

# Windowsill Garden Project



4-H is a community of young people who are learning **leadership**, **citizenship** and **life skills**.

## 4-H Essential Elements

- Engagement in Learning

## 4-H Life Skills

- Communications
- Learning to Learn
- Keeping Records

## Kentucky 4-H Core Curriculum

- National 4-H Gardening Series

## Educational Standards

Next Generation Science Standards:

*Science and Engineering Practices*

- Asking Questions and Defining Problems
- Analyzing and Interpreting Data
- Obtaining, Evaluating, and Communicating Information

*Crosscutting Concepts*

- Structure and Function

This guide is for volunteer leaders or county Extension personnel, and includes four lessons designed for youth in 3<sup>rd</sup>-5<sup>th</sup> grades. Each lesson focuses on an aspect of seeds, plants, and/or gardening. Three additional experiments are included in the *Digging Deeper* section that youth can do independently or in a group or classroom setting. At the end of the guide, additional resources and an appendix are available. The *National 4-H Gardening Series*, which includes 4 levels for grades 3<sup>rd</sup>-12<sup>th</sup> and a *Helper's Guide*, is recommended if additional background information is needed. The *National 4-H Gardening Series* includes projects and activities for youth that have an interest in continuing to learn more about plant science and gardening after completing their windowsill garden.

## Lessons

- 1: Learning the Basics of Seeds, Plants, and Plant Parts
- 2: Introduction to Seeds, Germination, and Planting
- 3: Transplanting to Bucket Gardens
- 4: From Seed to Salsa

## Digging Deeper Experiments

- 1: Can seeds be planted too deep or not deep enough?
- 2: Can seeds be planted upside down?
- 3: Does covering seeds with plastic help?

## Lesson 1: Learning the Basics of Seeds, Plants, and Plant Parts

### Learning Objectives

Youth will:

- Compare differences and similarities in seeds, plants, and plant parts.
- Be able to identify the major parts of a plant.

### Background Information

Note: Additional background information and a glossary are available in the *National 4-H Gardening Helper's Guide (4-H-1041-W)*.

Visit the 4-H Horticulture webpage at <https://4-h.ca.uky.edu/content/horticulture> for additional information.



*Background Information continued...* Seeds are the only way to reproduce annual plants (plants that live for only one growing season). Most vegetables and many favorite garden flowers are annuals. A seed can be called a small plant which is resting rather than actively growing. The basic parts of a seed include the embryo (the tiny plant), seed coat (which protects the embryo), and cotyledon (which provides temporary food for the embryo). Germination occurs when the embryo in the seed starts growing, pushes through the seed coat and uses up the stored food. In Lesson 2 germination and how to plant a seed and care for a seedling will be discussed.

The first leaves, or cotyledons, of seedlings are called seed leaves, baby leaves, or false leaves. These look very different from all the other leaves, called the true leaves, that the plant will produce later on. The cotyledons provide food for the young plants.

Some plants (such as onion, corn, and grass) have only one seed leaf and are called monocotyledonous plants or monocots. Monocots also have parallel veins in their leaves and many vascular bundles of xylem and phloem scattered through their stems. The xylem and phloem transport water and food.

Most vegetables and flowers have two seed leaves and are called dicotyledonous plants or dicots. Dicots have a branching network of veins in their leaves and a continuous circle of xylem and phloem in their stems.

Seedlings will push through the soil surface in different ways. The seed leaves appear above the surface in epigeous plants (such as bean, squash, and onion). The seed leaves remain below ground in hypogeous plants (such as pea and corn).

Even though appearances may differ, there are certain parts that most plants have in common.

- Roots – Plant roots usually grow down, hold the plant upright and give it support. The roots take in water and dissolved nutrients from the soil and carry them to the plant stem.
- Stems – Stems carry water and dissolved nutrients from the roots through the xylem tubes to the leaves where sugar is manufactured to serve as food for the plant. The food made in the leaves is then carried by phloem tubes in the stems throughout the plant. These tubes are easy to see if you put a stalk of celery in food coloring. The stalk of celery can even be split part of the way with the two pieces in different colors of food coloring. Both colors will be taken up to the leaves. Stems also serve to support plant leaves.
- Leaves – A plant leaf is like a small factory. It makes food that the plant uses to live and grow. In a process called photosynthesis, the green coloring substance (chlorophyll) in the leaves along with energy from the sun, make sugar from carbon dioxide and water. Putting aluminum foil over a leaf will keep the leaf from making chlorophyll. The leaf can even be covered with aluminum foil with a participant's initials or pattern cut into the foil. The part exposed to light will be a dark green color with the covered portion becoming yellow-green in a few weeks.
- Flowers – Plants grown in windowsill gardens will produce flowers which in turn make seeds. This is how the plant completes its life cycle. Seeds produced form new plants under proper conditions.

The plant parts discussed above may develop differently in different plants.

- Root systems may develop as taproots (carrot), globular roots (beet), tuberous roots (sweet potato) or fibrous roots (corn, trees, grass).
- Stems may be strong and woody (trees), weak and trailing (vines) or somewhere in between. Some stems (potato) are even used by the plant to store food.
- Leaves are all different sizes and shapes, and vary in arrangement on the stem. Leaves may have an opposite (maple tree), alternate (oak tree) or whorled (gingko tree) arrangement on the stem. Single leaves (maple tree, oak tree) and compound leaves (ash tree, locust tree) also are found.
- Flowers have different colors, shapes, and arrangements on flower stems. Head flowers (sunflower, carnations) and spike flowers (gladiolus) are common flower types.

