



Chapter 7: Tangerines 73

Chapter 8: Cooking Greens and Cabbage 82

Chapter 9: Broccoli and Cauliflower 92

Chapter 10: Carrots 106

Chapter 11: Potatoes 116

Chapter 12: Pears 126



WINTER



Demi Bowell second grade

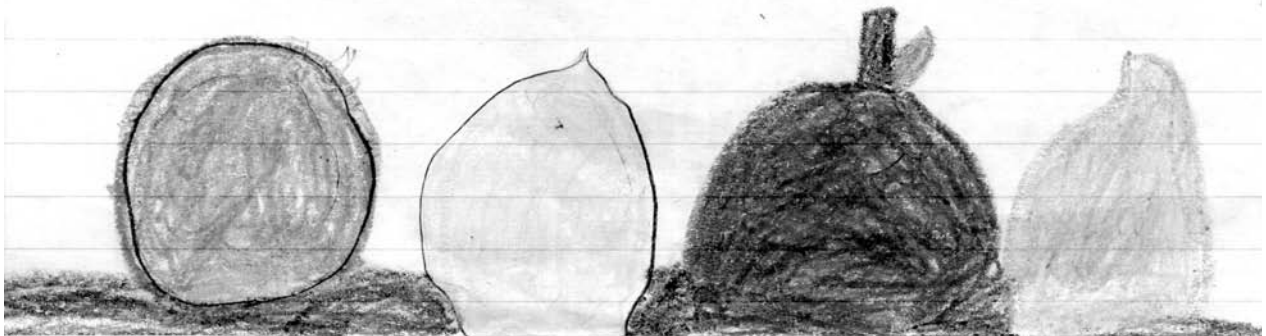
All citrus fruits have
peels and seeds.

Citrus fruits are cheapest
in the winter.

If you squeeze the peel
of the peels of fruits

It is an air freshener.

Citrus fruits grow in
warm places. I love
Citrus fruits!





Tangerines

Tangerines are a member of the citrus family, which also includes oranges, grapefruit, lemons, and limes. California-grown tangerines come into season in late November and December. Tangerines originated in China. They are also called *mandarins*, after the Mandarin Chinese traders who introduced the fruit to Europeans. The Chinese consider the tangerine a symbol of good luck, and tangerines are a prominent part of the Chinese New Year.

The tangerine's loose skin makes it easy for children to peel and eat, and its small segments are a perfect size for young students. Popular varieties of tangerine include D'ancy, Fairchild, Pixie, Satsuma, and Honey. Tangerines trees are available in dwarf varieties as well as full-size trees.

Seasonality and Growing Conditions

Tangerines grow well in the warm, temperate zones of California and are generally not planted in California's foggy, coastal regions. Tangerines can withstand cold better than oranges can but may still be injured by cold spells. During cold spells, some growers heat the trees by placing oil or gas heaters, burning wood, or wind machines in the orchards. The temperature in the orchards may also be modified through irrigation.

Citrus trees prefer acidic soil. They commonly will develop a deficiency of iron, zinc, or other minerals. Growers generally fertilize their trees with composted manure and treat severe deficiencies by spraying iron or zinc chelates on the leaves.

Tangerines can fall prey to a variety of insect pests. Dormant oil sprays are sometimes used during the summer months

to smother insect eggs before the trees bear fruit. Snails may also be a problem; they crawl up the trees and nibble on the fruit. Snails may be curtailed by placing copper bands around the tree trunks and by hand removal. Botrytis can be a detrimental disease to citrus, including tangerines. A severe outbreak of this disease can prevent the fruit from developing and can mean the devastating loss of an entire crop. Botrytis, a fungus, may be prevented by spraying compost "tea" on the fruit, adding organic matter to the soil, and careful sorting at harvesttime. Botrytis may appear as soft spots in harvested fruit.

Selection, Storage, and Nutrition Information

Fresh fruit provides the best source of vitamins. Processed citrus products (such as juice) lose some nutrients during the pasteurization process. Rigid, hard fruit is usually an indication of frost damage and is to be avoided. Tangerines are ideal for eating out of hand because of their loose peel; their sweet, tangy flavor also works well for juice and desserts. Tangerines are high in vitamin C and a good source of fiber. Ripe fruit has the strongest and sweetest aroma.



Tangerine Popsicles

Preparation Time: 10 minutes
 Cooking Time: 25 minutes
 Total Lesson Time: 60 minutes
 Recipe Level: Easy

Background

With this recipe, students investigate the different parts of the tangerine: zest, pith, segments, seeds, and sacs. When buying tangerines, try to find some that still have stems and leaves attached (farmers markets usually have these tangerines). The stems will assist students in making the connection that tangerines come from trees.

If making popsicles is too time-consuming or if you do not have a freezer, you can also construct a simple and effective lesson on the topic of fresh, squeezed juices. Fresh, squeezed juice is a treat and a wonderful new experience for children who generally drink reconstituted, fortified, or sweetened juices. To teach this lesson, buy the most flavorful tangerines (or a couple of kinds) that you can find. Have the children squeeze the tangerines and taste the juice, then describe it, and perhaps compare it with other juices they regularly drink.

Objectives

Students will be able to:

Identify and label the different parts of the tangerine fruit.

Show how the addition of a little sugar can heighten the flavor of tangy fruits.

Ingredients

For a class of 20:

20 large or 30 small to
 medium tangerines
 ½ cup sugar

Materials

For the class:

2 hand juicers (optional)
 3 ice trays
 40 toothpicks*
 1 box file-folder stickers
 (optional)
 plastic wrap
 vegetable peeler
 1 small saucepan
 hot plate
 8-cup pitcher
 freezer

For each group of 4:

2 vegetable peelers
 2 knives
 2 cutting boards
 2 spoons
 napkins
 journals

*Round or flat but not colored.

