



Pre-K/Kindergarten Fall Lesson

Tops and Bottoms Salad Garden



Objective:

Students will learn that the vegetables they eat come from different parts of the plant, and they will be able to identify the primary parts of the plant and whether the vegetable grows above or below the ground.

California State Content Standards:

1. Science

2b: Students know stories sometimes give plants and animals attributes they do not really have.

2c: Students know how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).

4c: Describe the relative position of objects by using one reference (e.g., above or below).

2. Language Arts

2.0 Reading Comprehension.

Comprehension and Analysis of Grade-Level-Appropriate Text

2.2 Use pictures and context to make predictions about story content.

2.3 Connect to life experiences the information and events in texts.

2.4 Retell familiar stories.

2.5 Ask and answer questions about essential elements of a text.

Lesson Outline:

A. Read/review Tops and Bottoms book.

a. Eat different parts of plants

b. Bottoms = carrots, radishes = roots

c. Tops = lettuce = leaves

d. Middle = broccoli = flower buds

B. Garden Rules

C. Planting Plan

D. Plant

Materials:

Seeds: Carrots—Thumbelina or Nantes

Radish—Easter Egg or Cherry Belle

Lettuce—Red and Green varieties

Broccoli—DiCicchio

Lesson:

This lesson is based on the book “Tops and Bottoms” so you or the teacher must read the book before the lesson, and you must have the book on hand during the lesson. Point to the book throughout lesson to reinforce concepts. This lesson is best done as a question/answer (i.e. “When Bear said he wanted the tops of the plants, Rabbit tricked him by planting vegetables that only taste good on the bottom. What vegetables do we eat that grow under the ground on the bottom of the plant?”).

Today we are planting a special salad garden that will teach us about the different parts of plants that we eat when we eat a salad. Today you will each get to plant some vegetable seeds. Then, you will get to watch your garden grow for the next few months. In a few months, you will have a special party where you get to harvest all the vegetables from the garden and eat a delicious salad that you grew!

Your teacher will/has read you Tops and Bottoms, a story about a hard-working rabbit who wants to grow food and a lazy bear. Review basics of the story.

Like Rabbit in the Tops and Bottoms story, we are going to plant some vegetables that only taste good on the bottom, some that only taste good on top and some that we eat only the middle.

For the bottoms, we will plant carrots and radishes. Do we eat the leaves of the carrot or radish plant? (Point to pictures of carrot and radish leaves in book). No, we eat only the bottom or the “root” of the carrot and radish plant.

For the tops, we will plant lettuce. When we eat lettuce, we are eating the leaves of the lettuce plants. Do we eat the roots of the lettuce plants (point to picture of lettuce roots in book). No, we eat only the leaves.

For the middles, we will plant broccoli. In the book, Rabbit plants corn. We are not planting corn because it is not the right season for corn to grow. Corn only grows in very warm weather—during the summer. Is it summer? No, it is fall and winter. It is too cold to grow corn. Instead we will grow broccoli, which likes to grow in the cool weather of fall and winter. Broccoli is a “middle” because we eat the flower bud of the broccoli plant. We leave the roots and leaves of the broccoli plant and just cut the flower buds out of the middle to eat.

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 as in your classroom, like no running, yelling, climbing, apply in the garden as well.
- 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:

- Students will each get to plant one type of seed or plant

- We will assign each student the type of seed or plant they get to plant
- We will tell you where and how to plant your seed.
- It doesn't matter what you plant today—the entire class will share the garden harvest. You will get to taste everything planted today, and you will not have to eat anything you do not want to eat at the harvest party.

Planting Directions:

For all seeds: Make rows 6 inches apart and ¼ inch deep. Have students place seeds 1 inch apart in row. 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 students pinch dirt closed and gently pat down to cover rows after they place their seeds.



Teacher Information

PEP/Kindergarten

Fall Planting

Tops and Bottoms Salad Garden



This week your Kindergarteners will participate in the GrowingGreat Garden program. All activities through the GrowingGreat Garden program support California State Standards in science, language arts, or social studies. Here are the details for your fall planting:

This garden is based on the book Tops and Bottoms by Jan Stevens. Please read the book to your students before the planting. The story teaches students that the different vegetables they eat come from different parts of the plant. Just like Rabbit in the story, the students will plant “bottoms,” “tops,” and “middle” vegetables. Carrots and radishes are the “bottoms,” lettuces are the “tops,” and broccoli is the “middle.”

California State Content Standards:

1. Science

- 2b: Students know stories sometimes give plants and animals attributes they do not really have.
- 2c: Students know how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).
- 4c: Describe the relative position of objects by using one reference (e.g., above or below).

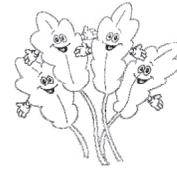
2. Language Arts

- 2.0 Reading Comprehension.
Comprehension and Analysis of Grade-Level-Appropriate Text
- 2.2 Use pictures and context to make predictions about story content.
- 2.3 Connect to life experiences the information and events in texts.
- 2.4 Retell familiar stories.
- 2.5 Ask and answer questions about essential elements of a text.

Please visit the garden throughout the season to watch the garden grow. We will plan a harvest party in several months when crops are ready.