## ***Do the Activity***

Time: 45 minutes

### ***Materials***

Fruit seeds, vegetable seeds, and seed pods

Lima bean seeds (one per youth)

Plant

Various plants or plant parts as described in *Instructor Preparation and Notes #4*

Chalkboard, dry erase board, or flip chart paper

*Parts of a Seed Handout* (one per youth)

*Parts of a Plant Handout* (one per youth)

Pencils

### ***Instructor Preparation and Notes***

1. Gather fruit seeds, vegetable seeds, and seed pods that differ in shape, size, color, and texture (such as avocados, bell peppers, apples, oranges, sycamore “balls”, and sunflowers).
2. Soak lima bean seeds in water the night before the activity.
3. Obtain an established plant with roots, stems, leaves, and flowers that youth can observe. (Plants are often readily available for purchase at grocery and big box stores.)
4. Have examples of the following: different types of roots (such as carrots – taproot, beets – globular roots, sweet potato – tuberous roots, grass – fibrous roots); different types of stems (such as tree – strong and woody stem, vines – weak and trailing stem, celery or asparagus – as an example of stem we can eat); leaves representing different leaf arrangements and different shapes, colors, and sizes (such as opposite arrangement – maple tree, alternate arrangement – oak tree, whorled arrangement – ginkgo tree); flowers representing different shapes, colors, arrangements, smells, and uses (edible, aesthetics, etc.). If the plant or plant part is not easily accessible, do a quick Internet search to find a colored photo of the plant or plant part you need that you can print off and use with youth.
5. Print *Parts of a Seed* and *Parts of a Plant* handouts (one per youth) available in the Appendix.

### ***Instructions for the Activity***

1. Provide examples of fruit seeds, vegetable seeds and seedpods. Ask youth to compare and contrast the different seeds (such as seed size, shape, color, texture, etc.). Record similarities and differences on a chalkboard, dry erase board, or flip chart paper.
2. Discuss with youth that although seeds may differ in size, shape, color, texture, etc., all seeds have the same three basic parts: embryo, seed coat, and cotyledon. Provide each youth with a lima bean seed that has been soaked in water overnight and a copy of the *Parts of a Seed Handout*. Have youth identify the three basic parts of the lima bean seed using the handout.
3. Discuss the different parts and functions of a plant (roots, stems, leaves, and flowers) with youth. Have an example of an established plant for youth to observe. Remove the plant from the pot and soil so youth can observe the entire plant, including the roots. Have youth draw the plant and label the plant parts using the *Parts of a Plant Handout*.
4. Discuss with youth how plant parts may develop differently in different plants. Provide examples of different types of roots, stems, leaves, and flowers (see *Instructor Preparation and Notes #4*). Have youth record observations about the different plant parts provided on the *Parts of a Plant Handout*. Encourage youth to use their sense of sight, touch, and smell. As a large group discuss the observations youth made about the different plant parts.

### ***Reflect***

- Encourage youth to think about and share the skills they used in this lesson as they learned about seeds, plants, and plant parts. (Answers may vary, but youth may note they used observations and communication skills). Ask youth where else they may use these skills.

## Lesson 2: Introduction to Seeds, Germination, and Planting

### *Learning Objectives*

Youth will:

- Understand what germination is and the essential factors necessary for germination to occur.
- Be able to identify the factors necessary for a seedling to grow.
- Learn how to properly plant a seed and care for a seedling.

### **Background Information**

Note: Additional background information and a glossary are available in the *National 4-H Gardening Helper's Guide (4-H-1041-W)*.

### **Germination (Sprouting)**

As discussed in Lesson 1, a seed can be called a small plant which is resting rather than actively growing.

Germination occurs when the embryo in the seed starts growing, pushes through the seed coat and uses up the stored food.

### **Factors Necessary for Germination**

Viability

Seeds must be alive and capable of germinating. If a seed was harvested before it was ripe, injured during harvest, processed improperly or stored too long, it may not be alive (viable).

Dormancy Removed

Newly formed seeds go through a rest period called dormancy which may last from a few days to many years. Such a rest period allows seeds to germinate at times when growing conditions are best. Sometimes seeds must be treated in special ways to overcome the conditions which are preventing germination. Some seeds (such as locust) have very hard seed coats which must be broken. Others (such as tomatoes) contain chemical substances which must be removed for the seeds to grow. Still other seeds (such as apple) must be exposed to cold temperatures before they will grow. Vegetable and flower seeds are best for this project because they will have little or no dormancy problems.

Proper Environment

Seeds will not germinate unless the necessary environmental conditions exist around them. Seeds must have the right amounts of air and water, plus the temperature must not be too warm or too cold.

- **Water:** Water is needed to soften the seed coat so that the small plant inside can break through. As water enters the seed, the seed coat begins to wrinkle and soften. The seed starts to swell and the root is able to break through the seed coat.
- **Air:** Sprouting seeds, like people, need oxygen. They take in oxygen from the air and give off carbon dioxide. Too much water in the soil around a germinating seed can keep out the oxygen that the seed needs. Having water and oxygen present is not enough. The right amount of each must be available for seeds to germinate.
- **Temperature:** Different seeds germinate best at different temperatures.

### **Factors Necessary for the Growth of Seedlings**

Water, Air and Temperature

Water, air and temperature must continue to be present in satisfactory levels if the young plants which the seeds produce are to grow well. Water keeps stems and leaves firm and prevents shriveled and wilted plants. Water carries nutrients (food) from the soil into the plants. Air provides oxygen for the plants to "breathe" and carbon dioxide to use in food making. The best temperatures for warm weather plants are 70 to 80 degrees F during the day and around 60 degrees F at night. Cool season crops prefer 55 to 70 degrees F during the day and 50 degrees F at night. In addition, light and nutrients from the soil are now needed by the plants to make food.

## Light

Light or energy from the sun is used by green plants which contain chlorophyll to make food (sugar) from carbon dioxide and water. This process is called photosynthesis. Some plants are adapted to grow in more sunlight than others.

## Food

Plants need 17 nutrients to grow. Carbon, hydrogen and oxygen come from water and air, but the 14 other nutrients must come from the soil where the plant is growing. Often the soil does not have enough of some elements, so they must be added by putting fertilizer in the soil. Fertilizers most often are used to add the three major nutrients (nitrogen, phosphorus, potassium). The remaining nutrients are sulfur, calcium, iron, manganese, zinc, copper, boron, molybdenum, cobalt, magnesium, and chlorine.

## Seed Selection Guide

The plants grown in a windowsill garden project depend on the objectives of the individual, group, or classroom. The project can be a basic plant science lesson in which various plants are studied closely or a project in which vegetables or annual flowers are grown and used as transplants in other activities. The following are examples of gardens that can be grown in a windowsill gardening project. The activity in this lesson uses tomato seeds, but can be adapted to meet your individual needs or the needs of your group or classroom.

