

GARDENING GUIDE FOR TENNESSEE'S TEACHERS

A PRACTICAL PLAN TO STARTING A SCHOOL GARDEN

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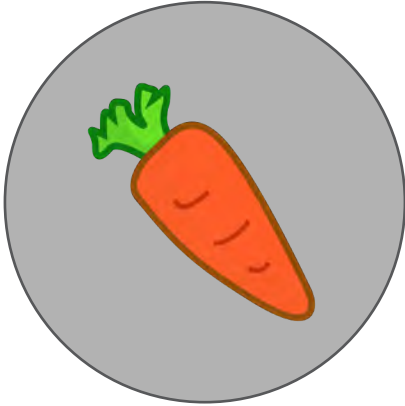
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**If they grow it, they
will eat it.**

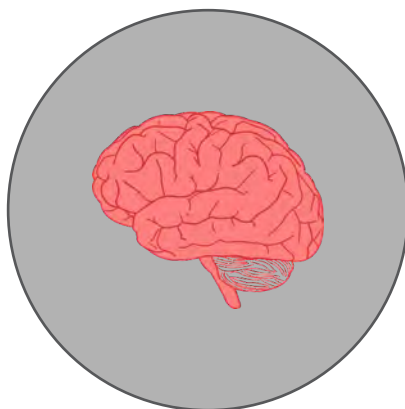
BENEFITS OF SCHOOL GARDENS



"School gardens provide students with a real-time look at how food is grown."³

When students are engaged in hands-on experiential learning that focuses on food and nutrition, their eating habits improve dramatically.²

Increased time spent outdoors is correlated with improved relationships and social well-being.⁴



Students' test scores, concentration, working memory and stress levels have all been shown to improve by increasing time spent in nature.^{1,4}

MAKE THE MOST OF IT

Foster connections between the garden and other learning areas including community connections, health and wellness to best utilize the garden as a youth development tool.

Nutrition Education

Research shows that most children receive inadequate levels of fruit and vegetable consumption, which can lead to future health risks such as obesity and diabetes.³

Studies have found that gardening may increase fruit and vegetable consumption among children, as it increases access to nutrient-rich foods and makes them more likely to try them. When gardening is included as part of school curriculum, vegetable consumption increases more than with nutrition education alone.^{2,3}



Skill Development

School gardens can be utilized to teach lessons such as responsibility, patience and a sense of pride in your work. Teamwork and respect can also be learned in the school garden. Furthermore, the garden is the perfect learning environment for creative problem solving and critical thinking. Community members can also be brought into the classroom to share their experiences with agriculture or gardening, which can help students learn social skills and foster community connections.

Real-Life Applications

The time spent learning in the garden can provide the students with lessons they can use in everyday life. By simply providing an opportunity for students to get their hands dirty and interact with nature, teachers can inspire personal growth and scientific exploration.



CONSIDERATIONS

A school garden should not be an additional burden on already busy teachers, but an opportunity to incorporate hands-on learning and fun experiences into the school day. Before breaking ground, consider these things:

Space

How much space do you have for a school garden? Will the garden be outdoors or completely indoors? Be sure to get permission from school administration to put a garden on school grounds before making any plans. Furthermore, some school gardens are utilized and accessed by all grade levels, while others are only used by one or two specific grade levels during a specific growing season. For example, if the growing area is small, first and second grade would utilize the garden in the fall, and third and fourth grades would have access to the garden in the spring. Also consider how many students will be in the garden at any one time so that all students can have adequate space to see and participate.

Content Standards

Brainstorm ideas with fellow teachers to develop student learning experiences in the garden to meet educational school standards. There are many lesson plans online that complement garden activities that are already aligned to meet student learning standards. One example resource is IXL, which can be found at ixl.com/standards/tennessee.

Time Commitment

Gardens take time. Will the students be able to work in the garden during the school day or will it be an after-school activity? Will the garden be cared for during the summer by teachers or summer student programs, or will it only be used during the school year? Discuss with school administration to see if there is a limit to the amount of time that can be spent in the garden during the school day. Some after-school time will be necessary to get the garden started. So, be realistic with the amount of time that the teachers, parents and students have to spend and plan accordingly. It is best to start small and add on!