First Grade Fall Lesson



Plant Part Salad

Objective:

Students will learn (1) that they eat different parts of plants when they eat vegetables, and (2) the primary parts of a mature flowering plant and their function.

California State Content Standards:

- 1) Science Standard 2b: Students know both plants and animals need water, animals need food, and plants need light.
- 2) Science Standard 2c: Students know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.
- 3) Science Standard 2e: Students know roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight.

Lesson Outline:

A. Lesson

- a. People eat plants—fruits, vegetables, grains
- b. Draw basic plant
- c. Label the plant parts and the vegetables we will plant
- d. Review what plants need to grow—soil, water, sun

B. Garden Rules

C. Planting Plan

D. Plant

Materials:

Seeds:

Carrots—Thumbelina, Nante or Babette

Radishes—Easter Egg or Cherry Belle

Swiss Chard—Bright Lights

Lettuce—Two varieties, one green and one red leafed

Broccoli--DiCiccio

Sugar Snap or Snow Peas—be sure they are pole variety, not bush, if you plan to have a climbing vine

Transplants (optional):

Edible Flowers—Pansies and/or Violas

Lesson:

****THIS LESSON IS BEST DONE USING A WHITEBOARD OR CHALKBOARD TO DRAW THE PLANT PARTS AS YOU TALK. ALSO USE QUESTIONS TO GET THEM TO GUESS WHICH VEGETABLE THEY EAT IS A ROOT v. LEAF, ETC.**

Today we are planting a special salad garden that will teach about the different parts of plants that we are eating when we eat a salad. Everyone will get to plant one type of seed or plant today. Then, you will get to watch your garden grow for the next few months. In a few months, you will have a special party where you get to harvest all the vegetables from the garden and eat a delicious salad that you grew!

When we eat fruits, vegetables and grains (like wheat in bread, rice, pasta), we eat many different parts of the plant. We will plant vegetables today that represent each of the five major parts of a plant—the roots, stems, leaves, flowers and seeds. Here are the vegetables we are planting (this is when you draw the picture—start by drawing a horizontal line for the ground and draw picture from the roots up or you may use a pre-drawn, labeled drawing):

Root – Carrots and Radishes – roots bring water up from the ground to the plant.

Stem – Swiss Chard – rainbow colored stems – stems support the plant.

Leaf – lettuces and swiss chard – make food for the plant from sunlight using “photosynthesis.”

Flower – Broccoli – the green balls are unopened flower buds. If not eaten, the buds grow into a big bouquet of yellow flowers. If you are doing transplants, pansies and violas are also edible flowers for in the salad—flowers attract pollinators like bees and butterflies to help the plant produce seeds that will grow another plant.

Seed – Peas – individual peas are the seed for the pea plant—you can show them that the peas from the seed package look just like dried out peas they would eat (remind them not to eat seeds because they are dirty) – seeds grow a new plant.

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 harvest.
- HAVE FUN!!!

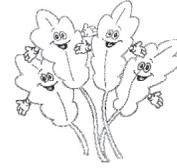
Planting Directions:

For all seeds: Make rows 6 inches apart and $\frac{1}{4}$ inch deep. Have students place seeds 1 inch apart in row. 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 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 and patting down dirt around it.



Teacher Information



First Grade Fall Lesson Plant Part Salad

Today your students planted a Plant Part Salad Garden. Students learned that when we eat vegetables, we are eating many different parts of plants. This garden features the many roots, stems, leaves, flowers, and seeds of plants that we eat. Your students planted radishes and carrots (roots), swiss chard (stems), lettuce and chard (leaves), edible flowers and broccoli (flowers), and peas (seeds).

California State Content Standards:

1.) Science

- 2b. Students know both plants and animals need water, animals need food, and plants need light.
 - 2c. Students know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.
 - 2e. Students know roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight.
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Please visit the garden throughout the season to see how your plants are doing. We recommend bringing your class to the garden weekly to observe which plant parts your students can identify. We will plan a harvest party in several months when the crops are ready.



2nd Grade Fall Lesson

Vegetable Cousins Salad Garden

Objective:

Students learn that all plants reproduce and understand that there are similarities and differences between two varieties of the same vegetable, as well as the differences between individual plants of the same variety.

California State Content Standards:

1. Science

2a: Understand organisms reproduce offspring of their own kind. The offspring resemble their parents and one another.

2d: Understand there is variation among individuals of one kind within a population.

2f: Understand flowers and fruits are associated with reproduction in plants.

If you do radish observation project:

4b: Measure length, weight, temperature, and liquid volume with appropriate tools and express those measurements in standard metric system units.

4c: Compare and sort common objects according to two or more physical attributes (e. g., color, shape, texture, size, weight).

4d: Write or draw descriptions of a sequence of steps, events, and observations.

4e: Construct bar graphs to record data, using appropriately labeled axes.

4f: Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.

4g: Follow oral instructions for a scientific investigation.

2. Social Science

2.4 Students understand basic economic concepts and their individual roles in the economy and demonstrate basic economic reasoning skills.