**Preparation**

1. Have students wash their hands. Discuss proper methods of handling food.
2. Wash the tangerines thoroughly to remove any wax, dust, or residues.

Safety Precautions

Review safety precautions for using knives.

Making the Recipe

1. Show the tangerines to the class. With a vegetable peeler, peel off the zest from one of the tangerines (the zest is the colored part of the peel, but not the white part). Take the peel off the tangerine; bend it so that the oil from the peel squirts into the air. Encourage students to smell the fragrant oil when they examine their own tangerines but also tell them that the oil can sting if it gets in someone's eyes. Point out the pith (the white part of the skin just below the zest) and mention that it has a bitter taste. Separate the segments, which hold the citrus flesh and seeds in a thin membrane. Identify the seeds and the sacs (tiny, individual pouches where the juice is stored).
2. Provide each student group with four tangerines to examine. Have students peel a small section of one tangerine with a vegetable peeler and investigate the zest and the pith.
3. Demonstrate how to cut a tangerine in half and juice it into a bowl either by using a hand juicer or by squeezing it and spooning out any seeds from the juice.
4. Allow students to juice their tangerines, remove any seeds from the juice, and pour the juice into the small bowl. Ask a student from each group to pour the juice from the small bowl into the common pitcher. Ask a student in one of the groups to mix $\frac{1}{2}$ cup juice with the sugar in a small saucepan. Place over medium heat and stir until the sugar is dissolved. Pour the sweetened juice back into the pitcher and stir.
5. Have one person from each group pour the juice into the three ice trays. Cover the trays with plastic wrap.
6. Provide each student with two toothpicks and two file-folder stickers. Have students write their name on the stickers, decorate them, and fold each around one toothpick.
7. Help students carefully push toothpicks through the plastic wrap into the middle of each cube. The toothpicks may not stand up straight, but you can adjust them later after the juice is partially frozen.
8. Place the ice trays into the school freezer.
9. Let the juice freeze solid. Usually, you will need to freeze the juice overnight, but if your school has a good freezer, you can do this recipe in the morning and the popsicles will be ready for an end-of-the-day snack.
10. Clean up materials. If you have a school or classroom compost or worm bin, place the food scraps there.

Candied Tangerine Peels

Preparation Time:	10 minutes
Cooking Time:	25 minutes
Total Lesson Time:	60 minutes
Recipe Level:	Advanced

Background

Any tangerine will work for this recipe, but varieties with thick, loose skins are the easiest to handle. Most markets have the Satsuma, a wonderfully flavorful variety that has a good peel for this recipe.

Because citrus fruits have so many layers (the zest, the pith, the membrane of each segment, and sacs inside the segment), it is fun for students to dissect the tangerines as they make the recipe.

Objectives

Students will be able to:

Identify and label the different parts of the tangerine fruit.

Ingredients

For a class of 20:

- 20 tangerines
- 2 quarts water
- 2 cups sugar

Materials

For the class:

- hot plate
- 4-quart pot with lid
- slotted spoon
- 2 large plates
- bowl
- measuring cups

For each group of 4:

- 2 peelers
- 4 napkins
- journals

**Preparation**

1. Have students wash their hands. Discuss proper methods of handling food.
2. Wash tangerines thoroughly because students will be eating the peels.
3. Boil 2 quarts of water in a 4-quart pot.

Safety Precautions

Review safety precautions for using knives and the hot plate. Take care when removing the candied peels from the pot and be sure to allow the peels to cool before serving and eating.

Making the Recipe

1. Show the tangerines to the class. With a vegetable peeler, peel off the zest from one of the tangerines (the zest is the colored part of the peel that is often used for cooking). Take the peel off the tangerine and bend it so that the oil from the peel squirts into the air. Encourage students to smell the fragrant oil when they examine their own tangerines but also tell them that the oil can sting if it gets in someone's eyes. Point out the pith (the white part of the skin just below the zest) and mention that it has a bitter taste. Separate the segments, which hold the citrus flesh and seeds in a thin membrane. Identify the seeds and the sacs (tiny, individual pouches where the juice is stored).
2. Provide each student group with four tangerines to examine. Have students peel the tangerines and investigate the zest and the pith, recording their observations in their journals.
3. Ask students to peel the zest and a little bit of the pith from the skins. This step prevents the peeled zest from becoming too fragile to handle. Collect these peels and place them in the pot of boiling water; reduce heat and simmer for 10 minutes.
4. While the peels simmer, have students investigate the other parts of the tangerine: the sections, the citrus sacs, and the seeds.
5. Allow each student group to draw and label the parts in their journals.
6. Ask students to gather around the demonstration table to observe the tangerine peels cooking. With the slotted spoon, remove the peels from the pot and set them aside in a bowl. Measure out 2 cups of the water and discard the rest. Put the 2 cups of water back in the pot.
7. Have a student add 2 cups of sugar to the water. Stir with the slotted spoon until the sugar dissolves in the water. Place the peels back into the pot and let them simmer for about 10 minutes on low heat until they become translucent.
8. Take the pot off the hot plate. Have a student use a slotted spoon to remove the peels from the pot and put them onto the large plates. Ask the class for observations about what happened to the peels.
9. Allow the peels to cool completely before eating them.
10. Clean up materials. If you have a school or classroom compost or worm bin, place the food scraps there.