Financial Commitment

A garden must be maintained. While financial assistance may be available to get started, consider how the garden will be funded in the future. Who is responsible for securing funding for the garden?

HOW TO BEGIN



BUILD A TEAM



GATHER RESOURCES



GROW AND LEARN

GETTING STARTED

Starting a school garden can be a tall task, but gardening can enrich students' learning experiences in extraordinary ways.

Build a Team

School gardens can be a great way to engage the entire community. School administrators, teachers, other staff, parents and even other community volunteers can all get involved! Extension agents and Master Gardener volunteers can also provide guidance and information.

Gather Resources

Determine what supplies and funding are needed. A sample budget is provided in this guide as an example, but each garden may have different needs. Contact your local USDA office, Farm Bureau, and nurseries or garden centers to inquire about funding opportunities or assistance for a school garden.

Grow and Learn

Once the garden is built, have a Planting Day to engage the school administration, parents and students. Involving the entire community will foster long-term support of and commitment to the garden.

OUTDOOR GROWING OPTIONS

BUILDING AND USING RAISED BEDS

A range of materials can be used to construct raised beds including wood, stone, brick, block, plastic or composite materials. Items can also be reused from their original purpose to become garden planters. When using containers of any kind, consider using compact or bush varieties of your vegetables to best fit the space. The following link is a video about raised beds and container gardening from the University of Wisconsin Extension: youtu.be/plXYWFe5l5s



Image Credit: Rachel Painter, Extension Agent

Traditional Raised Beds

A common raised bed is 4 feet by 6 feet and 12 inches in height. Pressure-treated lumber that is at least 2 inches wide is recommended for constructing a stable bed that will support the soil and plants.



Image Credit: Bob Bates, Coffee County Tennessee Extension Master Gardener

Accessible Designs

Garden beds can be constructed so they may be reached and enjoyed by all students. The height of the bed can be altered to accommodate those who may not be able to work at ground level.

GARDEN DESIGN

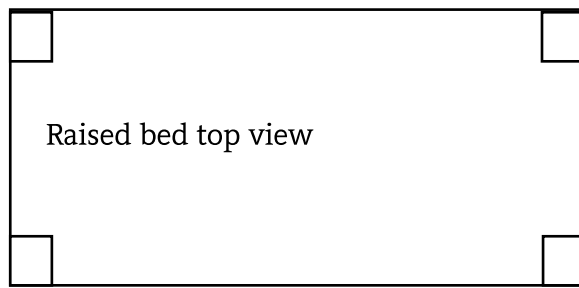
Embarking on building and starting a garden from scratch can quickly become a tall task. Keep in mind the practical size of the garden and the total number of students who will be involved when estimating cost. Also, quality and price of materials can vary by location. Be sure to find local prices and resources to make a garden plan and budget for the specific needs of the school. The example below is simply intended to be a starting place.

A simple raised garden bed can be a great start to a school garden. Elevating the bed can allow students easy access and create an ideal border to keep both weeds and students themselves out of the growing space.

Constructing a raised bed will require power tools, labor, and materials. Soil will also be needed to fill the bed after construction. A mixture of 1/3 compost to 2/3 vegetable garden soil or topsoil is ideal. Soil can be purchased in bags or in bulk at garden centers by the scoop or by the yard, or can be delivered by some landscaping companies generally for a delivery fee. Be wary of donated soil or even animal manures as compost as they could contain large amounts of weed seed or undesirable contents. Manure should be avoided completely as it can be a food safety hazard in a school garden.

