W 1059

1-2 YEARS IN PROJECT

Horticulture and Gardening

Beginner Project Area Guide

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Welcome to the **Beginner Horticulture/Gardening Project Area Guide**!

You will learn the basic knowledge and skills necessary for success in the first two years of the Horticulture and Garden project area.

Important Note
Many of the activities will require access to gardening materials and outdoor spaces for planting. If you do not have the necessary materials or physical space available to you at home, that is okay. Do the best you can with the resources available to you. **If you need help getting supplies or finding space for gardening, ask your 4-H agent for help.** They can help connect you to community resources so you can complete the activities.

Horticulture and Garden Activities

Ctrl+click on each activity number below to be taken to where it appears in the document.

Activity 1
Past, Present and Future

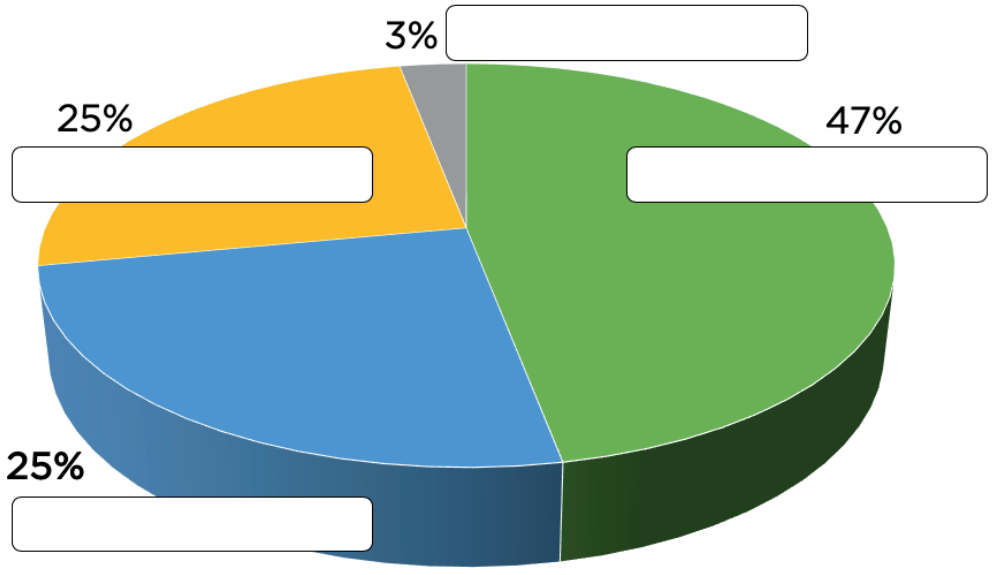
Outcomes:
- Identify what soil is and where it comes from.
- Explain how soils form.
- Understand basic soil properties such as pH, organic matter and nutrients.

Many people refer to soil as "dirt," but soil is so much more than that! The word **dirt** refers to dust and lint that can commonly be found around the floorboards of your house. Dirt has no mineral or nutrient value. Plants could not sustain life if they were grown in only dirt.

Soil, on the other hand, is an extremely dynamic material. Naturally, soil contains everything needed to sustain plant growth and is ever changing as old and new soils mix together over time due to erosion. All soil is made up of four main components:

1. Minerals
2. Organic matter
3. Water
4. Air

Think about the four soil components mentioned above (minerals, organic matter, water and air) and their proportion within the make-up or composition of soil. On the pie chart below, label the four components based upon which component of soil makes up what percentage of a soil sample.



Check your answers to all activity questions at the end of each activity.

Throughout this project area curriculum, you'll see images like the one on your right called QR codes. Use a QR reader or open the camera on a smart device to watch videos, read articles or play interactive games. Make sure you ask a parent or guardian first.

Click the image to open the linked URL.
Here, you can watch a video to understand soil.

So, if soils are made up of many different elements, how did soils get that way? How do soils form? In the video linked above you learned that the largest percent (47 percent) of a soil sample is made up of minerals. These minerals are sand, silt or clay, and they are created by the erosion of rocks. There are five factors that affect soil formation, which are listed below. After reading their descriptions, write one way you think that factor can affect the formation of soil.

5. Parent Material - This is found in an area before soil is formed, typically exposed rock. As wind, water and other elements erode away the rock, soil is formed. How would different types of parent material affect soil formation?

_____

_____

_____

4. Biota – These are the living organisms in soil. This includes microorganisms that can only be seen with a microscope all the way up to large animals, such as deer and humans. How do you think the biota affects soil formation?

_____

_____

_____

3. Climate – The overall weather pattern of an area, which affects the amount of precipitation and average temperatures. How do you think the climate affects soil formation?

_____

_____

_____

2. Time – The longer a soil has been around, the more weathered it will become, changing many of its characteristics. How would a younger soil differ from an older soil?

_____

_____

_____

1. Topography – The lay of the land affects how soil erodes and moves over time. For example, soil erodes faster off a steep mountain side than on flat ground. What are some landscape features that might affect erosion?

_____

_____

_____

So, if all soils are formed from eroding rocks, does that mean all soils are exactly the same?
Not at all!

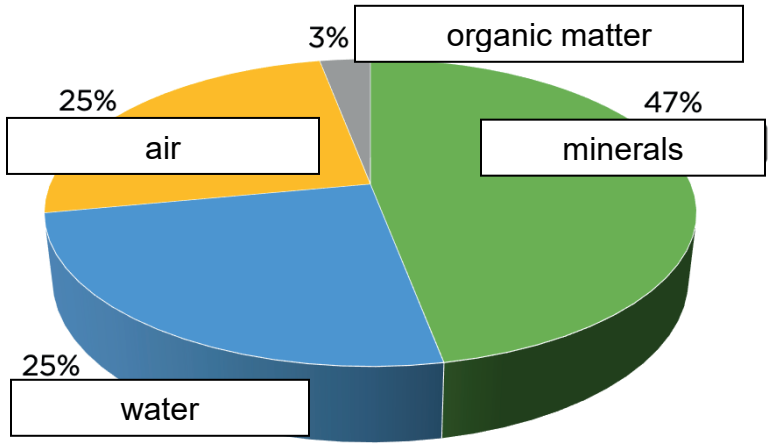
Soils are different. Some are made of sand, some of silt and others of clay. Soils also differ chemically from one another. Scientists test and understand basic chemical differences of soils, but the main three are 1) pH, 2) organic matter, and 3) nutrients.

