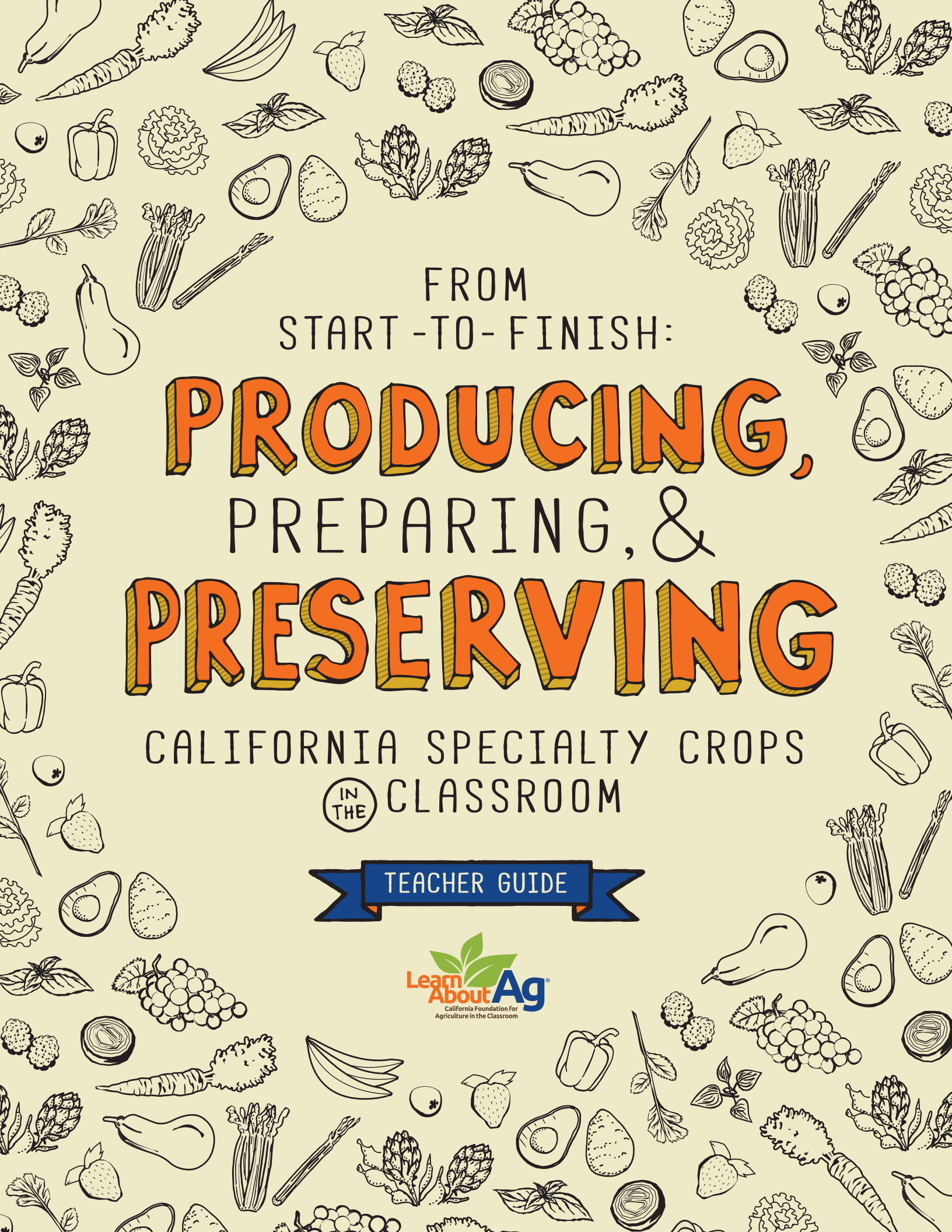

FROM
START-TO-FINISH:

PRODUCING, PREPARING, & PRESERVING

CALIFORNIA SPECIALTY CROPS IN THE CLASSROOM

TEACHER GUIDE

Learn About Ag®
California Foundation for Agriculture in the Classroom

FROM START TO FINISH

PRODUCING, PREPARING, AND PRESERVING CALIFORNIA SPECIALTY CROPS IN THE CLASSROOM

TABLE OF CONTENTS:

Learn About Ag®
California Foundation for Agriculture in the Classroom

VISION: An appreciation of agriculture by all.

MISSION: To increase awareness and understanding of agriculture among California's educators and students.

AUTHOR: Mandi Bottoms, *California Foundation for Agriculture in the Classroom*

FOR TEACHERS:

California Foundation for Agriculture in the Classroom creates and distributes resources to help students discover the many ways agriculture impacts their daily lives. The activities on the following pages are aligned to the Common Core and Next Generation Science Standards. Visit www.LearnAboutAg.org/StartToFinish for additional resources, including an answer key, lesson plans, and related videos.

ACKNOWLEDGMENTS

California Foundation for Agriculture in the Classroom is dedicated to fostering a greater public knowledge of the agriculture industry. The Foundation works with K-12 teachers and community leaders to help young people make informed choices by incorporating agricultural examples into classroom curriculum.

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UNIT OVERVIEW

Brief Description

This three-lesson unit for grades five through eight is designed to teach students about producing, preparing, and preserving California agricultural commodities, while fostering an appreciation for how fruits and vegetables "start" in the field and "finish" at the table. Lessons include inquiry-based, real life challenges that engage students in a meaningful way, as they discover the story behind how their food is produced.

These lessons can be used separately or together and may be taught in any order. In the first lesson, *Get Growing*, students will use engineering design principles to solve a realistic planting problem. The lesson also includes related multi-step math problems that farmers face daily. In the second lesson, *Tasty Testing*, students will use map skills to discover the geographic regions where basil, oregano, and cilantro have cultural significance. An herb observation and taste test will challenge students to use their senses when comparing common herbs. In the third lesson, *Preserving the Powerful Pepper*, students will investigate how probiotics play a part in preservation and create their own probiotic food. Finally, three fact and activity sheets are included on green (snap) beans, herbs, and bell peppers. The fact sheets include information about commodity production, history, nutrition, top producing counties, and economic values. The activity sheets provide specific lesson ideas and fun facts for each topic. To extend the lessons, student workbooks with independent reading and activities are available. Videos featuring California farmers demonstrating how bell peppers, green beans, and herbs are produced, preserved, and prepared are available at *LearnAboutAg.org.*

California Standards

A concerted effort to improve student achievement in all areas has impacted education throughout California. The California Foundation for Agriculture in the Classroom provides educators with numerous resource materials and lessons that can be used to teach and reinforce the current education standards for California Public Schools including Common Core and Next Generation Science Standards. The lessons encourage students to think for themselves, ask questions, and acquire problem-solving skills while learning the specific content needed to better understand the world in which they live.

This unit includes lessons that can be used to teach and reinforce many of the educational standards covered in grades five through eight. It can be used as a self-contained unit, to enhance themes and lessons already in use, or can provide technical information about nutrition and agriculture.

LESSON TITLE:

GET GROWING

Grade Level: 5-8
THREE OR FOUR
50-MINUTE LESSONS

LESSON OBJECTIVES:

- **Students will know planting specifications for green bean seeds.**
- **Students will design a green bean planter that meets set criteria and constraints.**
- **Students will solve mathematical challenges related to agricultural production.**
- **Students will understand the importance of engineering in agricultural production.**

STANDARDS

- NGSS: 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.

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

- NGSS: 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.

- CC Math: 5.NBT.5: Fluently multiply multi-digit whole numbers using the standard algorithm.

- CC Math: 5.NBT.7: Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

- CC Math: 5.MD.1: Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

- CC Math: 6.NS.2: Fluently divide multi-digit numbers using the standard algorithm.

- CC Math: 6.RP.3: Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

- CC Math: 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.

GET GROWING

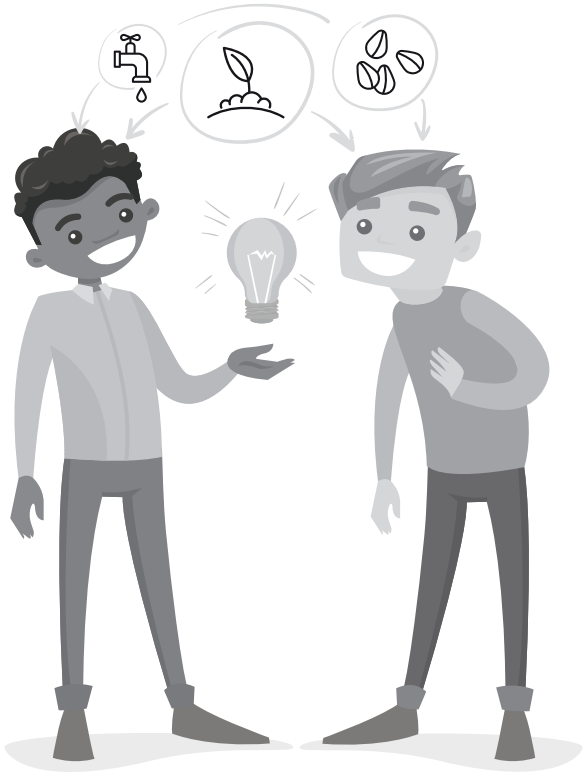
MATERIALS

- Chart paper or blackboard, with markers or chalk
- Handout: *The Planter Challenge* (one per student)
- Green bean seeds (one packet per group)
- Materials that can be used to create a simple machine. Choose some of the following: duct tape, clear tape, straws, toilet paper tubes, small and large cups, corrugated cardboard, plastic wrap, tin foil, newspaper, scissors, single-hole punch, paper clips, rubber bands, washers, wooden skewers, brass fasteners, string, card stock.