Raised bed example:

6' long X 4' wide X 16" high



(2) 2" X 8" X 10' board (cut to 6') ↑

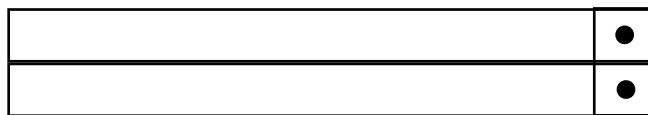
Materials for one raised garden bed:

- 4 - 2" X 8" boards of 10' length
 - (\$14 each = \$84)
- 1- 4" X 4" board of 8' length (\$11)
- Hardware screws (~\$8 per 1 lb. box)
- 1 yd. soil = ~27 cubic ft. soil (~ \$50)

← (2) 2" X 8"x 10' board (cut to 4')

← 4" X 4" post (cut to 1.5' high)

Raised bed side view (step 3 below):



← Screw through both the top and bottom 2" X 8" boards into the 4" X 4" post behind

Steps to build a raised garden bed:

1. Use a skill saw to cut the 4-by-4-inch post into four 1.5-foot pieces (or have pre-cut at the store).
2. Cut each 2-by-8-inch board into a 6-foot piece and a 4-foot piece (make one cut).
3. Start by holding a 6-foot board and 4-foot board at a 90-degree angle with the 1.5-foot post as a brace inside. Push the 1.5-foot post down into the ground to secure the bed to the ground (hit with a mallet). Screw all pieces together.
4. Continue with step 3 directions until the entire rectangle of bottom pieces is complete. Then add on the top boards.

CREATIVE CONTAINERS

Tires

Used tires can be a great reusable option for the garden. Depending on the space available, each student can have their own tire in which to plant, maintain and harvest. Ask local businesses or parents for used tire donations.



Image Credit: Valerie Everett, Flickr

Livestock Mineral Tubs and Plastic Pools

Both mineral tubs and plastic pools can serve as wonderful alternatives to traditional raised beds. They just need some preparation first. Start by drilling a few small holes around the sides at the bottom for drainage. Then, add a layer of rock or mulch inside and start planting!

Plastic pools are great for plants with shallow root systems. Mineral tubs offer more rooting depth and are better suited for root vegetables or more vertically designed gardens. Collaborate with your local farmers to coordinate the donation of these tubs.



Image Credit: Bob Bates, Coffee County Tennessee Extension Master Gardener

INDOOR OPTIONS

Aquaponics

There are many types of aquaponic growing options that could be used in a school setting. Many schools choose to place the aquaponic growing system in the library, cafeteria or even in the main office. Options can be large, such as a growing tower, or smaller and better suited for a table-top. Plants that have smaller root systems work well in these, such as leafy greens and even strawberries.



Image Credit: Rachel Painter, Extension Agent

Give Household Items New Life in the Garden



Many household items can be used to create small garden spaces. With a little bit of imagination, everyday items can be used to create perfect homes for the plants. While the plants more than likely will not be able to reach full maturity in these environments, the plants can be started from seed and transplanted into larger planters later. Such items include metal reusable baking trays, snack bags taped onto windows, egg cartons with plastic bread bags blown up and tied around them, and much more!

Image Credit: Anna Duncan, Extension Agent

GARDENING BY SCHOOL SEMESTERS

Garden vegetables can be divided into cool-season and warm-season vegetables according to the temperature ranges they require to grow. Cool-season vegetables are more productive and produce higher quality crops when grown during the cooler spring and fall temperatures. Alternatively, warm-season vegetables are better suited for the higher temperatures during the summer months. Warm-season vegetables are killed by frost and cooler temperatures. For this reason, it is important to learn and teach students about the local frost dates and plant accordingly. Coordinate the garden planting and harvesting with the semesters so that students will be able to harvest what they planted and see the garden to fruition.



Early Fall

Early fall gardens can be difficult for school gardens with issues such as drought and extreme heat. This is also a busy time for both teachers and students. However, by planting even just a small section of early fall crops, students can experience harvesting sooner. The end of summer to early fall is the time to plant crops such as broccoli, cabbage and cauliflower. Use transplants of these brassicas for best success.

Late Fall

Late fall is the best time to plant all other cool-season crops, especially the leafy greens. Mid-August is the perfect time to plant collards, kale, kohlrabi, lettuce, mustard greens, radishes and turnip greens. Spinach should be sown in September.