1) pH describes how acidic or basic a soil is.
2) Organic matter, as discussed in the video you watched earlier, is the living part of the soil.
3) Nutrients are parts of the soil that sustain life.

By understanding these three components, we can understand what exactly makes one soil sample different from another.

As you finish Activity 1, make sure to check your answers below.

Soil Composition Pie Chart



Five Soil Forming Factors

5. Parent Material – Different types of rocks are made of different minerals; therefore, they erode into different soils.
4. Biota – Biota can further erode the soil by walking on the soil or even picking it up and moving it.
3. Climate – Areas with more precipitation will have more water erosion, but only if the temperatures are warm enough to keep the water in liquid form rather than snow or steam.
2. Time – Older soil may be thicker, as it has had a longer time to form.
1. Topography – mountains, valleys, plateaus, rivers, lakes, islands and oceans.

Elements of this activity were adapted from Andrew Sherfy, Senior Lecturer, ESS 210, *Introduction to Soil Science.*

Activity 2
The Ground Beneath Us

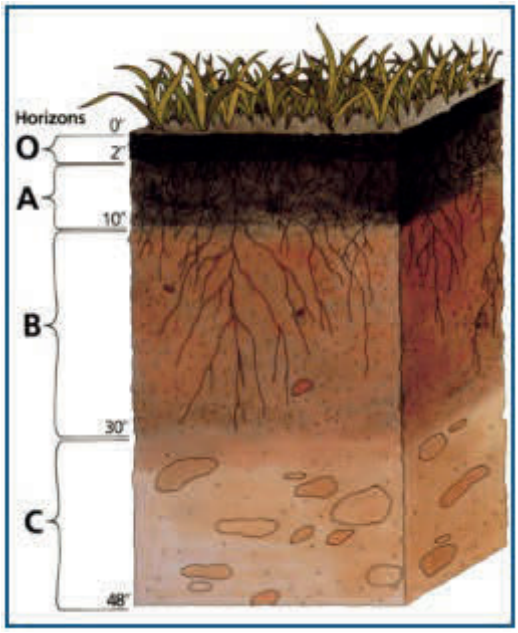
Outcomes:
- Identify soil layers.
- Summarize how they differ.

If you were to dig a sample of soil out of the ground, what would you see?

Well, obviously you would see a dark top layer of soil, which likely still has grass and plant roots stuck in it. Then below that, soil of a slightly different color. But what if you dug a really deep hole? You would see a few different colors of soil emerge as well. We call these different colors soil layers or **horizons** and label them as such:

- O
- A
- B
- C

Each horizon has specific characteristics that make it different from the next. Read the descriptions below and match the descriptions with the horizons (O, A, B, and C) in the picture above.



_____ 1. Also referred to as bedrock, this horizon is the toughest. It goes all the way to the bottom of the earth's crust and is where the parent material for new soil originates.

_____ 2. This horizon is the smallest and is where the base of plants can be found. It is also referred to as organic matter.

_____ 3. This layer can be found right above the bedrock and is typically lighter in color than the organic matter. This is because it is weathering the bedrock away directly to make new soil.

_____ 4. Also known as top soil, this horizon is found directly below the organic matter.

Answers: 1. C; 2. O; 3. B; 4. A

Optional Activity: Observing Soil Layers in Real Life

Supplies:

Ground to dig	Shovel	Tape Measure
Camera	PVC piping	Optional: Gardening Gloves

To Do:

1. Ask an adult for permission to begin digging in the yard and for safety assistance. Also, ask if there is anywhere around your home where you would be able to dig a large hole.

2. Take a shovel and dig out a hole large enough for you to see at least to the B horizon. Note: Hitting bedrock may be a bit overzealous!

3. Place the soil you have dug up in order on the ground next to your hole and watch as the color of the soil slowly changes color the further you dig.

4. Use a marker to label the different horizons. An example of what this may look like is provided below:

5. Take pictures of your labeled findings.

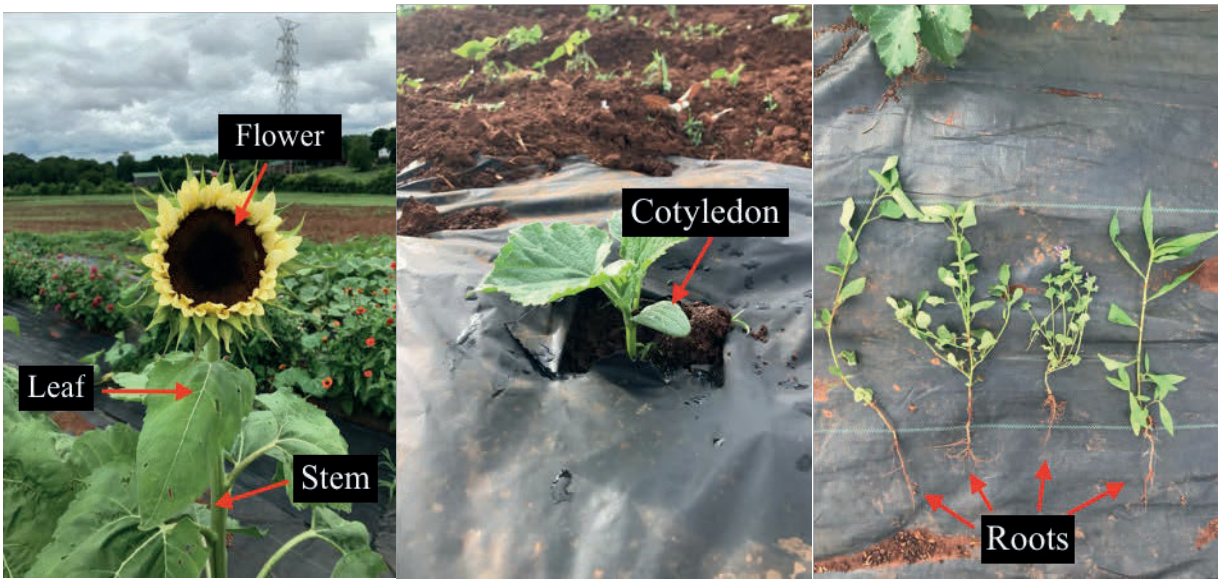
6. Share what you learned with your 4-H club members in a formal presentation like a poster or PowerPoint presentation. Make sure to upload your pictures and presentation to your digital portfolio.