**Plant Study Garden:** Select six vegetables that show distinct differences in seed and seedling characteristics. Try tomato, pea, summer squash, corn, bean, and beet.

**Mystery Garden:** Use the same vegetables as in the Plant Study Garden, but identify the seeds only by number. Provide participants with sketches of each seedling. Plants can be matched with the drawings, identified and labeled.

**Vegetable Transplant Garden:** Raise one or more of the flowering vegetables for transplanting to a permanent garden location: lettuce, cucumber, eggplant, pepper, squash, tomato.

**Annual Flower Transplants for the Home:** Grow one or more of the following flowers for transplanting to an annual flower bed or container once danger of spring frost is past. Flowers include: coleus, nasturtium, marigold, portulaca (moss rose), scarlet sage (red salvia), spider flower (cleome), sunflower, zinnia.

**Annual Flower Transplants for Community:** Have participants raise annual flowers to be used in a community event. The plants could be used for a flowerbed in a park, in front of the local courthouse or at a shopping center. Flowers planted in windowboxes or other containers also could be used to beautify public areas. Another possibility is to concentrate on neighborhood beautification with plantings of annual flowers on home grounds. For mass plantings such as these, it is best to grow only one or two types of flowers.

**Pizza Garden:** Plant tomatoes, basil, oregano, green peppers, and onions.

**Story Book Garden:** Plant a garden based on a favorite children's book, such as *How Groundhog's Garden Grew* by Lynne Cherry or *Growing Vegetable Soup* by Lois Ehlert.

## Do the Activity

### Time

Initial Activity: 1 hour

Weekly observations and discussions continue for a period of 5-6 weeks.

### Materials

See *Instructor Preparation and Notes* for additional information.

Peat pellets

Plastic or metal trays

2 tomato seeds for each expanded pellet

Small aluminum pie plates (one per group)

Pencils

Rulers (one per group)

Masking tape

Popsicle sticks

Clear plastic bags

Chalkboard, dry erase board, or flip chart paper

*Windowsill Garden Data Sheet*

*Germination and Growth of a Seedling Handout*

### Instructor Preparation and Notes

- Purchase peat pellets that when soaked in water will expand to approximately 1.5 to 2 inches in height and diameter.  
Prior to Activity:
  - a) Place peat pellets in a plastic or metal tray (without holes). Add water according to the package directions and allow pellets to soak several hours prior to the activity, allowing time for the pellets to fully expand. Have at least one expanded pellet per group.
  - b) Pour off any excess water from the tray after the pellets have swelled.
- This activity uses tomato seeds, however, other seeds can be used. The larger the seeds the more difficult it is for youth to bury the seeds too deep.
- Print copies of *Windowsill Garden Data Sheet* and *Germination and Growth of a Seedling Handout* (one per youth) available in Appendix.

### Instructions for Activity

1. Divide youth in groups.
2. Provide each group with one compressed pellet and one expanded pellet (expanded pellet can be placed on a small aluminum pie plate).
3. Have youth compare the compressed pellet with the expanded pellet.
4. Encourage youth to ask questions about why the pellets differ. (Questions such as why are the pellets different shapes, why is one pellet hard and the other pellet soft, etc.).
5. Discuss that peat is an organic material that consists of decomposed trees, roots, leaves, moss, grass and stems. Explain that organic materials are able to hold large amounts of moisture, and are an important component in soils. Ask youth why they think the two pellets provided to each group differ. Discuss how one pellet was soaked in water and that pellet expanded as it absorbed the water.
6. Provide each youth with one expanded pellet. Have youth use a ruler to measure  $\frac{1}{2}$  inch on their pencil and mark with a piece of masking tape. Next have youth punch a hole in the top of their expanded pellet with their pencil to make a hole  $\frac{1}{2}$  inch deep. Advise youth to be careful not to tear the nylon netting around the pellet.
7. Provide each youth with two seeds.
8. Have each youth place two seeds in their pellet's hole.
9. Ask youth why they think two seeds are planted in one hole. Discuss seed viability (that seeds must be alive and capable of germinating). If a seed was harvested before it was ripe, injured during harvest, processed

improperly or stored too long, it may not be alive (viable). Two seeds were planted in case one seed is not viable.

10. Cover seeds with peat.
11. Provide each pellet a unique number (to be used by youth when keeping simple records).
12. Have each youth label their seeds using a popsicle stick (use pencil not pen to mark). On the label have youth note the type of seed planted (such as tomato) and the pellet's unique number.
13. Have each youth place their expanded pellet on a tray.
14. Place each tray (with expanded pellets) in a plastic bag. Place the bagged tray in an area that is not in direct sunlight.
15. Provide each youth with a *Windowsill Garden Data Sheet*. Assign each youth one tray to observe. Instruct youth to keep simple records as outlined on the data sheet. Have youth make a drawing of the plant they planted as it emerges from the pellet.
16. Discuss germination and the factors necessary for germination to occur. Provide each youth with the *Germination and Growth of a Seedling Handout* to aid in discussion.
17. Have youth water the plants when the pellets begin to dry out. (See FAQ for watering information.)
18. When seeds sprout and plants begin to show, have youth carefully remove the plastic bag from each tray and put the trays in direct sunlight only after the bags have been removed.
19. If both seeds in the pellet sprout, have youth select the strongest looking plant in each pellet and remove the other plant. Have youth use scissors to cut the stem at soil level. Pulling the extra plant can disturb and injure the roots of the remaining plant. Ask youth why the weaker plant is being removed. Discuss how two plants will compete for water, space, light, and food. Removing the weaker plant will reduce competition for these essential factors necessary for seedling growth. Provide each youth with a *Germination and Growth of a Seedling Handout* to aid in this discussion.
20. Keep the plants on a windowsill so they can get plenty of sun. Have youth turn the plants every few days for balanced growth. (See FAQ regarding how often plants should be turned.)
21. Use a water-soluble plant food (fertilizer) according to package directions beginning when the seedlings are two weeks old. Ask youth why plant food is being added. Discuss the nutrients needed for proper plant growth, and how often the soil does not have enough of some nutrients, so these elements must be added by putting fertilizer in the soil. Discuss the importance of conducting a soil test before applying fertilizer to a garden or crop field (if fertilizers are applied in excess, nutrients may runoff and pollute local waterbodies). (Note: Fertilizer should be handled by an adult only.)