BACKGROUND INFORMATION

Green beans, also called snap beans, are edible pod beans that can be grown as bush beans or pole (climbing) beans. California farmers primarily plant bush beans. The seed is planted as early as March and as late as August, depending on first and last frost.

Seed is planted mechanically by a tractor pulling a machine called a planter. Planters place each green bean seed an optimal distance apart to yield the most beans per acre. The planter looks very complex, yet the basic concept is a simple machine that makes production of green beans more efficient and easier for the farmer. The beans are planted at 80 pounds per acre, two lines (rows) per 38-inch bed at six to eight seeds per foot. There are approximately 2,000 seeds per pound, depending on seed size.



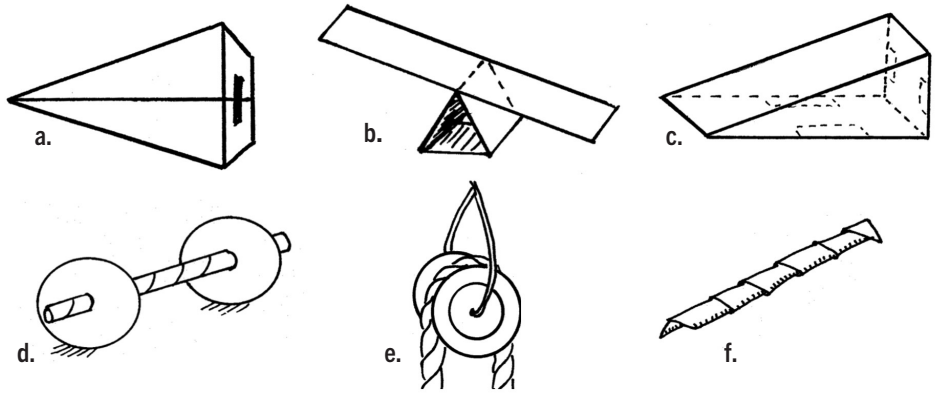
In this lesson, students will design a simple green bean planter. They will complete the design process by defining the problem, developing possible solutions, and improving their design. By the end of the lesson, students will appreciate how simple

machines make life easier.

PROCEDURE (PART 1)

1. Introduce the challenge. Tell students they will be building a green bean planter that will mechanically drop three or more seeds onto a piece of masking tape.

2. Engage students by reviewing the six types of simple machines. Write the names of each simple machine on the board, and invite students to give examples for each. If possible, also show an



example of each simple machine.

a. Wedge: Used to separate two objects, lift an object, or hold an object in place. *(Example: rubber door stop)*
b. Lever: Used to move an object or lift a load. *(Example: pliers)*
c. Inclined Plane: Used to lift or lower a load. *(Example: slide)*
d. Wheel and Axle: Used to reduce friction when an object is moved horizontally. *(Example: bicycle)*
e. Pulley: Used to reverse the direction of the lifting force—if you want to lift something up, you use force to pull down. *(Example: flagpole)*
f. Screw: Used to compress two objects or hold an object in place. *(Example: a jar and lid)*

3. Show students the materials and ask, *"How can you make a simple green bean planter from these materials?"* Give students additional design parameters and performance parameters:

a. The seeds must be dropped by the machine.
b. The seeds must be dropped in intervals.
c At least one simple machine must be employed.
d. You may only use the materials provided to the class.

After discussing their ideas, distribute *The Planter Challenge* handout and instruct students to complete the *Brainstorm and Design* section.

4. Have students explain their initial planter design to groups of three or four students. After each individual idea is explained, have the student groups create a group prototype which could include selecting one design to move forward with, or combining pieces from multiple student designs and creating a new prototype. Have students draw their proposed group design on *The Planter Challenge* handout.

5. Allow students 20 minutes to build and test their prototype. Remind students to follow their group prototype design, testing periodically and redesigning as necessary. Design problems and

solutions must be noted on *The Planter Challenge* handout in the *Build, Test, Evaluate, and Redesign* section. If needed, adjust time and material constraints to meet the needs of the students.

6. Evaluate student designs by having groups demonstrate their planter prototypes and determine if they meet design parameters and performance expectations.

7. Invite students to share their designs and how they solved any problems that came up. Emphasize the key themes in this challenge—using simple machines and achieving precise results—by asking questions such as:

a. *What limited your design solutions?*
b. *What methods did you use to move the seed precisely onto the target row?*
c. *What strategies were successful for planting one seed at a time?*
d. *How did your understanding of simple machines influence the design of your planter?*

8. Instruct students to complete the *Reflection* section on *The Planter Challenge* handout. Assess student work for completeness and accuracy.

PROCEDURE (PART 2)

1. Explain to students that having access to a machine that plants green bean seeds is important to farmers. Additionally, there is a great amount of planning that needs to happen before the planter can enter the field.

2. Distribute *The Math Challenge* handout. Read the introduction together, and instruct students to solve the problems independently.

3. Lead a class discussion on why we use machines and how long it would take students if they had to plant the seeds by hand. Have students synthesize information and share the importance of using machines in agricultural production.

VARIATION

Take the lesson outside and have students test their planter prototypes in a garden bed. Cover the seeds with soil and apply water. Routinely care for the plants and enjoy a harvest of green beans.

EXTENSIONS

• YouTube hosts a variety of videos that show commercial green bean planters in action! Share one of these videos with your students, then create a simple Venn diagram to illustrate the similarities and differences between student designs and commercially adopted designs.

• Gather different types of green bean seeds and classify them according to size, coating, color, etc.

• Explain to students that engineers must be mindful of design costs. Have students determine the cost of their prototype.

MATH CHALLENGE ANSWER KEY:
(FOR PAGE 10)

1. 6,580,000 seeds	**4. 2,047,320 square feet**
2. 3,290 pounds	**5. 31 miles**
3. $24,675.00	**6. 5 hrs and 10 mins**

THE PLANTER CHALLENGE

INTRODUCTION:

ADDITIONAL PARAMETERS AND EXPECTATIONS:

- The seeds must be dropped by the machine
- The seeds must be dropped in intervals
- At least one simple machine must be employed
- You may only use the materials provided to the class

1. How will the planter move down the row?

2. What's the best way to make a single seed drop?

3. How will you direct the seed onto the masking tape?

Use the materials to build your planter. Then test it by adding seeds and dropping them in a line. When you test, your design may not work as planned. When engineers solve a problem, they try different ideas, learn from mistakes, and try again. The steps they use to arrive at a solution is called the design process. Study the problems and then redesign.

FOR EXAMPLE, IF...

DESIGN PROBLEMS	OUR SOLUTIONS

REFLECTION

Name: _____ Date: _____ Class: _____

THE MATH CHALLENGE

INTRODUCTION: FARMERS USE A SIGNIFICANT AMOUNT OF MATH IN THEIR DAILY OPERATIONS. SOLVE THE PROBLEMS BELOW. SHOW YOUR WORK AND INCLUDE UNITS IN YOUR ANSWERS.

1. A farmer is planting a 47-acre field of green beans. How many seeds must be purchased if the farmer plants 140,000 seeds per acre?

2. Green bean seeds are sold in pounds. There are approximately 2,000 seeds per pound, depending on seed size. How many pounds should the farmer purchase?

3. The price of green bean seed is $37.50 for a five-pound bag. How much will it cost to plant the entire field?

4. An acre is an area of land equivalent to 43,560 square feet. What is the area, in square feet, of the farmer's field?

5. There are 351 rows in the field. Each row is 1,400 feet long. The planter can plant three rows at the same time. How many miles will the tractor drive to plant the entire field? *Hint: There are 5,280 feet in one mile.*

6. If a tractor travels at 6 MPH, how long will it take to plant the entire field?

LESSON TITLE:

TASTY TESTING

Grade Level: 5-8
TWO 50-MINUTE LESSONS

LESSON OBJECTIVES:

- **Students will know the geographic regions where basil, oregano, and cilantro have cultural significance.**
- **Students will understand the role of evaporation in herb drying.**
- **Students will recognize the different properties of dried and fresh herbs.**

STANDARDS

- NGSS: MS-LS-1.8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
- CA History-Social Science: 6.1.2: Identify the locations of human communities that populated the major regions of the world and describe how humans adapted to a variety of environments.
- CC Math: 5.G.1: Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates.
- CC Math: 5.G.2: Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
- CC ELA: Grades 5-8.1: Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- CC ELA: Grades 5-8.7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

TASTY TESTING

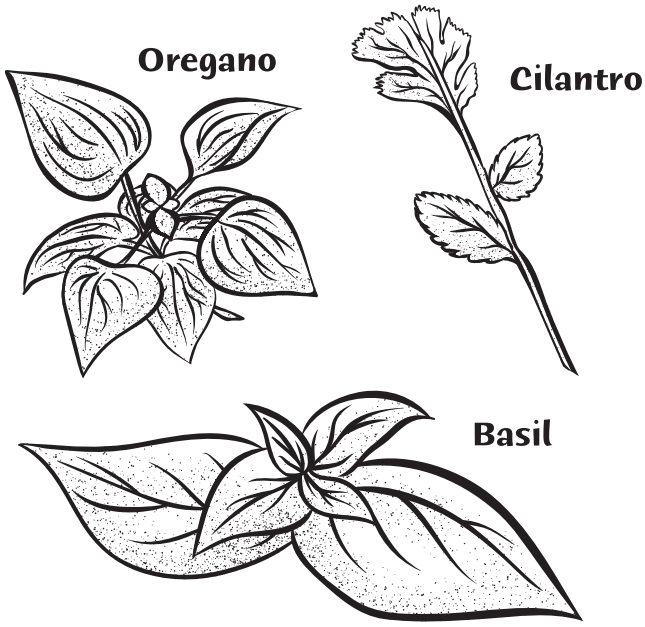
MATERIALS

- Chart paper or blackboard, with markers or chalk
- Student text: *The Wonderful World of Herbs* (one per student)
- Ruler (one per student)
- Handout: *Herb Observation Rubric* (one per student)
- Dried herbs: oregano, cilantro, and basil
- Fresh herbs: oregano, cilantro, and basil
- Small sampling cups (six per student or pair of students)

BACKGROUND INFORMATION

Herbs are plants useful for culinary, cosmetic, industrial, medicinal, landscaping, decorative, and fragrance purposes. They are different than spices. Herbs are typically leafy green or flowering plants, while spices are dried seed, bark, berries, or fruit and are often ground.