Image Credits: Rachel Painter, Extension Agent

SPRING AND SUMMER



Early Spring

Harvest any cool-season vegetables that have continued to grow over the break. Have students decide what to plant for the spring and summer, and design the layout and spacing. Direct seed peas, mustard, kale and collards the last week of February. Hardy cool-season crops are seeded or transplanted four to six weeks before the frost-free date.



Late Spring

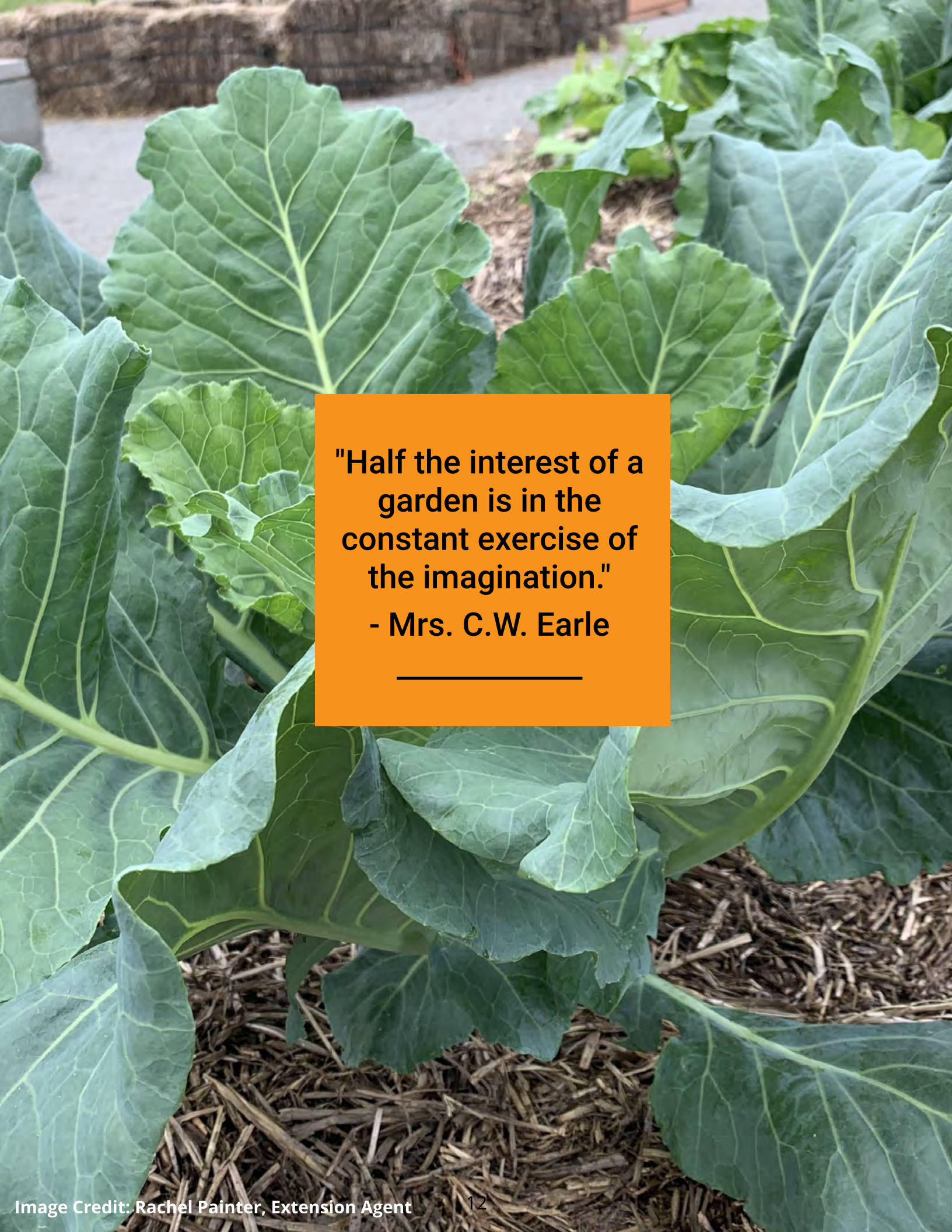
Plant less hardy cool-season crops two weeks before the frost free date. Start seeding warm-season transplants indoors around the first week of March. Don't forget to harden off transplants by slowly transitioning them to get used to outdoor conditions.