1. Describe food production and consumption long ago and today, including the roles of farmers, processors, distributors, weather, and land and water resources.
 2. Understand the role and interdependence of buyers (consumers) and sellers (producers) of goods and services.
 3. Understand how limits on resources affect production and consumption (what to produce and what to consume).
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Lesson Outline:

A. Lesson

- a. Similarities and differences among people from different families.
- b. Different types of specific fruits or vegetables are called “varieties.”

- c. Similarities and differences among vegetables and fruits of different varieties.
- d. Similarities and differences among vegetables and fruits of the same variety.
- e. Farmers choose which varieties to plant based on characteristics of different varieties and which characteristics consumers/customers will want to buy.

- B. Garden Rules.
- C. Planting plans.
- D. Plant.

Materials: At least 2 visibly different varieties of each vegetable

Seeds: Carrots – Thumbelina and Nante or Babette, or one of the new purple varieties of carrot if you can find the seeds!

Radishes – Easter Egg variety pack or Cherry Belle and French Breakfast

Lettuce – Two to four visibly different varieties (color and shape of leaves), i.e. Red Sails, Black Seeded Simpson, Lolla Rossa, Quatre Saisons, Oak Leaf

Broccoli – DiCiccio

Onion Bulbs – red and yellow or white

Peas—Sugar Snap (Cascadia) and Snow Pea (Oregon Sugar Pod I or II)

Transplants (optional):

Edible Flowers – Pansies or violas of different colors

Lesson:

Today we are planting a special salad garden that will teach us about the many different types of salad vegetables that you can try. Everyone will get to plant one type of seed or plant today. Then, you will get to watch your garden grow for the next few months. In several months, you will have a special party where you get to harvest all the vegetables from the garden and eat a delicious salad that you grew!

We will be planting a very special type of salad garden today—the Vegetable Cousins Salad Garden. Did you know that just like people from different countries and different families can look different, plants from the same family can look and taste very different. (Pointing to different kids in the class) We are all humans, but as I look around the room I see students with _____ (identify different characteristics of students—i.e. eye or hair color, straight v. curly hair, etc). That is because you all come from different families and have different family histories and ancestors.

Similarly, types of plants such as vegetables look different. Not all lettuces are alike—at the market you may see lettuce with all green leaves, leaves with some red on them, almost all red leaves, or lettuce with straight leaves and others with curly leaves. Radishes are the same way—we think of radishes as red, but there are white radishes, half-red/half-white radishes, even some that are white on the outside and red on the inside! These different kinds may taste different as well as look different. Different colors and shapes of vegetables are called “varieties.”

All the vegetables of the same “variety” look similar because they grow from seeds from parent plants of that same variety. Vegetables of the same variety share similarities, but they also can have differences. Just like people in the same family may look alike in some ways, but not look alike in other ways, vegetables of

the same variety are not all identical. Next time you are at the market, compare the different radishes in a bunch or the different carrots in a bunch. You will see that some are bigger, some smaller, some darker in color than others, some skinny v. some fat.

A farmer must decide which variety of plants he wants to plant. When he chooses he must consider many things—including which varieties would grow best on his farm and which varieties he thinks people would be most interested in buying. The farmer makes his money only when people want to buy the vegetables that he grows.

Today we will plant several different varieties of each vegetable so that you can see and taste their differences.

SHOWS PACKS OF SEEDS AS YOU TALK ABOUT THEM AND THEIR DIFFERENCES, for example:

Carrots – We will plant carrots that look like traditional carrots (Nante) and some that are little orange balls (Thumbelina), like an orange radish.

Radishes – Cherry Belle is a traditional round red radish v. French Breakfast is half red/half white.

Note: If you plant Easter Egg, they have several varieties in one packet ranging from all purple to all white.

Lettuce – Show the different varieties you will plant and highlight the differences.

Broccoli – We only plant one variety of broccoli, but when it grows you will see it looks different than the broccoli you buy in the store. Instead of one enormous head, it will have a small central head and lots of mini-broccoli heads. (There is also purple broccoli.)

Onions – Red v. white or yellow

Edible flowers – Pansies and violas come in a variety of different shapes, sizes and colors of flowers.

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 harvest.
- 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. 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; the top is pointy, the bottom has dried roots. Have them place the bulbs top side up in their holes. Once all the hole are filled with bulbs, 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.

Teacher Information



2nd Grade Fall Lesson

Vegetable Cousins Salad Garden

Today your 2nd graders planted a Vegetable Cousins Garden. This garden focuses on similarities and differences between two or more varieties of the same plant. We plant two or more varieties of radishes, carrots, edible flowers, and lettuce, along with other salad vegetables. This garden teaches to the California State Content Standards in Life Science. In addition, an expanded study program using radishes in the garden may be used to teach to the State Content Standards in Science Investigation and Experimentation and Math Measurement and Geometry. It can also be used to teach the Social Studies Content Standards in Economics on food production and competition among sellers, and connects to the year-long second grade focus on ancestors.

California State Content Standards:

1) Science—Life Science:

- 2a: Understand organisms reproduce offspring of their own kind. The offspring resemble their parents and one another.
- 2d: Understand there is variation among individuals of one kind within a population.
- 2f: Understand flowers and fruits are associated with reproduction in plants.