Making Compost “Tea”

Preparation Time:	Varies
Total Lesson Time:	30 to 50 minutes to set up the experiment, then a few minutes every three to five days for four weeks

Background

In sustainable agriculture different types of compost are used for many reasons. Compost improves the soil and helps it provide nutrients that plants need. Many farmers apply cow, horse, or chicken manure or other compost directly onto the soil. Other farmers make compost “tea” by mixing the compost with water. They may spray this tea on the soil before planting or during the growing season as part of the watering routine. (Compost tea is also often sprayed directly on the plants for several reasons, including disease suppression.) Some farmers do not necessarily use compost as a fertilizer but as a means of adding microbes, which then cycle nutrients.

In this activity, students will make compost tea and conduct an experiment to find out the effect of compost tea on growing plants. They will use a control plant (with only water) and compare the results with the entire class at the end of the data-gathering period. For safety reasons, do *not* use fresh or unsterilized manure. All animal manure is potentially hazardous and may contain *E. coli* or other disease-causing pathogens. Use only sterilized or fully composted manure for this activity. Aged manure is *not* the same as composted and may contain disease-causing organisms.

Objectives

Students will be able to:

Make observations about compost or worm castings.

Make compost tea.

Describe the results of an experiment that compares the effects of compost tea and water on growing plants.

Differentiate between opinion and conclusions supported by observations.

Materials

For the class:

waterproof pen

For each group of 4:

copies of Beck Grove farm profile
 1 large paper cup (12 oz)
 3 cups worm castings or decomposed (mature) compost from school compost bin or fully composted or sterilized chicken manure from nursery
 paper towels
 4 plants of similar height in pots
 2 1-quart jars
 journals
 plastic measuring cup or other device for measuring liquids
 ruler

Preparation

1. Buy seedlings that are in season (beans for spring, tomatoes for summer, carrots for winter). Set up the plants in a sunny spot.
2. Using a pencil, poke small holes in the bottoms of the paper cups to use cups as strainers.
3. Buy or collect compost.



Doing the Activity

1. As a class read the Beck Grove farm profile. Ask students what they understand about biodynamic farming. Introduce the activity by explaining that compost tea is one of the “preparations” used in biodynamic farming.
2. Show students the compost for making the compost tea and discuss the origin of compost. (If you have a classroom worm box or school yard compost bin, students should easily be able to make the connection between lunch scraps and compost. Help them understand that compost is nutrient-rich material consisting of decomposed leaves, peels, or other organic matter.)
3. Ask students how they might be able to test whether compost tea helps plants grow and how they will distinguish evidence from opinion. Explain to them that they will make compost tea and that they will compare what happens when they apply compost tea to some plants and plain water to other plants.
4. Give each group a handful of worm castings, compost, or fully composted or sterilized chicken manure on a paper towel. Students examine the compost and then make drawings and write descriptions about the compost in their journals.
5. Demonstrate how to make compost tea: Place compost in the one-quart jar and fill with water. Cover and let stand overnight. Have the students fill their own containers in the same way. Explain how letting the mixture stand will allow more nutrients in the compost to enter the water. The following day, demonstrate how to filter the solution. Place a paper towel inside the paper cup that has been perforated and set the cup into the neck of the empty jar, pouring the solution slowly into the cup. Ask the students to take care not to pour too much of the solids into the cup and to pour slowly to avoid overflowing.
6. Give each group the materials to make compost tea. After making the tea, students record in their journals their observations about the tea.
7. Ask the class to predict which plants will grow more: the three that are watered with compost tea or the one watered with plain water. Have students record their predictions and the reasons for these predictions in their journals.
8. Have students examine their group’s four seedlings and record their observations. Students may make many different observations, but make sure they record the height of the seedlings and the number of leaves on each plant. Have each student in the group measure the height and have the group agree on the correct measurement. Discuss the idea of how repeated measurements increase the chances of accuracy. Have students use a waterproof pen to label one plant “water” and the other three “tea.” Students will water or “tea” each plant when needed. Make sure students understand that the four plants should get the same amount of water or tea by using the measuring cup.
9. Have the students help design and make a class chart for recording the height and number of leaves for each plant. Set a schedule to make observations about once every three to five days.
10. After each observation session, discuss with the students some of their observations. Continue the investigation for about four weeks. Compare the results with the entire class at the end of the data-gathering period.
11. At the end of the investigation, have students compare the results with their original predictions. They can organize their results into charts, graphs, or diagrams and present their findings to the class. Discuss how the data allowed them to make their conclusions and the difference between a conclusion based on data and one based on unsupported opinion.
12. (Optional) When the plants are large enough, transplant them into the school garden and continue to monitor them until they are ready to harvest.

Beck Grove

It is 5:30 a.m. at Beck Grove, a 33-acre farm in Southern California. While most of California is fast asleep, Helene and Robert Beck are up and ready to start their day.

At this early hour, the Becks are making sure that they have buyers for their produce. “We’re making phone calls, taking sales orders, passing out picking lists, and seeing that the fruit gets to market,” explains Helene.

The main crops at Beck Grove are citrus fruits. “We’ve got Minneola tangerines, blood oranges, navels, kumquats, limes, and Meyer lemons,” says Helene. In addition to all this citrus fruit,

the Becks also grow persimmons, Asian pears, and lemongrass.

Of all of their fruit crops, Helene claims the tangerines are the sweetest. The Becks have almost 400 Satsuma tangerine trees yielding 30,000 pounds of fruit each year. The Becks have little trouble finding buyers for their tangerines, which are sold at markets all over the country.

Customers, Robert says, often ask for Beck tangerines by name. “It kind of gives you a nice glow,” he adds.





One thing that attracts customers to the Becks' tangerines is the fact that they are organic. Beck Grove is certified organic, which means that a third party has inspected the grove and found that only organic farming practices are used. Therefore, all the fruit has a label that assures buyers that the fruit is grown in accord with the U.S. Department of Agriculture regulations defining organic practices.