Summer

Transplant many warm-season transplants in the garden around the last week of April or after the chance of frost has passed. Direct seed other warm-season crops in May. Be sure to make a plan for watering, weeding, and harvesting the garden during the summer break.

Image Credits: Rachel Painter, Extension Agent



**"Half the interest of a garden is in the constant exercise of the imagination."
- Mrs. C.W. Earle**

COOL SEASON CROPS IN TENNESSEE

Vegetable	Planting Interval	Inches Between Plants (thinning may be required)	Seed Planting Depth (inches)
Broccoli, Cauliflower	3/15 - 4/15	15	transplants
Cabbage	3/15 - 4/15	15	transplants
Carrots	3/1 - 5/1	2 - 3	0.25
Collards	2/15 - 4/15	15	0.25 - 0.5
Kale	2/15 - 4/15	12 - 15	0.25 - 0.5
Lettuce, head and leaf	3/1 - 4/15	12 - 15, head 6, leaf	0.25
Onion	3/1 - 4/15	3 - 6, storage 2 - 3, bunch	1 - 2
Peas, English and snap	2/15 - 4/15	2 - 4	1
Radish	3/1 - 4/15	1 - 2	0.25 - 0.5
Spinach	2/15 - 4/15	3 - 4	0.25 - 0.5
Swiss chard	3/1 - 4/15	6 - 8	0.5
Turnips, greens and roots	3/1 - 4/15	2 - 4	0.25 - 0.5

Table 1. Cool Season Crops in Tennessee (from Table 5 in UT Extension Publication "W 346-B The Tennessee Vegetable Garden: Garden Planning, Plant Preparation and Planting").

WARM SEASON CROPS IN TENNESSEE

Vegetable	Planting Interval	Inches Between Plants (thinning may be required)	Seed Planting Depth (inches)
Beans, Bush or Snap	4/10 - 6/30	3 - 4	1 - 1.5
Beans, Lima	5/1 - 6/30	3 - 4	1 - 1.5
Cucumber	5/1 - 6/15	12	0.5 - 1
Eggplant	5/1 - 6/15	24	transplants
Okra	5/1 - 6/15	6 - 12	1
Pepper	5/1 - 6/15	18 - 24	transplants
Pumpkin	5/1 - 6/30	48	1
Squash, summer	5/1 - 6/30	12 - 24	1
Squash, winter	5/1 - 6/30	24 - 36	1
Sweet potato	5/1 - 6/30	12	slips
Tomato	4/15 - 6/30	24 - 36	transplants
Watermelon	5/1 - 6/30	48	1

Table 2. Warm Season Crops in Tennessee (from Table 5 in UT Extension Publication "W 346-B The Tennessee Vegetable Garden: Garden Planning, Plant Preparation and Planting").



**"There are no
gardening mistakes,
only experiments."**

**- Janet Kilburn
Phillips**

HARVESTING



Most leafy greens are at their peak before flowering begins. Harvest when leaves are crisp and at the desired size for eating.



Cucumbers are ready to harvest when seeds are small, the flesh is still firm, and the color is green rather than yellow.



Summer Squash are ready to harvest when the skin is still tender and glossy and the large end is 1-2.5 inches in diameter.

Image Credit: Rachel Painter, Extension Agent

For more signs of maturity and readiness for harvest, please see Table 2 in UT Extension Publication "W 346-I: The Tennessee Vegetable Garden: Harvest, Handling and Storage of Vegetable Produce."

HARVESTING

Proper harvesting and handling can help ensure higher quality and prolong shelf-life. Teaching students to harvest carefully can protect the plants for future production and harvesting.