Activity 3
Plant Part Pop Quiz

Outcomes:
- Label the major roles of each of the main plant parts (roots, stems, leaves, flowers).
- Classify plants as monocots or dicots.
- Examine flowers, seeds and seedlings to find the different parts and classify them as monocots or dicots.

Plants can be broken down into a few basic parts: the **flower**, **leaves**, **roots** and the **stem**. However, you might be surprised to find out that each of these parts are made up of many different parts, and each has a specific function to help the plant survive.

Look at the pictures to learn basic plant anatomy.



So, we know where the parts are on plants, by why do plants have them?

Cotyledon: the first leaf to emerge from a seed after a plant germinates
Flower: the reproductive part of the plant which creates fruit and new seeds
Leaf: photosynthesis occurs in the leaves of a plant, which is how plants make food
Roots: anchors the plant in place and takes up water and nutrients
Stem: supports the plant and allows water and nutrients to travel through the plant

Now that you know the basic parts of plants, it's time to put that knowledge to the test. Using the empty space below, draw or press a plant you find outside. Label the different parts listed above to make your own plant anatomy diagram. Don't forget to upload your diagram to your digital 4-H portfolio.

Activity 4
What's in Your Soil?

Outcomes:
- Take a soil sample, and send it to a soil lab to measure pH, nutrients and organic matter.
- Be able to explain the recommendations that were provided in the soil report from the lab.

Soil testing is an important step in the production of any quality crop. As you've already learned, soil is a dynamic entity, with soils being different across the state or even in different areas of your yard!

By testing a sample of soil, you will be able to identify specific characteristics of your soil and determine which plants will grow best there.

So, let's try it! View the directions for sending in your own soil sample to the University of Tennessee for testing.

Click here: ag.tennessee.edu/spp/Pages/lawnandgardensampling.aspx

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After sending in your soil test to the lab, read this University of Tennessee Extension publication to interpret your sample's results.

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After reading the publication, look over your results and answer the following questions about the results of your soil test. If you need extra help understanding your test results, check out this publication from University of Tennessee Extension.

1. What is the pH of your soil? _____
2. How much phosphorous (P) is present in your soil? _____
3. Which nutrient does your soil have the most of? _____
4. How much organic matter is present in your soil? _____
5. How much lime is recommended at this time? _____

Now, use the results given on your sheet to create a presentation telling another person about the recommendations for your soil. Being able to effectively communicate is an important part of science (and life) so this activity will help you practice!

Make a PowerPoint, Keynote, Google Slides, other digital storytelling tools or a poster board to explain what the soil sample was tested for and what it recommends you do to the soil to improve it for the next growing season. Make sure to list a few crops that would do well in your soil. If you have a specific crop that has different soil needs (like blueberry), then make sure to tailor the presentation to that crop.

Here are some suggestions for creating your presentation:

- Title Page - include your name and date
- Where you took the sample (include pictures if you can!)
- Why you selected this sample location
- List the water pH
- List the phosphorous results and rating (low, medium, high or very high)
- List the potassium results and rating
- List the calcium results and rating
- List the magnesium results and rating
- List the fertilizer recommendations per acre
- Explain how you implemented (or plan to implement) these recommendations
- What you plan on planting at this location
- Add as many pictures as you like

If you need help understanding your test results, check out this publication from University of Tennessee Extension.

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Give your presentation at the next 4-H meeting or present it to someone who will be using the soil that you tested.

Upload a link or a picture of your presentation to your digital 4-H portfolio!

Activity 5
The Plant Buffet

Outcomes:
- Describe how plants depend on soil for growth.

So, you've looked at the parts of a plant, parts of soil and the nutrients in the soil. But why is this important? Why is there such a wide variety of minerals and nutrients in the soil?

Well, plants need nutrients and food like us. They get required nutrients from the soil. The nutrients are dissolved in the water within the soil, which makes up 25 percent of the soil. The plants absorb water through their roots.

Here are some of the most common nutrients that plants need: nitrogen (N), phosphorous (P), potassium (K) and sulfur (S). These are called **macronutrients** because plants need them in large quantities. Plants also need **micronutrients**, such as iron (Fe), manganese (Mg) and nickel (Ni), but plants need these nutrients in much smaller amounts.

For this activity, review your soil sample report. See if you can identify the macronutrients and micronutrients listed in your soil report. In the chart below, write how much of each nutrient was found in your sample.

Macronutrients		Micronutrients	
nitrogen (N)		iron (Fe)	
phosphorous (P)		manganese (Mg)	
potassium (K)		nickel (Ni)	
sulfur (S)			

What type of nutrient was your most abundant nutrient? Circle the most abundant nutrient.

macronutrient micronutrient

Does the most abundant nutrient make sense for which group of plant nutrients it belongs to? Why or why not?

Make sure to upload a copy of your soil test results' table to your digital 4-H portfolio.

Activity 6
What's the Deal with Cool and Warm?

Outcomes:
- Identify the most common warm and cool season vegetable crops.
- Identify the basic requirements for plant growth.
- Define the growing conditions for common warm and cool season crops.

As you probably know, certain plants grow better during certain times of the year. For example, you wouldn't plant cucumbers outside in the middle of winter. You also wouldn't plant them outside as soon as the last frost date comes in the spring. You might be asking, "Why?"

Cucumbers are a warm season vegetable. There are cool and warm season vegetables, meaning you can grow different crops throughout the spring and summer growing season.

Read the descriptions of cool season and warm season crops below and review the given examples.

Cool Season Crops	Warm Season Crops
• Require cooler spring temperatures to germinate, grow and fruit. • They should be the first vegetables you plant after the spring frost free date. • Many may be sown (planted) again in the early fall as summer temperatures begin to lower.	• Require warmer temperatures to germinate, grow and fruit. • They should be planted once air and ground temperatures are warm enough during both the day and night. • Cold nights in the beginning of spring can cause the fruits of warm season crops to have a bad flavor.
Examples: lettuce, kale, kohlrabi, broccoli	Examples: squash, cucumber, watermelon, cantaloupe

Ask for permission to complete an internet search and identify five or more examples of a cool season crop and five or more examples of a warm season crop. Fill in your research on the chart below. This would be great information to share with your 4-H club!

Cool Season Crops	Warm Season Crops
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Make sure to upload your research to your digital 4-H portfolio!

Activity 7
Monocot and Dicot Matching

Outcomes:
- Classify plants as monocot and dicot.
- Classify common vegetable crops by whether they are monocots or dicots.

Monocot and dicot are two words used to categorize flowering plants. The main difference occurs when a plant is first germinating. **Monocots** have one cotyledon, while **dicots** have two.

