



# Square Foot Garden

## Grade 1

### Standards

1: GPS.S1L1.a; NGSS.1.LS1.A;  
MCC1.G.3 and MCC1.MD.2  
K: NGSS K.LS1.C; NGSS K.ESS3.A

### Time

(2) 45-60 minute periods

### Supplies

- Blue painter tape
- 12"x12" paper (50 sheets)
- Dry beans or paper punch circles ( $\pm$ 500)
- Garden beds (square or rectangular)
- Watering cans or containers, with water
- String (approx. 50 ft)
- Thumbtacks for raised beds (20 -30)
- Toothpicks (1 per student)
- Scissors (1) Hole punches (1 – 6)
- My Square Foot Garden Plan (1 per child)
- Craft sticks (1 per child)
- Vegetable Planting Calendar (1)
- Square Foot Planting Guide and Data Table
- Seasonal vegetable seeds
- Book: Good Enough to Eat by Lizzy Rockwell

### Garden Connection

Students will design and plant a Square Foot Garden. A square or rectangular raised bed marked with 12" grid lines is ideal for this purpose, but in-ground gardens can also work.

### STEM Connection

Science and math are integrated in this lesson as students take up the Engineering Design Challenge of designing and planting a Square Foot Garden that meets the needs of different plant species for spacing (access to light), and accomplishes this spacing by applying math skills to partition squares into halves, quarters, eighths or sixteenths.

### Overview

Students will discover the basic needs of plants; design a square foot garden by using a data chart and partitioning squares to create a planting template; and plant a fall garden from seeds. This activity can be done at any time of year using corresponding seeds for each season. Refer to the planting calendar to see what grows when!).

Optional: Plant seeds with different edible parts (root, stem, leaves, flowers and fruit or seed) to harvest for the Plant Parts Salad lesson.

### Guiding Questions

How do I design and plant a garden?

What do plants need to stay alive and healthy?

### Engaging Students

Students will participate in a role playing activity to make a living model of a garden and demonstrate that plants need sufficient space to collect light. Students will also predict other survival needs of plants; use a data chart to determine how far apart seeds for specific plants should be planted; explore how paper squares can be folded into fractions to make planting templates; design planting plans for one square foot; and listen to a book about gardening.

### Exploration

Students will plant a square foot garden based on the planting plans they designed. They will return to the garden to tend it over the next four to eight weeks, when it is ready to harvest.

### Explanation

Students will be able to identify basic needs of any plant and justify their planting plans based on 1) the plant spacing data table and 2) how a square can be partitioned to make a template for planting.

### Extension

Students may set up an experiment to whether air, water, light and nutrients are essential for plant growth.

### Environmental Stewardship

Students will tend the seeds they planted in an organic garden, supporting pollinators such as bees and butterflies.

### Evaluation

A rubric is provided to assess students' ability to identify the 4 basic needs of plants, and to design and plant seeds in an appropriate number for the species and in a geometrically equidistant pattern.

## Standards

### Georgia Performance Standards in Science (first grade)

S1L1. Students will investigate the characteristics and basic needs of plants . . . .

a. Identify the basic needs of a plant.

1. Air
2. Water
3. Light
4. Nutrients

### Next Generation Science Standards (kindergarten)

#### NGSS K.LS1.C Organization of Matter and Energy Flow in Organisms

Plants need water and light to live and grow. (K-LS1-1)

#### NGSS K.ESS3.A: Natural Resources (kindergarten)

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1)

### NGSS 1.LS1.A Structure and Function (first grade)

1. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)

### Georgia Performance Standards in Common Core Math (first grade)

#### MCC1.G Understanding Shapes and Fractions (first grade)

MCC1.G.3 Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

#### MCC1.MD Measure Units Indirectly and by Iterating Length Units (first grade)

MCC1.MD.2 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.

## Background Information

Recommended gardening books to read with students:

Water, Weed and Wait by Edith Hope Fine & Angela Demos Halpin

The Dandelion Seed by Joseph Anthony

In a Nutshell by Joseph Anthony

For more about square foot gardens expanding biodiversity, making crop rotation easy, reducing water needs, supporting pollinators, and increasing productivity of organic gardens: <http://www.backyardplanter.com/squarefoot.html>

Explore these excellent resources for details on square foot gardening:

How to Plant a Square Foot Garden

<http://www.plantandplate.com/2013/04/how-to-plant-a-square-foot-garden>

Square Foot Garden Spacing Table

<http://www.mysquarefootgarden.net/plant-spacing/>

Square Foot Garden Planting Guide (illustrated table with plants and spacing info)

