. By Texas law, schools must implement integrated pest management (IPM) as part of their maintenance programs. The school district must have an IPM policy statement, a designated IPM coordinator, and follow strict instructions when applying any pesticide for control of weeds or insects.

## Conduct a Site Analysis

- Does the site receive at least 6 hours of direct sunlight?
- Is the site spaced far enough away from nearby trees and shrubs that might compete for nutrients, water, and light?
- Is there a nearby water source?
- Is there adequate room for students to work?
- Does the area drain well after rains?
- Is the site located away from possible pesticide exposure?
- Is the area near where tools are stored?
- Is the site close by and easy to get to?

## Meet with the School District's IPM Coordinator

Discuss the site and design plans for the garden with your District's IPM coordinator. Ask the coordinator about products used to control fire ants and weeds and discuss how that will affect the proposed garden. Ask about any school building plans that might affect the garden space in the future. Make sure your plans will not conflict with current IPM practices.

## Plan for Planting

Select plants that are suitable for the appropriate United States Department of Agriculture (USDA) Hardiness Zone. Plant seeds or transplants in the recommended month or season. Establish the edible garden with consideration of the time it takes vegetable and herb plants to reach maturity and produce a harvest relative to the duration of the garden project. In the Appendix section of this guide you'll find a USDA hardiness zone map, a vegetable and herb planting calendar, and recommended safety precautions.

## Prepare for Maintenance of Butterfly Gardens

Whereas edible gardens are planted, later harvested, and then either removed or mulched and left unplanted until the next planting opportunity, butterfly gardens are more permanent. Many of the plants are perennials that return year after year and even reseed and multiply. To maintain the butterfly garden, enlist adult volunteers who will carry the project over from year to year. It is helpful if these volunteers represent all grades. Before summer break, add mulch to the butterfly garden to discourage weeds. When the students return after summer break, they can restore the garden by removing weeds and adding new plants as needed.





# Cylinder Garden

**CYLINDER GARDENING IS AN EASY, INEXPENSIVE WAY** to educate students on plant growth from seed planting to harvesting. Cylinder gardening started in 1986 under the leadership of the Men's Garden Club of Houston, TX and has been continued by the Harris County Master Gardener Association and by the Fort Bend County Master Gardeners.

Cylinder Gardening is a method of gardening that uses bottomless cylinders as small, individual gardens. This works especially well in areas with poor soil, which would normally need extensive amendments and labor to support an actively producing garden. This method, which is not labor-intensive, works well for demonstration purposes for numerous gardening experiments for students. Cylinder gardening requires little land and little pre-gardening preparation or experience. Once the cylinders are filled and planted, the only labor is minor maintenance, watering, and harvesting. This type of gardening eliminates the time consuming effort that is usually needed for soil preparation for a successful garden. Plants mature from seed in 30 to 90 days. Installation and removal of garden is quick and clean.

This guide provides the basic steps to cylinder gardening and what to do at each step. Major deviations from these steps can cause the garden to not function properly. The area must look like a garden patch and have a neat layout and design. Other classes and parents will visit the garden and learn. These instructions are set up for a class of 24 students, working in teams of two per cylinder.

## MATERIALS NEEDED

Cylinders

Landscape staples

Seeds or transplants

Fertilizer

Potting soil

Corrugated cardboard

Pine straw to mulch  
planted cylinders

Bark mulch to cover  
corrugated cardboard

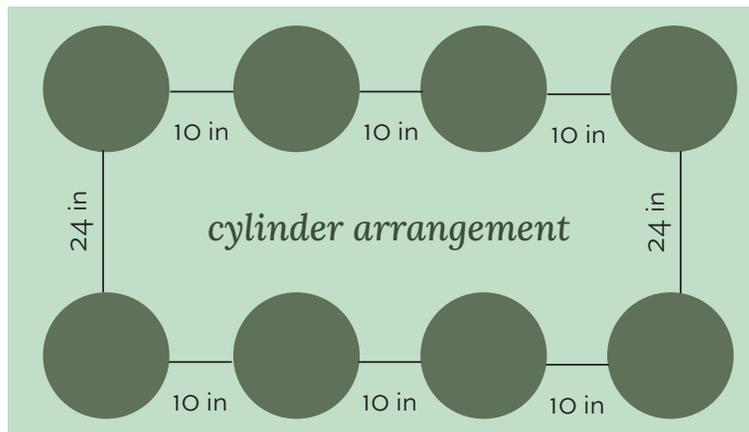


*Photo by Angela Romans, Seven Lakes Middle School*

**"Sammy Cylinder"** (program mascot)  
Cylinder Gardening is a curriculum enrichment program  
of the Texas A&M AgriLife Extension Service.



*Place the garden in an area that is accessible and easily viewed*



### *Location and Layout of the Garden*

Place garden in an area that is accessible and easily viewed for all to see, including other classes, teachers, and visiting parents. Being in view will help ensure the plants will be cared for regularly and also will decrease the opportunity for vandalism or neglect. Choose a well-drained location. Don't place in standing water or under a gutter drain.

Try to place garden near a water source or be prepared to transport water by watering can or clean one-gallon plastic jugs.

Place the spring garden in an area with sufficient sunlight (a minimum 6 hours of direct sunlight). For winter, full sun exposure is required, preferably on the south side of any close-by buildings.

A sample arrangement would be eight cylinders placed 10 inches apart in two rows. Place the rows 24 inches apart to allow accessibility to all cylinders. The objective should be to arrange the cylinders so that the overall effect looks like a regular garden.

Cylinders must be level with large end down. Where weeds and nut grass are a problem, cylinders may be placed on a concrete or asphalt surface.

### *Cylinders, Potting Soil, Fertilizer*

While the use of food-grade buckets is recommended, cylinders can be made from any large 5-gallon bucket. Adults should rinse the buckets well with water and again with a weak bleach solution (10% solution - 9 parts water to 1 part bleach). Using a hand saw or electric saber saw, remove the bottom and cut the cylinder in half. If 5-gallon buckets are unavailable, the heavy, recyclable 5-gallon plant pots may be used. These also need to be washed with a 10% bleach solution and have the bottoms cut out with a sturdy pair of scissors or electric saber saw. The plant pots will not need to be cut in half.

Potting soil can be obtained from local feed stores, nurseries, garden supply, or home improvement centers. Students can be engaged in calculating the approximate

volume of potting soil that will be needed to fill the number of cylinders being used.

A one-time application of a granular time-release fertilizer should be applied according to the label instructions under adult supervision. Thereafter, a water-soluble fertilizer may be used once a month, if needed.