Actually, the Becks practice a special type of organic farming called biodynamics, which is based on the writings of a German scientist, Rudolph Steiner, who wrote during the early part of the twentieth century. Farmers who practice biodynamics make up so-called preparations, which are special mixes of such things as cow manure, cow horns, nettles, and other natural ingredients. These preparations are applied to the soil at specific times and on specific days, determined by the phases of the moon. Planting is also done according to this special timetable.

Few farmers in the United States practice biodynamics; Robert estimates that there are no more than 20. When asked if farming this way is a lot of work, Robert laughs and replies, "Well, the trees do a big part of the work for us."

Tangerine trees are slow growing, Robert explains. This means that he has had to do almost no pruning (cutting back the branches) and that harvesting the fruit is easy. "The branches are so low that I don't even need to use a ladder to pick them," says the grower.

In the years since 1983, when the Becks bought their farm, they have seen the surrounding countryside change. Many neighboring farms have been sold and divided into residential lots. Where once there was farmland, now there are houses. "Pretty soon we'll be an island," says Helene of their grove. "It's disappointing, but it isn't going to change what we do. We will continue on."

Cooking Greens & Cabbage

Cooking greens (sometimes called braising greens) are dark green, leafy vegetables, also called cole crops, that can be eaten fresh but are generally cooked. Many of them have strong, assertive flavors and tough, fibrous leaves. Cooking the greens helps to break down their structure, making them tender and delicious. *Braising* refers to a cooking method in which tough cuts of meat or vegetables are nearly covered in liquid and then slowly simmered until tender. One example of a braised green is the southern dish of collards with ham hocks.

Though spinach is the most well-known green, other greens are having a resurgence in popularity, including kale, chard, collards, and green cabbage.

Spinach was domesticated about 2,000 years ago in Iran. By 1,000 years ago, spinach was introduced to southern Europe. Spinach contains oxalic acid, a compound that inhibits calcium and iron absorption in the human body and also gives the green its slightly bitter taste. Oxalic acid, however, does not significantly diminish





spinach's nutritional benefits. Many varieties are available, including Bloomsdale Savoy Long Standing, a ruffled spinach with distinctive, curly leaves, and King Denmark, a smooth-leaf variety.

Most other cooking greens, including kale, collards, and cabbages, are members of the botanical family Brassicaceae (also called Cruciferae). These plants are almost always eaten cooked because they are spicy when eaten raw. This spiciness is caused by the same chemical found in the mustard plant, also a member of this family. Table mustard is made from the ground seeds of this plant.

Kale, also known as borecole, is a member of the crucifer (cabbage) family. It is an old crop, but its exact date of domestication is uncertain, anywhere from hundreds to thousands of years B.C. It is eaten only as a cooked vegetable. It is popular in the northern European diet because it can remain fresh and good to eat while there is snow on the ground. As with all dark, leafy greens, it is a nutritional powerhouse. Red Russian is one of the more popular varieties.

Collards are another member of the crucifer family. Long a traditional staple in the southern United States, they require long, slow cooking. Their hardy constitution makes them better able to withstand intense summer heat than can most other cooking greens. Collards closely resemble wild cabbage, which is still found throughout Europe. Their leaves are similar to those of cabbage, but they do not form heads.

Cabbages form heads in a variety of shapes, including flat, conical, and round. The green cabbage is composed of heavy, tightly wrapped leaf bundles, while some varieties, such as the Savoy and Napa (or Chinese) cabbages have elongated heads with intricate, lacy leaves.

Cabbage comes from the French word *cab-oche*, meaning "head."

Seasonality and Growing Conditions

Cooking greens can be grown year-round in moderate climates but are generally thought of as winter vegetables; they enhance soups, stews, braised meat, and other winter dishes. Cooking greens, especially kale, do well in most soils. Collards prefer a very fertile soil enriched with rotted manure, while cabbage likes any soil type as long as there is adequate moisture and it is fertilized with composted manure or other soil amendments. Spinach is a cool-weather crop, requiring well-drained and mulched soil with lots of moisture.

Cooking greens are susceptible to a number of insect pests, the most common being flea beetles and aphids, which may be removed by spraying the vegetables with a hose. Diseases common to greens include clubroot and black-leg, which are fungi. Greens in the cabbage family are also susceptible to cabbage worms, which are controlled with a Bt spray. Farmers add limestone to the soil to deter these diseases; vigilant mulching and composting will help as a preventive measure.

Most greens are harvested by individual leaves, which are cut from the plant, allowing new leaves to sprout. Cabbage is harvested by cutting the whole head.

Selection, Storage, and Nutrition Information

Choose greens that have good color for their type and leaves that are crisp and stiff to the touch. Cabbage should feel heavy for its size and have tightly wrapped leaves unless it is the Savoy or Napa type. Greens are high in vitamins A and C. Spinach is also high in folate and iron and is a good source of fiber. Cabbage is high in vitamin C.

Braised Collards with Bacon

Preparation Time:	20 minutes
Cooking Time:	10 minutes
Total Lesson Time:	60 minutes
Recipe Level:	Advanced

Background

Collards came to the United States when Africans brought collard seeds with them and grew them in their gardens for food. Collards were an important source of vitamins and minerals for Africans enslaved in the southern United States. These greens grew year-round because they adapted well to the climate. Africans added ham, when it was available, to enhance the flavor and the nutritional quality.

Because collards have such large leaves, students can examine them in great detail. Students can dissect the leaves and identify the veins that transport nutrients to and from the leaf; the cuticle, which is the waxy, waterproof outer layer of the leaf; and the epidermis, which is the green under-layer of the leaf.

Objectives

Students will be able to:

Observe and describe the patterns and parts of the collard leaves.

Describe the origins of collards as a staple food in the early history of the United States.