<http://refreshingthehome.com/square-foot-planting-guide>

Square Foot Gardening Data Table and Planting Season Chart in One

<http://www.thelegacypodcast.com/wp-content/uploads/chart%20for%20square%20foot%20gardening.pdf>

Cut-apart Square Foot Gardening Chart for Planning Entire Garden Layout

<http://plantandplate.com/p-downloads/PlantandPlate-SFG-planner.pdf>

Book: Square Foot Gardening with Kids by Mel Bartholomew

## Teacher Preparation

- Obtain all needed supplies and materials, including seeds appropriate for the season.
- Refer to the Vegetable Planting Calendar below to decide which seeds students may choose from, based on the season. Consider planting seeds for fruits, vegetables and greens the class can harvest in 4 – 8 weeks for the Plant Parts Salad lesson. This would include plants with various edible parts, i.e. root, stem, flower, fruit, seed, and leaf.
- Make copies of the following materials for each child:
  - Square Foot Planting Guide (chart or table that shows number of seeds per square, for various plants)
    - Alternatively, show this chart with an lcd projector so all can see, instead of making copies
  - My Square Foot Planting Plan (included below)
- Cut apart this Square Foot Garden Planner Chart into individual squares, for an extension math activity, if desired:  
<http://plantandplate.com/p-downloads/PlantandPlate-SFG-planner.pdf>

## PROCEDURES FOR LESSON ACTIVITIES

Day 1: In the Classroom

### Engagement (15- 20 min)

#### Square Foot Garden Role Play

- Introduce the idea that students will be designing and planting a square foot garden, where a different type of plant is grown in each square. Read a book to the class about gardening.
- Mark off a 5 ft x 5 ft square on the floor of the classroom with blue painter tape (or a smaller square for fewer kids) and tell students this represents one square in a square foot garden.
- Invite several students at a time to come to the taped square and join other students playing the part of seeds by squatting in the square, until the entire class is squished together with at least one foot inside the square. When the teacher says, “Grow!” students should pretend to grow and bloom, standing up with their arms out and palms up, like leaves trying to capture light. There will be lots of hands in people’s faces and general discomfort.
- Next, tell students they may step out of the square to stand one arm’s length from each other and squat down to play the role of seeds again. When the teacher says “Grow!” students should pretend to grow and bloom, standing again with arms out and palms up, like leaves trying to capture light.
- Ask students whether they would get more sunlight on their leaves if they grew close together or spread out? (Accept student answers and agree that plants need sunlight to make food inside their leaves. When plants are crowded together, some of the leaves cannot get sun because they are shaded by other plants).
- Important point: Just like animals, some types of plants grow up to be big and other types grow up to be tiny. The size of the plant is one way to decide how much space it needs in the garden, so it can get enough sunlight to grow. In the square foot garden, a plant that will grow up to be big will need the whole square for itself. However, several smaller plants may fit into one square foot.
- Ask students to freeze in place and imagine that their legs are stems that cannot move. Students should pretend they are stuck standing where they are now, forever! Ask what would they need to survive? (Accept and record all answers. Then distinguish between wants and needs. Needs = Light, air, nutrients and water)
- Important point: Plants make their own food inside their leaves, using sunlight and air. However in addition to the food they make, plants also need nutrients – vitamins and minerals usually obtained from soil - to be healthy.

Still Day 1: In the Classroom

### Exploration

#### Engineering Design Challenge Preparation: Folding a Square to Partition into 1/2s, 1/4s, 1/8s, and 1/16s (15- 20 min)

- Provide each student with a sheet of 12 x 12 paper and approximately 16 dry beans (or paper punch circles). Have extra sheets of paper available for children who need to start over.
- Project a Square Foot Planting Guide on a screen OR provide copies for students. Show students how the data table provides information about the names of plants and the number of seeds for each type of plant that can be planted in one square. (The number of seeds is based on the size of the plant when it is fully grown: not the size of the seed).
- Pick a plant for which two seeds should be planted in one square foot and point it out on the data table. Tell students they will be pretending to plant these 2 seeds an equal distance apart, so they have enough space to collect sunlight.
- Challenge students to fold the paper any way that makes two equal halves, so the paper can be used as a template (model) for planting 2 seeds, when unfolded. Horizontal, vertical or even diagonal folds are acceptable solutions, as long as the square is divided into two equal parts. Students may place a bean or other marker on each half of the paper to show how they would plant two seeds in a square foot garden.
- Ask students to find a plant on the data table for which 4 seeds are recommended per square and point it out. Read the plant’s name and ask students how they could fold the same piece of paper into four equal parts. Students should

discover that they can divide the square into quarters by folding it in half twice. Students may place a bean in the middle of each of the four quarters of the square, to show how they would space apart and plant four seeds.