In addition, the radishes are a wonderful tool for scientific study to satisfy the Investigation and Experimentation Science Standards. Radishes have a thirty-day life cycle. By visiting the garden weekly, students can visually observe and their growth, stage of life cycle, and height. This study would allow the students to make a comparison between the two varieties and to master the life cycle of a plant. In addition, the students can make observations of animals and insects in the garden, weather conditions, and record soil and air temperature. The students can analyze the data they collect and look for relationships, differences, and trends.

The Radish Study supports the following California State Science Standards—Investigation and Experimentation:

- 4b: Measure length, weight, temperature, and liquid volume with appropriate tools and express those measurements in standard metric system units.
- 4c: Compare and sort common objects according to two or more physical attributes (e. g., color, shape, texture, size, weight).
- 4d: Write or draw descriptions of a sequence of steps, events, and observations.
- 4e: Construct bar graphs to record data, using appropriately labeled axes.

4f: Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.

4g: Follow oral instructions for a scientific investigation.

2) Math: This radish study could also be used to support State Math Standards

MEASUREMENT AND GEOMETRY

1.0 Students understand that measurement is accomplished by identifying a unit of measure, iterating (repeating) that unit, and comparing it to the item to be measured.

1.1 Measure the length of objects by iterating (repeating) a nonstandard or standard unit.

1.2 Use different units to measure the same object and predict whether the measure will be greater or smaller when a different unit is used.

1.3 Measure the length of an object to the nearest inch and/or centimeter.

3) Social Studies:

By planting multiple varieties of each vegetable, this garden can be used to support lessons on the Economic Standards. Why do farmers grow different varieties of the same vegetables? Why are scientists and farmers constantly developing new varieties of these same vegetables? Are the varieties available in markets today the same as our ancestors ate? How do different varieties create competition among food sellers? These questions relate to the following California State Social Studies Standards:

2.4 Students understand basic economic concepts and their individual roles in the economy and demonstrate basic economic reasoning skills.

1. Describe food production and consumption long ago and today, including the roles of farmers, processors, distributors, weather, and land and water resources.

2. Understand the role and interdependence of buyers (consumers) and sellers (producers) of goods and services.

3. Understand how limits on resources affect production and consumption (what to produce and what to consume).

Please visit the garden throughout the season to watch the garden grow. We will plan a harvest party in several months when crops are ready.



2nd Grade Radish Experiment

Objective:

Students collect data in the garden on radish growth rates and weather and then graph that data to learn about variation among individuals of a species, as well as develop their investigatory science and graphing skills.

California State Content Standards:

1. Science—Life Science

- 2d: Understand there is variation among individuals of one kind within a population.
- 4b: Measure length, weight, temperature, and liquid volume with appropriate tools and express those measurements in standard metric system units.
- 4c: Compare and sort common objects according to two or more physical attributes (e. g., color, shape, texture, size, weight).
- 4d: Write or draw descriptions of a sequence of steps, events, and observations.
- 4e: Construct bar graphs to record data, using appropriately labeled axes.
- 4f: Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.
- 4g: Follow oral instructions for a scientific investigation.

2. Math—Measurement and Geometry

- 1.0 Students understand that measurement is accomplished by identifying a unit of measure, iterating (repeating) that unit, and comparing it to the item to be measured.
 - 1.1 Measure the length of objects by iterating (repeating) a nonstandard or standard unit.
 - 1.2 Use different units to measure the same object and predict whether the measure will be greater or smaller when a different unit is used.
 - 1.3 Measure the length of an object to the nearest inch and/or centimeter.
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Materials:

Popsicle sticks
Rulers
Clipboards
Pencils
Student Data Observation Worksheet (sample attached)
Teacher Data Observation Worksheet (sample attached)
Weather Description Handout (attached)
Soil Thermometer
Weather Thermometer

Teacher Directions:

Once the seeds germinate, students go into the garden weekly or every other week for to record their observations. Ideally, the students continue their observations until the radish plants flower (approximately 3 months). Working alone or in small groups, students collect data and fill out their Data Observation worksheets for that day. Teacher should fill out her own master data observation worksheet. The teacher can have students use data from the master worksheet for graphing at the end or use the master data for filling in information in individual student worksheets where students have been absent or have incomplete or incorrect data.

Preparation:

1. Place popsicle stick, labeled with the plant name, next to one of each type of radish plant. Instruct students to observe the same plant every time.
2. Place soil thermometer in vicinity of the two labeled radish plants (but far enough away so that groups of students can be doing soil temperature observation at same time as others are doing radish observation) for measuring soil temperature. Ideally, the thermometer stays in the garden at all times, or it can be placed early on the day of the observation. The thermometer will need to be in place for some time before students come out in order for it to reflect the temperature accurately.
3. Place an outdoor weather thermometer in the garden for measuring air temperature.
4. Have blank worksheets on clipboards for students.
5. Have students bring a pencil into the garden.
6. Have several Weather Description handouts available for students to review in the garden (preferably laminated or protected in plastic covers).

