Square Foot Salad Garden

Overview: In many school and home landscapes, growing space is limited; therefore, maximizing every inch of soil to its fullest is essential. Teaching students how to design gardens that use space and resources efficiently provides them with valuable life-long skills and a unique understanding of plant needs. In this lesson, students will explore the principles of square foot gardening while also practicing math skills and learning foundational science concepts.

Grade Level/Range: 3rd – 8th Grades

Objective(s):
Students will:
- Learn the basic principles behind square foot gardening
- Investigate and consider plant needs for healthy growth
- Practice design and math skills.

Time: 1 hour

Materials:
- pots
- potting soil
- seeds for fast-growing plants like basil or lettuce
- clipboard
- paper
- pencils
- seed packets or access to printed or digital seed catalogs
- Square Food Salad Garden Student Worksheets

Background Information:
The concept of Square Foot Gardening was introduced by Mel Bartholomew in his book titled *Square Foot Gardening,* first published in 1981. Noting that traditional gardens planted in parallel rows created unused soil space that typically received water but more often than not became a battle with weeds, he encouraged gardeners to divide planting space into adjoining squares measuring 1' x 1' and populate them with a diversity of crops rather than single crops. Benefits of this planting technique included:
- Obtaining a larger harvest in the same-sized garden plot
- Decreasing bare soil resulting in fewer weeds to pull
- Shading the soil, keeping it cooler, and conserving moisture
- Encouraging the planting of a diversity of plant species

The Square Food Gardening Foundation estimates that compared to row-style gardening, square foot gardening costs 50% less, uses 20% less space, uses 10% of the water row-style does, and requires just 2% of the work.

To plant successful square foot gardens, gardeners must carefully consider plant needs when designing and making variety selections. All plants need light, water, air, nutrients, and enough room to grow. Their growth and health will be impacted if they do not meet any of these needs. That being said, although plants all have the same basic needs, they do not need each of the inputs in the same amount. In square foot gardens, plants that have smaller growth habits and require less space can really shine. Often called compact or dwarf varieties, plants that thrive in smaller spaces have been found in nature and are also developed by people through breeding programs. Read more about some common compact vegetable varieties.

In addition to thinking about growth habits, plant selection for square foot gardening benefits from considering how plants interact with each other. In nature, diversity is critical to ensuring a healthy ecosystem. Plant and animal life, both above and underground, form relationships that help keep their populations in balance with the natural resources available to them. For example, plants adapted to shade can grow low on the ground. They tolerate the shade from taller plants and help protect the soil from erosion. A diversity of plant life also encourages a diversity of animal life. Herbs with abundant flowers attract beneficial insects that can help pollinate vegetable crops and decrease pest insect populations. Square foot gardening more closely mimics how plants grow in nature, with a variety of species growing together in non-uniform patterns.

Plants with growth habits and life cycles that complement each other are often called companion plants. Plants with different requirements — for nutrients, sunlight, and space, for instance — often make good garden buddies. Because they are unlikely to compete for resources, you can plant them close together to save space. What's more, some combinations can actually help one or more of the companions flourish. Learn more about different types of symbiotic relationships between plants in Growing Garden Companions.

Advanced Preparation:
For the Exploration: Six weeks before the lesson, plant five pots (4" or 6" pots will work) with different numbers of basil or lettuce seeds (or another fast-growing plant) and place them in a sunny window or under grow lights. Your end goal is to demonstrate that the plants will grow differently when they have more space available, so vary the number of seeds planted in each pot. An example would be to have pots with 1, 3, 5, 7, and 10 plants, but you can change those numbers based on pot size and seed availability. You may want to plant a few extra seeds in each pot in case they do not all sprout. Then, after germination, carefully cut away extra seedlings and thin the pots so that you have the desired distribution.

Laying the Groundwork:
Plan an observation walk in a school garden, school yard, or a nearby park or nature center. Have students bring a clipboard, paper, and pencils. Look for a well-filled landscape bed or natural area for students to observe. If the bed does not have a definite border, add stakes and string or flagging tape to identify your target location. Ask students to create an inventory of every type of plant they see within the marked-off space, from the smallest weed or grass to the tallest tree. Along with the inventory, encourage them to note the size and health of the plants.