Ingredients

For a class of 20:

- 3 large bunches collards
- 6 slices bacon*
- 2 teaspoons salt
- water

Materials

For the class:

- knife
- cutting board
- hot plate
- large, heavy-bottomed pot
(8-quart)
- plates
- paper towel
- spatula
- forks
- napkins
- journals

*If students have dietary restrictions against eating pork, replace with 6 tablespoons olive oil.

**Preparation**

1. Have students wash their hands. Discuss proper methods of handling food.
2. Separate collards into five equal portions, one for each student group.

Safety Precautions

Review safety precautions for using the hot plate.

Making Braised Collards with Bacon

1. Give each group its portion of collards. Have students observe the collard leaves and write their observations in their journals (see Background).
2. Have students gently wash the collard leaves, shake off the excess water, and place the collards on the plates. Cut the collard leaves lengthwise into 2-inch pieces.
3. Collect the plates of collards. At the demonstration table, cut the bacon into half-inch pieces. Introduce the origin of this recipe (see Background). Ask students to name other recipes that may have significance in their families.
4. Cook the bacon in the pot over medium heat. Once the bacon begins to sizzle, turn it. When the bacon is cooked but not crispy, have another student add the collards and a cup of water. Turn the heat down to low. Add salt and cook covered for about 15 minutes, depending on the thickness of the collards. Check periodically and add a few tablespoons of water as necessary to maintain a little braising liquid.
5. Remove the pot from the hot plate when the collard leaves are completely tender. Serve on plates.
6. While students eat, continue a discussion about the cultural significance of collards.
7. Clean up materials. If you have a school or classroom compost or worm bin, place the food scraps there.

Kale & Potato Soup

Preparation Time: 20 minutes
 Cooking Time: 45 minutes
 Total Lesson Time: 1 hour and 15 minutes
 Recipe Level: Advanced

Background

One of the heartiest greens, kale grows well in winter because it can survive snow and frost in the harshest climates. Kale is popular all over northern Europe, especially in Russia, for this reason. In this recipe the kale's pungent flavor marries well with the sweetness of waxy potatoes, such as Yellow Finn and Yukon Gold. Such potatoes are often labeled "boiling" potatoes in retail food stores. When you select potatoes for this soup, stay away from the starchy potatoes, such as Russet, because they will fall apart in the soup.

There are many different varieties of kale, including Dinosaur Kale (named for its ribbed leaf texture) and Red Russian, which vary greatly in texture and taste. If possible, look for different kale varieties at the farmers market or supermarket and use them to illustrate the diversity within crops.

This recipe is adapted from a traditional Portuguese dish. The most traditional versions include slices of spicy sausage, such as *linguiça*.

Objectives

Students will be able to:

Work in collaborative groups to make a recipe.

Read and discuss how one farm grows greens.

Ingredients

For a class of 20:

- 3 bunches kale
- 3 onions
- 3 lbs potatoes
- 15 cloves garlic
- 6 tablespoons olive oil
- 3 sprigs thyme
- 1 bay leaf
- 3 quarts vegetable stock,
low-sodium chicken stock,
or water
- 1 to 2 teaspoons salt
- ½ teaspoon dried red pepper
flakes (optional)

Materials

For the class:

- hot plate
- 6-quart pot with lid
- colander
- measuring spoons and cups
- ladle
- large spoon
- vegetable peeler

For each group of 4:

- 2 cutting boards
- 2 knives
- 2 peelers
- 4 bowls
- 4 spoons
- 4 plates
- 4 napkins
- copies of Green Gulch
farm profile
journals



Preparation

1. Have students wash their hands. Discuss proper methods of handling food.
2. Separate the kale, onions, potatoes, and garlic into five equal portions, one for each student group.

Safety Precautions

Review safety precautions for using knives and the hot plate. When serving the soup, make sure that it is not burning hot.

Making the Recipe

1. Demonstrate how to peel and slice an onion by cutting it in half, turning the flat side down, and slicing. Demonstrate how to wash and chop the kale. Demonstrate how to peel and cut a potato into ¼-inch cubes by cutting it in half, turning the flat side down, slicing, then cubing. Demonstrate how to smash garlic. To chop it finely, separate the cloves of garlic. Place the garlic clove (with its skin intact) on the cutting board, lay the flat side of the knife blade on the clove, and smash the blade with your fist. This action will break open the garlic skin, making it easy to remove. Mince the garlic by cutting it first one way and then the other in a repetitive motion.
2. Give each group its equally divided portion of kale, onions, potatoes, and garlic to prepare. Have groups place their ingredients on separate plates.
3. Collect the plates and place them on the demonstration table. Have students gather around the demonstration table.
4. Heat the oil in a pot over medium heat. Ask one student to add the onions and 1 teaspoon salt.
5. Stir and cook for 5 minutes until the onions are soft.
6. Add the potatoes, garlic, (optional) red pepper flakes, thyme sprigs, and bay leaf. Cook for another 5 minutes.
7. Stir in the kale, then cover with water or vegetable stock. Bring to a boil and let the soup simmer for 30 minutes. Taste for salt. Meanwhile, read or have students read the Green Gulch farm profile and lead a discussion about living on a farm such as Green Gulch.
8. When the soup is ready, take out the bay leaf and the thyme before serving the soup in the bowls. While students eat, discuss words that describe the different flavors in the dish. They can write these words in their journals.
9. Clean up materials. If you have a school or classroom compost or worm bin, place the food scraps there.

Frozen, Canned, or Fresh: Which Do You Prefer?

Preparation Time: 10 minutes
Total Lesson Time: One to two hours,
depending on class

Background

In this activity, students design an experiment; carry it out; and report on the differences between frozen, canned, and fresh spinach. This activity can serve as a basic outline for a teacher or student who wishes to perform a more thorough examination of the same food preserved and fresh. The activity is designed to explore taste preferences rather than nutritional content.