As you learned earlier, cotyledons are the first leaf to emerge from a seed after germination. Look at the chart below for more information on the differences between the two, then complete the activity below!

Monocots	Dicots
• Only one cotyledon • Flower parts in multiples of three • Parallel leaf veins • Examples: all grasses, lilies, daffodils, irises, tulips, bluebells	• Two cotyledons • Flower parts in multiples of four or five • Non-parallel leaf veins • Examples: most vegetable and flowering plants, roses, apple, mint, many herbs

Classify each of the following as either monocot or dicot. If you are unsure of what these plants look like, do an internet search for a picture of the flower of each plant. Remember to look at flower petals or veins in the leaves.

Word Bank: Azalea, Banana, Bamboo, Beans, Corn, Daffodils, Daisies, Lettuce, Mint, Palm Tree, Peas, Rice, Tomato, Wheat

Monocot	Dicot

Answer Key:
You should have placed the following plants under monocot: bamboo, banana, corn, daffodils, palm tree, rice and wheat. You should have placed the following plants under dicot: azalea, beans, daisies, lettuce, mint, peas and tomato.

Activity 8
The Needs of Seeds

Outcomes:
- List the basic requirements for germination of seeds.
- Compare germination of some common vegetables under different temperature conditions.

You know by now that to grow a plant, you must put a seed into the soil and cover it up. But what else do seeds need? It can't be that simple…or can it?

It is definitely not!

Seeds require specific conditions for them to decide it is time to grow into a plant. All seeds have different specific requirements, but all seeds require three basic conditions: temperature, light and water.

Let's test how these conditions affect the germination of some common vegetables with a little experiment. We will be testing two different variables with this experiment: temperature and water amounts.

Supplies

Eight small plastic or bathroom cups	Seeds: cucumber, bean	Permanent marker
1 Tablespoon (Tbsp)	1 teaspoon (tsp)	Potting soil

Procedure

1. Generate a hypothesis to explain what you think will happen to the seeds using different temperatures and water amounts. A hypothesis is a proposed explanation made on the base of limited evidence as a start for further investigation.

Hypothesis: _____

_____

_____

2. Using a permanent marker, label the plastic cups with the codes below. Hint: Use the codes to create a shorthand.
    i. Seed Variables = C: cucumber, B: bean
    ii. Temperature Variables = c: cold, w: warm
    iii. Water Variable = T: Tablespoon, t: teaspoon

    - Cucumber/cold/Tbsp
    - Cucumber/cold/tsp
    - Cucumber/warm/Tbsp
    - Cucumber/warm/tsp
    - Bean/cold/Tbsp
    - Bean/cold/tsp
    - Bean/warm/Tbsp
    - Bean/warm/tsp

3. Put one seed into each cup according to the label. For example, you should have one cucumber seed in each cup labeled cucumber or "C."

4. Add water. For each cup labeled "Tbsp" or "T," add 1 Tablespoon of water. For each cup labeled "tsp" or "t," add 1 teaspoon of water.

5. Place the four cups labeled "cold" into the refrigerator.

6. Place the four cups labeled "warm" onto either a window ledge that gets plenty of sun or under a lamp.

7. After one week, check for germination.

8. Record the number of plants that have sprouted on your data chart under "Week 1."

9. Wait one more week and check how many sprouts you have again.

10. Record the number of plants that have sprouted under "Week 2" on your data chart.

11. Answer the questions found after your data chart.

Note: If it's spring or summer, you can plant your sprouts outside in the garden for your family to enjoy later.

Upload a copy of your data charts and answers to the follow-up questions to your digital 4-H portfolio.

Seed Cup Experiment Growth
Data Chart

Week 1	1 TBS (Tablespoon) water	1 tsp (teaspoon) water
Cold Climate		
Warm Climate		

Week 2	1 TBS (Tablespoon) water	1 tsp (teaspoon) water
Cold Climate		
Warm Climate		

Seed Cup Experiment Growth Recap Questions

1. Which condition was better for germination: cold or hot?

2. Which condition was better for germination: 1 Tbsp or 1 tsp?

3. Which plant had the most germination: beans or cucumbers?

4. How many plants **total** had sprouted by Week 1?

5. How many plants **total** had sprouted by Week 2?

Activity 9
pH

Outcomes:
- Define pH.
- Explain why soils can have different pH levels.

You may have noticed on your soil test report that the pH of the soil was listed, but what is **pH**? Complete the following activity to find out.

pH is the measure of how acidic or basic a substance is. pH is measured on a scale of 1-14.

1–6 = acidic
7 = neutral
8–14 = basic

Water is typically measured as 7 and considered the universal neutral.

Lower numbers are classified as strong acids, while higher numbers are classified as strong bases.

Complete an internet search and look up common acids and bases.

Acid examples: _____

_____

_____

Base examples: _____

_____

_____

What does pH have to do with plants and their ability to grow?

As you saw in your soil test report, the pH of soil is measured because plants grow best between 6.5–7, so plants prefer a slightly acidic to neutral soil.

Soil pH is affected by the nutrients found in the soil.

The most common basic nutrients are potassium (K), sodium (Na), calcium (Ca) and magnesium (Mg).

The most common acidic nutrients are aluminum (Al), iron (Fe) and hydrogen (H).

Each of these serve as food to plants. Their availability to plants changes as the pH changes.

Dip pH strips into different solutions around your home (baking soda, hand soap, lemon juice, vinegar, soft drink, and tap water). Classify the items as acid, base, or neutral. Share your results on your digital 4-H portfolio.

Activity 10
What is N-P-K?

Outcomes:
- Understand basic soil properties such as pH, organic matter and nutrients.
- List different types of fertilizers.

As you know by now, plants require food to grow just like you and your friends. But have you ever considered what exactly plants require to grow or where their food comes from? Aside from sunlight and water, plants need **nutrients** to grow. Nutrients are chemical elements found in the soil that a plant takes up through its roots. Without enough nutrients, a plant will die.

The three main nutrients that plants need are nitrogen (N), phosphorous (P) and potassium (K).
- Nitrogen (N) is important for yield.
- Phosphorous (P) is important for root development.
- Potassium (K) is important for growth.

These three nutrients are so important that almost all fertilizers sold have a portion of N, P and K in them. Usually, the front of the fertilizer bag will tell you the quantity of each nutrient. For example, a fertilizer bag labeled 10-15-10 has 10 percent N, 15 percent P and 10 percent K. The numbers are always written in the order N-P-K.