After giving them ample time for the inventory, spark discussion by asking the following questions:

- *How many types of plants did you discover? Do you think they were planted by people, or do you think they grew on their own?*
- *What do you notice about the variety of sizes of the plants? Do they look healthy? Do you think the plants benefit from being different sizes?*
- *Can you see the soil? How do you think plants covering soil is helpful?*

Exploration:

1. Transition from the Laying the Groundwork by summarizing your findings. Share with students that in nature, having a diversity of plants with different characteristics and needs helps create a healthy ecosystem. Ask students to list the basic plant needs as a review: light, water, nutrients, air, and a place to grow. Although plants have the same basic needs, they need each in a different amount. Explain that sometimes plants meet their needs with help from other plants. For example, a plant that needs less light and may need to be shaded from the hot summer sun will grow well when growing beside a taller plant that can provide shade in the heat of the day. Ask students to brainstorm some other ways plants can complement each other. You can get some ideas from Companion Planting and Growing Garden Companions.

2. Introduce the concept of Square Foot Gardening. Square Foot Gardening encourages planting a diversity of crops and rotating them frequently. Students may enjoy watching the YouTube video Square Foor Gardening with Steve Bartholomew from Central Texas Gardener.

3. In addition to offering a variety of plants, a second key to designing a Square Foot Garden is to provide each plant enough space to grow. Display the pots of plants you started as part of Advanced Preparation (basil, lettuce, or another fast-growing plant with a different number of seeds growing in them). Ask students to make observations about the sizes and overall health of the plants in each pot. Ask: *does spacing seem to be impacting the plants' growth? If so, how? Do you think spacing is important? How can we use this information when planning gardens?* To extend the investigation, you can also complete the Room to Grow lesson plan.

4. Provide students with seed packets or online/printed digital seed catalogs to explore. Point out the instructions about proper spacing of plants. You can also share The Square Foot Gardening Foundation's Planting Chart Cheat Sheets with them.

5. Now that students have learned the importance of choosing a diversity of plant varieties and providing proper plant spacing for a successful square foot garden, they can practice some math skills by designing their own square. You can use the Square Foot Salad Garden Student Worksheets to guide their designs.

6. Let students present their garden design to the class and display it for others to view.

Making Connections:

Square foot gardens are a design solution for growing a bountiful harvest in small amounts of space. The Square Foot Gardening Foundation estimates that square foot gardening costs 50% less, uses 20% less space, uses 10% of the water of traditional row-style gardening, and requires just 2% of the work.

Watch the YouTube video, Square Foot Gardening Essentials | Grow More in 80% Less Space by the Square Foot Gardening Foundation which offers a model of where these numbers come from. Have students brainstorm experiment ideas for testing these estimations for accuracy. Create a list of all the supplies you would need and create a price list for your investigations.

Branching Out:
If space, time and financial resources allow, a great follow-up for this design activity is to provide students the opportunity to plant their planned garden. Raised beds are ideal for successful Square Foot Gardens, however container gardens such as simple square-shaped 5-gallon buckets can also be used.

If you have plenty of garden space, try experimenting by planting the same vegetables in square foot gardens and traditional row gardens so students can observe and collect their own data comparing the two growing techniques.

Connections to Standards:
This lesson can be used to teach the following Next Generation Science Standards:

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential

impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Related Resources:
Square Foot Gardening:
https://kidsgardening.org/resources/gardening-basics-square-foot-gardening/

Room to Grow:
https://kidsgardening.org/resources/lesson-plan-room-to-grow/

Celebrating Diversity in the Garden: https://kidsgardening.org/resources/lesson-plan-celebrating-diversity-garden/

Square Foot Salad Garden Planning Worksheet

Square foot gardens divide garden beds into plots 1' X 1' to encourage diversity and efficiency. In larger planting beds, each square foot plot can be planted with one type of vegetable or herb plant, and the plots can be positioned in complementary patterns. In smaller beds where only a couple of plots are available, you can combine different types of plants within each square foot.