Objectives

Students will be able to:

Design an experiment to compare the flavors and textures of spinach.

Explain the differences by using charts and graphs during their group presentation.

Decide from their findings whether they prefer frozen, canned, or fresh spinach.

Materials

For the class:

- 3 frozen packages spinach
- 3 cans spinach
- 3 bunches fresh spinach
- journals
- 3 medium-sized pots
- hot plate
- water
- forks
- plates
- napkins

**Preparation**

1. Cook or heat up the three kinds of spinach. The fresh spinach should be well washed, drained, and cooked in the residual moisture.
2. Divide spinach so that each student group has an equal share of frozen, canned, and fresh spinach.

Doing the Activity

1. Show students a frozen package of spinach, a can of spinach, and a bunch of fresh spinach. Explain that each group will design an experiment that will examine the visual appearance, taste, texture, and smell of frozen, canned, and fresh spinach.
2. As a class, discuss possible methods of observing and recording the different features of the spinach. As students make suggestions, write them on the board so that they can see various methods for designing their experiment.
3. Set clear objectives for the experiments, such as teacher approval of experimental design and recording methods; time limits for examination; and organization of the data, such as graphs or charts for presentation.
4. Give each student group its share of the three kinds of spinach. Remind students that they need to set up a plan to investigate the spinach before handling it.
5. Have students present their plan (it should have between 3 and 5 steps) to you for approval. This is a good time to raise any problems you foresee with a given proposal. If needed, let students revise their plan.
6. Allow 20 to 30 minutes for students to conduct their experiments and record their observations.
7. Ask students what conclusions they can make based on the information they gathered. At this time, it may be important to discuss with the class different ways to present the information.
8. After the discussion, allow groups time to create graphs, charts, or other materials for making a brief presentation to the class. Make sure groups plan how each group member will participate in the presentation.
9. Provide time for groups to practice their presentation. Give each group one to two minutes to present its findings.
10. Clean up materials and compost the spinach if compost is available.

Green Gulch Farm



Just north of San Francisco along the California coast, Route 1 winds its way past beautiful views of the Pacific Ocean and lush green hills. One of the most stunning sights along the way is a small farm nestled in a valley. This farm, called Green Gulch, is also a center where people come to meditate and study Zen Buddhism.

Meditation is a way of “quieting the mind,” says Emila Heller, who lives and works at Green Gulch. For most people, this means sitting in silence, focusing on breathing and clearing away all their thoughts and worries. Meditation is a spiritual practice of Zen Buddhism, a religion that was founded on the teachings of Buddha, who lived in India over 2,000 years ago.

“This is a unique place where we live together, meditate together, study Buddhism together, and work on the farm together,” says Emila.

Emila notes that farming is not the main purpose of Green Gulch, but it is an integral and important part of life there. Many of the people who come to live and study at Green Gulch have never worked on a farm before, so this is a totally new experience for them.

“We get up at 4 o’clock in the morning and we sit in meditation until 7 o’clock. Then we work on the farm until noon. After lunch we go back out to work for the rest of the afternoon,” says Emila. In the evening, there are classes on Buddhism. Green Gulch also offers lectures and farm activities for visitors, including classes on gardening, composting, bread making, crafts, writing, and the study of plants and wildlife on the farm.



Because Green Gulch is on the Pacific coast, the weather is usually cool and often foggy. This means that cool-season crops—those that usually grow in the winter in California’s Central Valley—do very well at Green Gulch in the summer. One such crop is cooking greens. Cooking greens look a bit like salad greens, such as lettuce, but they are much tougher and usually taste best when they are cooked. Only when they are very young with small leaves are they tender enough to mix into a salad.

The most familiar cooking greens are spinach, kale, collards, and chard. All these greens may be found all year long at Green Gulch.

While the weather favors the growing of these crops, there are sometimes problems with pests, such as flea beetles, eating the tender leaves of young plants. Emila explains that the best way to protect the plants is to make them healthy and vigorous. This task is accomplished at Green Gulch by applying to the soil an organic compost high in nutrients.

Sometimes the workers at Green Gulch will make a compost “tea” by mixing compost with water and letting it sit a while. (See also the compost tea activity in Chapter 7.) Workers carry spray bottles of this tea in backpacks. Wearing the backpack, a worker will walk through the fields, spraying the compost tea on plants. This strengthens the leaves and the roots to help the plant fight off pests and diseases.

Most of the cooking greens and other vegetables grown at Green Gulch are used to feed people on the farm, both the residents and the many visitors who come out for a day. The farm feeds anywhere from 60 to 200 people each day.

Some of the produce goes to local restaurants. What is left goes to some of the farm’s neighbors and a few markets.

Green Gulch also hosts field trips, often from city schools with many students who have never been to a farm before. “We give classes a tour of the farm, and they get to do some harvesting,” explains Emila. Because Green Gulch farm is close to San Francisco, it gets many requests for field trips. Schools are asked to make reservations well in advance of when they want to visit.

One type of harvesting is called gleaning. After the main harvest, there are usually some leftover vegetables in the fields. Gleaning means picking these vegetables so they do not go to waste. Green Gulch donates these vegetables to a soup kitchen. By helping with the gleaning, kids visiting the farm help feed people who are hungry.

Broccoli & Cauliflower

Broccoli and cauliflower are both in the cruciferous family of plants, also called cole crops. Originally from the northern Mediterranean countries of France, Italy, and Greece, broccoli and cauliflower grow best in moderate climates. Most of the broccoli and cauliflower eaten in the United States are grown on the southern part of the Central Valley in winter and in Monterey County year-round. Both broccoli and cauliflower come to market with few leaves and a prominent head of flowers.