To practice reading fertilizer nutrient labels, visit the University of Tennessee Extension publication about common fertilizers.

SCAN ME

Review the charts from Activity 5 to help you complete the table below.

Using the chart on the next page, fill in the percentages of N-P-K for each fertilizer.

Urea		Triple Superphosphate	
N		N	
P		P	
K		K	
Diammonium Phosphate		**Potassium Nitrate**	
N		N	
P		P	
K		K	

Upload a final version of your chart to your digital 4-H portfolio.

Activity 11
Do We Really Need Soil?

Outcomes:
- Define growing media.

As you have learned through the previous activities, plants take up their nutrients from the soil they are planted in so they can grow. However, do we really need soil?

The answer may surprise you: no! The job of soil is to provide nutrients and anchor the plants in place, and both of those jobs can be done with non-soil-based components we call **soilless media.**

There are many different types of media available for purchase, but why would you choose media over soil? Complete the following activity to find out.

Read the following information about media, then answer the questions:

Media is lighter than soil, lowering shipping costs and making it easier to move potted plants around. It can hold on to fertilizer/nutrients for plant use. Some media holds on to nutrients more loosely than soil, which can be an advantage of hydroponics. Unlike soil, media can also be relatively pathogen free, which can help prevent soilborne pathogens and diseases.

1. How does the weight of media compare to soil?

_____

_____

2. What benefits does media provide for plants?

_____

_____

_____

3. What are the benefits to media being relatively pathogen free?

_____

_____

_____

For the above questions, here are some possible answers:

1. Media is lighter than soil.
2. Media holds on to fertilizer/nutrients for plant use. It also holds nutrients more loosely than soil, which can be an advantage of hydroponics.
3. Media being relatively pathogen-free can help prevent soilborne pathogens and diseases.

Now that you know why media is used, let's talk about what media is made of! There are many different components which can be mixed into media, but some of the most common building blocks of media are peat moss, pine bark, vermiculite and perlite. Each component of media serves a different purpose and can change the way the plants interact with the media. See the following page for pictures and descriptions of the common building blocks of soilless media.

Peat Moss

This is one of the most common components of media and makes up anywhere from 40 percent or more of the total media in many potting mixes and greenhouse mixes. Peat is harvested from large peat bogs. Peat has a great water holding capacity. Peat is very acidic so must be balanced with more basic components.

Pine Bark

Pine bark is often used in media mixes in place of peat, making up 40 percent or more of the total media. Pine bark or hardwood bark can both be used. Pine bark has similar properties to the peat it replaces. Pine bark is partly composted before use.

Vermiculite

Vermiculite is an expanded mica material that provides a high-water holding capacity, good aeration and is light weight. Depending on the source of the vermiculite, it can provide needed plant nutrients such as potassium, magnesium and calcium. Typically makes up 25-50 percent of the media mix.

Perlite

Perlite is made from volcanic rock that has been crushed and heated to over 1,800 degrees F. Perlite is extremely lightweight and is used to increase aeration within the media. Perlite can make up between 25-50 percent of the media. Use a smaller percentage of perlite when growing larger plants so they do not fall over in their pots. Propagation often uses 100 percent perlite because it drains well in mist systems.

To make things more confusing, some media has soil and sand mixed in as well as the pine bark, peat moss, vermiculite and perlite. Media is highly variable when it comes to ingredients because media has to be adapted to work well for the type of plants a person wants to grow and the growing environment! There are nearly endless possibilities for media components, and we are still finding more that can be used.

With a parent's permission, do a Google search for coconut coir and then for rice hulls in media. The two of these media components are still relatively new to the industry and can contribute to sustainable farming! Instead of purchasing and shipping in pine bark or peat moss, areas with lots of rice or coconut production have found ways to use coir and rice hulls instead! A little creativity can go a long way when creating a media for any planting operation!

Your turn to try it! Ask an adult to help you mix your own media that you can use for potted plants around your house. Choose one component from each list below (don't pick the same thing from more than one list!) and add the components to a large bucket. Using a small spade shovel or your hands, mix the media components together. Make sure to mix it really well! Then use your new media to fill pots and plant some flowers or vegetables around your house! Take pictures and upload them to your online 4-H portfolio. Save some of the media you have made to use in the next activity!

Group 1 - choose one. Use for 50 percent of media

- Peat Moss
- Pine Bark
- Soil

Group 2 - choose one. Use for 25 percent of media

- Soil
- Sand
- Vermiculite

Group 3 - choose one. Use for 25 percent of media

- Perlite
- Vermiculite
- Sand

Remember, don't pick the same thing from two different categories!

Facts about media components taken from Carl Sams' Greenhouse Management Class PowerPoint on the subject.

Activity 12
Garden Site Selection

Outcomes:
- List types of plant containers.
- Identify the main factors in selecting a vegetable garden site.

So, with all this great soil and plant information, you are ready to start planning and planting your very own vegetable garden!

You may already know what you want to plant, and you have learned about soil factors and nutrients needed to grow healthy plants.
But what important thing must you do before you can begin planting? You need to select a site for your garden to be planted!

There are many factors that go into the decision of where to plant, and we will discuss the many questions a gardener must ask themselves below.

Garden Site Selection Factor 1: Space Availability

Assuming you will be planting your garden somewhere around your house, survey your home for potential garden areas. Do you have a large backyard available, unused flower beds right around your house or even just a porch? Before you make the decision for sure, the site needs to pass a few more tests.

Garden Site Selection Factor 2: Plant Size

How large are the plants you wish to grow? Do they require a lot of space and legroom? If so, you must make sure the area you select for your garden is large enough to accommodate their needs. For example, tall corn or okra plants may not have enough room on a covered porch in containers, but they will do well in ground with plenty of room to grow tall and wide. On the other hand, if you want to plant a compact cucumber, that plant would do well in a smaller space.

Garden Site Selection Factor 3: Topography

The “lay of your land” is important to consider when picking a garden site. When considering an area, you need to look at:

- the slope of the land, as planting on steep slopes is not a good plan
- how much sun and shade the area gets throughout the day
- the water infiltration—does this area flood every time it rains, or does it absorb water well?
- and the type of soil—do the plants you wish to grow prefer sandy or clay soils?