The use of plants as herbs has been important to all cultures since long before history was recorded. Hundreds of tribal cultures have used wild and cultivated herbs for religious, medicinal, and food purposes for thousands of years. As civilizations developed so did the knowledge for the use of herbs. Today, culinary herbs are often used in dried and fresh forms. Fresh herbs can be found in grocery stores or backyard gardens, but have a relatively short shelf-life. Dried herbs allow for storage and year-round availability. In this lesson, students will learn about three specific herbs that are commonly found in student kitchens: basil, oregano, and cilantro.



PROCEDURE (PART 1)

1. Ask learners:
    - *Which herbs does your family cook with at home?*
    - *What herbs are in foods you like?*

2. Record responses on chart paper. At this point, students may respond with herbs or spices. That's okay, accept all responses. Record responses in two columns, with spices on one side and herbs on the another. Do not label the columns. After adequate time brainstorming, ask students, *"What heading would you place above these columns?"* Explain the difference between herbs and spices. Tell students that today they will be exploring herbs around the world.

3. Distribute the student text titled, *The Wonderful World of Herbs*. Students will read the text and answer related questions. Allow students 5-10 minutes to complete the fill-in-the-blank portion of the activity.

4. Review answers and facilitate related discussion.

5. If necessary, demonstrate how to find coordinates on a map. As a class identify the x-axis (the equator) and the y-axis (the prime meridian). Review the points of a compass and their related quadrants. Students will integrate the information from the text with the latitude and longitude coordinates to plot and label each location on the map. Allow 10-20 minutes to complete the activity.

6. Have students share the name of each country plotted on the map, popcorn-style. Remind students that the use of plants as herbs has been important to all cultures since before history was recorded. Tell students that tomorrow they will use their senses to compare the herbs they learned about in today's lesson.

7. Collect the handouts and assess for completeness and accuracy.

PROCEDURE (PART 2)

1. To prepare for this activity, place a small sample of each dried herb and each fresh herb in six separate tasting cups. Label the fresh herbs with their common names. Label the dry herbs A (for cilantro), B (for oregano), and C (for basil). Prepare a set for each student (or pair of students).

2. Explain to students that they will use their senses to gather information about herbs. Describe how when you taste something, approximately 10,000 taste buds respond to the food stimuli by sending messages to the brain. In addition, our olfactory system (our sense of smell) sends messages to the brain. These messages integrate to create our perception of flavor. Our taste experiences inform our behavior and are often stored as memories.

PROCEDURE (PART 2) CONT.

3. Guide students to compare the fragrances of fresh and dried herbs. Instruct students to match each fresh herb to the herb's dried version, using only their sense of smell. For example, instruct students to smell fresh basil. Then, smell all three dried herbs and attempt to identify which is dried basil. Repeat this process for cilantro and oregano. Reveal the identity of the herbs (A: cilantro, B: oregano, C: basil). Direct students to label their previously unknown samples correctly.

4. Distribute the *Herb Observation Rubric*. Review the rubric with the class, and emphasize the importance of providing detailed and descriptive observations. They will taste each sample individually and record their observations in the appropriate cell. Have students complete their rubric.

5. After completing their observations, discuss:

a. Favorite or least favorite herbs of the six samples.
b. Similarities and differences between dry and fresh herbs.
c. Similarities and differences between different herbs.
d. Strength of flavor in dry and fresh herbs.

VARIATIONS

• Lead students through the process of drying their own herbs. After cutting fresh herbs from the garden, make small bunches with string. Hang the bunches up to dry, leaves downward, covered loosely with thin paper bags. Allow seven to 10 days to dry, depending on the size of the bunches and humidity.

• Use an online mapping tool to plot coordinates for map activity.

EXTENSIONS

• Instruct students to find a family or cultural recipe that includes basil, oregano, or cilantro to share with the class. Bind recipes together to create a class cookbook, or bring prepared dishes to share in a class potluck.

• Use a conversion chart to convert fresh herbs to dry herbs in your favorite recipes (or dry to fresh).

• Use photo chromatic material to capture herb shadows outside.

• Plant a variety of herbs, including basil, cilantro, and oregano in a school garden or classroom planter box.

STUDENT TEXT:

The wonderful world of herbs

The use of plants as herbs has been important to all cultures since long before history was recorded. Hundreds of tribal cultures have used wild and cultivated herbs for religious, medicinal, and food purposes for thousands of years.

Native to Arab countries near the Mediterranean region, cilantro made its way along the spice routes in Spain. From there, the Western expansion of the Spanish empire brought new cooking styles and ingredients across the ocean to the "New World." It continues to be grown in Brazil, Cuba, the Dominican Republic, El Salvador, Costa Rica, Puerto Rico, Mexico, and the United States. Cilantro is harvested in fresh cut bunches, and has a distinct "fresh" flavor. Most salsas that you dip your chips into contain cilantro as it is a staple herb in Latin America. The seeds of the cilantro plant are dried and appear in spice racks whole or ground with the name of coriander.

Oregano is a culinary herb with leaves that have an aromatic, warm, and slightly bitter taste. This popular herb is commonly used in Italian cooking, mostly in its dried state, as a "pizza sauce herb" but has its origins in Greece. The Romans also used oregano because they enjoyed the taste and found it easy to grow. Their love of the herb helped spread its use throughout Europe and Northern Africa. It is used in the Philippines, Argentina, and throughout Latin America. In Mexico, it can be used to season meats, stews, and soups and the aroma in the leaves is often used to flavor Mexican rice.

Basil has been cultivated for more than 4,000 years. There are more than 200 different varieties of basil. Basil is native to areas in Asia and Africa and grows wild as a perennial on some Pacific islands. Basil was brought from India to Europe through the Middle East in the sixteenth century, and subsequently to America in the seventeenth century. Basil is a popular culinary herb used in many cuisines including Italian and Thai. Italians use a mortar and pestle to grind basil with oil, garlic, cheese, and nuts to make pesto. Pesto is commonly used as a pasta sauce. In Thailand, basil is used to infuse flavor into foods, like the traditional Thai green curry. The herb is added at the end of the cooking process to retain its aroma and flavor.

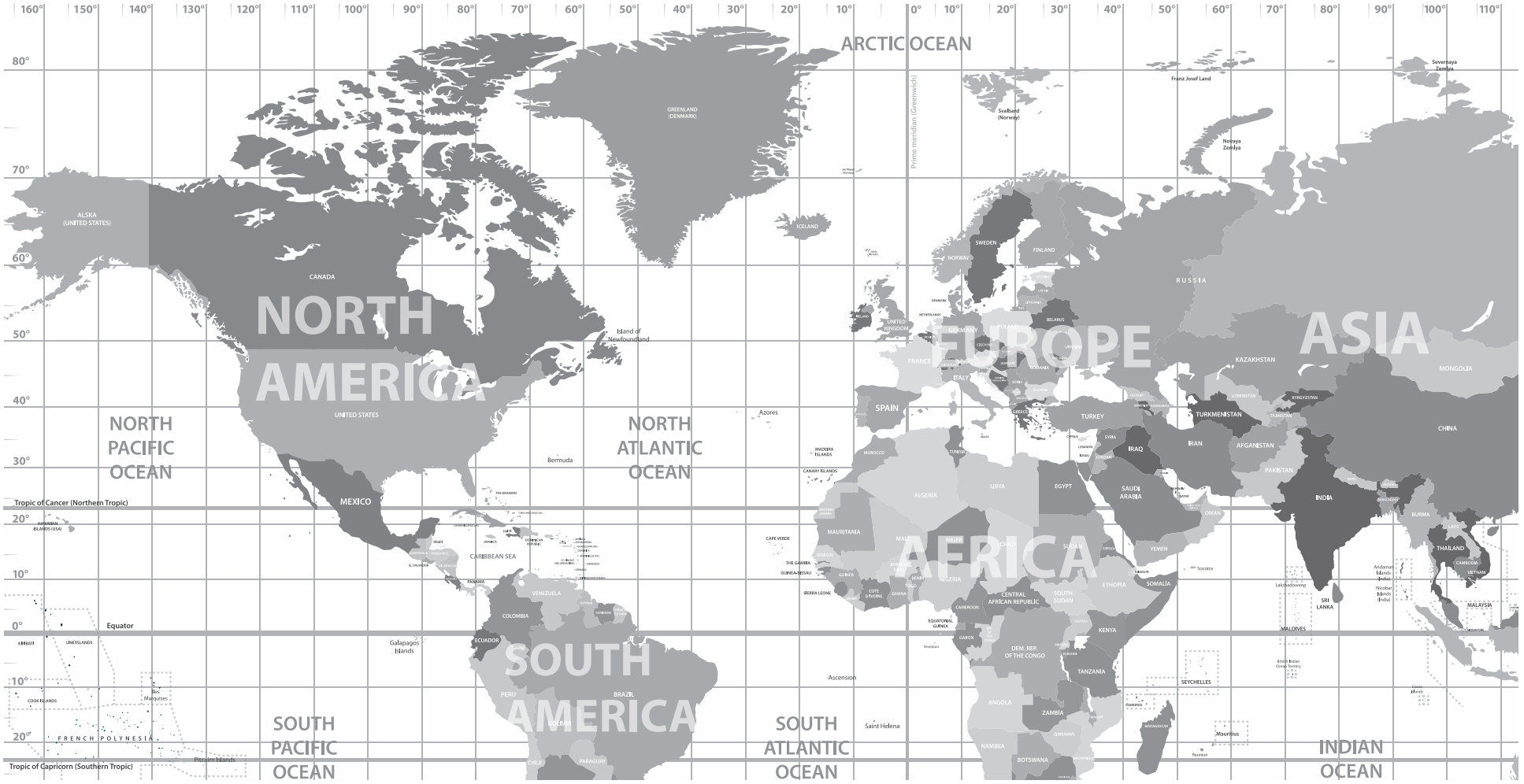
Herbs have been used to improve the flavor of foods throughout history. It is no different today. Take a trip around the world without even leaving your kitchen—use herbs!