- Ask students to predict how many parts there would be if they folded the paper in half three times. Let students make the folds and compare results to predictions; then find plants in the data table for which 8 seeds should be planted and use beans to show how those seeds would be spaced and planted in the square.
- Repeat the process, with students predicting and then checking to see how many parts would be created with four folds; and placing a bean in each of the sixteen squares.
- Ask students if they can find a way to fold the paper into nine equal parts. (There are at least two possible solutions for planting 9 seeds equidistantly: the paper can be folded in thirds horizontally and then in thirds vertically, to create nine equal squares, and a seed planted in the middle of each. Alternatively, the paper can be folded in half four times to create 16 equal squares and a seed can be planted at all nine intersections of horizontal and vertical fold lines).

### **Engineering Design Challenge: Planning to Plant a Square Foot Garden (15-20 minutes)**

- Divide students into pairs for the engineering design challenge. (Papers must still be completed individually).
- Give each student a copy of fresh 12x12 paper, recycling the old.
- Let each pair of students choose a type of plant from among those the teacher has available. Students should find the plant on the Square Foot Garden Planting Guide and determine how many seeds can be planted in a square foot; then divide 12x12 paper into an appropriate number of equal parts and show where seeds go, by placing peas on paper.
- After the teacher checks and confirms the location and number of seeds for the species, students will be allowed to use a hole punch to make a hole in the middle of each part of their folded papers. When opened and placed on top of the garden soil, the paper will serve as a template for planting seeds by pushing them through the holes.
- After punching the holes, each student should complete the My Square Foot Garden Plan worksheet.
- Let student choose from among plants preselected by the teacher. Continue to display the Square Foot Garden Guide
- Laminate students' Square Foot Garden Plans and glue or staple to craft sticks, for use as plant markers.

Day 2: In the Garden

## **Environmental Stewardship**

### **Engineering Design Challenge: Planting a Square Foot Garden (30 minutes)**

- In advance: Use thumbtacks to pin pieces of string across raised bed(s) and make a grid of 12" by 12" squares.
- Explain garden work and behavior expectations to students before going outside (e.g. staying with partners, keeping within assigned boundaries, listening quietly for directions).
- Things to take outside include seeds, laminated plant markers (aka students' My Square Foot Garden Plan" worksheets attached to craft sticks), string, scissors, thumbtacks, toothpicks, seeds for selected plants and watering can with water. Each pair of students should bring one of their 12" x 12" seed planting templates.
- Let students assist in arranging the Square Foot Garden. One at a time, each set of partners should place their seed template within the grid on top of the soil, pinning it in place with toothpicks. For best results, rearrange to locate all the tall or climbing plants along the north edge of the garden.
- Pass out seeds to each pair of students, based on their Square Foot Garden Plans. Partners will push seeds in the holes and into the soil beneath their templates; then pick up the templates and cover seeds with soil.
- Continue to bring the class back to the garden over the next six to eight weeks to tend their plants. Discuss the value of the garden to pollinators and let students take and display pictures of the pollinators who visit.

## **Explanation**

Ask students whether the newly planted seeds are getting their basic needs met? Have watering cans ready and allow students to water. Discuss with students how healthy plants contribute to the health of people who eat them.

## **Evaluation**

A rubric is attached to assist in assessing student demonstration of proficiency in meeting the basic needs of plants.

## **Extension**

Challenge students to make use of leftover seeds and space in the garden bed to set up an experiment that is a "fair test" of whether a presumed basic need of a plant is actually essential to its survival. Students may plant seeds in test plots and investigate one variable at a time, such as whether sunlight is essential to plants. Encourage the class to brainstorm ways to carry out the investigation so that a test plant can be compared to a control plant that is treated exactly the same way—except for one variable (such as covering the test plant or planting too many seeds in one square). Consider whether the experiment may cause unintended consequences (confounding variables) such as increasing heat beneath the cloth.