Garden Site Selection Factor 4: Plant Nutrient Needs

Once you have narrowed down a few potential garden sites, take a soil test of each one to determine if the proper nutrients are available for vigorous plant growth. When sending your samples in, make sure to specify that you will be growing a vegetable garden so that any data and recommendations provided by the test report will be tailored to growing vegetables. Be sure to send in separate tests for each different location. A soil test is not required if growing your plants in artificial media in containers.

Garden Site Selection Factor 5: Water Availability

How close is the area you have chosen to a water source? Do you have a hose that will reach to the site, or will you have to carry watering cans out? How far can you carry a full watering can without it becoming too heavy? Are you able to connect a drip line irrigation system from a water source? Watering your vegetables will become extremely important in the long hot days of summer, so make sure the site you select has water easily available.

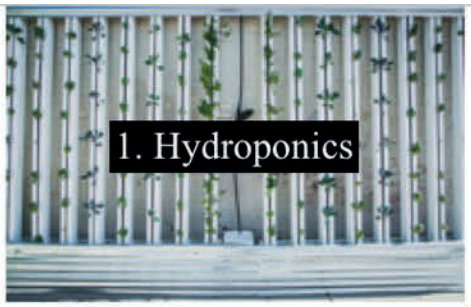
Garden Site Selection Factor 6: Growing System

How do you plan on growing your vegetables? There are many other options aside from simply planting the seeds in ground! A few examples include growing in containers, in raised beds or hydroponics. Choosing a system requires many of the same considerations as choosing a garden site, so the decision goes hand in hand. For example, if you want to grow your garden on the back porch, container growing is the best system choice. If you have a large backyard, in ground or raised beds may be a good choice. If you enjoy building and trying new things, a hydroponics system can be built to fit in most areas. Your available resources and expertise will help you choose the best system. Check out this chart below for help picking the perfect system for you.

Garden System Pros and Cons:

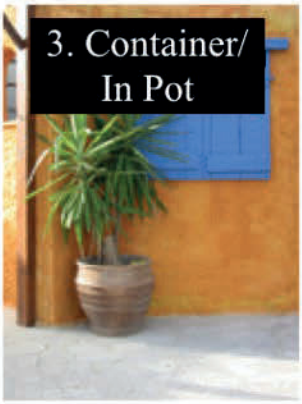
System	Pros	Cons
In Ground	Cheap, simple, not a lot of extra equipment required, lots of available information	Soil may need amended, weed seed bank may be large
Raised Beds	Can add better soil or media, no tillage required for large areas, versatile in size	Requires some building skills, must purchase more materials
Container/In Pot	Extremely versatile, can grow plants anywhere around the home, allows creativity	Must purchase pots and soil/media, potential to blow over in wind
Hydroponics	High level of control over plant nutrients, can grow indoors or out, fun to build and maintain	Highly technical, requires knowledge on building and maintaining system, potentially expensive

See if you can match the pictures below with the correct system description:



This system is what most people think of when they hear vegetable garden. Typically, larger outdoor space and flat land are required for this system to be a success.

This system works very well in small spaces such as porches or on the sides of homes. Getting creative with this system is easy; some people have even grown vegetables out of shoes!



This system requires minimal construction to create, however is great if you are worried about the quality of topsoil in your area. It can be made both large and small, making it versatile.

This system is highly mechanized and requires some construction to create, and can be a fun innovative way to grow vegetables! In some cases, this system does not require media.

Answer Key:

1. Hydroponics - This system is highly mechanized and requires some construction to create, but it can be a fun innovative way to grow vegetables! In some cases, this system does not require media.
2. In Ground - This system is what most people think of when they hear vegetable garden. Typically, larger outdoor space and flat land are required for this system to be a success.
3. Container/In Pot - This system works very well in small spaces such as porches or on the sides of homes. Getting creative with this system is easy; some people have even grown vegetables out of shoes!
4. Raised Beds - This system requires minimal construction to create, however it is great if you are worried about the quality of topsoil in your area. It can be made both large and small, making it versatile.

Now it's your turn! Your job now is to scope out the perfect summer garden location at your home. Don't worry if you do not have a large yard or a porch, you can get creative with container gardens in windowsill flower boxes, hanging baskets, shoes or anything else you can dream of! Remember, you can ask your 4-H agent for help with finding space or materials. Draw a garden map or take a picture of the location you have chosen and upload it to your online 4-H portfolio.

Activity 13
Transplant Trial

Outcomes:
- Define transplanting and describe how it can be an advantage in the garden.
- Start tomato transplants in both greenhouse media and garden soil, and compare germination and early growth.

Now that you know the difference between soil and media and have a place to grow your garden, let's put the two to the test! In this experiment, you will be testing the differences in germination and plant height of tomato transplants started in both soil and media.

"What is a **transplant?**," you ask. A transplant is a plant started from seed in the greenhouse which will eventually be planted in the field once it has grown big enough.

There are several advantages to transplanting seedlings rather than direct seeding everything you grow, including lowering the threat of early growth pests and diseases in the field, controlling the environment to ensure the seeds receive the proper moisture and nutrients to grow quickly and strong, and the ability to have even stands of plants in the field (meaning you avoid gaps between plants that did not germinate when direct seeded).

Let's get started on the experiment!

Materials
12 Tomato seeds
Two separate 6-pack trays (like the kind flowers and bedding plants come in at the store)
One bucket of soil from your yard (with parent/guardian permission)
One bag of media (purchased or left over from the previous activity)
Duct tape
Permanent marker
Ruler or tape measure with centimeters (cm)
Optional: small garden spade

Procedure

1. Take one of the 6-pack trays and put a small piece of duct tape on the outside. Use the permanent marker to write “Soil” or “S” on the piece of tape.
2. Fill the 6-pack tray all the way up with soil using your hands or a small garden spade.
3. In each of the six small wells in the tray, plant one tomato seed roughly 1 inch from the surface of the soil.
4. Gently water the seeds and place them in a sunny spot in your home/growing space, or if you have access to a greenhouse put them in there.
5. Repeat steps 1-4 with the second 6-pack tray, but this time label the tray “Media” or “M,” and fill the pack with the media you purchased or mixed yourself in the previous activity.
6. Wait one week and check on your seeds. Record the number of seeds that have germinated week 1 on table 1. Make sure you are watering your seeds consistently.
7. After week 2 of growth, check for germination again and write down the total numbers of germinated seeds on table 1.
8. After week 3 of growth, use a ruler or tape measure to measure the height of each of the plants that have germinated from the soil to the very top in centimeters, and record your results on table 2.
9. After week 4 of growth, measure the height of all plants again and record your results on table 3.
10. Now it is time to transplant your tomatoes into the outdoor garden! To do so, place the 6-pack trays outside for 1-2 days to allow the young plants to “harden off,” or to get used to living outside rather than inside. After that, dig holes either in ground or in the potting soil in a container that are large enough to fit the whole root mass of the transplant. Carefully pull each plant out of the 6-pack, including the roots and most of the soil/media, and place them into the hole you have dug. Cover the root ball up with the soil or media you are using in the garden. Congratulations, you have just transplanted tomatoes!

