



Fifth Grade Fall Lesson

Mars Colony Test Garden

Objective:

Students will learn the importance of vegetables for sustaining the health of their bodies. They will compare the nutritional and production attributes of different varieties of vegetables to evaluate which varieties would work best to feed an isolated colony of humans on Mars.

California State Content Standards:

Life Sciences

2. Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept:

- a. Students know many multicellular organisms have specialized structures to support the transport of materials.
- b. Students know how blood circulates through the heart chambers, lungs, and body and how carbon dioxide (CO₂) and oxygen (O₂) are exchanged in the lungs and tissues.
- c. Students know the sequential steps of digestion and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of the digestive system.
- d. Students know the role of the kidney in removing cellular waste from blood and converting it into urine, which is stored in the bladder.
- e. Students know how sugar, water, and minerals are transported in a vascular plant.
- f. Students know plants use carbon dioxide (CO₂) and energy from sunlight to build molecules of sugar and release oxygen.
- g. Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide (CO) and water (respiration).

Math – if the teacher elects to have students develop and diagram a planting plan

1.0 Students understand and compute the volumes and areas of simple objects:

- 1.3 Understand the concept of volume and use the appropriate units in common measuring systems (i.e., cubic centimeter [cm³], cubic meter [m³], cubic inch [in³], cubic yard [yd³]) to compute the volume of rectangular solids.
- 1.4 Differentiate between, and use appropriate units of measures for, two- and three-dimensional objects (i.e., find the perimeter, area, volume).

2.0 Students identify, describe, and classify the properties of, and the relationships between, plane and solid geometric figures:

- 2.1 Measure, identify, and draw angles, perpendicular and parallel lines, rectangles, and triangles by using appropriate tools (e.g., straightedge, ruler, compass, protractor, drawing software).

Lesson Outline:

1. Growing food will be necessary for long-term survival in an isolated colony on Mars.
2. Plants are important for nutrition.
3. Critical characteristics for plants grown for food in isolated situation.
4. Traditional or heirloom varieties are the best answer.

Seeds—use only open-pollinating varieties:

Radish
Carrots
Onion
Lettuce
Spinach
Broccoli
Peas

Lesson:

Students will combine their science standards for understanding the operation and needs of the human body with their standards for understanding the solar system to plan and plant a garden that could be used to provide food for long term settlement of a colony on Mars. If desired, teachers may incorporate math standards by having students plot and draw a planting plan for a planting bed.

1. Growing food will be necessary for long term settlement of a colony on Mars.
 - a. Humans need food and water to survive—through their digestive system, humans convert food into energy to fuel their bodies.
 - b. Once food is consumed, the energy is removed and the body eliminates the remaining substances as waste.
 - c. In order to survive, humans need a constant source of food. We will assume that the colony on Mars is isolated and not able to receive regular deliveries of food from Earth. The International Space Station requires regular deliveries of food to its astronauts because it does not produce its own food.
2. Plants, and especially fresh fruits and vegetables, are an important part of a healthy diet—for example, a salad can provide a broad variety of the healthy nutrients humans need.
 - a. The three primary nutritional components of food.
 - i. Carbohydrates—carrots, radishes, lettuce, broccoli
 - ii. Protein—legumes such as peas and beans
 - iii. Fats—available in some fruits such as avocado and olives, as well as nuts and seeds.
 - b. Vitamins and minerals
 - i. Broccoli, radishes-- $\frac{1}{2}$ cup broccoli has more Vitamin C than a cup of orange juice
 - ii. Carrots, dark lettuces—Vitamin A—Important for healthy skin and vision
 - iii. Spinach—iron for healthy blood
 - c. Fiber—clean your system

3. Three critical characteristics for plants grown as food on Mars.
 - a. Quick = regular source of food: This salad garden will be ready to eat in approximately 3 months and can produce over 2-4 months.
 1. Lettuces – leaf lettuce varieties can be harvested as needed and the plant just keeps growing new leaves – better than head lettuce where you harvest the whole plant at once.
 2. Peas, broccoli – harvesting encourages continued production of bud and seed pods.
 3. Carrots, radishes – successive sowing every two weeks to keep production going.
 - b. Easy to Grow=dependable: high germination rates, not susceptible to plant diseases (molds, funguses, etc) and pests. Do not want fussy plants!
 - c. Reproducible—must reproduce naturally because you can't be buying new seeds each season! Plants must be open pollinated—reproduce themselves under natural conditions through using their own seeds. Compare to modern hybrid varieties that have been scientifically altered so the seeds the plants produce do NOT produce the same variety of plant as the parent.
4. Traditional or Heirloom seeds—seeds passed down for generations—are the best bet for this type of use.
 - a. They have stood the test of time—people have been planting them for generations because they grow well, taste good, are less prone to disease or pests.
 - b. The seeds are naturally produced by their parent plant so you will have a source of seeds to keep planting.
 - c. Studies show significantly more nutritional value in some traditional varieties.