### ***Caring for Windowsill Gardens Frequently Asked Questions (for Instructor)***

What if natural light is not available?

In the absence of natural light, fluorescent lights may be used. Refer to *Home Vegetable Gardening in Kentucky ID-128* for additional information on artificial lighting.

How often should we water?

Peat pellets should remain moist, but never soggy. Also, never allow them to dry out. Danger signals for drying out include wilted plants and pellets turning from dark brown to light brown. In the classroom, a Tuesday and Friday watering schedule often works well.

Why do we have to turn plants and how often should that be done?

Plants on windowsills need to be turned every few days so that all sides of the plants receive equal amounts of sunlight. This will keep them from becoming lopsided.

### ***Reflect***

- Ask youth to share observations and results from their *Windowsill Gardening Data Sheet*.
- Record observations and results on a chalkboard, white board, or flip chart paper.
- Ask youth to compare observations and results.
- Encourage youth to ask additional questions (such as why are my observations and results different from my peers, why did this plant grow taller than that plant, etc.).

## Lesson 3: Transplanting to Bucket Gardens

Note for youth who are to take their plant(s) home: Due to the large quantity of soil mix needed and the difficulty in transporting planted gardens, it may be more practical for youth to do the actual transplanting at home after receiving the information in this lesson.

### Learning Objective

Youth will:

- Learn how to properly transplant plants and care for a bucket garden.

### Background Information

Note: Additional background information and a glossary are available in the *National 4-H Gardening Helper's Guide (4-H-1041-W)*.

### What is transplanting?

Transplanting is the process of moving plants started indoors to a permanent garden location outdoors. This is done when the plants are large enough (six to eight inches tall) and weather conditions permit. April 1 is a good date to aim for with cool season crops (such as cabbage, kale, lettuce) and May 15 for warm season crops (such as beans, tomatoes, peppers, corn, marigolds). The use of transplants allows gardeners to get a head start on the growing season since seeds can be planted indoors about eight weeks before outdoor temperatures are warm enough.

Many vegetables and flowers can be transplanted into container gardens where they will grow just as well as in the ground. Container or bucket gardens are very practical when only a few vegetables are grown or there is very little space for a garden. Bucket gardens can be started even earlier if the containers can be brought inside on cold nights.

### Container Selection

Container size should be matched to the mature size of the plant. The list below gives the proper container sizes for some vegetables commonly used in the windowsill garden project. See Table 1. For tomatoes, a 3-gallon container is needed per plant.

Table 1. Container sizes for vegetables commonly used in windowsill garden projects.

<b>Crop</b>	<b>Container Size</b>	<b>Distance Apart</b>
Beets	10-12" deep	2-3"
Bush beans	8-10" deep	4"
Carrots	10-12" deep	2-3"
Cucumbers	1 gallon/plant	1 in a hanging basket
Eggplant	3 gallon/plant	---
Kale	6-10" deep	6"
Lettuce	4-6" deep	4"
Marigold – dwarf	1 gallon	3"
Marigold – standard	2-3 gallons	4"
Mustard	6-10" deep	4-5"
Onions	8-10" deep	2-3"
Peppers	1 gallon/plant	---
Radishes	4-6" deep	1"
Spinach	6" deep	8-10"
Swiss Chard	8" deep	4-5"
Squash	5 gallon/plant	---
Sunflowers	3 gallon/plant	---
Tomatoes – dwarf	1 gallon/plant	---
Tomatoes – miniature	8-10" pot	---
Tomatoes – standard	3 gallon/plant	---
Turnips	8-10" deep	3-4"

Purchased or recycled containers can be used. Make sure when using a recycled container that the container was only used for food or other non-toxic items. Recycled containers, such as plastic pickle buckets from fast food restaurants or tubs from ice cream stores can be used for vegetables which need 3-gallon containers. Bushel baskets can provide 5-gallon containers. Flower boxes and pots, coffee cans, plastic and metal buckets, and cut-off milk containers are satisfactory when a 1-gallon or smaller size is needed.

### **Container Preparation**

Containers should be washed with hot, soapy water. Rinse and dry thoroughly.

Decorate containers to make them more attractive. Painted designs or drawings of flowers, vegetables or related subjects are possibilities. Three to four ¼-inch drainage holes must be made in the bottom or lower sides of the container. Otherwise, plant roots might stand in water causing the plants to die.

A packaged peat-moss based, soilless mix is recommended because it is lightweight and sterile. However, an adequate potting mix can be made. Most vegetable crops in containers do best when the majority (up to 75%) of the mix is made up of organic material (peat or coir, and equal or lesser amounts of compost). The remainder is made up of the inorganic components of perlite and/or vermiculite, and lime is added to adjust to the pH needs of the desired crop. It is very important to have your soilless mix tested prior to adding any plant nutrients or pH altering amendments such as lime. Garden soil alone is not satisfactory in containers. Garden soil will stay too wet and is likely to have diseases, insects and weed seeds. Fill the container to within one inch of the top with mix. This will allow the container to hold water as it seeps into the soil.

### **Transplanting Procedure**

Dig a hole the size of the peat pellet in the center of the container. Place the plant in the hole and press the soil firmly around the roots, just covering the top of the peat pellet. Water thoroughly until water runs through the holes in the bottom of the container. A stake to support tomatoes or a trellis for cucumbers should be placed in the container at the time of planting. Strips of cloth can be used to tie the plant to the support as it grows. Plants also can be tied to a porch railing, if available.

### **Garden Location**

Bucket gardens can be placed on patios, balconies or porches. Most vegetables are pollinated by wind or insects so the containers should be located outdoors to ensure that a vegetable crop develops. A sunny location should be found except for shade loving flowers.

Plants should be moved gradually from an indoor growing spot to their permanent outdoor garden. This “hardening-off” process toughens plants to withstand the outdoor environment. The bucket garden can be placed outdoors in a sheltered spot for several hours each day with the time increasing to 24 hours by the end of a week. Then move the plant to its permanent location.