Instruction:

1. In classroom, review how to fill out the worksheet and explain the procedures. A good system is to have students do their observations as a rotation between 4 stations: Radish Observation, Soil Thermometer and Air Thermometer, wildlife observation. Divide students among the stations to begin, and then call out rotation times in the garden to keep students on task. Students that finish early can explore the garden and add any additional wildlife observations to the worksheet.
2. In the garden, instruct students on how to read the thermometers and how to use a ruler to measure the height of the radish plants.
3. In the garden, review how to use the weather description handout to describe weather. Students should choose at least one word from three of the four columns (three words total).
4. Once students are finished collecting data, the teacher can teach them to graph the radish growth, soil and air temperature data. By reviewing the graphs of the radish growth and the variations in soil and air temperature, students can make a number of connections: (1) see that there is variation among individuals of a species, (2) significant changes in temperature (heat waves or cold fronts) can correspond with faster or slower growth, and (3) soil temperature changes over time.

Student name: _____

Today's date: _____



GARDEN OBSERVATIONS

PLANTS



Radish #1

1. Stage in life cycle: _____

2. How many weeks old? _____

3. Plant Height: _____

Radish #2

1. Stage in life cycle: _____

2. How many weeks old? _____

3. Plant Height: _____

4. Detail drawing with labels:

ANIMALS



1. What animals did you see in the garden today?

2. Where did you find animals?

3. Draw an animal you found:

WEATHER

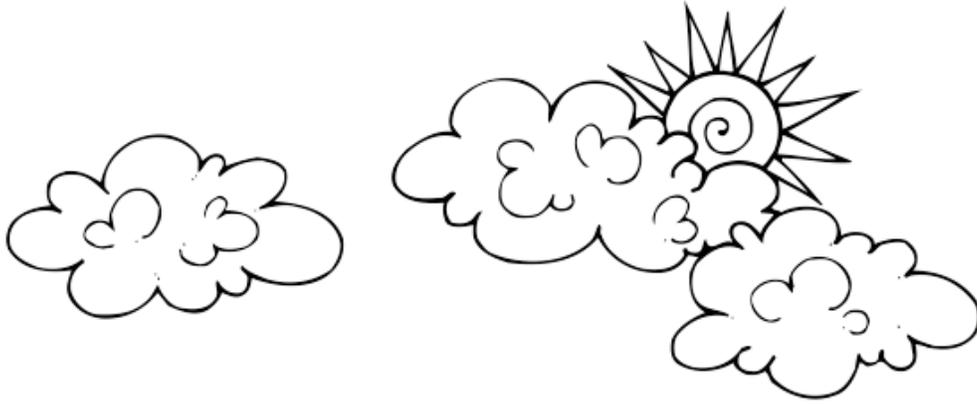


1. Air temperature: _____

2. Soil temperature: _____

3. Describe the weather today:

Weather Descriptions



hot

calm

dry

sunny

warm

breezy

moist

partly cloudy

cool

windy

drizzly

cloudy

cold

rainy

foggy





Third Grade Fall Lesson

Endangered Species Salad Garden

Objective:

Students learn that many of the traditional varieties of vegetables planted by our ancestors, using seeds saved and passed on each year, are in danger of becoming extinct because modern farmers plant primarily modern, hybridized seed. Students learn about the traditions of saving seed, the importance of biodiversity in our food chain, and plant and taste heirloom varieties of common salad vegetables.

California State Content Standards:

1) Sciences – Life Science

3. Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:

- a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.
 - d. Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.
 - e. Students know that some kinds of organisms that once lived on Earth have completely disappeared and that some of those resembled others that are alive today.
-

Lesson Outline:

A. Lesson

- a. Our ancestors ate different varieties of vegetables than we eat today.
- b. These traditional varieties, called “heirloom varieties,” are in danger of becoming extinct because no one is planting them and saving their seeds each year.
- c. Modern v. traditional farming.
- d. Biodiversity in agriculture is important.
- e. Heirloom varieties of vegetables have many special attributes.

B. Garden Rules

C. Planting Plan

D. Plant

Seeds: Try to use open-pollinated, heirloom varieties of seeds.

Carrots – Nante, plus one of the new purple varieties of carrot if you can find the seeds! Carrots were originally all purple so this is the renaissance of a long lost variety

Radishes – French Breakfast

Lettuce – Two to four different heirloom varieties, such as Black Seeded Simpson, Lolla Rossa, Quatre Saisons, Oak Leaf, Speckles

Broccoli – DiCiccio

Transplants (optional):

Edible Flowers – King James violas are an heirloom variety still commercially available

Lesson:

Today we are planting a special salad garden that we call our Endangered Species Salad Garden. This garden will teach you why certain varieties of vegetables are in danger of becoming extinct and what we can do to save them. Everyone will get to plant one type of seed or plant today.

1) Many different varieties of vegetables exist – imagine the supermarket or farmers market (take suggestions of different varieties) – all green lettuce v. red-leafed lettuce, red onions v. yellow onions, red potatoes v. white potatoes, etc.

2) Endangered Species of Vegetables – some vegetable varieties are in danger of becoming extinct.