Make sure to upload your completed data tables to your digital 4-H portfolio. There are follow-up questions after your data tables, so answer those questions and submit your responses to your digital 4-H portfolio.

	Total # of Plants Germinated Week 1	Total # of Plants Germinated Week 2
Soil		
Media		

Week 3 Seedling Height in cm	Soil	Media
Plant 1		
Plant 2		
Plant 3		
Plant 4		
Plant 5		
Plant 6		

Week 4 Seedling Height in cm	Soil	Media
Plant 1		
Plant 2		
Plant 3		
Plant 4		
Plant 5		
Plant 6		

1. Which variable had the highest total number of plants germinate? Soil or media?

_____

_____

_____

2. Which variable had the tallest average plant height (in inches) by week 4? Soil or media? (To take the average, add up all six of the soil heights in table 3, then divide by six. Repeat for the media results.)

_____

_____

_____

3. Based on these results, which do you think is the best option for growing tomato transplants? Soil or media?

_____

_____

_____

Share your results and question answers with your 4-H club members to find out if your results were the same as theirs. Often in science when you repeat an experiment, you may find that you will get different answers than the first time around. This is why replicating experiments several times is very important. If your results differ from that of your other club members, work together to come up with ideas explaining why.

Activity 14
What is Organic Matter?

Outcomes:
- Define soil organic matter and what it can impact in soil.

Have you ever heard the term **organic matter** before? If so, you have probably heard that organic matter is extremely important for the functioning of our soils, and that plant growth would be extremely difficult, if not impossible, without organic matter. But what is organic matter?

Organic matter is the living portion of the soil. Often abbreviated as OM, organic matter plays a large role in nutrient cycling in the soil and is important to overall soil health. OM makes up the upper most portion of the soil and is soil horizon O as seen in one of the earlier activities in this project area guide. OM is made up of living, recently dead and long dead components. Let's look at each of these components individually.

Living OM

The living portion of organic matter is made up by live roots of plants, worms and other soil dwelling insects and bacteria. The microorganisms which live in the soil play a large role in the breakdown and cycling of nutrients such as carbon and nitrogen. These nutrients are important to plant

Recently Dead OM

This portion of OM is made up of dead plants and animals that are in the process of decomposing. The bacteria and microorganisms that make up the living OM eat the recently dead OM. As they do, they release nutrients which were in the plants and animals before they died back into the soil.

Long Dead OM

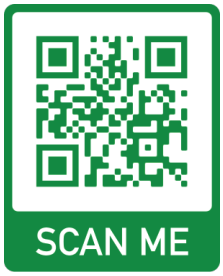
This portion of OM is actually called **humus**. Humus is old OM which has been completely decomposed and is very stable. It is dark in color and is the top layer of soil. Composting is a process people do to make their own humus to add to the soil. Humus protects the soil from erosion and holds on to water.

Based on the information above, circle all of the following that OM can affect in the soil:

Soil nutrients	Number of soil bacteria	Plant cultivar
Water infiltration	Amount of nitrogen	Plant nutrients
Season plant grows	Erosion	

Want to watch your own soil organic matter grow? Scan the QR code below to watch the following video for directions on making your own compost! Compost is a great way to both provide organic matter in your garden and to cut down on the amount of waste you send to the landfill. Follow the instructions on the video below to create your own compost bin, then use the created compost to fertilize your home garden or house plants.

Needed Materials:
Empty 2-Liter Bottle
Scissors
Push Pin
Soil
Newspaper Scraps
Food Scraps such as Banana or Potato Peels



Answer Key:

OM can affect: soil nutrients, water infiltration, number of soil bacteria, amount of nitrogen, plant nutrients and erosion.

Activity 15
Vegetables and All Their Cousins

Outcomes:
- Classify common vegetable crops by their botanical family.

Just like you have a first and last name, vegetables have several name classifications to tell us how they are related to one another. You are likely familiar with the common names of many vegetables, such as tomato, squash and cucumber, but each of these vegetables belongs to a **family** of vegetables. The family name for plants is similar to a last name for people; the botanical family name tells us that the vegetable is related to other similar vegetables in the same family. Plants in the same botanical family often have similar growth periods, are susceptible to the same diseases and are grown using the same methods.

The following are some common vegetable family names: **cucurbitaceae**, **brassicaceae** and **Solanaceae.**

Ask permission to use the internet to look up each of the three families listed above and see if you can match the following vegetables to the correct family: broccoli, cucumber, tomato, squash, brussels sprouts, zucchini, cabbage, potato, kale, pumpkin, bell pepper, muskmelon, eggplant, cauliflower, watermelon and jalapeño turnips.

Write your answers below.

Cucurbitaceae:

Brassicaceae:

Solanaceae:

Answer Key:

Cucurbitaceae: cucumber, squash, zucchini, pumpkin, cantaloupe, watermelon

Brassicaceae: broccoli, brussels sprouts, cabbage, kale, cauliflower, turnips

Solanaceae: tomato, potato, bell pepper, eggplant, jalapeño pepper

Activity 16
Annuals and Perennials

Outcomes:
- Classify common vegetable crops by whether they are annual or perennial.

So far, we have learned how to classify plants by their family name, growth season (cool versus warm), and by monocot versus dicot. In this project, we will be learning about one more common way plants are classified: annual versus perennial. This is a way of classifying the different life cycles of plants. Let's look at some quick definitions:

Annual: A plant which completes its lifecycle in the course of one year. The same year the seed is planted, the plant will grow to maturity, flower, produce seed and die. Examples would include beans and corn.

Perennial: A plant which will survive longer than two years. The year the seed is planted, the plant will either die to the ground or go dormant during part of the year, then the plant will continue to grow and develop the following year. Examples would include trees, grape vines, blueberry bushes and many herbaceous garden plants such as coneflower, hostas and daylilies. Rhubarb and asparagus are examples of perennial vegetable garden plants.