Harvesting Practices

The best time to harvest most garden crops is in the morning once the dew has lifted. If plants are still wet while harvesting, there will be a higher potential to spread plant diseases.

Teach students to carefully remove fruit from the plants to prevent injury to the stems or leaves. Fruits with strong stems, like peppers, should be cut from the plant to prevent pulling and damaging the plant.

Storage and Safety

After the produce has been picked, protect the harvest from direct sun and transport it to a cool location as soon as possible to maintain quality. Students should use caution when handling the harvested produce to prevent bruising or crushing. Stems of tomatoes can even be removed to prevent puncturing other surrounding fruits. If any produce is damaged or diseased, it should be discarded as to not reduce the quality of other nearby produce.

Sanitary Practices

Ensuring food safety is of utmost importance in a school garden. Areas of concern include the garden area itself, the water source, and any tools including hands and containers for storage. Wildlife and domestic animals should be kept out of the garden area. Any water used for washing produce and watering the crops should be potable or drinking water. Also be sure that students wash their hands before picking produce and that all containers and tools are kept clean using a mild detergent and rinsed clean with water.

GARDEN READY RECIPES

Half the fun of gardening is eating what you grow! Try these easy and delicious snacks with students using the fruits and vegetables grown in the garden.



Salads

Combine lettuces and other greens with a variety of vegetables from the garden to create new textures and flavors for your students to try.

Image Credit: National Ag in the Classroom Foundation



Kale Chips

Cut the kale into small pieces about the size of a chip. Wash the kale and dry it very well. Place the dried kale into bowls and put a small bit of olive oil on the students' hands. Massage the kale leaves until all are evenly coated in oil. Sprinkle with sea salt. Place kale on parchment-lined baking sheets and bake for 10 minutes or until crispy.

Image Credit: Kasey Shuler, Flickr



Image Credit: Pixabay

Veggie Pizza

Get creative with your pizza toppings! Squash, tomatoes, and spinach can make delicious pizza toppings. Herbs can also be incorporated into a pizza creation. Try them on a whole-grain cracker or cauliflower pizza crust for a balanced snack.



Image Credit: narya, Pixabay

Veggie Sticks

Slicing vegetables like carrots, zucchini, and yellow squash into fun shapes like sticks can encourage students to try them. Offer various dips such as hummus or ranch dip to accompany the vegetables.



Image Credit: JeffryW, Flickr

Salsa

Combine tomatoes, peppers, and cilantro for a simple summer salsa. Throw in some onions, garlic, and beans if you grow them as well. Salsa can also include out of the box items like corn, beans, strawberries, and other items grown in the summer garden.



ART

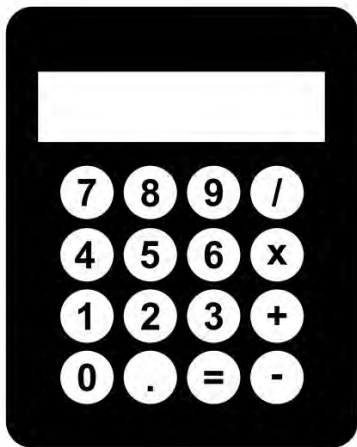


SOCIAL STUDIES



PHYSICAL
EDUCATION

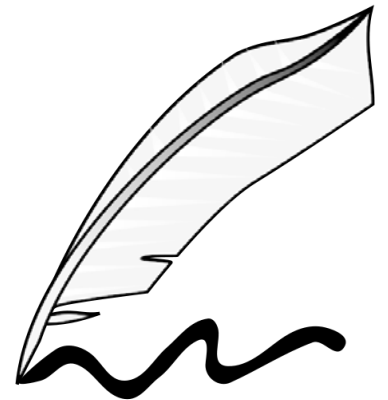
BEYOND THE GARDEN



MATH



SCIENCE



LANGUAGE
ARTS

LESSONS IN THE GARDEN

The opportunities to learn in the garden are endless. Learning can extend beyond the garden into every subject area.