Use the information below to plan your own Square Foot Salad Garden:

Plant Name	Seed Spacing
Beans 'Blue Lake'	6"X6", 36 boxes
Broccoli 'Small Miracle'	12"x 12", 144 boxes
Carrots	3" X 3", 9 squares
Collard Greens	12"x 12", 144 boxes
Kale 'Dwarf Blue Curled'	6"X6", 36 boxes
Leaf Lettuce	6"X6", 36 boxes
Parsley	6"X6", 36 boxes
Radishes	3" X 3", 9 squares
Sugar Snap Peas*	144 boxes*
Swiss Chard	6"X6", 36 boxes

*Sugar Snap Peas grow on vines and will be planted around three stakes, forming a pyramid. On the design, draw three clusters of seeds spaced around the square foot plot. Plan to plant two to three seeds around each stake.

Plant Descriptions:

Beans 'Blue Lake'
The 'Blue Lake' variety of bean is a bush bean, which means the plant will grow in a bush form and does not need an extra trellis or stake for support.

- Number of days until plants will emerge after planting: 6 days
- Number of days from planting until harvest: 60 days

Broccoli 'Small Miracle'
We eat the immature flower buds of the broccoli plant. It can be eaten raw or cooked. Broccoli plants like cooler temperatures.

- Number of days until plants will emerge after planting: 7 to 10 days
- Number of days from planting until harvest: 54

Carrots
We eat the roots of carrots. Varieties range in size from baby carrots to foot-long roots. Although orange carrots are most common, yellow, white, orange, and maroon varieties are available.

- Number of days until plants will emerge after planting: 12 to 18 days
- Number of days from planting until harvest: 75 days

Collard Greens
Collard greens are a leafy green in the cabbage family. They stand out from other cabbage-family plants in their tolerance to

cold and hot temperatures and high humidity. Their loose-leaf (non-heading) form makes them less susceptible to fungal diseases than their tight-leaved and head-forming relatives, such as cabbage and cauliflower.

- Number of days until plants will emerge after planting: 5 to 10 days
- Number of days from planting until harvest: 75 days to maturity, but leaves can be harvested and consumed earlier

Kale 'Dwarf Blue Curled'

Kale is related to cabbage and has thick green leaves. The leaves can be eaten raw or cooked. This variety offers smaller, more compact plants.

- Number of days until plants will emerge after planting: 5 to 10 days
- Number of days from planting until harvest: 60 days

Leaf Lettuce

Leaf lettuce grows loose rather than in a tight head. You can pick a few leaves at a time, and as long as you don't pick too many, it will continue to grow. In cool weather, you could potentially harvest lettuce for many months.

- Number of days until plants will emerge after planting: 6 to 8 days
- Number of days from planting until harvest: 45 to 50 days

Parsley

Parsley is high in Vitamin A, and by weight, it has more Vitamin C than an orange! The curly variety has tight, mounding growth that resembles a bed of soft moss, making it a nice "touch plant."

- Number of days until plants will emerge after planting: 10 to 28 days
- Number of days from planting until harvest: 60 days

Radish

Radishes grow quickly. You eat the root of the plant that has a spicy, pepper-like flavor. It can be added to salads or eaten alone.

- Number of days until plants will emerge after planting: 3 to 6 days
- Number of days from planting until harvest: 23 days

Sugar Snap Peas

Sugar snap peas are a type of pea that you can eat the pod along with the seeds inside. They are often used for salads or eaten fresh by themselves.

- Number of days until plants will emerge after planting: 3 to 6 days
- Number of days from planting until harvest: 64 days

Swiss Chard

Swiss Chard is grown for edible petioles (leaf stalks) and leaves. The variety 'Bright Lights' is popular with kids because its stems and leaf veins come in a range of bright colors, including yellow, pink, red, orange, purple, white, and green.

- Number of days until plants will emerge after planting: 7 to 14 days
- Number of days from planting until harvest: 45 to 60 days

Square Foot Salad Garden Planning Map Graph

Each box represents 1” X 1”

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