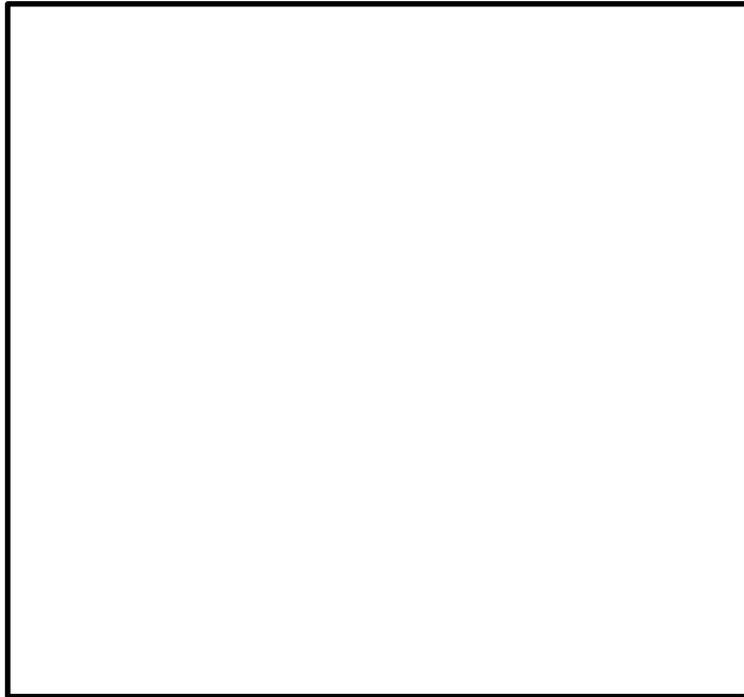
## My Square Foot Garden Plan

Name: \_\_\_\_\_

The type of seed I will plant in my garden square is:

\_\_\_\_\_

For this type of plant, the number of seeds of that have room to grow in a square foot is \_\_\_\_



My drawing shows the number of seeds I will plant and how I will space the seeds equally apart, by marking an X for each seed.

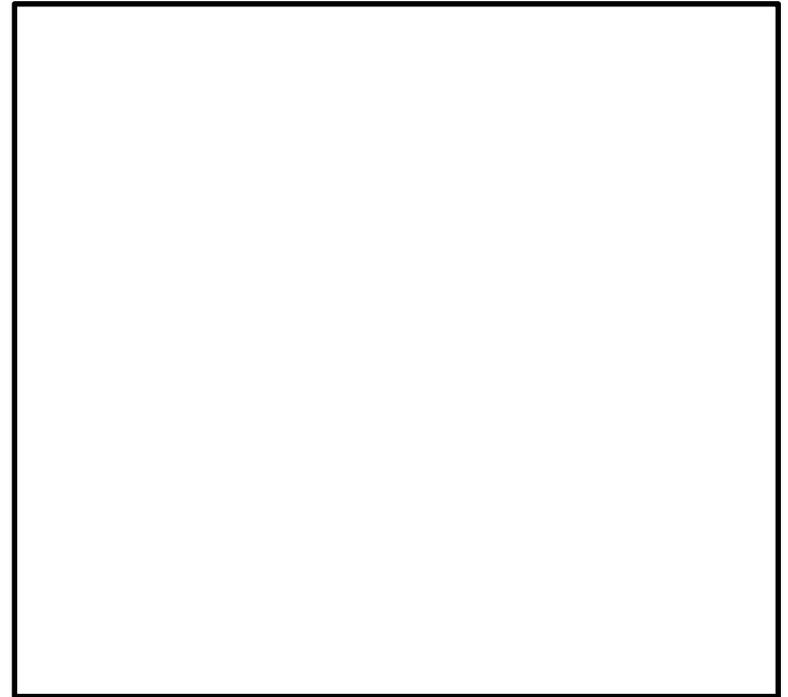
## My Square Foot Garden Plan

Name: \_\_\_\_\_

The type of seed I will plant in my garden square is:

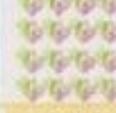
\_\_\_\_\_

For this type of plant, the number of seeds of that have room to grow in a square foot is \_\_\_\_



My drawing shows the number of seeds I will plant and how I will space the seeds equally apart, by marking an X for each seed.