### *Filling and Planting the Cylinders*

After deciding on the arrangement of cylinders, place corrugated cardboard under the entire area. Place the cylinders on top of the cardboard. Secure them to the ground by placing two or three landscape staples on the outside of the cylinder. Fill with potting soil to the very top of the cylinder, but do not compress or compact the soil.

Sprinkle fertilizer in each and water well. Some settling will occur after watering—this is normal and will result in a ½ to 1-inch space at the top of the cylinder. Do not add more potting mix at this point.

A planting calendar for various edible crops is contained in the Appendix. Plant seeds to the approximate depth of the diameter of the seed. If using transplants, plant them at the same depth that they were planted in their pots. Water well again. Add pine straw loosely atop each cylinder. You may choose to cover the corrugated cardboard with bark mulch for aesthetic purposes.



*Place the cylinders on top of the cardboard. Secure them to the ground by placing two or three landscape staples on the outside of the cylinder.*

### *Garden Removal*

The garden may be completely removed or plants removed and cylinders left in place for the next season. To leave in place for next season, remove all mature or spent plants. Fluff up the potting mix.

To completely remove the garden, empty the cylinders and wash them with soap and water. Stack them out of sight for use next year. The potting mix that is removed from the cylinders may be raked into the surrounding turf grass or added to gardens. Cardboard may be discarded or composted. Soon all traces of the garden will be gone.

Condensed from "Cylinder Gardening for Young Gardeners on the Move – Teacher's Guide", Texas A&M AgriLife Extension Service – Harris County, Texas.

## Container Garden

**LIKE CYLINDER GARDENING, CONTAINER GARDENING IS AN IDEAL CHOICE FOR A SCHOOL GARDEN** because it is inexpensive to establish, can be utilized anywhere there is sufficient sunlight and access to water, and lacks the long-term commitment and permanence of a yard garden. It is an excellent way to introduce children to the joys and rewards of vegetable gardening but on a slightly larger scale than cylinder gardening.

### MATERIALS NEEDED

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Containers

---

Seeds or transplants

---

Fertilizer

---

Garden soil mix

---

Corrugated cardboard

---

Pine straw to mulch  
planted containers

---

Bark mulch to cover  
corrugated cardboard

### *Choose Containers*

Almost any type of container can be used for growing vegetable plants, provided it has holes in the bottom for drainage. For example, try using large nursery containers, bushel baskets, drums, tubs, felt grow bags, or wooden boxes. A sturdy 20-gallon plastic nursery container is a good choice for container gardens. If the containers don't already have drainage holes at the base, prepare to use a power drill to add some.

### *Location and Layout of the Garden*

Place garden in an area that is accessible and easily viewed for all to see, including other classes, teachers, and visiting parents. Being in view will help ensure the plants will be cared for regularly and also will decrease the opportunity for vandalism or neglect. Choose a well-drained location. Don't place in standing water or under a gutter drain. Try to place garden near a water source or be prepared to transport water by watering can or clean one-gallon plastic jugs.





Place the spring garden in an area with sufficient sunlight (a minimum 6 hours of direct sunlight). For winter, full sun exposure is required, preferably on the south side of any nearby buildings.

Place the containers 24 inches apart to allow accessibility. The objective should be to arrange the containers so that the overall effect looks like a regular garden.

### *Fill with Growing Media*

All growing media must provide water, nutrients, and physical support in order to grow healthy plants. A good growing media must also drain well. For large containers, a garden soil mix that is a blend of sandy loam soil and compost is preferred. Garden soil mix can be purchased either in bulk or by the

bag from nurseries and garden centers. *Note: garden soil is not the same as potting soil.*

After deciding on the arrangement of containers, lay out corrugated cardboard under the entire area. Place the containers on top of the cardboard. Fill with garden soil mix to within ½ to 1 inch of the top of the container. Sprinkle appropriate amount of fertilizer in each container and water well.

### *Plant the Containers*

1. Plant seeds to approximate depth of the diameter of the seed.
2. Plant transplants at the same depth that they were planted in their pots.
3. Water well and add pine straw mulch loosely atop each container.
4. Cover the corrugated cardboard with bark mulch for aesthetic purposes.

Almost any vegetable or herb that will grow in a typical backyard garden will also do well as a container-grown plant. Vegetables that are ideally suited for growing in containers

include tomatoes, peppers, eggplant, green onions, beans, lettuce, squash, radishes and parsley. Pole beans and cucumbers also do well in this type of garden, but they require considerably more space because of their vining growth habit. Crop selection will be dependent on the plants' growing seasons relative to the school year. A planting calendar for both fall and spring semesters is provided in the Appendix.

### *Garden Removal*

At the end of the semester or school year, the garden may be completely removed or plants removed and containers left in place for the next season. To leave in place for next season, remove all mature or spent plants. Fluff up the garden soil mix.

To completely remove the garden, empty the containers and wash them with soap and water. Stack them out of sight for use next year. The garden soil mix that is removed from the containers may be raked into the surrounding turf grass or added to landscaping beds. Corrugated cardboard may be discarded or composted. Soon all traces of the garden will be gone.



Condensed from "Vegetable Gardening in Containers" by Joseph G. Masabni, Texas A&M AgriLife Extension.

## Raised Beds

**RAISED BEDS ARE FREESTANDING GARDEN BEDS CONSTRUCTED ABOVE THE NATURAL TERRAIN.** Unlike cylinder and container gardens, raised bed gardens are more permanent in their construction. Where a permanent garden is desired, raised bed gardens improve growing conditions for plants by lifting their roots above poor soil. Soil in the beds can be amended to provide a better growing medium for plants. The soil in raised beds warms up earlier in the spring and is less apt to be invaded by certain grasses and by tree roots. Also, the height of raised beds may make them easier to maintain.

### BENEFITS OF RAISED BEDS

Control over soil quality (not dependent on native soil)

Soil warms up more quickly in spring than in-ground

Growing area less likely to be impacted by grasses and tree roots

Height allows easier access and maintenance

### *Plan the Design*

A raised bed does not have to be very deep to be effective. Eight to 12 inches is usually adequate. A four foot width enables the bed to be worked from the outside. The material used to edge a raised bed should be stable, durable, and attractive. It is the edging that gives the bed its “look” within the landscape. It also establishes the outline of the bed and holds the soil in place. Recommended edging materials include untreated pine or cedar, cinder blocks, and plastic composite material. The edging material you chose should be strong enough to hold the growing media and withstand being bumped into by a lawn mower. It should be installed properly and complement the rest of the landscape.