NAME: _____ DATE: _____ CLASS: _____

Fill in the blanks with names of different spices.

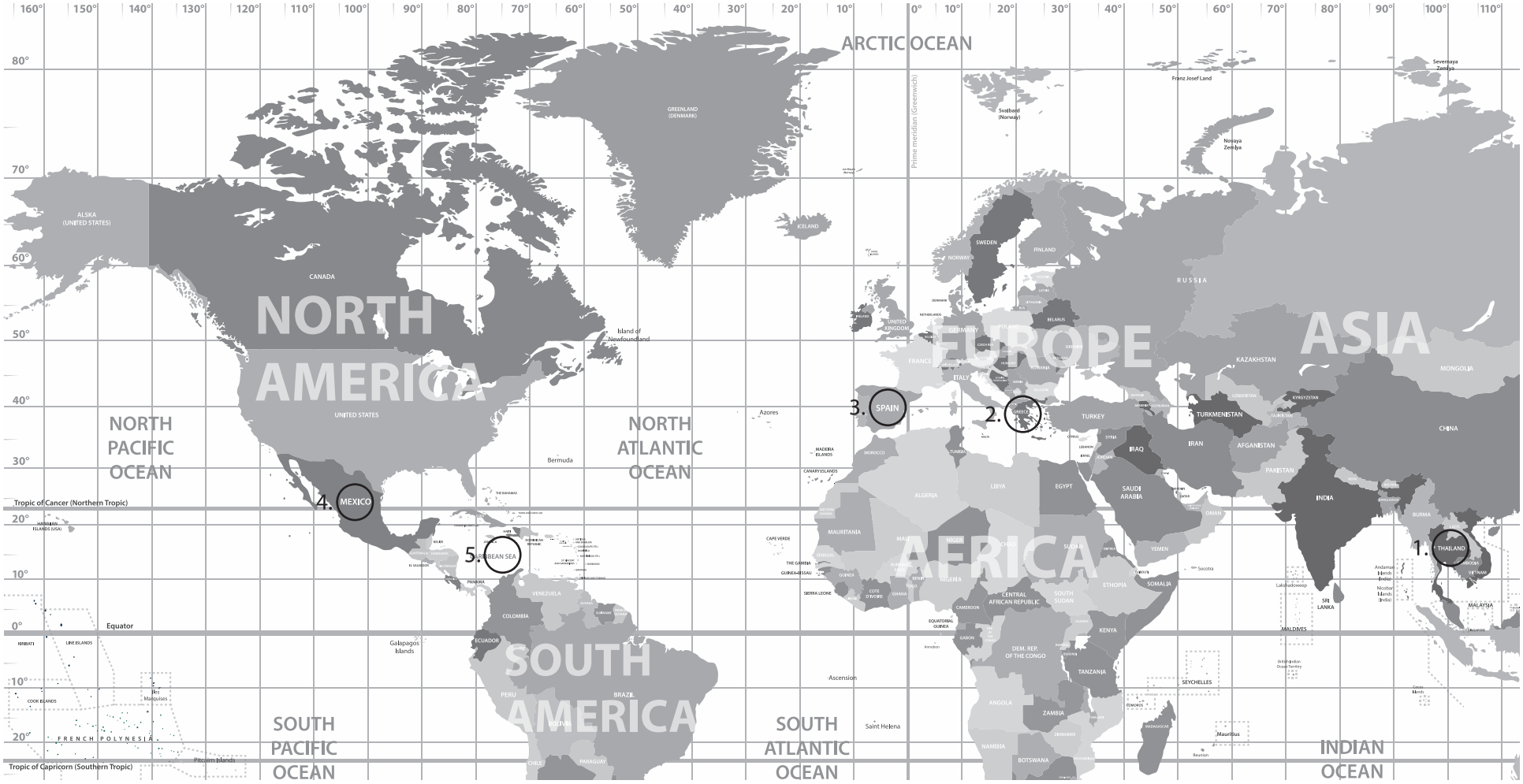
USE THE LONGITUDE AND LATITUDE COORDINATES TO PLOT AND LABEL EACH LOCATION ON THE MAP.

1. _____ , is an herb that is added to food eaten in this country's culture. (15°N, 101°E).
2. _____ , used in pizza sauce, originally had its roots in this country. (39°N, 22°E).
3. Native to Arab countries near the _____region, cilantro made its way along the spice routes to this country. (40°N, 4°W)
4. The aroma of oregano leaves is often used to flavor_____in this country. (24°N, 103°W)
5. Known for its "fresh" flavor,_____is presently grown in countries that border this body of water. (15°N, 75°W)



Answer Key

1. _____Basil_____ , is an herb that is added to food eaten in this country's culture. (15°N, 101°E).
2. _____Oregano_____ , used in pizza sauce, originally had its roots in this country. (39°N, 22°E).
3. Native to Arab countries near the___Mediterranean___region, cilantro made its way along the spice routes to this country. (40°N, 4°W)
4. The aroma of oregano leaves is often used to flavor_____rice_____in this country. (24°N, 103°W)
5. Known for its "fresh" flavor,_____cilantro_____is presently grown in countries that border this body of water. (15°N, 75°W)



Name: _____ Date: _____ Class: _____

Herb Observation Rubric

	BASIL		OREGANO		CILANTRO	
	FRESH	DRIED	FRESH	DRIED	FRESH	DRIED
SKETCH What does the sample look like?						
COLOR What is the specific color?						
TEXTURE What does it feel like?						
TASTE What adjective describes the taste?						
FLAVOR How strong is the flavor on a scale from 1-10? 1 is weak, 10 is strong						

LESSON TITLE:

PRESERVING THE POWERFUL PEPPER

Grade Level: 5-8
ONE 50-MINUTE LESSON

LESSON OBJECTIVES:

- **Students will understand the health benefits of probiotics.**
- **Students will preserve peppers to create their own probiotic food.**
- **Students will observe properties of preserved foods and state changes that have occurred.**

STANDARDS

- NGSS: MS-LS-1.5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- NGSS: MS-PS-1.2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- CC ELA: RST-6-8.3: Analyze in detail how a key individual, event, or idea is introduced, illustrated, and elaborated in a text (e.g., through examples or anecdotes).
- CA Health Education Content Standards: Grade 5: 7.2.N: Demonstrate how to prepare a healthy meal or snack using sanitary food preparation and storage practices.
- CA Health Education Content Standards: Grades 6-8: 1.1.N: Describe the short- and long-term impact of nutritional choices on health.

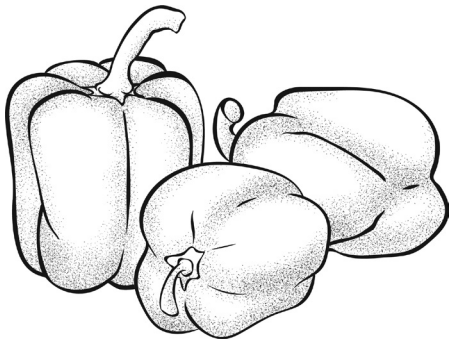
PRESERVING THE POWERFUL PEPPER

MATERIALS

- Chart paper or whiteboard, with markers
- Fresh bell pepper and spoiled bell pepper in sealable plastic bag
- Student Text: *Perfectly Pickled: Probiotics Pack a Punch* (one per student)
- Text Analysis: *Perfectly Pickled: Probiotics Pack a Punch* (one per student)
- Sweet and sour brines (teacher prepared, see recipe)
- Lab Handout: *Creating Pickled Bell Peppers* (one per student)
- Disinfectant wipes (one per group)
- Mixed bell peppers, washed, seeded, and chopped (approximately 14 cups)
- Pint jars and lids, clean and sterile (two per group)
- Canning funnel (one per group, optional)
- Permanent marker (one per group)
- Masking tape (4" strip per group)

BACKGROUND INFORMATION

One characteristic of produce is its perishability. Unless produce is eaten within a relatively short timeframe, it must be preserved. Once preserved, the nutritional value is maintained and the presence of pathogens can be avoided. Bell peppers are perishable and can last up to three weeks whole, but typically only a few days once cut.