# Square Foot Planting Guidelines

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

Courtesy of Refreshing the Home and WarrDude

## Vegetable Planting Calendar for Atlanta Area

Vegetable	Jan 1-15	Jan 16-31	Feb 1-15	Feb 16-28	Mar 1-15	Mar 16-31	Apr 1-15	Apr 16-30	May 1-15	May 16-31	Jun 1-15	Jun 16-30	Jul 1-15	Jul 16-31	Aug 1-15	Aug 16-31	Sep 1-15	Sep 16-30	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-30	Dec 1-15	Dec 16-31		
<b>Greens</b>																										
Cabbage																										
Chard																										
Collards																										
Kale																										
Lettuce																										
Mustard greens																										
<b>Roots</b>																										
Beets																										
Carrots																										
Garlic*																										
Onions*																										
Potatoes, Irish*																										
Potatoes, sweet*																										
Radishes																										
Turnips																										
<b>Flower/Seed</b>																										
Beans, green																										
Broccoli																										
Cauliflower																										
Corn, pop/dry																										
Corn, sweet																										
Peas, edible pod																										
Peas, Southern																										
<b>Fruit,veggie</b>																										
Eggplant																										
Okra																										
Pepper																										
Squash, summer																										
Squash, winter																										
Tomato																										
<b>Fruit, sweet</b>																										
Cantaloupe																										
Pumpkin																										
Watermelon																										
<b>Key:</b>	Direct seed	Transplan	Seeding and harvest over									Harvest	Summer break													

## Planting Calendar Definition

### **Definitions:**

#### **Direct seed:**

**Plant seeds directly into garden.**

\*indicates crops whose vegetative parts are planted directly into garden

Garlic: plant individual cloves

Onions: plant 'sets,' young onion shoots available during planting season at garden centers

Irish potatoes: cut up organic potatoes, with at least one 'eye' per piece, and plant pieces

Sweet potatoes: plant 'slips' into garden (available at garden centers or grow your own, see 2nd grade George Washington Carver lesson)

#### **Transplant:**

**Plant starts (young vegetable plants) in garden**

These are available at garden centers during planting seasons, and can also be grown in the classroom from seed under proper conditions

#### **Seeding and harvest overlap**

With some crops, seeds can be planted over several weeks for an extended harvest. In this case, sometimes the crops from the first planting are ready to harvest while the planting window is still open.

#### **Harvest**

This is when the crop should be ready to pick, though harvest time is subject to change depending on the weather in any particular year. Harvest times can be extended through protecting plants from harsh weather in both winter and summer.

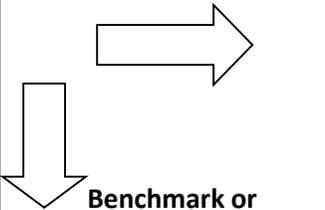
#### **Summer break**

This is shown on the calendar for planning purposes. If no one is available for summer garden maintenance, it is best to avoid planting crops which are mainly harvested in June and July.

# Assessment for Square Foot Fall Garden

Student Name:

Date:

<p><b>Level of Mastery</b></p>  <p><b>Benchmark or Performance Measure</b></p>	 <p><b>EMERGING</b> Not yet proficient <b>1 point</b></p>	 <p><b>COMPETENT</b> Partially proficient <b>4 points</b></p>	 <p><b>PROFICIENT</b> Mastered task <b>5 points</b></p>	<p><b>TOTAL POINTS</b></p>
<p><b>Student can identify the four basic needs of plants.</b> (Clarification: space is not considered a basic need of a plant but give credit if student can explain that space or crowding determines whether a plant gets enough sunlight).</p>	<p>Student names 0 or 1 of the 4 needs of plants in the garden.</p>	<p>Student names 2 or 3 of the 4 needs of plants in the garden.</p>	<p>Student names the 4 basic needs of plants in the garden: Air, water, light, nutrients.</p>	
<p><b>Student can partition a square into halves, quarters, or smaller fractions to create a template for correct seed spacing.</b></p>	<p>Student can demonstrate folding a square once to divide it in half.</p>	<p>Student can demonstrate folding a square in once to divide it in half, and folding it again to divide it in fourths (quarters).</p>	<p>Student can divide a square into two, four, or eight equal parts. (When given a paper square, student demonstrates folding in half multiple times to get smaller parts).</p>	
<p><b>Student can make a planting plan that is appropriate for the plant selected, in a square foot garden.</b> (Clarification: student does not need to represent plant in drawing of planting plan. Seeds may be represented by any mark)</p>	<p>Planting plan is attempted but is missing information about type of plant, number of seeds, or drawing that shows seed spacing.</p>	<p>Planting plan identifies name +/- or number of seeds for that species correctly, but drawing of seed spacing is not correct or does not match text (or vice versa).</p>	<p>Planting plan identifies name of plant and correct number of seeds for that species in one square foot; drawing shows correct number of seeds spaced <i>approximately</i> equidistant.</p>	
<p><b>Student can work in a pair or a team to plant a square foot garden.</b></p>	<p>Students do not space their seeds correctly in their paper square foot or in the garden</p>	<p>Students space their seeds correctly in either the paper square or the garden</p>	<p>Seeds are correctly planted for the species, according to spacing chart.</p>	