## *Lay Out the Perimeter*

If the bed has straight lines, use stakes and string to outline the perimeter. Garden hose or rope works well for outlining curved beds. Most vegetable beds are square or rectangular so that vegetables can be planted in rows. Many ornamental beds are curved. To make maintenance easier, particularly mowing, design the bed with long, flowing curves rather than many tight ones. Make the garden narrow enough to work in while standing on the outside.

## *Remove Existing Vegetation*

The preferred methods of removing any existing vegetation are to do so manually by digging it out or apply a systemic herbicide to kill perennial grass and weeds and prevent them from returning. If these methods are not practical, vegetation can be killed by covering the bed area with clear plastic (anchor edges with rocks or soil) for 1 to 2 months. If both day and night temperatures are warm, the heat generated under the plastic will kill plants, though not as quickly as herbicides. After the site is clear of vegetation, till the soil thoroughly to loosen it.

While less effective in removing vegetation than the above methods, an alternative is to cover the existing vegetation with corrugated cardboard and build the raised bed above it. Grass and weeds may eventually grow through the cardboard, especially as it degrades.



## *Install Edging and Add Soil*

First install edging material (ex: wood, cinder blocks). Put down a weed barrier between the edging and the soil to help keep lawn grasses out of the bed. The weed barrier can be as simple as a layer of corrugated cardboard or thin layers of newspaper. Then add soil.

The soil should hold water well enough so that plant roots do not dry out, but it should also have good drainage. Soil with too much sand does not hold water well; soil with too much clay does not drain well.

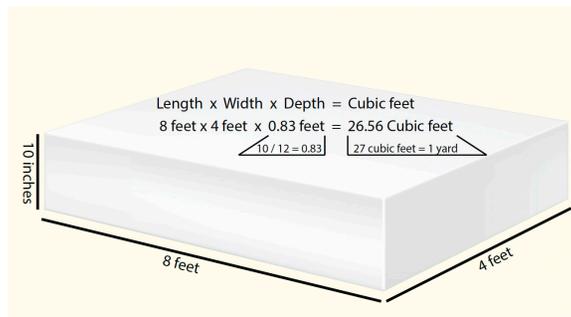
A high quality garden soil mix can be ordered by the cubic yard and delivered to the site or it can be purchased in bags. Students can be engaged in calculating the volume of soil needed to fill the garden. Leave 2 inches of space above the soil to add mulch after planting. Multiply the length of the bed (in feet) by the width (in feet) and by the depth of soil mix desired (in feet). Divide this total by 12 and then again by 27 to obtain the amount of soil mix needed in cubic yards.

## Plant

Plant vegetable seeds and transplants following spacing requirements for each variety. A planting calendar for various vegetable crops is included in the Appendix.

## Mulch

Mulching may be the most important finishing touch to the raised bed garden. Mulch keeps plant roots cool in summer, reduces water evaporation from the soil, controls erosion by softening the impact of rain and slowing runoff so it can soak into the soil, and suppresses weeds. Mulches also add to the attractiveness of the landscape.



After all the plants are in the bed, apply a 2- to 3-inch-deep layer of mulch, tapering it to the bases of the plants. To determine how much mulch is needed: Multiply the length of the bed (in feet) by the width (in feet) and by the depth of mulch you want (in feet). Divide this total by 12 and then again by 27 to obtain the amount of mulch needed in cubic yards.

Shredded native hardwood bark and pine straw are both good organic mulch choices.

## Maintenance

Maintaining a raised bed garden involves weeding, irrigating, pruning, replacing decomposed mulch, and removing spent plants. Here are some guidelines for keeping your garden looking its best:

- Irrigate the bed when needed, letting the top inch of soil dry out between watering. If the plant species are complementary, their water requirements will be similar.
- Keep 2-3 inches of mulch on the bed.
- Add compost or top-dress with organic mulch twice each year in the spring and fall. This replenishes the soil and acts as a slow release fertilizer. If adding



compost, simply rake back the mulch, add the compost, and replace the mulch or add new mulch over the old. Or, add an inorganic slow release fertilizer before and during active plant growth.

- Prune each plant properly according to its use and the intended design.

A properly designed, constructed and maintained raised bed will be a lasting source of beauty for any school.

Condensed from "Building a Raised Bed Garden" by Priscilla Files, Michael Arnold, Douglas Welsh, and Frank Dainello, Texas A&M AgriLife Extension.

## After You Plant

### *Fertilizing*

Time release fertilizer is recommended at planting, applied according to the label directions, which often is sufficient for several months. If plants seem to need more feeding, a weak application of water-soluble fertilizer may be used, applied according to the label directions.

### *Watering the Garden*

The first week, water every day that there is no rainfall. New seeds need constant moisture for germination and transplants need constant moisture to establish their root systems. Starting the second week, water every Monday, Wednesday, and Friday that it does not rain, if needed. Use your finger, a pencil, or a soil moisture meter to test the soil for dryness before watering.

Water carefully with a gentle flow to avoid injuring young plants. Use a watering can or pouring water through your hand held over the plants to keep from displacing the seeds or small plants. Continuous watering is essential to the success of this project. The mulch that was placed on top of the growing mix will help to reduce water loss.

### *Thinning and Transplanting*

If too many seeds are planted for the cylinder or container or the area of the raised bed, after they sprout they should be thinned to allow adequate room for growth without competition. This is difficult, but necessary. Thinning can be accomplished by carefully pulling the seedling out or snipping it off with a scissors. Young greens such as lettuce and spinach can be eaten. Other thinned seedlings should be discarded or sent home with the students for their personal use.





### *Tasting*

Lettuce, radishes, and greens can be tasted early. Pick young leaves, wash, and eat. Even though pesticides are not used in the garden, it is important to wash all produce before eating.

Harvest crops when mature. Some plants, such as broccoli, will produce secondary flower buds if the weather allows. Encourage students to try vegetables even if they claim they don't like them—peer pressure and the pride of growing it themselves will make lots of converts. If harvest is abundant, send the extra home or share with other classes.

### *Pests and Disease*

Each visit, check for signs of pests and disease that could damage plants. Practice Integrated Pest Management: start with good quality plants; handle plants carefully before and during planting; select plants that are adapted to the region; scout for pests; remove pests by hand if possible; use chemicals as a last resort. For more information about Integrated Pest Management visit [landscapeipm.tamu.edu/what-is-ipm](http://landscapeipm.tamu.edu/what-is-ipm)



Keep garden area clean and weeds pulled. It would be helpful if maintenance crews can keep the surrounding area mowed. This will help cut down on insect and disease opportunities. Any diseased plants should be completely removed. Keep the garden clean and attractive because there will be others watching and learning.

Understand your responsibility for responding to pest and disease problems by asking your IPM coordinator how your district wants you to handle these problems.