Bell peppers are most often preserved by freezing or pickling. These preservation processes help maintain the nutritional value of the pepper for up to one year. Peppers are an excellent source of vitamin C and vitamin A. Vitamin A and vitamin C are antioxidants, which are substances that remove potentially damaging oxidizing agents (sometimes called free radicals) in a living organism—humans included. Eating one red bell pepper provides 100 percent of the vitamin C and 45 percent of the vitamin A the body needs each day. Studies suggest that nutrients found in red bell peppers reduce stress, lower inflammation, and decrease the risk of cardiovascular disease and cancers.

Eating preserved peppers that have been pickled offers additional health benefits. During the pickling process, live microorganisms are introduced. These microorganisms are linked to numerous health benefits when consumed, including weight loss, improved digestion, enhanced immune function, better skin, and a reduced risk of many diseases.

PROCEDURE (PART 1)

1. Before the lesson, write the words “perishable,” “preserve,” and “probiotic” across the whiteboard or chart paper.

2. Show students a fresh bell pepper and a spoiled bell pepper in a sealable bag. Pass around the peppers and discuss the differences in appearance, smell, and texture.

- As students make comments about the spoiled pepper, capture brainstormed words around the word “perishable.”

- Ask students what methods could be used to maintain the texture, flavor, and nutritional value of the pepper. Guide students towards the words: canned, dried, frozen, and pickled. Capture these words around the word “preserve.”

- Ask students to consider the origin of the word “probiotic.” Explain that the Latin prefix “pro” means for and the Greek root “bio” means life. Capture these words around the word “probiotic.”

3. Distribute the student text titled, *Perfectly Pickled: Probiotics Pack a Punch*. Guide students through a close reading of probiotics focusing on the essential question, *“What are probiotics and how do they contribute to human health?”*

4. Allow students 10-15 minutes to complete the text analysis. Collect student work and assess for completeness and accuracy.

PROCEDURE (PART 2)

1. For this activity, prepare the *Pepper Brine Recipes* in advance. Create one batch of each recipe. Place containers on a clean table top with cups or utensils for pouring into jars.

2. At the beginning of the lesson, remind students that before working with any type of food it is important to make sure that the environment is clean and hands are washed. Review classroom protocol for hand washing.

3. Tell students that today they will be creating their own probiotic food, pickled peppers. They will be fermenting two jars of peppers, one sweet and one sour. Divide students into groups of five. Distribute the *Creating Pickled Bell Peppers* lab handout. Read the instructions together, answer questions, and circulate around the room to guide students through the lab.

4. Provide opportunities for students to make daily observations of their pickled peppers for the following six days. After six days, sample the peppers and discuss the following questions:

- *What changes did you observe in your pickled peppers over the course of six days?*
- *Based on your reading of* ***Perfectly Pickled: Probiotics Pack a Punch****, what key ingredients must be in the brine recipe to promote the growth of good bacteria?*
- *Why was it important to keep jars sealed and refrigerated during the process?*
- *How did the fermentation process change the flavor and texture of the bell peppers?*
- *Did this experiment cause a chemical or physical reaction? Use evidence to support your claim.*

VARIATIONS

- Provide a variety of fresh or dried herbs for students to add to their pickled pepper recipe. Organize a class taste test and vote to determine the most flavorful recipe.

- Use bell peppers grown as part of a school gardening project.

EXTENSIONS

- Browse the many different episodes of *The Fermentation Podcast* and listen together to learn more about the health benefits of fermented food. *(fermentationpodcast.com)*

- Compare the cost of fresh bell peppers with value-added products like pickled peppers or roasted bell peppers. Calculate the percent increase per ounce for value added products.

- The Exploratorium website features articles about fermented foods and additional experiments. Learn more at *exploratorium.edu/cooking/pickles.*

STUDENT TEXT

Perfectly Pickled: Probiotics Pack a Punch

Long before probiotics became a health and nutrition buzz word, cultures throughout history and across the globe were celebrating fermented, or pickled, foods. Historically, the process of pickling foods was intended as a preservation method. Today, nearly every global culture includes at least one fermented food in its culinary heritage.

Russian microbiologist Elie Metchnikoff (1845-1916) was the first to associate the consumption of fermented dairy products with the good health and longevity of Bulgarians back in 1907. He proposed that the acid-producing bacteria in fermented dairy products could prevent what he called "fouling" in the large intestine. He believed if eaten regularly, these foods could lead to a longer, healthier life.

It is increasingly understood that consuming certain types of microorganisms, also called bacteria, may have positive health outcomes. Our bodies are home to both good and bad bacteria. They are everywhere, including the stomach. Under normal conditions, good bacteria in the stomach outnumber the bad bacteria. Probiotics found in pickled foods provide a boost in healthy bacteria and create a physical barrier against unfriendly bacteria.

Lactic acid fermentation, or lacto-fermentation, is among the most common methods and one of the easiest to experiment with at home. In this type of fermentation, the vegetable is soaked in a salt brine, allowing the growth of bacteria that eat the vegetable's sugars and produce tart-tasting lactic acid. Salt plays a pivotal role in traditional fermentation by creating favorable conditions for the good bacteria, preventing the growth of bad bacteria, and adding flavor.

According to the Harvard School of Medicine, the scientific community agrees that there are potential health benefits to eating foods with probiotics. However, more research is needed to solidify the claims. Medical researchers affirm, "the best we can say right now is they won't hurt and may help."

Global cultures have crafted unique flavors and traditions around fermentation.

Kimchi – A spicy cabbage dish popular in Korean culture.
Kombucha – A tangy tea flavored with herbs and fruit that originated in China.
Miso – A paste made from barley, rice, or soybeans with its roots in Japanese culture.
Chutney – A spicy condiment made of fruits or vegetables originating in India.

Sources: Harvard Health Publishing. (2017, June 7). *The Benefits of Probiotics Bacteria*. Retrieved July 13, 2018, from https://www.health.harvard.edu/staying-healthy/the-benefits-of-probiotics

Academy of Nutrition and Dietetics. (2017, May 17). *The History and Health Benefits of Fermented Food*. Retrieved July 13, 2018, from https://foodandnutrition.org/winter-2012/history-health-benefits-fermented-food/

Name: _____ Date: _____ Class: _____

TEXT ANALYSIS

PERFECTLY PICKLED: PROBIOTICS PACK A PUNCH

1. Give two examples of fermented foods and the cultures they originated in.

PROBIOTICS MAY HELP:

- Improve immune function
- Protect against hostile bacteria to prevent infection
- Improve digestion and absorption of food and nutrients.

2. What did Russian microbiologist Elie Metchnikoff believe about fermented foods?

3. What is one of the most common methods of fermentation?

4. In your own words, what are probiotics?

5. What does lactic acid bacteria do?

6. What role does salt play in the fermentation process?

7. Should people be encouraged to eat foods with probiotics? Why or why not?

Perfectly Pickled: Probiotics Pack a Punch

ANSWER KEY

1. Give two examples of fermented foods and the cultures they originated in.

Examples of fermented foods include Kimchi (Korea), Kombucha (China), Miso (Japan), Chutney (India).

PROBIOTICS MAY HELP:

- Improve immune function
- Protect against hostile bacteria to prevent infection
- Improve digestion and absorption of food and nutrients.

2. What did Russian microbiologist Elie Metchnikoff believe about fermented foods?

Russian microbiologist Elie Metchnikoff believed bacteria in fermented dairy products could prevent "fouling" in the large intestine. He believed eating fermented foods regularly could lead to a longer, healthier life.

3. What is one of the most common methods of fermentation?

Lactic acid fermentation is among the most common methods of fermentation.

4. In your own words, what are probiotics?

Probiotics are bacteria that are good for you. When eaten, they increase the good bacteria in your gut and protect against the bad bacteria.

5. What does lactic acid bacteria do?

Lactic acid bacteria is bacteria that is grown with vegetables in a salt brine. The bacteria eat the vegetable's sugars and produces lactic acid.

6. What role does salt play in the fermentation process?

Salt plays a pivotal role in traditional fermentation by creating favorable conditions for the good bacteria, preventing the growth of bad bacteria, and adding flavor.

7. Should people be encouraged to eat foods with probiotics? Why or why not?

Answers will vary.

PEPPER BRINE RECIPES

Altering quantities—especially those of vinegar, vegetables, and salt—can lead to the spread of spoilage-causing bacteria. Scrupulously clean all cooking utensils in hot, soapy water. Rinse thoroughly.

SOUR PEPPER BRINE RECIPE

INGREDIENTS:

- 3 cups distilled white vinegar or cider vinegar
- 3 cups water
- 2 tablespoons plus 2 teaspoons sea salt
- 2 tablespoons sugar

Combine all ingredients in a large pan over high heat and bring to a boil until salt is dissolved. Continue boiling for two minutes and remove from heat. Store in a large container labeled "Sour Pepper Brine."

SWEET PEPPER BRINE RECIPE

INGREDIENTS:

- 3 cups distilled white vinegar or cider vinegar
- 3 cups water
- 1 tablespoon plus 2 teaspoons sea salt
- 1 1/2 cups sugar

Combine all ingredients in a large pan over high heat and bring to a boil until salt and sugar is dissolved. Continue boiling for two minutes and remove from heat. Store in a large container labeled "Sweet Pepper Brine."