### **Care of Plants**

Water plants when the soil feels or looks dry. Water may be needed every day during the hottest part of the summer. Always water thoroughly until water drains from the bottom of the container. Fertilize plants regularly with a water-soluble plant food for flowers and vegetables following package instructions.

## **Do the Activity**

### ***Time***

Initial Activity: 1 hour

Weekly observations and discussions can continue until plant dies or produce is harvested.

### **Materials**

Containers (see *Container Selection* section in *Background Information*)

Drill with ¼-inch drill bit

Washcloths or sponges

Hot, soapy water

Potting soil (or soilless mix)

Fertilizer

Stake or tomato cage

Small garden shovels

Garden gloves (optional)

*Transplanting to Bucket Gardens Handout* (for youth transplanting at home)

*Bucket Garden Data Sheet* (one per youth)

### **Instructor Preparation and Notes**

Drill three to four ¼-inch drainage holes in the bottom or lower sides of each container. Youth may be able to assist depending on their age and skill level.

### **Instructions for Activity**

Note: If youth are transplanting their plants at home, please refer to the *Transplanting to Bucket Gardens Handout* available in the Appendix. This handout can be sent home in addition to the *Bucket Garden Data Sheet* with youth so they can successfully transplant their plant and care for their bucket garden, and make observations as the plant grows.

Instruct youth to:

1. Use hot, soapy water and washcloths, sponges, or old rags to wash containers. Containers should be thoroughly washed, rinsed and dried. (Optional: Youth can decorate containers to make them more attractive.)
2. Fill the container to within 1-inch of the top with potting soil (or soilless) mix.
3. Dig a hole the size of the peat pellet in the center of the container.
4. Place your plant and peat pellet in the hole and press the soil firmly around the plant and roots. Place a stake or tomato cage in the pot to help support the plant.
5. Water thoroughly until water runs through the holes in the bottom of the container.
6. Discuss with youth the “hardening-off” process. When weather conditions permit, gradually move the plant from an indoor growing space to a permanent outdoor location. The bucket garden can be placed outdoors in a sheltered spot for several hours each day with the time increasing to 24 hours by the end of a week. Then the plant can be moved to its permanent location. May 15 is a good date to aim for tomato plants.
7. Discuss with youth when and how to properly water. Water plants when the soil feels or looks dry. Water may be needed every day during the hottest part of the summer. Always water thoroughly until water drains from the bottom of the container.
8. Fertilize plants regularly with a water-soluble plant food for flowers and vegetables following package instructions (fertilizer should be handled by an adult only).
9. Provide each youth with a *Bucket Garden Data Sheet*. Instruct youth to make observations and keep simple records for their plant.

### **Reflect**

- Ask youth to share observations and results from their *Bucket Garden Data Sheet*.
- Record observations and results on a chalkboard, white board, or flip chart paper.
- Ask youth to compare and discuss observations and results.

## Lesson 4: From Seed to Salsa

### **Learning Objective**

Youth will:

- Identify food products that use tomatoes.
- Trace ingredients used in salsa from their source to the end product.

### **Background Information**

Note: Additional background information and a glossary are available in the *National 4-H Gardening Helper's Guide (4-H-1041-W)*.

### **Do the Activity**

#### **Time**

1 hour

#### **Materials**

Ingredients (see *Fresh Tomato Salsa Recipe* and *Instructor Preparation and Notes*)

Medium sized bowl

Knife

Serving spoon

Plates

Napkins

Chips

Chalkboard or dry erase board

Flip chart paper

Markers

#### ***Fresh Tomato Salsa Recipe***

***Source: A Harvest of Recipes with USDA Foods***

Ingredients

1 cup tomatoes (finely chopped or ½ can, about 8 ounces, low-sodium diced tomatoes)

½ cup apple (peeled and finely chopped)

¼ cup onion (finely chopped)

2 tablespoons lime or lemon juice

1 teaspoon garlic (finely chopped)

½ teaspoon vegetable oil

¼ teaspoon salt

Recipe Directions

1. In a medium-size bowl, combine tomato, apple, onion and lime juice (or lemon juice). Mix well.
2. Add garlic, vegetable oil, and salt to bowl. Mix well.
3. Cover bowl and refrigerate for 15 minutes. Serve cold.

#### ***Instructor Preparation and Notes***

- Depending on the age and skill level of youth, you may want to chop ingredients prior to activity.
- For onions, lime or lemon juice, and garlic, have actual items present (whole onion, lemon or lime, and head of garlic) and a processed version of the item (bag of chopped frozen onions, bottle of lemon or lime juice, and a jar of minced garlic). You can have the actual item or a picture of the item.

### ***Instructions for Activity***

1. Brainstorm with youth different recipes and food products that use tomatoes (such as spaghetti sauce, soups, salsa, etc.). Record items on a chalkboard, white board, or flip chart paper.
2. Ask youth to trace a tomato seed from the time the seed is planted to when the actual tomato is eaten. Consider a tomato grown in a small garden eaten by the gardener and a tomato grown by a large farm processed and sold as a jar of salsa. Discuss growing, harvesting, transporting, processing, and selling both the garden tomato and the jar of salsa.
3. Place youth in groups.
4. Assign each group one ingredient from the recipe (apple, whole onion, whole lemon or lime, garlic head, bag of chopped frozen onions, bottle of lemon or lime juice, and jar of minced garlic).
5. Have each group trace their ingredient from seed to consumption on a piece of flip chart paper using text and/or drawings.
6. Have each group present.
7. After each group has presented, prepare the salsa with youth.
8. Provide each youth with a plate and napkin. Serve salsa with chips. Eat and enjoy.

### ***Reflect***

Ask youth:

- To think about other food products they have eaten that day or earlier in the week. Discuss those food products and trace those items from source to consumption.
- To consider other items, such as clothing, paper, pencils, etc. Trace those items from source to end product.
- To reflect on how each of these processes (growing, harvesting, transporting, processing, and selling) effect the environment.

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## **Digging Deeper**

This section provides additional experiments to expand upon Lessons 1, 2, and 3. These experiments can be completed individually or as a group.

### **Experiment 1: Can seeds be planted too deep or not deep enough?**

#### ***Time***

Initial Activity: 30 minutes

Daily observations over period of 2-3 weeks.