Biennial: A plant which completes its lifecycle in parts of two calendar years. Commonly, biennials will germinate and grow in a summer or fall, live through the winter and then flower, produce seeds and die the next year. Examples include Queen Anne's lace and many brassicas.

Similar to the last activity, ask permission to use the internet to look up six of your favorite garden vegetables. Write them in the correct category below and share your results with your 4-H club. See if everyone agrees with the classifications as well as learning other people's favorite garden vegetables to grow!

Annual

Perennial

Biennial

Activity 17
Interview a Gardener

Outcomes:

- Classify the most common challenges found in the home garden.
- Ask gardeners you know what some of their challenges are and how they avoid or overcome them.

When beginning any sort of new project or activity, it is always helpful to identify challenging areas so you can be prepared to handle them as they arise.

In this activity, it is your job to write down two things which you think would be the most challenging aspect to maintaining a garden. After you have come up with the answers on your own, ask two gardeners whom you know what their most common challenges are and how they avoid or overcome them.

Write down what you think are the most common challenges to gardening:

1. _____

_____

_____

_____

_____

2. _____

_____

_____

_____

_____

Now interview two gardeners and write down their answers to the question, **"What are your most common gardening challenges, and how do you avoid or overcome them?"**

1. _____

_____

_____

_____

_____

_____

2. _____

_____

_____

_____

_____

Activity 18
Seed to Seedling

Outcomes:

- Grow broccoli, cabbage, pepper and tomato transplants by providing the most appropriate environments and using proper media and containers.

It's now time to put your horticultural knowledge to the test! Within this project, you have learned many of the basics of vegetable gardening, as well as lots of general plant knowledge. It's your turn to use that knowledge to start your very own spring vegetable garden at your home or community!

Answer the following multiple-choice questions to refresh your memory on some general planting concepts, then refer to the annual Tennessee garden calendar for further planting instructions. Happy gardening!

For your garden, choose 1) broccoli or cabbage and 2) tomatoes or peppers. You could also choose a combination of three or all four to grow.

1. Which season and plant family do broccoli and cabbage belong to?

    a. Cool; brassicaceae
    b. Cool; cucurbitaceae
    c. Warm; brassicaceae
    d. Warm; cucurbitaceae

2. Which season and plant family do tomatoes and peppers belong to?

    a. Cool; brassicaceae
    b. Cool; solanaceae
    c. Warm; brassicaceae
    d. Warm; Solanaceae

3. Based on your answers to the previous two questions, which plants should you start seeding first, broccoli/cabbage or tomato/peppers?

    a. Broccoli/cabbage

    b. Tomato/pepper

The next group of questions will have different answers depending on what type of garden you want to grow and will help you narrow down your options.

- Do you have a large outdoor area suitable for an in-ground garden?
- Do you have a porch with good lighting suitable for container gardening?
- Based on previous experiments, do you prefer to grow in soil or media?
- Do you have the proper containers to start transplants, or would you prefer to direct seed your crops?
- What is the frost-free date in your area?

Now, scan the QR code to follow the link for information about planting dates as well as gardening tips for the Tennessee home garden for the year 2021. The calendar is updated every year, so be sure to check back next year!

SCAN ME

Enjoy your garden and upload your pictures and progress to your digital 4-H portfolio.

Answer Key:
1. A
2. D
3. A

Activity 19
Market Metrics

Outcomes:

- Classify crops that could be grown in your garden according to their price and availability in the store.

As you have learned, all crops have a specific season that they grow best throughout the year (cool versus warm season crops). However, all the same fruits and vegetables are available all year round in the grocery store! This is because throughout the year, crops are shipped into your local area from all over the United States and even other countries where that crop is currently in season.

Because of this, the most common crops for sale in the grocery store will differ in price and appearance at different times of the year. To put this to the test, you will be conducting an observational study at your local grocery store.

With an adult, go to your local grocery store and decide on the four most common crops you see for sale there. Write them down in the boxes below, as well as a description of what they look like and their price. Go back to the same store every two months and write down the same information for one year. At the end of the year, look back at all of your notes and write down any patterns you saw.

Crop Name:		
Month	Price	Appearance Notes
1		
3		
5		
7		
9		
11		

How did the prices change throughout the year?

_____

_____

_____

Crop Name:		
Month	Price	Appearance Notes
1		
3		
5		
7		
9		
11		

How did the prices change throughout the year?

_____

_____

_____

Crop Name:		
Month	Price	Appearance Notes
1		
3		
5		
7		
9		
11		

How did the prices change throughout the year?

_____

_____

_____

Crop Name:		
Month	Price	Appearance Notes
1		
3		
5		
7		
9		
11		

How did the prices change throughout the year?

_____

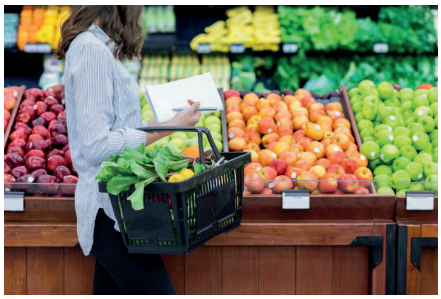
_____

_____

Activity 20
Garden or Store?

Outcomes:

- Find the most common crops in the grocery store and observe how they differ in appearance and price through the year.



For this last activity, you will get an idea of how much common garden crops sell for at the grocery store and their availability.

In Tennessee, some of the most common garden crops are green beans, squash/zucchini, tomatoes, peppers, cucumbers and watermelon. Your job is to go to your local grocery store with an adult and fill out the chart below to describe the price and availability of each of these crops. Repeat in the summer and winter to see how they change.

Green Beans	Summer	Winter
Price		
Organic options?		
Many or few available?		

Squash/Zucchini	Summer	Winter
Price		
Organic options?		
Many or few available?		

Tomatoes	Summer	Winter
Price		
Organic options?		
Many or few available?		

Peppers	Summer	Winter
Price		
Organic options?		
Many or few available?		

Cucumbers	Summer	Winter
Price		
Organic options?		
Many or few available?		

Watermelon	Summer	Winter
Price		
Organic options?		
Many or few available?		

Congratulations!

You have now completed the Beginner Horticulture and Garden Project Area Guide. Throughout this curriculum, you learned about the most important things to get you started in the project. You may now feel more confident in growing a garden and teaching others about horticulture. Continue to seek opportunities to gain garden and horticulture skills in your home, neighborhood or community.

More information can be found on the Tennessee 4-H Horticulture and Garden project page, including the project outcomes and curriculum for the Intermediate level.

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