Condensed from "Cylinder Gardening for Young Gardeners on the Move – Teacher's Guide", Texas A&M AgriLife Extension Service – Harris County, Texas.

## Beneficial Insects

These “bonus attractions” will help pollinate flowers and keep harmful creatures in check.



### Bees

Large and small, bees are pollinators. As they gather nectar and pollen to feed themselves and their young, they transfer pollen to flower parts that become fruit and seeds. Many never sting. Honey bees avoid stinging because stinging ends their life.

*Left to right: carpenter bee, honey bee, and mason bee*



### Flies

Syrphid, hover, and flower flies may aid in pollination. However, the big benefit in the garden is their larvae which eat many soft-bodied insects such as aphids and mealy bugs.



*Two kinds of fly larvae*



### Lacewing

Lacewing adults are very delicate insects. They are welcome in the garden as predators of pest insects. The larvae may look like tiny alligators or bits of moving debris but they also eat pests like aphids, mealy bugs, mites, and thrips. Eggs are laid in groups on thin stalks.



*Two kinds of lacewing larvae*



### Lady Beetles

Both adult lady beetles and their larvae devour aphids, mealy bugs, and spider mites. Not all are orange with black spots. The mealy bug destroyer is a very small lady beetle. See photo at right: that's a yellow aphid behind the mealy bug destroyer. Its larva looks like a mealy bug.



*Mealy bug destroyer and larva*



### Paper Wasps and Mud Daubers

Paper wasps and mud daubers capture and paralyze caterpillars, spiders, and other small insects. They take them to their nest and put them in cells with an egg. When the egg hatches, the larvae have food to eat.



### Assassin Bugs

Adults and their nymphs patrol plants looking for insects, large and small, to eat. Even the tiny nymphs eat aphids, mites, and other small insects.

Photo credits: Nancy Shafer except Lady Beetle Adults-Iowa State U., Lacewing Adult-Bugguide, Mason Bee-M.Warriner at NPSOT.org, Syrphid Fly larva No.1 –N. Carolina State U.

# Butterfly Garden

**A SCHOOL BUTTERFLY GARDEN WILL OFFER STUDENTS INSIGHT INTO THE SPECIAL RELATIONSHIP** adult butterflies and their caterpillars have with the plants they need for food and shelter. Students can observe life cycles of butterflies and plants, the role weather and other environmental conditions can have on the life cycles and the role people can have on the life cycles.

## *Butterfly Garden Design*

A raised bed will work best for a butterfly garden. However, some host and nectar plants can be included in cylinder or container gardens, along with vegetables and herbs. Some herbs are host plants and flowering plants attract many pollinators. See pages 25–26 for two sample garden designs: rectangular and oval.

## *Maintenance*

Maintenance procedures for a butterfly garden are similar to those for a vegetable garden with a few exceptions. Caterpillar damage is acceptable and desirable in a butterfly garden. Care should be taken not to do anything to harm eggs or caterpillars. For example, a forceful spray of water used to remove aphids or other pests, may wash away eggs and even kill small caterpillars.





Adult butterflies need nectar for energy so spent flowers on nectar plants should be removed to encourage plants to continue to bloom. Remember, in this garden, blooms, not seeds or fruit, are needed.

In a butterfly garden, pesticides, even those labeled organic, cannot be used because they will kill butterflies and caterpillars. Plants treated with pesticides before they are purchased must not be used either. Gardens located near a street may receive pesticides from city mosquito spraying programs. School maintenance crews should be informed of your project.

### *Plant Choices*

Plants for a butterfly garden should be chosen because they are either host plants for a particular butterfly or a nectar source for butterflies. See pages 22–24 for charts of host and nectar plants for butterflies in our region.

Some plants for a butterfly garden will be perennials that continue to grow from year to year. Some perennials will lose leaves and stop blooming in winter or in the high temperatures of summer. Gardeners should be aware of this and should not remove them during dormant periods. Some plants will be annuals and will need to be replaced at the end of growing seasons.

Plants with flowers will attract a wide variety of pollinators and other animals. Moths, bees, wasps, beetles, bugs, spiders, and hummingbirds are a few. They should be considered welcome guests and present an opportunity for students to learn even more about relationships between plants, animals, and the environment.

Butterflies prefer to get nectar from a flower with a surface on which they can land, but they will get nourishment from other flowers as well as tree sap, animal dung, and damp or muddy soil.

Suitable plants can be found at reputable independent nurseries.

# Four Locally Common Butterflies and Their Host Plants

Host Plant	Availability	Perennial or Annual	Sun/Shade Preference	Details
 <p><b>Milkweed*</b> All <i>Asclepias</i> species <i>Asclepias curassavica</i> and <i>Asclepias tuberosa</i> most easily found</p>	Spring, summer, fall (purchase plant)	Perennial	Sun, part shade	Both foliage and flowers are used by adults and caterpillars. Three insect pests of milkweed are Large Milkweed Bug, Swamp Milkweed Beetle, Aphids. Control these by mechanical means. Milkweed plants should be cut back to ground level between Oct. 1 and Nov. 20 to encourage Monarchs to continue their migration.
 <p><b>Passion vine/passion flower/maypop</b> All <i>Passiflora</i> species <i>Passiflora incarnata</i> varieties and <i>Passiflora foetida</i></p>	Spring, summer, fall (purchase plant)	Perennial	Sun, part shade	Vine that needs the support of a trellis, teepee, or fence. Leaves, stems and sometimes, flowers are eaten by caterpillars. Native species are invasive; however, love-in-a-mist ( <i>P. foetida</i> ) is less invasive.
 <p><b>Parsley, dill, and fennel</b> Easily found by common name</p>	Spring, fall (purchase plant or grow from seed)	Parsley: treat as annual Dill: annual Fennel: may live through mild winters in Fort Bend Co.	Sun, part shade. All like some shade from western sun	These plants are grown for human consumption so can easily be found and used in the garden. Parsley may bloom in summer and will die. Dill and fennel can be grown from seed.
 <p><b>Pipevine, Dutchman's Pipe, and White Veined Dutchman's Pipe</b> <i>Aristolochia fimbriata</i></p>	Spring, fall (purchase plant)	Perennial	Sun, part shade. <i>A. fimbriata</i> needs shade from western sun	<i>A. fimbriata</i> grows as a ground cover.

\*CAUTION All parts of milkweed plants are toxic. By feeding on these plants and flowers, Monarch and Queen butterflies, as well as their caterpillars, are able to incorporate the toxins into their bodies making them distasteful and poisonous to predators. The sap of milkweed plants will cause redness and blurry vision if gotten into the eye. Medical attention should be sought. Humans, pets, and livestock can be affected by the toxins.