- a. Who knows what an “Endangered Species” is? (TAKE ANSWERS). An endangered species is a species of animal or plant that is “in danger” of dying out and no longer living on this earth. We think of this usually in terms of animals such as the Panda or Tiger—if the last tiger dies without reproducing a baby tiger, tigers would be extinct and there would never be another tiger on this earth. This is something you will spend more time studying this year.
- b. Plants can be endangered as well. We know that plants reproduce from seeds.
 - i. If a plant grows in only one place and we pave that field and turn it into a shopping mall, could that plant become extinct? Yes!
 - ii. What if the seeds of a certain plant never get planted, could that plant become extinct? Yes!
 - iii. Seeds do not last forever—most seeds will not grow into a plant after several years. If a person collects all the seeds for a plant and never plants them, after several years those seeds will die and that plant will become extinct. This is exactly how certain varieties of vegetables, such as types of lettuce or carrots that were planted long ago, are in danger of becoming extinct—farmers are no longer planting some types of vegetable seeds.
- c. We call this our Endangered Species Salad Garden because we are going to plant several of these traditional varieties of vegetables that are no longer being planted by farmers today.

3) Modern v. Traditional Farming.

- a. **Farming in history--People grew their own food.** Not so long ago (100 years only!),

2

there were no supermarkets—people grew all or most of their own food. There were also no plant nurseries or hardware stores like Home Depot where they could buy seeds. Families grew vegetables for themselves and to share with neighbors. They grew the varieties of vegetables that grew best on their land and that they thought tasted the best.

- b. **Saved seeds.** So that they could keep growing their favorite vegetables year after year, farmers saved seeds each year to replant the following year. They did this by not harvesting the vegetables from some of their plants so that those plants could produce seeds. Then they collected the seeds from those plants and saved them in a cool, dark place until the next growing season.
- c. **Travelling seeds.** If they moved, they would bring the seeds with them, and they would share their favorite seeds with friends and family. Many of the vegetables we eat today first were brought to America by immigrants who brought their favorite seeds with them from their home countries—broccoli, carrots, radishes all came to America from Europe.
- d. **Heirloom Vegetables.** These old varieties are called “heirloom vegetables,” which means something valuable passed down through families.
- e. **Modern farmers** don’t plant these old-fashioned or heirloom varieties of plants because they are no longer just growing food for their families.
 - i. The food we get from the market comes from giant farms very far away from our cities. The vegetables have to be able to (1) travel great distance without rotting, (2) be strong enough to be handled by machines harvesting in the field and boxing it up for the market, and (3) be resistant to pests and diseases that are more difficult to control on a giant modern farm.
 - ii. Most old fashioned varieties are best fresh picked and eaten that day so they do not work well for large farms and supermarket sales. They also may be more susceptible to certain pests or plant diseases that are more present on large farms.
 - iii. Because modern farmers no longer plant these heirloom varieties, they are in danger of becoming extinct.
 - iv. Problem—biodiversity in agriculture is important because if only one type of lettuce is grown and it gets a disease or pest problem, the entire crop could be wiped out and there could be food shortages. Having many varieties of vegetables growing helps ensure that no one pest, plant disease or unusual weather pattern will risk killing off all of the plants on a farm.

4) Saving Heirloom Varieties. Just like with animals, people are worried about losing traditional varieties so are working hard to save and keep growing these heirloom vegetable seeds. Also, many people are rediscovering that these heirloom vegetables taste better and are more interesting to grow. Small, local farmers grow them and sell them at Farmers Markets directly to customers; families grow them in their vegetable gardens in their yards. We are going to plant some of these heirloom varieties ourselves to see if we think they are any better. I am going to tell you how long the varieties of vegetables we are going to plant have been being grown. Remember this does not mean that the seeds we are planting are 100 years old!!! It means that people have been saving seeds and replanting the seeds each year for 100 years.

- Radish – French Breakfast; came to US from France in 1880 – over 120 years
- Carrot – Nantes; came from Europe in late 1800s – over 100 years (purple carrots – carrots originally came from Persia, which is now Iraq and they were purple. Today they are reintroducing purple carrot seeds)
- Broccoli – DiCiccio; came from Italy 1890 – over 110 years

- Lettuce – Oakleaf; Maryland and Pennsylvania 1880s, over 120 years; Speckles/Freckles – Pennsylvania in 1799, over 210 years; Black-Seeded Simpson – 1850, over 150 years; Quatre Saison (French for “Four Seasons”) – from France in 1885, over 115 years
- Edible flowers – Violas and Pansies became very popular in early 1900s – over 100 years.

Garden Rules:

1. **IMPORTANT REMINDER** Plants can be poisonous: Plants and flowers in the school garden are safe for eating because we plant them specifically 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:

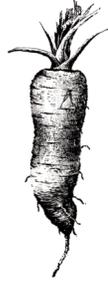
- You will each get to plant one type of seed or plant.
- We will assign each of you the type of seed or plant you get to plant.
- We will tell you where and how to plant your type of seed or plant.
- It doesn't matter what you plant today—the entire class will share the garden.
- HAVE FUN!!!

Planting Directions:

For all seeds: Make rows 6 inches apart and ¼ inch deep. Have students place seeds 1 inch apart in row. For most control, you can hold seeds and have 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 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.