Measuring and Other Math Skills

The garden is the perfect place to practice measurement skills and practice addition, subtraction, and multiplication. Get students involved in measuring out the spacing of plants or measuring the depth to plant a seed. For more advanced students, the garden can be used to practice calculating surface area, volume, and yields.

Observing and Record Keeping

While taking measurements in the garden and waiting for signs of ripeness, students are practicing their observation and critical thinking skills. This can easily be combined with lessons on record-keeping and note-taking. Ask students to observe an insect in the garden or to keep track of weekly growth of the size of a plant or the fruits.

Predicting

"There are no gardening mistakes, only experiments."

- Janet Kilburn Phillips

It's true - there is no better place to introduce the scientific method than the garden. There are many things students can predict and test in the gardens. Students can predict when the first frost will be in the fall, when the first fruit will start to form, and even the days to harvest for each plant.

LESSON PLANS

"Working in a garden is a real-world activity; it engages students and encourages them to explore and reason independently."
(Harvard, 2018)

More than Seeds

Propagation can be used to teach lessons in multiplication, measurement, intercellular communication, and more.

Materials

Potted Basil or Other Herb
Pruners or Scissors
Plastic Cups
Water

Permanent Marker
Potting Soil
Pots

Instructions

Demonstrate for the students how to snip a 4-6 inch stem of the basil and remove any leaves on the lower 3 inches. Use the marker to write the student's name on the cup, and fill it with water. Place the cutting in the cup and put it in indirect sunlight for approximately 10 days or until roots begin to form. Then, help students plant the rooted cuttings in small pots. These can be transplanted later on into larger pots, raised beds, or into the ground.

You can find more lesson plans for your school garden at these websites:

- shop4-h.org
- agclassroom.org/teacher/matrix
- kidsgardening.org/educator-resources/

RESOURCES

Pests and Diseases

Many insects and diseases are common in vegetable gardens. Reach out to your local Extension Office for advice on how to best manage them and visit UTHort.com for further information.



Tomato Hornworm


Local Support

When looking for resources for your school garden, look no further than your neighbors. Organizations such as Cooperative Extension and their Master Gardener programs offered through land-grant universities can offer research-based information for your garden. 4-H, FFA, Farm Bureau, NRCS, and other similar organizations can also offer assistance or guidance. Reach out and see what your local community can offer in regards to education, reference materials, and perhaps even financial assistance.

Other Resources

Other organizations such as NASA, U.S. Forest Service, etc. offer citizen-science programs and resources that pair well with school gardens.

Consider reaching out to your local 4-H groups or attending a training from the Tennessee Foundation for Ag in the Classroom. to get new ideas and meet other youth development professionals who are facilitating educational garden programs for youth.



**"If you have a garden
and a library, you have
everything you need."**

**- Marcus Tullius
Cicero**

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- ³ Shafer, L. (2018, July 31). Let It Grow. Retrieved from <https://www.gse.harvard.edu/news/uk/18/07/let-it-grow>
- ⁴ U.S. Department of Agriculture, Forest Service. 2018. Urban nature for human health and well-being: a research summary for communicating the health benefits of urban trees and green space. FS-1096. Washington, DC. 24 p.

ADDITIONAL RESOURCES

UT Extension Publication "W 346-B: The Tennessee Vegetable Garden: Garden Planning, Plant Preparation and Planting."

<https://extension.tennessee.edu/publications/Documents/W346-B.pdf>

UT Extension Publication "W 346-I: The Tennessee Vegetable Garden: Harvest, Handling and Storage of Vegetable Produce."

<https://extension.tennessee.edu/publications/Documents/W346-I.pdf>

UT Extension Publication "W 346-E: The Tennessee Vegetable Garden: Building and Using Raised Beds."

<https://extension.tennessee.edu/publications/Documents/W346-E.pdf>

UTHort.com

extension.tennessee.edu/publications

agclassroom.org/tn

agfoundation.org

tennesseeag.org



Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.



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