## Nectar Plants for Butterfly Gardens

		Availability	Bloom Time	Perennial or Annual	Sun/Shade Preference	Details
	<b>Blanket Flower</b> <i>Gaillardia</i> species	Spring, fall (purchase plant or grow from seed)	Summer, late fall	Perennial	Sun	Plants can be purchased, can be grown from purchased seed, and plants will reseed.
	<b>Coreopsis, tickweed</b> <i>Coreopsis</i> species	Spring, fall, (purchase plant)	Summer, late fall	Perennial	Sun	Will make a large clump that can be divided for more plants.
	<b>Cosmos</b> <i>Cosmos sulphureus</i> , <i>Cosmos bipinnatus</i>	Late spring, summer (grow from seed)	Summer, fall	Annual	Sun	Cosmos can be grown from seed and will reseed. <i>C. sulphureus</i> – yellow or orange <i>C. bipinnatus</i> – shades of pink
	<b>*Duranta, sky flower</b> <i>Duranta erecta</i>	(can be purchased at local nurseries)	Spring to late fall	Perennial	Sun	Shrub with purple flowers. A mature Duranta can grow to 6 feet with a spread of 3 to 4 feet. May be affected by very low temperatures but will regrow in the spring.
	<b>Greg's Blue Mist Flower</b> <i>Conoclinium greggii</i>	Spring, fall (purchase plant)	Fall. Possibly a few flowers in spring.	Perennial	Sun	<i>Conoclinium coelestinum</i> , common name Blue Mist Flower or Wild Ageratum is a native mist flower that is abundant in Fort Bend County. It is invasive and should not be used in a school garden.
	<b>*Lantana</b> <i>Lantana horrida</i>	(can be purchased at local nurseries)	Spring to late fall	Perennial	Sun	Shrub with clusters of small flowers. Numerous varieties are available. Texas lantana, <i>Lantana horrida</i> , is a native that has mostly red or reddish orange flowers in the clusters. One Lantana shrub will spread 3 to 5 feet. May be affected by very low temperatures but will regrow in the spring.

\*LARGE SIZE These plants are very attractive to butterflies but may get very large. All are perennials and will require at least yearly pruning. If space is available, they are worth planting. They could be used as an addition to school landscaping.

## Nectar Plants for Butterfly Gardens *cont.*

		<i>Availability</i>	<i>Bloom Time</i>	<i>Perennial or Annual</i>	<i>Sun/Shade Preference</i>	<i>Details</i>
	<b>Pentas</b> <i>Pentas</i>	Late spring, summer (purchase plant)	Late spring, summer, fall	Annual; may survive mild winter	Sun, part shade	Pentas are a host plant for the <i>Tersa</i> moth, a kind of sphinx moth. The large brown or green caterpillar can do significant damage to a plant but could be considered a bonus for study.
	<b>Purple Cone Flower</b> <i>Echinacea purpurea</i> , and other <i>Echinacea</i> species	Spring, summer, fall (purchase plant)	Late spring, summer, fall	Perennial	Sun	Color is usually pink. Nectar is produced in the brown center. Older varieties produce more nectar than newer hybrids.
	<b>Verbena</b> <i>Verbena</i> var. 'Homestead Purple' or other species	Spring, summer, fall (purchase plant)	Late spring, summer, fall	Annual; may be perennial in Fort Bend County	Sun	Many varieties. Plants may die back in heat of summer but reappear when temperatures cool .
	<b>White Mist Flower</b> <i>Ageratina havanensis</i>	Spring, fall (purchase plant)	Fall. Possibly a few flowers in spring	Perennial	Sun	Monarch and Queen butterflies are attracted to this native plant.
	<b>*Yellow Cestrum</b> <i>Cestrum aurantiacum</i>	(purchase plant)	Spring to late fall	Perennial	Sun	Shrub with spikes of yellow flowers. A mature Cestrum can become 5 feet tall with a spread of 3 to 4 feet.
	<b>Zinnia</b> <i>Zinnia</i>	Late spring, summer, early fall (grow from seed)	Late spring through late fall	Annual	Sun	Taller varieties with the center of flower visible are best. Can be grown from seeds. Reseeds. Plant late spring and fall.

\*LARGE SIZE These plants are very attractive to butterflies but may get very large. All are perennials and will require at least yearly pruning. If space is available, they are worth planting. They could be used as an addition to school landscaping.