NAME: DATE: CLASS:

CREATING PICKLED BELL PEPPERS

INSTRUCTIONS: **IN THIS ACTIVITY, YOUR GROUP WILL MAKE TWO DIFFERENT VERSIONS OF PICKLED PEPPERS BY USING DIFFERENT BRINE RECIPES. ONE VERSION WILL PRODUCE SOUR PICKLED PEPPERS AND ONE VERSION WILL PRODUCE SWEET PICKLED PEPPERS. READ AND COMPLETE EACH STEP CAREFULLY.**

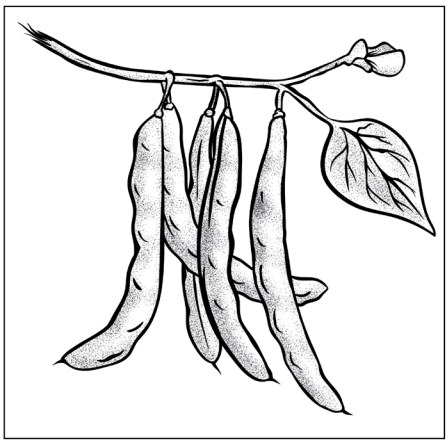
1. Sanitize your tabletop area with disinfectant wipes.
2. Wash your hands.
3. Retrieve glass pint jar with lid.
4. Fill pint jar with chopped bell peppers, to within 1/2 inch of top.
5. Fill jar with brine to cover peppers.
6. Seal jar with lid and wipe clean.
7. Label jar with masking tape and permanent marker. Include group members' names, date, and brine used (sweet or sour).
8. Repeat process using alternate brine recipe.
9. Refrigerate both jars for approximately six days.
    a. Monitor daily to ensure the brine is completely covering the peppers, add more brine as necessary. Do not open jars during monitoring, unless necessary.
    b. After six days, remove the film present on the surface. If the film is white and flat, it is most likely yeast. Yeast is a common occurrence in pickled vegetables, it is not harmful, but should be removed from the jar.
    c. Sample and compare the sweet and sour versions.
10. Reflect on the these questions; your teacher may ask you to write or discuss:
    a. What changes did you observe in your pickled peppers over the course of six days?
    b. Based on your reading of Perfectly Pickled: Probiotics Pack a Punch, what key ingredients must be in the brine recipe to promote the growth of good bacteria?
    c. Why was it important to keep jars sealed and refrigerated during the process?
    d. How did the fermentation process change the flavor and texture of the bell peppers?
    e. Did this experiment cause a chemical or physical reaction? Use evidence to support your claim.

Commodity Fact Sheet

Green (Snap) Beans

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – Snap beans, also referred to as green beans or string beans, are edible pod beans that can be grown as bush beans or pole (climbing) beans. California farmers primarily plant bush beans.



Snap beans are a warm season crop, with an ideal growing temperature that ranges from 65° to 85°F. The seed is planted as early as March and as late as August, depending on first and last frost. Seed is planted mechanically by a tractor pulling a planter. The beans are typically planted at 80 pounds per acre, depending on seed size, with two rows on each bed.

Most varieties mature in 50 to 60 days. High temperatures (above 90°F) and late season rains can cause blossoms to drop without the opportunity for fruit to set, greatly reducing yield. Since excess water at any time during growth can increase the plant's susceptibility to root rot infection, many growers use drip irrigation.

Snap bean pods are harvested two to three weeks after blooming. Marketable pods are fleshy, tender, and green for only a short period; they will quickly become tough, fibrous, and overmature if not harvested on time. Pods of desirable length, shape and width are selected, harvested, and graded. Harvesting can be done by hand or by machine. Hand-harvesting allows for multiple harvests of a field, while machine-harvesting is a one-time operation because the plants are destroyed in the process.

Snap beans are highly perishable and should be cooled quickly after harvest. Some growers practice field packing so snap beans are quickly moved from field to cooler with minimum handling. Snap beans destined for further processing are transported to a facility where they are sorted, washed, and trimmed prior to freezing or canning.

History – The common bean was cultivated in ancient Mesoamerica approximately 8,000 years ago. Beans were even found in the mummy covering of a woman in a Peruvian cemetery dating back to pre-Inca civilization. Snap beans originated in the tropical southern part of Mexico, Guatemala, Honduras, and Costa Rica. They spread from this center of origin to North and South America long before European explorers ever arrived.

When early explorers first returned home with these, natives of Central and South America and Europeans used them not as food crops but as ornamentals. They appreciated the butterfly-like blossoms in shades of red, pink, or white, but did not appreciate the tough texture of the pod.

Snap beans, by nature, had a fibrous strip that ran down the length of the bean. This portion had to be removed before it could be enjoyed. This led to the nickname "string beans." Botanists, however, found a way to remove the string through breeding and in 1894 the first "stringless" bean plant was cultivated. Today, commercial varieties of edible pod beans are grown without the strings.

Varieties – Snap bean varieties can be flat or round. The flat types, called Kentucky Wonder, include varieties such as Magnum, Greencrop, and Calgreen. The round types, called Blue Lake, include Benchmark, Strike, and Landmark. Yellow-podded varieties are Goldrush and Slenderwax. A popular Italian flat bean variety is Romano. Snap beans also come in purple-podded varieties. The purple pods are flavorful, and turn green when cooked.

Commodity Value – California is ranked second in the nation for production of fresh market snap beans, while Florida is the top producer. Approximately 95 percent of the snap bean crop in California is marketed as fresh, with the remainder marketed for processing. Last year, California's snap bean growers harvested more than 41,200 tons on 7,000 acres throughout the state. The state's crop value reached $55 million in 2017.

Top Producing Counties – Snap beans are produced in many areas of California. Primary production areas include Tulare County, Riverside County, and Orange County.

Nutritional Value – A 1/2 cup serving of snap beans is a good source of fiber, folate, and beta-carotene. Our bodies use beta-carotene to make vitamin A, a nutrient important for vision, immune function, and skin and bone health. Snap beans also contain small amounts of calcium and vitamin C. Green, yellow, and purple snap beans are similar in taste, texture, and nutrition.

For additional information:
Orange County Produce
Website: ocproduce.com

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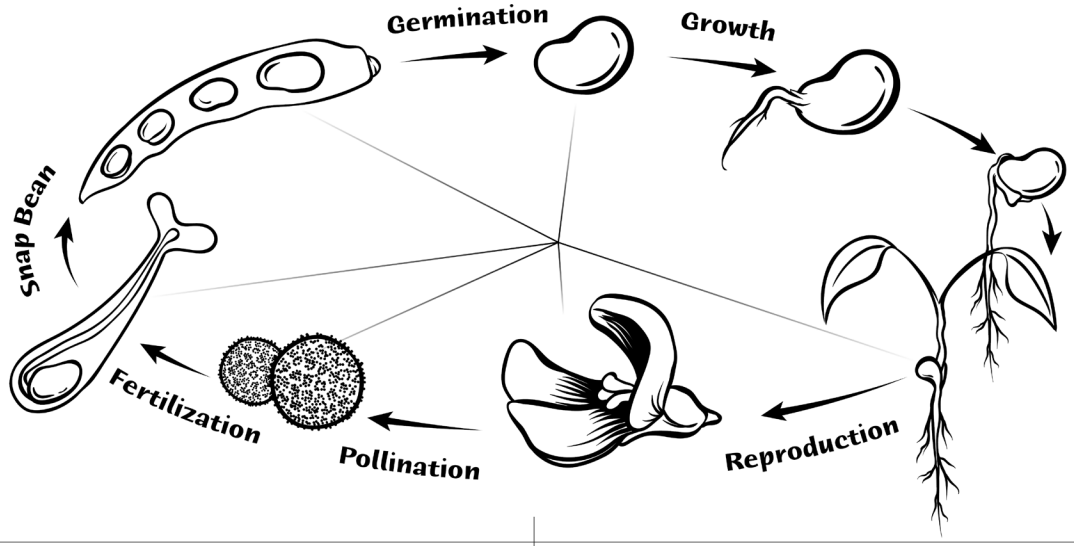
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Green (Snap) Beans Activity Sheet



Lesson Ideas

- Dissect a bean and record observations in a science journal. Include labeled diagrams.
- Germinate beans in a damp paper towel inside of a plastic sandwich bag. Tape the bag to a window and make daily observations of bean growth.
- Compare different varieties of snap beans. Make a table to organize data such as color, shape, number of beans, length, and taste.
- Measure the length, mass, and volume of snap bean pods. Create a class average and discuss how common traits have been established through science.
- Design an experiment that identifies the best practices for fresh snap bean storage. Share your findings with your school's food service workers.
- Taste frozen, fresh, and canned snap beans. Record similarities and differences.

Fantastic Facts

1. Snap beans were named for the snapping sound produced when breaking off the end of the pod.
2. The pod color of snap beans can be green, golden, purple/red, or streaked, but the beans inside the pod are always green.
3. Snap beans are nitrogen fixers, which means they draw nitrogen from the air and return it to the soil. Farmers often plant beans to replenish the soil.
4. The Asian Yardlong variety of snap beans have pods that measure up to 18 inches long.
5. The Spaniards initially used snap beans as ornamental plants because they found the bean pods tough, but very much liked the flowers.
6. Snap beans are the third most commonly grown home garden vegetable in the United States, outranked only by tomatoes and peppers.

Lesson Plan: Oh Snap! Finding the Right Soil for Snap Beans

Introduction: Snap beans are grown on many soil types in a pH range of 5.5 to 7.5. Well-drained soils are preferred. Excessively wet soils encourage root diseases and nutrient problems. Snap beans have a semi-shallow root system, and the crop requires frequent irrigation.

Objective: Students will investigate how snap beans grow in different soil types.