Broccoli grows with its leaves spread out to catch the sun's rays and develop the plant's chlorophyll. A common type of broccoli has large inflorescences (clusters of tightly packed flowers) that are often very big (up to six

inches wide). Broccoli raab (broccoli rabe) is another type that has smaller inflorescences and thinner stems. The flavor is slightly stronger. Romanesco broccoli is a beautiful, geometrically shaped broccoli with pointed, spiral clusters on its inflorescence, a lighter green color, and a flavor similar to that of cauliflower. The leaves of broccoli are also edible and tasty and resemble collard greens.

Cauliflower is another vegetable that has a big inflorescence, called *curds*, or head. Cauliflower curds are a pale color. As the plant grows, its big leaves shield the head of the cauliflower from the sun. Compared with broccoli, cauliflower has hardly any stem.





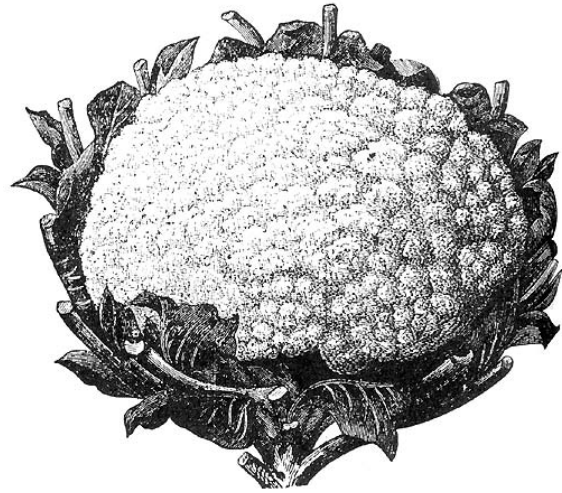
There are more than 40 varieties of cauliflower, most of which are defined by their varying leaf patterns. School gardeners should select varieties with large leaves that will provide adequate sun protection. Cauliflower seeds or transplants can be planted directly into the garden. Tie the leaves with string.

Seasonality and Growing Conditions

In foggy coastal climates, broccoli and cauliflower grow year-round, but in most other parts of the state they are winter vegetables. Depending on the variety, they will grow well in fall or spring, producing a stronger flavor that not everyone likes.

Broccoli requires a moderately rich, well-drained soil with lots of moisture. After the main head has been cut from sprouting varieties, side shoots will continue to form heads and provide a steady harvest. For maximum flavor, broccoli should be harvested before the flower buds begin to expand and bloom. Broccoli raab, however, is often sold after the flower buds have opened.

Cauliflower needs a deep-dug, loose, high-nitrogen soil. The nitrogen helps to develop the heads. A deficiency of nitrogen will result in yellow, stunted, dead leaves. Composted manure is a source of nitrogen. Cauliflower should be harvested when the heads are six inches in diameter and the curds are still compact. When the curds have already begun to separate, the plant is past its harvesting date. Broccoli and cauliflower are susceptible to various insect pests, including aphids, cabbage maggots, cabbage worm, slugs and snails,



and a disease known as clubroot. Pests may be removed by hand or by spraying with a hose. Adding limestone to the soil can prevent clubroot.

Selection, Storage, and Nutrition Information

When choosing broccoli, look for heads that are a deep, green color with tight buds. Avoid limp heads or those with open or yellowing buds. Broccoli can be stored in an airtight plastic bag in the refrigerator for up to four days. The plants are nutritional powerhouses high in vitamins A and C and a good source of fiber and folate.

Cauliflower heads should feel heavy for their size and have tight, compact curds that are a creamy white color. Storage is the same as for broccoli. Cauliflower is high in vitamin C and is a good source of fiber.

Broccoli Italian Style

Preparation Time:	20 minutes
Cooking Time:	15 minutes
Total Lesson Time:	60 minutes
Recipe Level:	Advanced

Background

This recipe reminds one of broccoli's Italian origins. All the spices and herbs in this recipe complement the taste of broccoli to make it even more delicious. When preparing recipes with broccoli or any of the plants from the cabbage family, be careful not to overcook it. A sure sign of overcooked broccoli is a distinct, sour odor caused by the release of sulfur compounds.

In this activity allow plenty of time for the students to examine the broccoli while they break it apart. Have students identify parts (stem, leaf, and flower). You may want to have them write down observations as they prepare the recipe.

Objectives

Students will be able to:

Describe, draw, and label the stem, flower, and leaf of a broccoli plant.

Understand that the most edible part of broccoli is its flower.

Ingredients

For a class of 20:

- 4½ lbs broccoli
with leaves attached
- 6 to 8 garlic cloves
- 1 tablespoon chopped,
fresh oregano, marjoram,
or thyme
- water
- 2 teaspoons salt
- ½ cup olive oil
- 2 lemons

Materials

For the class:

- hot plate
- 8-quart pot
- colander
- large skillet
- wooden spoon
- measuring spoons
- cutting board
- slotted spoon

For each group of 4:

- 2 cutting boards
- 2 knives
- 2 peelers
- 4 napkins
- 4 plates
- journals

**Preparation**

1. Have students wash their hands. Discuss proper methods of handling food.
2. Separate the broccoli, garlic, and oregano into five equal portions, one for each student group.
3. Fill the pot halfway with water. Add 1 teaspoon salt and set to boil while students are making observations of the broccoli.

Safety Precautions

Review safety precautions for using knives and the hot plate. Use caution when adding ingredients to the hot oil as it can splatter and burn.