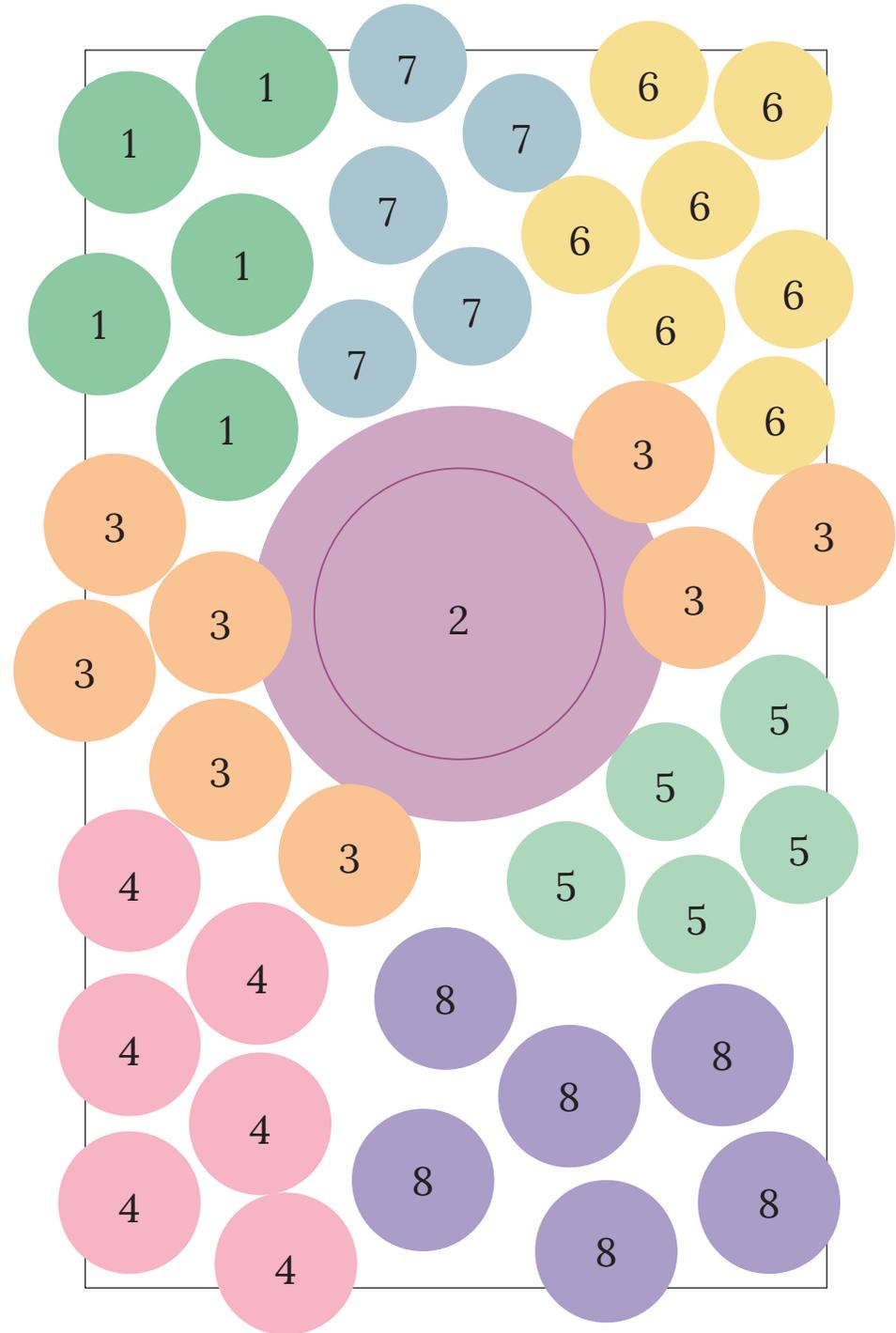
# Rectangular

## Butterfly-Friendly Flower Bed with Host and Nectar Plants

For this rectangular shaped flower bed, dimensions are approximately 6 ft wide and 10 ft long. Grouping several plants of the same type together creates a pleasing clump or drift effect.

### PLANT LIST

- |   |  |
|---|--|
| <p><b>1   Pipevine*</b><br/><i>Aristolocia fimbrialta</i></p>   | <p><b>6   Zinnia**</b><br/><i>Zinnia</i></p>   |
| <p><b>2   Passionvine*</b><br/><i>Passiflora incarnata</i><br/>Use one plant only on a trellis.</p>                                       | <p><b>7   Coneflower*</b><br/><i>Echinacea</i></p>   |
| <p><b>3   Milkweed*</b><br/><i>Asclepias curassavica</i> or<br/><i>Asclepias tuberosa</i><br/>Trim to 4 in height after Thanksgiving.</p> | <p><b>8   Verbena*</b><br/><i>Glandularia bipinnatifida</i></p>  |
| <p><b>4   Pentas**</b><br/><i>Pentas lanceolata</i></p>   | <hr/> <p>*Perennial plants live two or more years. Cut back dead plant material in winter months.</p>            |
| <p><b>5   Fennel**</b><br/><i>Foeniculum vulgare</i></p>  | <p>**Annual plants which need to be replanted each year. Note: <i>fennel</i> may last through winter months.</p> |



# Oval

## Butterfly-Friendly Flower Bed

with Host and Nectar Plants

For this oval shaped flower bed, dimensions are approximately 8 ft wide and 6 ft deep. Anchor the center of the bed with an obelisk or pyramid trellis that can be appreciated from all sides. Grouping several plants of the same type together creates a pleasing clump or drift effect.

### PLANT LIST

#### 1 | Gregg's Blue Mist Flower\*

*Conoclinium gregii*

Use one plant only. Mature size is 4x4 ft but can be pruned smaller. It may die back during colder winters but will return.

#### 2 | Passionvine\*

*Passiflora incarnata*

Use one plant only on a trellis.

#### 3 | Milkweed\*

*Asclepias curassavica* or *Asclepias tuberosa*

Trim to 4 in height after Thanksgiving.