#### ***Materials***

Bean seeds (or other large seeds)

5 containers (at least 6 inches deep)

Potting soil

Ruler

Masking tape

Markers

#### ***Instructions for Activity***

Instruct youth to:

1. Label each container as ¼-inch, ½-inch, 1-inch, 3-inch, and 6-inch using masking tape and markers.
2. Fill each container to within 1-inch of the top with potting soil.
3. For each container, plant three bean seeds to a depth of either ¼-inch, ½-inch, 1-inch, 3-inch, and 6-inch (according to the container label).
4. Place in a windowsill or location that is sunny.
5. Water each container thoroughly using the same amount of water for each.

6. Continue to water as needed, always watering each container the same amount each time.
7. Keep simple records including the date each seed pushes through the soil, and the date the first two leaves are produced.

### **Reflect**

Ask youth:

- Which plants are the strongest? Weakest? Why?
- Which plants had the largest number of leaves after two weeks?
- Why was it important to use the same amount of water for each container?
- What is a smaller seed (like a lettuce seed) had been used?
- What can you conclude about depth of planting from this experiment?

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## **Experiment 2: Can seeds be planted upside down?**

### **Time**

Initial Activity: 30 minutes

Daily observations over period of 2-3 weeks.

### **Materials**

Bean seeds (or larger seeds)

2 containers

Potting soil

Masking tape

Markers

### **Instructions for Activity**

Instruct youth to:

1. Label one container UP and one container DOWN using masking tape and markers.
2. Fill each container to within 1-inch of the top with potting soil.
3. Plant three bean seeds with the seeds pointing up in the UP container. Plant the seeds at the depth specified on the seed packet. Use a ruler to ensure you are planting at the proper depth.
4. Plant three bean seeds with the seeds pointing in the opposite direction in the DOWN container. Use a ruler to make sure you are planting the seeds at the same depth as the seeds in the UP container. (*Note to instructor:* The aim for this experiment is to make sure all the seeds in the UP container are planted in the same direction, and all the seeds in the DOWN container are planted in the same direction – so youth can observe and compare.)
5. Place in a windowsill or location that is sunny.
6. Water each container thoroughly using the same amount of water for each.
7. Continue to water as needed, always watering each container the same amount each time.
8. Keep simple records including the date each seed pushes through the soil, and the date the first two leaves are produced.
9. After 2-3 weeks, take the plants out of the containers and remove the soil. Record your observations.

### **Reflect**

Ask youth:

- Which seed pushed through the soil first?
- Did all the seeds eventually push through the soil?
- When you took the plants out of the containers and removed the soil what did you observe?
- What conclusions can you about seed growth from this experiment?
- Think about seeds in nature. Do you think seeds in nature are all planted in the same direction? Why or why not?

## Experiment 3: Does covering the seeds with plastic help?

### *Time*

Initial Activity: 30 minutes

Weekly observations over period of 2-3 weeks.

### *Materials*

Large seeds (such as bean seeds)

Small seeds (such as lettuce seeds)

4 containers

Potting soil

Clear plastic wrap

Ruler

Masking tape

Markers

### *Instructions for Activity*

Instruct youth to:

1. Fill each container to within 1-inch of the top with potting soil.
2. Label two containers LARGE SEEDS and two containers SMALL SEEDS using masking tape and markers.
3. Plant three large seeds in each of the containers labeled LARGE SEEDS.
4. Plant three small seeds in each of the containers labeled SMALL SEEDS.
5. Water each container thoroughly using the same amount of water for each.
6. Cover one of the containers labeled LARGE SEEDS with clear plastic wrap.
7. Cover one of the containers labeled SMALL SEEDS with clear plastic wrap.
8. Place the containers in an area that receives light but not full sun, as full sun can create heat to build up under the plastic wrap and kill the seeds.
9. Continue to water as needed, always watering each container the same amount each time.
10. Keep simple records including the date each seed pushes through the soil, and the date the first two leaves are produced.
11. After 2-3 weeks, take the plants out of the containers and remove the soil. Record your observations.

### *Reflect*

Ask youth:

- Which seeds germinated first?
- Does the plastic wrap help more with the small seeds or the large seeds? Why?
- What conclusions can you from this experiment?
- Encourage youth to investigate tools and techniques gardeners and producers use to aid in growing plants (such as greenhouse, season extenders, etc.).

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## Additional Information and Resources

### *Partners*

- Master Gardeners
- Gardening Club
- Local nursery or garden supply store

### *Supporting Events*

- Take youth on a tour of a greenhouse, farm, and/or community garden. Have youth compare and contrast the production practices and tools used on their tour with their windowsill garden project.

- Have youth choose their favorite food and investigate the ingredients used to make that product. Have them choose one ingredient and research how that ingredient is grown or produced, harvested, and processed (from farm to fork). Have youth create a display showcasing their research.
- Encourage 4-H members to participate in local and state fair events. Information for horticulture-related state fair events is available online at <https://4-h.ca.uky.edu/content/state-fair-catalog>.

### **Additional Resources**

#### National 4-H

- Gardening Helper's Guide (includes background information on plant science and gardening, hands-on activities such as Garden Bingo, and self-guided activities such as a Garden Word Search. The Helper's Guide is available for purchase and is also available as a free download from the Purdue Extension Education Store at <https://mdc.itap.purdue.edu/subcategory.asp?subCatID=360&CatID=16>.
- Gardening Curricula (includes four levels) [http://www.4-hmall.org/Category/4-hcurriculum-gardening.aspx?\\_ga=1.193012709.938448316.1470839958](http://www.4-hmall.org/Category/4-hcurriculum-gardening.aspx?_ga=1.193012709.938448316.1470839958)

#### University of Kentucky Publications

These publications are available online or at your county Extension office.

- Home Vegetable Gardening in Kentucky (ID-128) <http://www2.ca.uky.edu/agcomm/pubs/id/id128/id128.pdf>
- Starting Plants from Seeds at Home (HO-56) <http://www2.ca.uky.edu/agcomm/pubs/ho/ho56/ho56.htm>
- Vegetable Cultivars for Kentucky Gardens (ID-133) <http://www2.ca.uky.edu/agcomm/pubs/id/id133/id133.pdf>
- YouTube Video: Basil Seed Germination Time Lapse Video by Elizabeth Driscoll  
<https://www.youtube.com/watch?v=3XhTkYPJTts&feature=youtu.be>

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### References

USDA. Fresh Tomato Salsa Recipe. Accessed at <https://whatscooking.fns.usda.gov/recipes/food-distribution-fdd/fresh-tomato-salsa> on February 23, 2017.