Teacher Information



Third Grade Fall Lesson Endangered Species Vegetable Garden

Today your 3rd graders planted an Endangered Species Vegetable Garden. This garden features “endangered,” or “heirloom,” species of salad vegetables including radishes, carrots, broccoli and four different varieties of lettuce. This garden project teaches students that few people today grow their own vegetables. We rely on produce that is grown by large-scale farms, which primarily grow modern, hybridized varieties of vegetables designed to be resistant to insects/disease, withstand travel and extensive handling and packaging, and have a long shelf life. Traditional heirloom varieties of vegetables do not meet these requirements. As a result, many varieties of vegetables that our ancestors planted are sadly at risk of being lost forever. These heirloom vegetables are valuable because of the historical tradition of passing down seeds through the generations, and also because they are often the tastiest and most nutritionally potent of all vegetable varieties. Without people like us to plant these seeds, we would lose them forever!

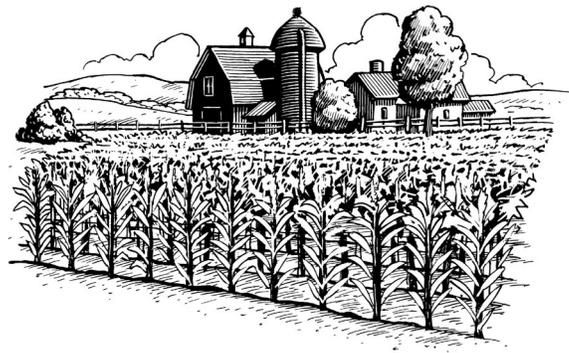
California State Content Standards:

1) Sciences – Life Science

3. Adaptations in physical structure or behavior may improve an organism’s chance for survival. As a basis for understanding this concept:

- a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.
 - d. Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.
 - e. Students know that some kinds of organisms that once lived on Earth have completely disappeared and that some of those resembled others that are alive today.
-

Please visit the garden throughout the season to watch the garden grow. We will plan a harvest party in several months when crops are ready.



Fourth Grade Fall Lesson

California Agriculture Salad Garden

Objective:

Students will learn how important California agriculture and farmers in their daily life and for the rest of the United States and the world. They will learn about the different California agricultural regions and why they are important.

California State Content Standards:

1.) Life Sciences

2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:

- a. Students know plants are the primary source of matter and energy entering most food chains.
- b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.
- c. Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.

3. Living organisms depend on one another and on their environment for survival.

As a basis for understanding this concept:

- a. Students know ecosystems can be characterized by their living and nonliving components.
- b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
- c. Students know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.
- d. Students know that most microorganisms do not cause disease and that many are beneficial.

2) Social Sciences

4.1 Students demonstrate an understanding of the physical and human geographic features that define places and regions in California.

3. Identify the state capital and describe the various regions of California, including how their characteristics and physical environments (e.g., water; landforms, vegetation, climate) affect human activity.
4. Identify the locations of the Pacific Ocean, rivers, valleys, and mountain passes and explain their effects on the growth of towns.
5. Use maps, charts, and pictures to describe how communities in California vary in land use, vegetation, wildlife, climate, population density, architecture, services, and transportation.

Lesson Outline:

1. Define Agriculture
2. Agriculture is important in student's daily lives.
3. Agriculture is an important industry in California.
4. California agriculture is important for the entire United States and the world.

Seeds/Supplies:

Seeds:

Carrots – Nante or Babette

Cabbage

Lettuce – Two to four visibly different varieties (color and shape of leaves), i.e. Red Sails, Black Seeded Simpson, Lolla Rossa, Quatre Saisons, Oak Leaf

Broccoli – DiCiccio

Onion Bulbs – red, yellow or white

Peas – Sugar Snap (Cascadia) or Snow Pea (Oregon Sugar Pod I or II)

Spinach – Bloomsdale

Transplants (optional):

Edible Flowers—Pansies or violas of different colors

Lesson:

Today we are planting a special salad garden that will teach us about California Agriculture. Farming and California agriculture is very important in your daily life, as well as in the lives of people throughout the US and the world.

1. Definition of Agriculture: practice of growing or raising plants or animals for our use or consumption—farming of fruits and vegetables, raising livestock or dairy cows for milk, meat and leather; forestry and nurse plants for landscaping and floral markets.
2. Agriculture is a huge part of your daily life. In many ways, agriculture has touched your life today through the food you eat, clothes you wear, and things you do. Let's walk through your day and see all the agriculture links
 - a. Wake up in the morning—sleep on cotton sheets; put on clothes of cotton, wool, and leather shoes; brush your teeth with toothpaste or use lotion that have plant ingredients (seaweed in toothpastes, herbs for flavoring or scent, vegetable oils in lotions).
 - b. Breakfast—all food and drink—orange juice, milk, eggs, wheat or corn in cereal, wheat toast, strawberry jam
 - c. Drive to school—leather or fabric seats
 - d. At School--paper you write on and in books, ink in your pens, wood tables, wood in buildings, lunch you eat.
 - e. Afterschool--leather soccer balls, any snacks, etc.
 - f. Yet, only 2% of U.S. population grows all these agricultural items for the rest of us!
3. Agriculture is a very important industry in California.
 - a. Quiz: True or False