California Standards: CC Math: 7.SPC.8; NGSS: MS-LS1-5

Materials: Four identical containers (per group), potting soil, sandy soil, clay soil, snap bean seeds, tray for pots

Procedure:

1. Divide students into groups. Distribute snap bean seeds and containers.
2. Instruct students to fill each container with the same volume of soil, using each of three available soil types. Students must label each container properly.
3. The fourth container will have a student-designed mixture of the three soil types. Have students record the ratios and label the container.
4. Plant the snap beans in each container, at a depth of one inch.
5. Ask students to identify techniques for measuring plant growth. As a class, determine which techniques will be used to measure plant growth in this experiment. These techniques may include: measuring plant height, counting leaves, determining surface area of leaves, observing plant color, or identifying number of days to flower.
6. Apply the same volume of water to the plants at consistent intervals.
7. Routinely employ techniques to measure plant growth, and record measurements in science journals.
8. Use data to graph results and summarize findings.

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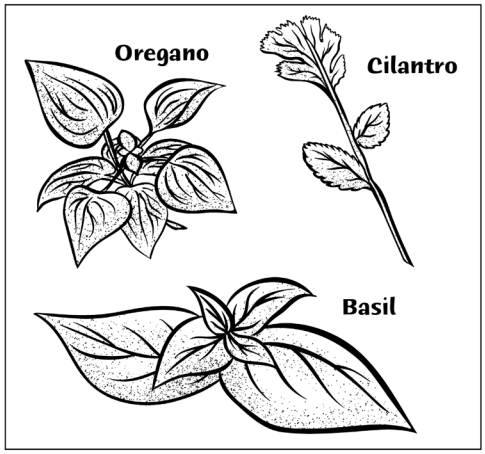
Commodity Fact Sheet

Herbs

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Herbs are plants useful for culinary, cosmetic, industrial, medicinal, landscaping, decorative, and fragrance purposes. Both fresh and dried herbs may be used for culinary purposes. Additional purposes for processed herbs include décor, essential oils, teas, dyes, and cosmetics. Herbs are among some of the easiest plants to grow. They require plenty of sunlight and typically grow well in most soils.



Oregano – Oregano has purple flowers and spade-shaped, olive-green leaves. Oregano seeds are planted in greenhouses for 6-8 weeks before being transplanted to the field in spring. A perennial herb, with creeping roots, oregano requires some irrigation, but once established it requires very little water. Well drained soil is ideal, but it does not require especially fertile soil. Oregano is ready for harvest 45 days after planting, before full flower. Oregano is harvested by hand 4-6 times per year. If oregano is harvested early in the morning, the need for cooling is minimized. Oregano intended for the fresh market is kept in cold storage, while oregano intended for the dry market is transported to a dehydrator.

Cilantro – Cilantro leaves are light green, feathery, and flat. While the leaves are used as an herb, the dried seeds, called "coriander," are used as a spice. Cilantro seed is grown year-round—in the winter in the desert and in the summer along the coast. Extremely hot weather may cause plants to "bolt," or produce flowers prematurely. Cilantro matures in 40 to 45 days. It is often used as a rotation crop; however, some growers may double-crop each year. Cilantro has a relatively shallow root system and thrives on frequent, short irrigations. It is commonly grown in high-density planting on 80-inch wide beds that are sprinkler irrigated. Cilantro can be harvested by hand and sold in bunches to be used as a fresh herb or mechanically harvested and loosely packed into totes. Once cut, cilantro is immediately cooled and kept in cool storage.

Basil – Basil leaves are glossy and oval-shaped, with smooth or slightly toothed edges. Basil is directly seeded or transplanted to the field in late spring. Most growers use drip irrigation to water basil plants regularly. Basil is a warm season herb, and is harvested from March through mid-November. The timing and method of harvest depends on the use of the herb. For dried basil leaves, the plant is cut just prior to appearance of flowers. To produce essential basil oil, the plant is harvested when the flowers are in full bloom. Fresh basil is typically harvested several times during the growing season. For the fresh market, leaves are washed and stems are packed in bulk boxes in the field and transferred to cold storage rooms. Once transported to the packinghouse, the herb is hand-sorted into plastic clamshells for retail sales. For the dried herb, low temperature drying of the leaves under forced air is used to retain maximum color.

History – The use of plants as herbs has been important to all cultures since before history was recorded. For thousands of years, tribal cultures have used wild and cultivated herbs for medicinal and food purposes. Historians have found documentation that suggests that hunters and gatherers wrapped meat in the leaves of bushes, accidentally discovering that this process enhanced the taste of meat, as did certain nuts, seeds, berries, and bark.

Evidence of early herb gardens dates to Europe in the Middle Ages. Egyptian schools of herbalists have existed since 3000 B.C. Some herbal benefits are symbolic. For example, basil was given to those who needed strength to endure fasting, while rosemary was given to others for remembrance.

Commodity Value – California leads the nation in herb production. In 2016, the value of fresh market organic herbs was approximately $9.4 million, while the value of organic dry herbs was approximately $250,000. California is the largest cilantro producing state with annual production exceeding 56 million pounds. The United States produces approximately 200 billion pounds of herbs and spices per year.

Top Producing Counties – Ventura, Imperial, and Monterey counties lead the state in cilantro production. Individual county data is not available for oregano and basil.

Nutritional Value – Most herbs are highly nutritious, but the benefits are not particularly relevant since they are consumed in limited quantities. Oregano, cilantro, and basil are all good sources of dietary fiber, zinc, and calcium. The essential oils produced from these herbs may be applied topically or used aromatically for a variety of medicinal benefits.

For additional information:
UC Master Gardener Program
Website: mg.ucanr.edu

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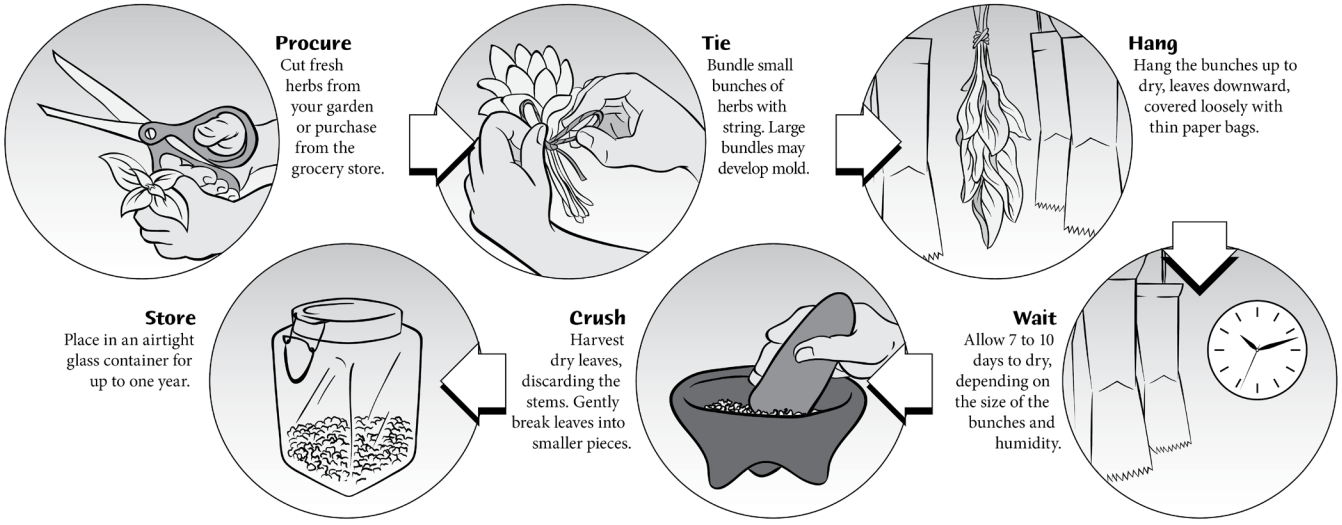
Herbs Activity Sheet



Lesson Ideas

- Dry herbs to make a loose-leaf tea.
- Research the medicinal properties of different herbs.
- Create nature prints by using herbs and sun-sensitive fabric or paper.
- Harvest and crush seeds from a cilantro plant to make the spice coriander.
- Make a woven lavender wand.
- Taste and describe different varieties of the same herb.
- Use herbs to make your own potpourri.
- Compare storage methods of fresh herbs.
- Plant your own mini-herb garden in a container.
- Classify herbs by leaf shape, color, and texture.

Fantastic Facts

1. The word oregano comes from the Greek, meaning "joy of the mountain." It was believed Aphrodite, the goddess of love, grew it on Mount Olympus.
2. Cilantro was brought to North America by the English in 1670.
3. Heat diminishes the flavor of fresh herbs, which is why dry herbs are often used in cooking.
4. Oregano was introduced to the United States by soldiers returning from Italy after World War II.
5. Some people may be genetically predisposed to dislike the taste of cilantro.
6. In ancient history, basil was used to embalm mummies.
7. Cilantro seeds are called coriander, which is a spice that has its own unique flavor.

Lesson Plan: Making Herb Butter

Introduction: Butter has long been used as a spread and as a cooking fat. In fact, approximately a third of the world's milk production is devoted to making butter. To make butter, the cream is agitated (stirred up) so that the fat molecules get shaken out of position and clump together. Eventually, after enough agitation, the fat molecules clump so much that butter forms. In this lesson, students will make their own herb butter.

Objective: Students will understand how churning separates the butterfat (the solids) from the buttermilk (the liquid).

California Standards: NGSS: MS-PS1-1, MS-PS1-4; ELA CC: RST.6-8.3

Materials: Heavy whipping cream, finally chopped herbs of your choice, small liquid-tight container with lid, plastic knives, crackers

Procedure:

1. Fill the container halfway with heavy whipping cream and add ¼ teaspoon of herbs.
2. Close the container and begin shaking. The faster you shake it, the faster you make it.
3. As you shake, you will see the cream begin to thicken.
4. Keep vigorously shaking until you see the liquid has separated from the solid.
5. Once you have butter, STOP SHAKING (if you keep shaking the butter will melt). Drain and discard the remaining liquid.
6. Spread butter over crackers and enjoy.
7. While enjoying your butter, discuss how long it took for the butter to form.
   - What variables cause the butter to form more quickly?
   - What is happening at a molecular level?
   - What would be the quickest or most efficient way to turn cream into butter?