#### 4 | Pentas\*\*

*Pentas lanceolata*

#### 5 | Fennel\*\*

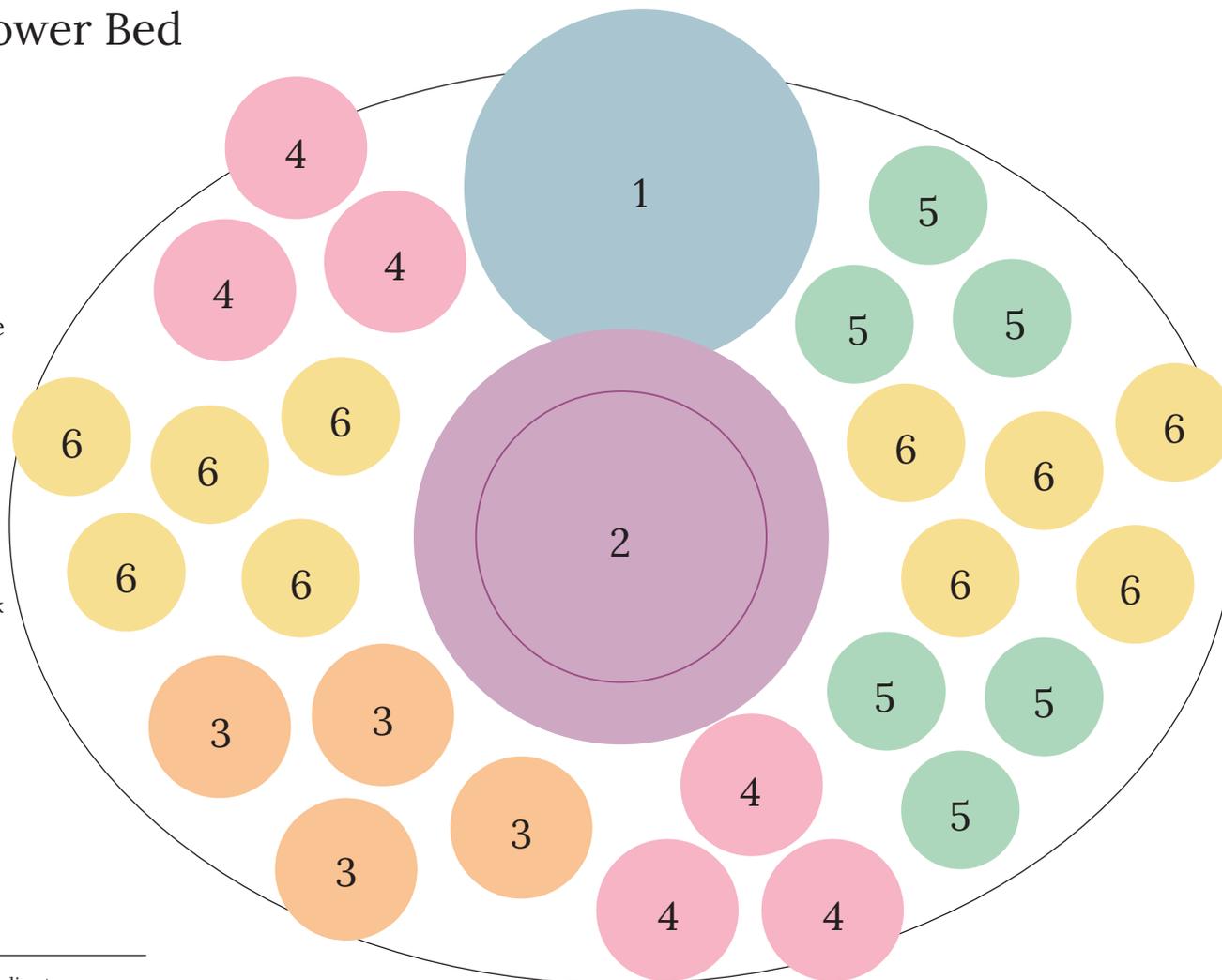
*Foeniculum vulgare*

#### 6 | Zinnia\*\*

*Zinnia*

\*Perennial plants live two or more years. Cut back dead plant material in winter months.

\*\*Annual plants which need to be replanted each year. Note: fennel may last through winter months.





# Appendix

## TABLE OF CONTENTS

Safety Precautions.....	28
USDA Hardiness Zones .....	29
Planting Calendar: Fall .....	30
Planting Calendar: Spring .....	31



**WATCH WHAT YOU EAT** | Remind students that not all plants are edible. Allow them to eat only those plants or plant parts that are known to be safe.



**BLEACH** | When cleaning, take extra care with bleach especially around students. Bleach is toxic and can burn skin and damage clothing.



**PESTICIDES** | Botanical and synthetic pesticides are toxic substances. We strongly discourage their use.



**DUST** | When pouring prepared potting mix containing perlite, vermiculite or peat moss, a cloud of dust will rise. This is irritating to respiratory passages. Reduce this dust by pouring some water into the mix first to wet it before pouring, and pour carefully. Cover your nose and mouth with dust mask or cloth whenever you pour. For students with allergies, a handkerchief and rubber gloves may be worn.



**FUNGICIDE TREATED SEEDS** | Certain seeds that are susceptible to fungus problems (beans, cucumbers, corn) are often treated with a fungicide and dyed (usually pink) for identification. The fungicide is mildly toxic and it may make the seeds look appealing to students. Store seeds carefully, warn students of the danger, and wash hands thoroughly after handling treated seeds.



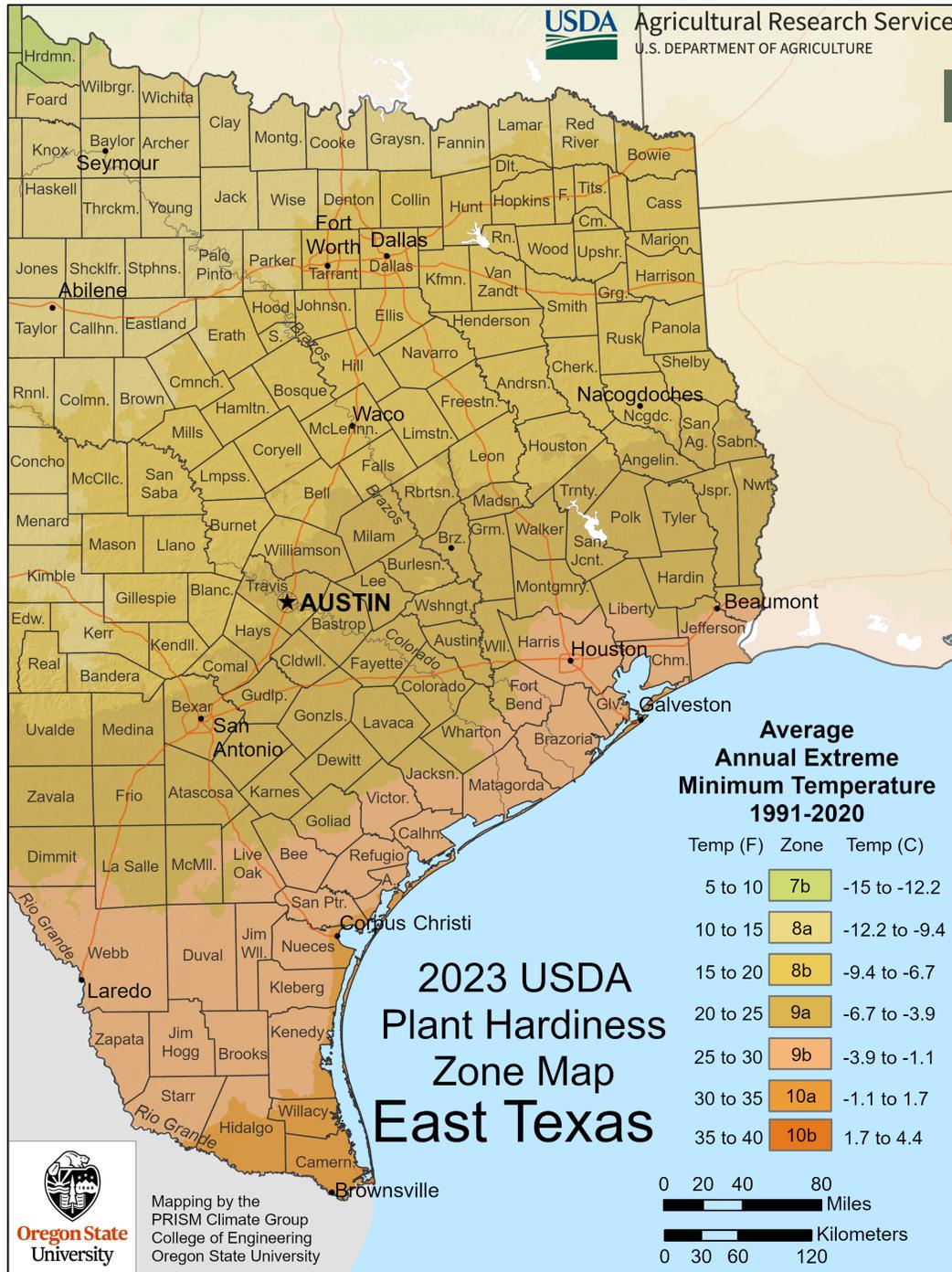
**FERTILIZER** | Fertilizer is made of concentrated chemical salts that can be dangerous if taken internally. Blue, water-soluble fertilizer might be a particular temptation to young gardeners and will stain skin and clothing. Slow-release fertilizers are easily eaten beads and could be a hazard. Store these supplies out of the reach of students, and discuss these safety issues early on with the class.