- i. Agriculture is one of California's leading industries --True.
 - ii. California is the #1 farming state in the United States --True.
 - I. California produces almost double the value of crops as Texas, which is the #2 farming state.
- b. If California was its own country (like France or Germany, instead of part of the United States), California would be one of the Top 5 agriculture producing countries in the whole world!!
- c. Why is California such a big agricultural state? Mainly because of our weather. We can grow many vegetables all year long. In most other states, such as Ohio or Massachusetts or New York or Colorado, you can not grow vegetables in the winter because the ground freezes. Those states must import their vegetables from California or other countries during the winter season.
 - i. Some fruits and vegetables harvested year round in California: lemons, artichokes, avocados, broccoli, cabbage, carrots, cauliflower, lettuce, spinach, celery, mushrooms, squash.
- d. California agriculture is also very big because California is such a large state with diverse geography in its various regions—each region can produce different crops because it has such different climates. Below are some important crops in each region.
 - i. Southern Coast—lettuce, strawberries, oranges, broccoli
 - ii. Southern Interior—desert—cattle, alfalfa and wheat and other grains, melon, lettuce
 - iii. Central Valley—grapes, poultry, cotton, tomatoes, almonds, peaches, cattle, oranges, beef, milk, pistachios, walnuts,
 - iv. Central Coast—artichokes, lettuce, broccoli
 - v. Northern Coast—cattle, sheep, apples, pears
 - vi. Northern Interior—rice, forestry, cattle, apples, pears
- 4. California Agriculture is important nationwide and worldwide.
 - a. What do all of these items have in common? California produces 99% of all of these crops that are grown in US. For some crops, we produce the large majority of that crop for the rest of the world.
 - 1. Almonds (80% of total world production)
 - 2. Artichokes
 - 3. Dates
 - 4. Figs
 - 5. Kiwi
 - 6. Olives
 - 7. Pistachios (2nd Largest producer in world)
 - 8. Pomegranates
 - 9. Raisins
 - 10. Prunes (70% of total world production)
 - 11. Walnuts (60% of total world production)
 - b. California produces 75% or more of many crops consumed in U.S.: lettuce, broccoli, carrots, tomatoes, melons, grapes, strawberries.
- 5. Today we are planting some of the vegetables that grow year round in California.
 - a. Carrots, cabbage, lettuce, spinach, peas and onions
 - b. Edible flowers—great in our salads and they represent an important type of coastal California agriculture—nursery plants and flowers

Garden Rules:

- 1. IMPORTANT REMINDER** Plants can be poisonous: Plants and flowers in the school garden are safe for eating because we plant them specifically 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 ¼ 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 ¼ 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 is 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 vs. pulling out of pot by neck of plant), and placing in hole, adding and patting down dirt around it.



Teacher Information

Fourth Grade Fall Lesson

California Agriculture Garden



Today your 4th graders planted a California Agriculture garden. This garden features varieties of vegetables that are important California agricultural crops. Agriculture is important because it touches nearly every part of our daily lives from the clothes we wear to the food we eat. California is the most productive (and important) agricultural state in the United States. In fact, the Central Valley of California is often referred to as the “bread basket” of the U.S. Due to the moderate climate of California, we are able to plant crops year-round. Not only is California agriculture important to the U.S., but it also produces important crops that are exported to other countries. The 4th Graders planted a number of important vegetables that farmers all across California grow including lettuce, broccoli, carrots, spinach, cabbage, radishes, and onions.

California State Content Standards:

1.) Life Sciences

2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:

- a. Students know plants are the primary source of matter and energy entering most food chains.
- b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.
- c. Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.

3. Living organisms depend on one another and on their environment for survival.

As a basis for understanding this concept:

- a. Students know ecosystems can be characterized by their living and nonliving components.
- b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
- c. Students know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.
- d. Students know that most microorganisms do not cause disease and that many are beneficial.

2) Social Sciences

4.1 Students demonstrate an understanding of the physical and human geographic features that define places and regions in California.

3. Identify the state capital and describe the various regions of California, including how their characteristics and physical environments (e.g., water, landforms, vegetation, climate) affect human activity.
4. Identify the locations of the Pacific Ocean, rivers, valleys, and mountain passes and explain their effects on the growth of towns.
5. Use maps, charts, and pictures to describe how communities in California vary in land use, vegetation, wildlife, climate, population density, architecture, services, and transportation.

Please visit the garden throughout the season to watch the garden grow. We will plan a harvest party in several months when crops are ready.



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!!!
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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.
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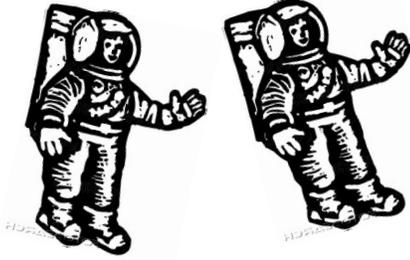
Planting Directions:

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.

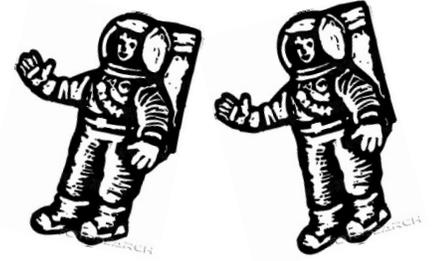
For transplants: Assign 2-3 students to each transplant. Plant transplants one foot apart. Students to take turns digging hole (remind them only as deep as potted transplant), removing transplant from pot (turn upside down and tap, catching plant as it falls out v. pulling out of pot by neck of plant),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

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 (CO₂) 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).
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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.