Garden Rules:

1. **IMPORTANT REMINDER** Plants can be poisonous: Plants and flowers in the school garden are safe for eating because we plant them specially for food and do not use any chemicals or pesticides that would be harmful if eaten.
 - Children must NEVER eat a plant or flower they find growing anywhere at school, home or in their neighborhood unless their parent or another responsible adult says it is ok!!!
 - Many plants are VERY POISONOUS. Plants are tricky because many look alike. You may think it is a plant that is safe to eat, but it may not be.
 - Many people put chemical pesticides on their plants to kill bugs or give plants special food called fertilizer that is safe for the plants, but not safe for people. These chemicals are NOT SAFE for people to eat!!!
2. Quiet voices, no running—do not disturb the creatures in the garden or the students in nearby classrooms. The garden is a classroom just like all the other classrooms at school. All the same rules apply as in your classroom, such as no running, yelling, or climbing.
3. Listen to instructions and plant as you are told or your plants may not grow. If you plant too many seeds or put the seeds in the wrong place, your seeds will not grow.

Planting Plan:

- You will each get to plant one type of seed or plant.
- We will assign each of you the type of seed or plant you get to plant.
- We will tell you where and how to plant your type of seed or plant.
- It doesn't matter what you plant today—the entire class will share the garden.
- HAVE FUN!!!

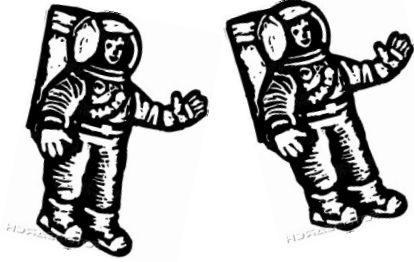
Planting Directions:

For all seeds: Make rows 6 inches apart and $\frac{1}{4}$ inch deep. Have students place seeds 1 inch apart in row. It is easiest if you hold seeds and students pinch them from your hand/cup one at a time. Do not let students dig holes for seeds—seeds will be planted too deep and will not grow. Have student pinch dirt closed and gently pat down to cover rows after they place their seeds.

For onion bulbs: Make rows 3 inches apart and $\frac{1}{4}$ inch deep. Bulbs need to be planted 2” deep, which is the depth to the students second knuckle. Demonstrate to students how to push their finger into the soil just to the first knuckle. Remind them that if planted too deep (i.e. up to the beginning of their palm), the onions will not grow. Have students make their holes in the row. Show them the difference between the top and bottom of the onion bulb (Top is pointy, bottom has dried roots). Have them place the bulbs top side up in their holes. Once all the hole are filled, have students pinch the rows closed and pat down.

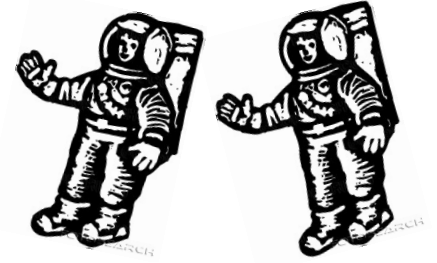
For transplants: Assign 2-3 students to each transplant. Plant transplants one foot apart. Students to take turns digging hole (remind them only as deep as potted transplant), removing transplant from pot (turn upside down and tap, catching plant as it falls out v. pulling out of pot by neck of plant), and placing in hole, adding and patting down dirt around it.

MATH LESSON – USE THE PLANT SPACING INFORMATION ABOVE ALONG WITH THE AREA OF THE PLANTING BED TO HAVE STUDENTS DESIGN A PLAN FOR PLANTING A VARIETY OF VEGETABLES IN A SET AREA.



Teacher Information

Fifth Grade Fall Lesson Mars Colony Test Garden



Today your 5th graders planted a Mars Colony Test Garden. This garden features a variety of salad vegetables that, together, would create a nutritionally balanced and beneficial salad that could be used to keep humans alive and healthy in space. Students learned about the need for a constant source of fresh food, the importance of fruits and vegetable for good health, and the characteristics of plants that would be necessary in designing a sustainable, isolated vegetable garden.

This garden supports the following California State Science and Social Science Standards:

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Please visit the garden throughout the season to see how your plants are doing. We will plan a harvest party in several months.