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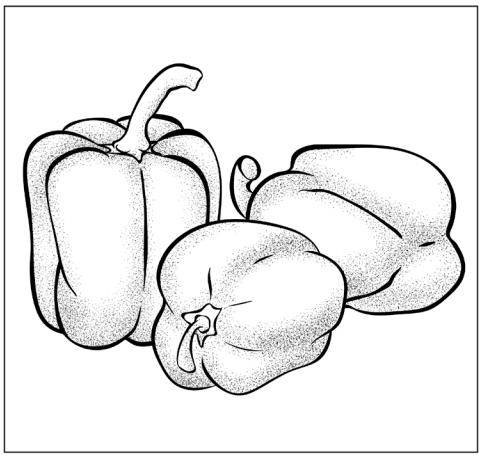
Commodity Fact Sheet

Bell Peppers

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – The pepper plant is a member of the *Solanaceae* or nightshade family, which also includes tomatoes and potatoes. Pepper plants are planted in the field as seeds or as young plants, called transplants. Bell peppers are warm-season crops, sensitive to freezing temperatures at any growth stage. The ideal growing temperature is between 75° and 85°F, with night temperatures between 55° to 65°F. If planting seeds directly into the ground, the producer typically sows seeds March through May. If planting by transplant, plants are grown in greenhouses for two months before being transplanted out in the field from March through July.



Bell peppers are a slow-growing crop, with up to 180 days until the final harvest. Due to their slow-growing nature, they face greater exposure to elements such as inclement weather, pests, and weeds. Therefore, bell pepper fields require significant input costs such as water, labor, and crop protection. Bell peppers are also susceptible to sunscald, which occurs when ripening fruit is not adequately shaded by leaf cover. Adequate fertilization to increase canopy coverage helps control this problem. The color of bell peppers change as they ripen on the vine. Most bell peppers are primarily sold as green peppers, but red, yellow, orange, purple, and black colors will show as the plants ripen. Peppers are ready for harvest between early July and October. Fresh market peppers are harvested by hand, with multiple harvests occurring within a single season. Peppers intended for processing are often harvested mechanically. In this process, each plant is cut at the base and peppers are shaken from the plants. The shaken peppers are hand-sorted on the machine. Conveyor belts transfer the peppers into produce bins pulled by a tractor following alongside.

The bins are transferred onto flatbed trucks using a forklift. Trucks haul processing peppers to a facility where they are peeled, sliced, or diced into the familiar frozen, canned, or dehydrated pepper products seen on store shelves. Fresh market peppers are graded and packed in sheds located near the fields to assure maximum freshness.

History – About 9,000 years ago, the wild pepper plant originated near Bolivia and Peru. It was later cultivated for its fruits by the Olmecs, Toltecs, and Aztecs. The seeds spread throughout Central America by both nature (wind, animals) and human activity (migration, exploration).

Bell peppers were carried throughout the world by Spanish and Portuguese explorers. The misleading name "pepper" was given by Europeans when Christopher Columbus brought the plant back to Europe. Due to the versatility of the bell pepper, it quickly became a staple in diets throughout the world including Central Europe where they were dried and ground to make paprika. Commercial bell peppers were first grown in the United States in the early 1920s.

Varieties – Varieties are selected on the basis of yield potential, quality, market acceptability, and disease resistance or tolerance. There are nearly 200 different varieties of bell peppers grown throughout California for both fresh market and processing. These include varieties with the traditional multi-lobe shape as well as longer more pointed varieties. Common bell pepper varieties used for commercial production include: Huntington, Classic, and Baron.

Commodity Value – California is the nation's leading producer of bell peppers. Last year, California's pepper growers harvested more than 410,000 tons on 19,800 acres throughout the state. The state's crop value reached $400 million in 2017. Most of California's peppers are consumed within the US. Canada is the top export market, valued at $26 million.

Top Producing Counties – Riverside is the top producing county in California generating nearly $78 million. The second highest producing county is Ventura generating $61 million, followed by San Benito at $32 million, and Santa Clara at $19 million.

Nutritional Value – One serving of red bell peppers is an excellent source of vitamin A and vitamin C and a good source of vitamin B6. Vitamin B6 helps the body break down or metabolize protein, aids in the formation of red blood cells, and helps maintain normal brain function. Bell peppers are also an excellent source of dietary fiber and provide small amounts of several other vitamins and minerals.

For additional information:
California Pepper Commission
(559) 591-3925
Website: calpeppers.com

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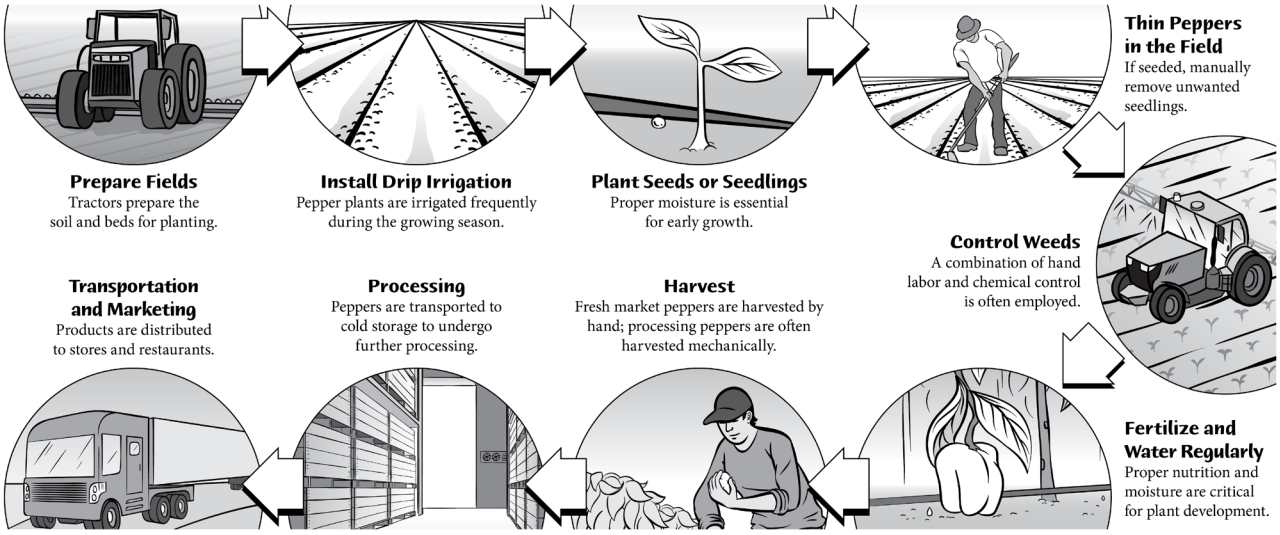
Bell Peppers Activity Sheet



Lesson Ideas

- Research preserved peppers throughout history and plot significant dates on a timeline.
- Study the anatomy of the bell pepper. Label the different parts.
- Examine the capsicum genus and compare the different species of peppers.
- Create an alliterative phrase about peppers. Try to say it three times fast.
- Compare the edible mass of a traditional bell pepper and a sweet mini pepper.
- Explore different types of preserved peppers and compare price per ounce.
- Identify cultures that use peppers in cooking and locate them on a map.
- Research the Scoville rating for a variety of peppers, make a bar graph to illustrate.

Fantastic Facts

1. Peppers are fruits because they are produced from a flowering plant and contain seeds.
2. Columbus and Spanish explorers named bell peppers while searching for peppercorn plants to make black pepper.
3. Bell peppers are called by different names throughout the world (US: bell pepper; England: pepper; Japanese: papurika; Australia: capsicum)
4. Red bell peppers have twice the vitamin C content as green bell peppers.
5. Bell peppers are the only member of the pepper family to not contain capsaicin, the main compound that gives chili peppers their heat.
6. Green bell peppers are less sweet and almost bitter since they have not been able to fully ripen.

Lesson Plan: Sort Your Salsa

Introduction: Peppers add color, flavor, and texture to salads, pizza, pasta, and ethnic foods. In recent years, salsa has become one of America's favorite condiments. For every bottle of ketchup purchased, Americans are purchasing two jars of salsa. Along with fresh tomatoes, salsa often contains bell and chili peppers.

Objective: Students will analyze, determine ingredient ratios, and explore the essential role of peppers in salsa.

California Standards: CC Math: 3-4.MD.2, 6-7.RP.3

Materials: Fresh salsa that contains peppers, paper plates, toothpicks, cheesecloth, magnifying lenses

Procedure:

1. Before the lesson, use the cheesecloth to drain as much liquid as possible from the salsa.
2. Ask students to raise their hand if they have salsa in their home right now. Discuss the different styles of salsa. Have students raise their hands to vote for their favorite style.
3. Brainstorm ingredients of salsa and record them.
4. Predict the ratios of each ingredient in a salsa recipe.
5. Distribute toothpicks, a paper plate, and two tablespoons salsa to each group. Instruct groups to weigh and record the mass of their salsa.
6. Using toothpicks and magnifying lenses, instruct students to separate their salsa by ingredient. Find the mass of each ingredient. Record data.
7. Use proportional reasoning to convert weights to percentages (or degrees) and create a pie chart.
8. Compare results and discuss how peppers change the color, flavor, and texture of salsa.

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This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.


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