*4BC-04PO and 4BC-04LA 4-H Windowsill Garden Project prepared by Dr. Bill Fountain, Extension Specialist for Horticulture, and Dick LeMaster, former Extension agent. Revised by Ashley Osborne, Extension Specialist for 4-H Youth Development, 2021.*

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### Appendix (pages 16-24)

The Appendix provides handouts that can be used and adapted for the 4-H Windowsill Garden Project.

Learn more at [www.kentucky4h.org](http://www.kentucky4h.org) or contact your county extension office.

# Parts of a Seed

## 4-H Windowsill Garden Project Lesson 1

Name \_\_\_\_\_

Date \_\_\_\_\_

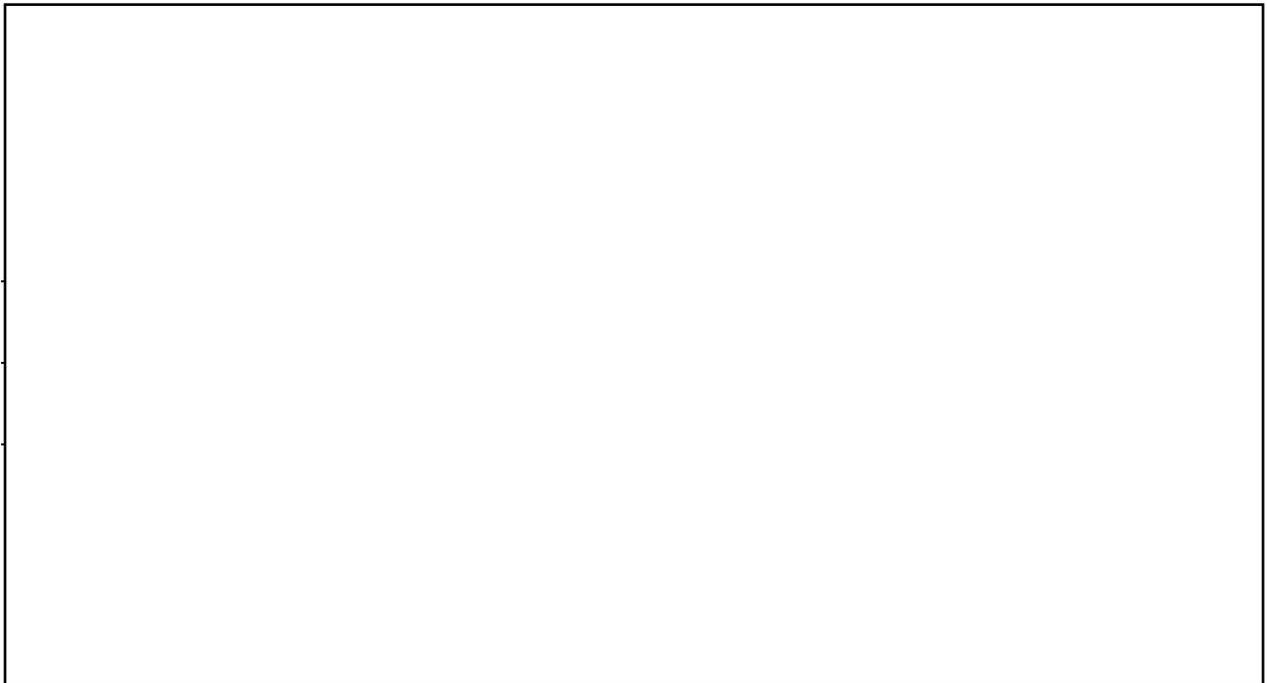
Name the three basic parts of a seed.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

Draw the lima bean seed. Include and identify the three basic parts listed in #1.



# Parts of a Plant

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## 4-H Windowsill Garden Project Lesson 1

Name \_\_\_\_\_

Date \_\_\_\_\_

Name the four basic parts of a plant.

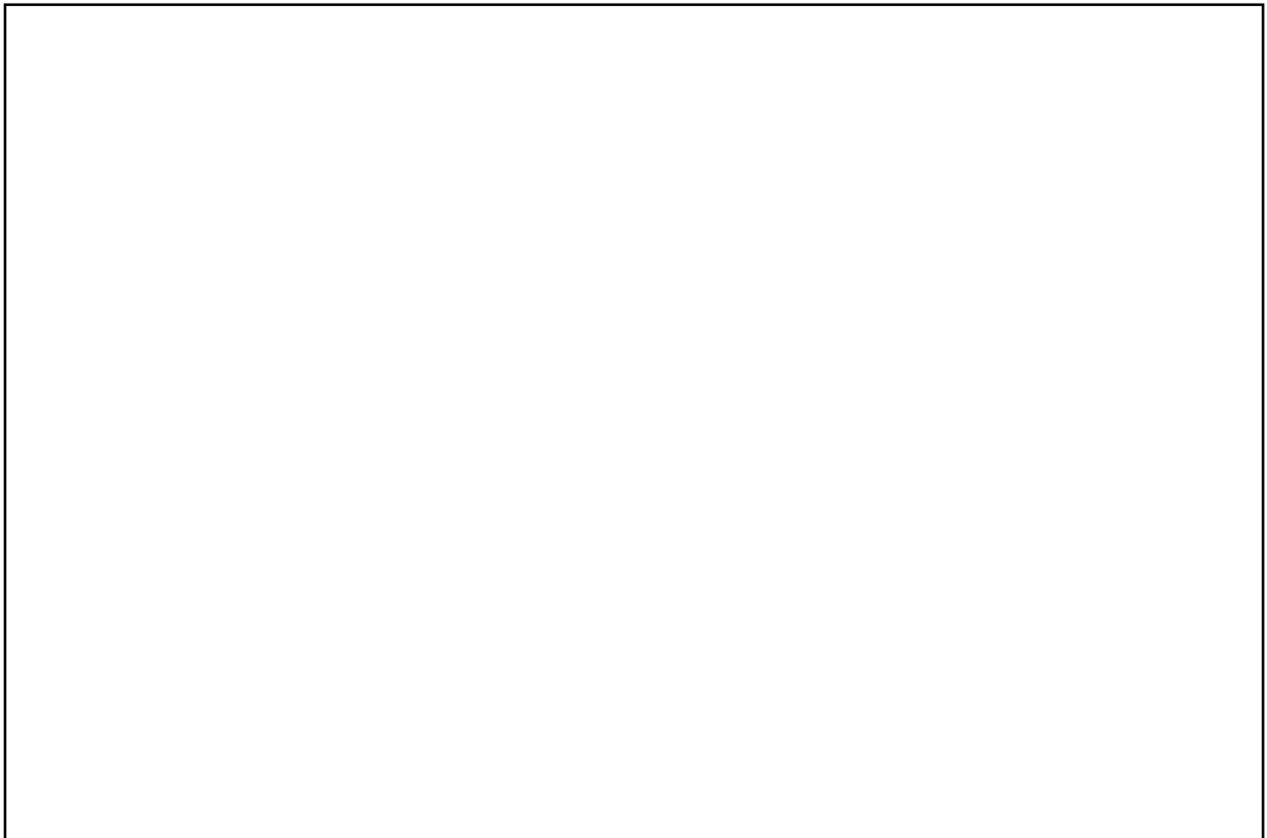
1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