**TOOL SAFETY** | Discuss tool safety with students before use. Take caution with sharp edges when carrying, using, and storing tools.



Condensed from "Cylinder Gardening for Young Gardeners on the Move – Teacher's Guide", Texas A&M AgriLife Extension – Harris County, Texas.



The greater Houston area is in Zone 9,

with average low temperatures

ranging from 20 to 30° F.

The U.S. Department of Agriculture's Plant Hardiness Zone Map serves as a general guide for growing perennial plants based on average temperatures in a given area. The USDA's 2023 zone maps factor in 30 years of weather data (1991–2020).

Note that many other environmental factors, in addition to hardiness zones, contribute to the success or failure of plants, including:

- Wind
- Soil type
- Soil moisture
- Humidity
- Pollution
- Snow
- Light

The way plants are placed in the landscape, how they are planted, and their size and health also influence their survival.

For more information about the 2023 USDA Plant Hardiness Zone Map, scan the QR code or visit [planthardiness.ars.usda.gov](http://planthardiness.ars.usda.gov)



# Vegetable & Herb Planting Calendar

## FALL SEMESTER



### September

Plant	Seed or Transplant	Days to Harvest
Beans	Seed	55 - 70
Beets	Seed	50 - 56
Broccoli	Transplant	45 - 55
Cabbage	Transplant	50 - 75
Cauliflower	Transplant	65 - 75
Chard	Seed	50 - 59
Collards	Seed	55 - 75
Kohlrabi	Transplant	40 - 55
Parsley	Seed	72 - 75
Peas	Seed	60 - 65
Radish	Seed	20 - 30

### October

Plant	Seed or Transplant	Days to Harvest
Beets	Seed	50 - 56
Broccoli	Transplant	45 - 55
Cabbage	Transplant	50 - 75
Carrots	Seed	70 - 78
Cauliflower	Transplant	65 - 75
Chard	Seed	50 - 59
Collards	Seed	55 - 75
Kohlrabi	Transplant	40 - 55
Lettuce	Seed	50 - 75
Onion	Transplant	--
Parsley	Seed	72 - 75
Peas	Seed	60 - 65
Radish	Seed	20 - 30
Spinach	Seed	40 - 50
Turnip	Seed	35 - 45

**Sources**

Texas A&M AgriLife Extension Fort Bend County Vegetable Garden Planting Dates

Randall Ph.D., Bob (1999, 2000-06) *Year Round Vegetables, Fruits and Flowers For Metro Houston, A Natural Organic Approach Using Ecology* 12<sup>th</sup> Edition.

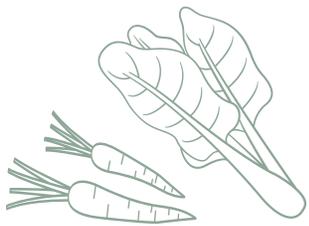
Houston, Texas: Year Round Gardening Press

### November

Plant	Seed or Transplant	Days to Harvest
Beets	Seed	50 - 56
Broccoli	Transplant	45 - 55
Cabbage	Transplant	50 - 75
Carrots	Seed	70 - 78
Cauliflower	Transplant	65 - 75
Chard	Seed	50 - 59
Collards	Seed	55 - 75
Kohlrabi	Transplant	40 - 55
Lettuce	Seed	50 - 75
Onion	Transplant	--
Parsley	Seed	72 - 75
Radish	Seed	20 - 30
Spinach	Seed	40 - 50
Turnip	Seed	35 - 45

### December

Plant	Seed or Transplant	Days to Harvest
Radish	Seed	20 - 30
Spinach	Seed	40 - 50
Turnip	Seed	35 - 45



# Vegetable & Herb Planting Calendar

## SPRING SEMESTER

### January

Plant	Seed or Transplant	Days to Harvest
Broccoli	Transplant	45 - 55
Carrots	Seed	70 - 78
Cauliflower	Transplant	65 - 75
Chard	Seed	48 - 59
Collards	Seed	55 - 75
Kale	Seed	50 - 55
Kohlrabi	Transplant	40 - 55
Leeks	Transplant	75 - 130
Lettuce	Seed	50 - 75
Onion	Transplant	--
Peas	Seed	60 - 65
Radish	Seed	20 - 30
Spinach	Seed	40 - 50
Turnip	Seed	35 - 45

#### Sources

Texas A&M AgriLife Extension Fort Bend County Vegetable Garden Planting Dates  
 Randall Ph.D., Bob (1999, 2000-06) *Year Round Vegetables, Fruits and Flowers For Metro Houston, A Natural Organic Approach Using Ecology* 12<sup>th</sup> Edition.  
 Houston, Texas: Year Round Gardening Press

### February

Plant	Seed or Transplant	Days to Harvest
Broccoli	Transplant	45 - 55
Beets	Seed	50 - 56
Carrots	Seed	70 - 78
Cauliflower	Transplant	65 - 75
Chard	Seed	50 - 59
Collards	Seed	55 - 75
Kale	Transplants	50 - 55
Kohlrabi	Transplant	40 - 55
Lettuce	Seed	50 - 75
Onion	Transplant	--
Parsley	Seed	72 - 75
Peas	Seed	60 - 65
Radish	Seed	20 - 30
Spinach	Seed	40 - 50
Turnip	Seed	35 - 45

### April

Plant	Seed or Transplant	Days to Harvest
Beans	Seed	55 - 70
Cantaloupe	Seed	80 - 90
Corn	Seed	80 - 95
Cucumber	Seed	50 - 60
Eggplant	Transplant	50 - 65
Okra	Seed	50 - 65
Peas	Seed	60 - 65

### March

Plant	Seed or Transplant	Days to Harvest
Beets	Seed	55 - 70
Cantaloupe	Seed	80 - 90
Collards	Seed	55 - 75
Corn	Seed	80 - 95
Cucumber	Seed	50 - 60
Eggplant	Transplant	50 - 65
Kohlrabi	Transplant	40 - 55
Lettuce	Seed	50 - 75
Parsley	Seed	72 - 75
Peppers	Transplant	65 - 75
Pumpkin	Seed	--
Radish	Seed	20 - 30
Squash	Seed	45 - 55
Tomato	Transplant	35 - 45

Peppers	Transplant	65 - 75
Potato	Seed	80 - 90
Pumpkin	Seed	--
Radish	Seed	20 - 30
Squash	Seed	45 - 55
Tomato	Transplant	35 - 45
Watermelon	Seed	70 - 90

## Special Thanks

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