Draw the plant. Include and identify the four basic parts listed in #1.



Record observations about the different plant parts provided in the space below.



# Windowsill Garden Data Sheet

## 4-H Windowsill Garden Project Lesson 2

Name \_\_\_\_\_

Date \_\_\_\_\_

Type of Seeds \_\_\_\_\_

Planting Date \_\_\_\_\_

Record the number of the peat pellets in Column 1 that you are observing. For each peat pellet, record the height of the plant and the number of leaves each week. If two seedlings emerge from one pellet note that in the space provided for additional observations, and include the height and number of leaves for the second seedling (remember to include the peat pellet number here too).

Number	1 <sup>st</sup> Week		2 <sup>nd</sup> Week		3 <sup>rd</sup> Week		4 <sup>th</sup> Week		5 <sup>th</sup> Week		6 <sup>th</sup> Week	
	Height	Leaves										

Note any additional observations in the space below.

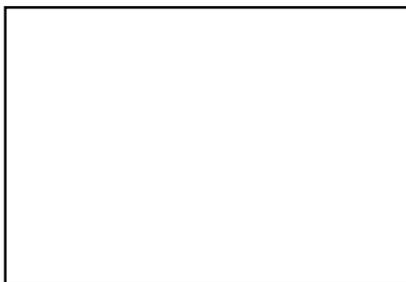
Record the date and amount of water provided (each pellet should receive the same amount).

Date												
Amount												

Record the type, date, and amount of fertilizer provided (each pellet should receive the same amount).

Type												
Date												
Amount												

Draw your plant as it emerges from the pellet in the spaces below. Record the date of each of your drawings. Use an additional piece of paper if extra space is needed.



# Germination and Growth of a Seedling Handout

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## 4-H Windowsill Garden Project Lesson 2

Name \_\_\_\_\_

Date \_\_\_\_\_

List the factors needed for germination to occur.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

List the factors needed for the growth of a seedling.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_



# Transplanting a Tomato Plant to a Bucket Garden Handout

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**Parent/Guardian:** Your child has participated in the 4-H Windowsill Garden Project, and has learned about seeds, plants, and gardening. He/she has planted a small tomato seed and has watched that seed germinate and grow into a small tomato plant. The plant is now ready to be transplanted into a container or bucket garden. Below are instructions for you and your child on how to transplant and care for his/her tomato plant.

## Materials Needed

3-gallon container or bucket  
Potting soil or soilless mix  
Stake or tomato cage  
Fertilizer  
Small garden shovel  
Garden gloves (optional)

## Instructions

1. Container or bucket: Use hot, soapy water and washcloths, sponges, or old rags to wash container(s). Container(s) should be thoroughly washed, rinsed and dried. (If using a recycled container, make sure that the container was only used for food or other non-toxic items.) Drill three to four ¼-inch drainage holes in the bottom or lower sides of the container for water drainage.
2. Fill the container to within 1-inch of the top with potting soil or soilless mix. A packaged peat-moss based, soilless mix is recommended because it is lightweight and sterile.
3. Dig a hole the size of the peat pellet in the center of the container.
4. Place your plant and peat pellet in the hole and press the soil firmly around the plant and roots. Use a stake or tomato cage to help support the plant.
5. Water thoroughly until water runs through the holes in the bottom of the container.
6. When weather conditions permit, gradually move your plant from an indoor growing space to a permanent outdoor location. This process is called “hardening-off”. The bucket garden can be placed outdoors in a sheltered spot for several hours each day with the time increasing to 24 hours by the end of a week. Then your plant can be moved to its permanent location. May 15 is a good date to aim for tomato plants.
7. Water your plant when the soil feels or looks dry. Water may be needed every day during the hottest part of the summer. Always water thoroughly until water drains from the bottom of the container.
8. Fertilize your plant regularly with a water-soluble plant food for flowers and vegetables following package instructions (fertilizer should be handled by an adult only).
9. Use the *Bucket Garden Data Sheet* provided to make observations on the growth of the plant.



# Bucket Garden Data Sheet

## 4-H Windowsill Garden Project Lesson 3

Name \_\_\_\_\_

Date \_\_\_\_\_

Type of Plant \_\_\_\_\_

Transplant Date \_\_\_\_\_

For your plant, record the following each week.

	1 <sup>st</sup> Week	2 <sup>nd</sup> Week	3 <sup>rd</sup> Week	4 <sup>th</sup> Week	5 <sup>th</sup> Week	6 <sup>th</sup> Week
Height						
Number of leaves						
Number of flowers						
Number of Fruit						
Other Observations						

Record the date and amount of water provided.

Date												
Amount												

Record the type, date, and amount of fertilizer provided (fertilizer should be handled by an adult only).

Type												
Date												
Amount												

Draw your plant each week in the spaces below. Record the date of each of your drawings. Use an additional piece of paper if extra space is needed.