Making the Recipe

1. Provide each group a set of materials and a portion of the broccoli, garlic, and oregano.
2. Demonstrate how to trim the stem from the head, peel the stem, and cut it into half-inch slices. Demonstrate breaking the head into florets. Demonstrate peeling and chopping garlic and chopping the oregano. Have students prepare the ingredients and arrange them neatly on the plates.
3. Collect the broccoli and place it into the salted boiling water for three to four minutes or until crisp-tender. Scoop out the broccoli and set it aside on a plate.
4. Collect plates of chopped garlic and oregano and place them on the demonstration table next to the skillet and the hot plate. Have students gather around the demonstration table.
5. Heat the oil in the skillet. Ask a student to scrape the garlic into the skillet. When the garlic begins to sizzle, have another student add the broccoli, 1 teaspoon salt, and the oregano. Stir ingredients for another three to four minutes.
6. Take the skillet off the hot plate. Stir the broccoli as two students squeeze lemon halves onto the broccoli. Serve on plates.
7. While students eat, discuss other types of flowers that people eat.
8. Clean up materials. If you have a school or classroom compost or worm bin, place the food scraps there.

Cauliflower with Cheese Sauce

Preparation Time: 20 minutes
 Cooking Time: 15 minutes
 Total Lesson Time: 60 minutes
 Recipe Level: Easy

Background

This recipe is a nutritious and delicious version of macaroni and cheese, a favorite of many children. You can make different versions with broccoli or a combination of both broccoli and cauliflower instead of just cauliflower. You may also expand the recipe to a main dish by combining it with a pound of pasta (cooked) and doubling the recipe for the sauce. Students can dissect the cauliflower to discover the stems, leaves, and flower. If you buy cauliflower at the farmers market, it will usually come with its leaves still covering the flower, shading it from the sun.

While preparing this dish, you may want to draw attention to the cooking process of the butter, flour, milk, and cheese. Students are always fascinated when watching transformations.

Objectives

Students will be able to:

Understand that they are eating the flower part of cauliflower.

Observe and describe the transformation process of making the sauce.

Ingredients

For a class of 20:

3 medium heads cauliflower
 4 cups milk
 4 tablespoons butter
 5 tablespoons flour
 1½ teaspoons salt
 1 lb cheddar cheese
 pepper

Materials

For the class:

hot plate
 large, 6-quart pot
 colander
 2-quart pot
 large skillet
 measuring spoons
 and cups
 wooden spoon
 3 cheese graters
 whisk

For each group of 4:

2 cutting boards
 2 knives
 2 plates
 4 napkins
 4 forks
 journals

**Preparation**

1. Have students wash their hands. Discuss proper methods of handling food.
2. Separate cauliflower into five equal portions, one for each student group.
3. Begin to boil water while students are making cauliflower observations. Add 1 teaspoon salt to the water.

Safety Precautions

Review safety precautions for using knives and the hot plate.

Making the Recipe

1. Give each group a set of materials and a portion of the cauliflower.
2. Demonstrate how to trim the stem from the head and break the head into florets. Have students prepare cauliflower florets and arrange them neatly on plates. Have students gather around the demonstration table.
3. Collect the cauliflower and place it into the salted boiling water for 5 minutes or until tender. When it is done, drain the cauliflower in a colander and set it on the demonstration table.
4. Ask two students to measure out 4 tablespoons butter, 5 tablespoons flour, and 4 cups milk. While they measure out the butter, flour, and milk, ask three other students to grate the cheese.
5. Make the sauce. Warm the milk in the 2-quart pot. Melt the butter in the large skillet over medium heat. Whisk in the flour and $\frac{1}{2}$ teaspoon salt. Now slowly whisk in the warmed milk. Ask students to make predictions about what will happen to the sauce as it cooks.
6. Once the sauce has thickened and is smooth, slowly add the cheese while stirring constantly. Ask students what role stirring plays in the cooking process. Add ground pepper, if desired.
7. When the cheese is thoroughly melted, serve the cauliflower and cheese sauce on plates. While students eat, review the cooking process with the class.
8. Clean up materials and compost food scraps.



Spiced Broccoli & Cauliflower

Preparation Time: 20 minutes
 Cooking Time: 15 minutes
 Total Lesson Time: 1 hour
 Recipe Level: Advanced

Background

This recipe is inspired by Indian cuisine and is a great opportunity to lead a discussion about ethnic dishes. Tie this lesson together with a history or geography lesson, using a world map to show where India is located and discussing various spices commonly used in Indian dishes, such as ginger, cumin, and mustard seed. Discuss other ethnic foods the students have eaten. Find the places on the map where those foods originated.

The spices needed for this dish can be found in most grocery stores. The spices, when mixed together at medium heat, combine to give the broccoli and cauliflower a unique, spicy flavor.

In this activity, allow plenty of time for students to compare broccoli and cauliflower as they break them apart. You may want students to record their observations in their journals while they observe different parts of the produce. While cooking, discuss with students some of the differences of garlic, broccoli and cauliflower, cumin and mustard seeds, peppers, ginger, and cilantro. Have students try to identify which ingredients represent different plant parts.

Objectives

Students will be able to:

Describe, draw, and label the stem, flower, and leaf of broccoli and cauliflower plants.

Understand that the most edible part of broccoli and cauliflower plants is the flower.

Ingredients

For a class of 20:

- 3 lbs each of broccoli and cauliflower
- $\frac{3}{4}$ bunch cilantro
- 6 garlic cloves
- $\frac{1}{2}$ cup vegetable oil
- 2 teaspoons salt
- 3 dried chili peppers (optional)
- $1\frac{1}{2}$ teaspoons mustard seeds
- $1\frac{1}{2}$ teaspoons cumin seeds
- 1 medium knob ginger root (about 1 inch by 1 inch)
- $1\frac{1}{2}$ teaspoons black onion seeds (nigella) (optional)
- 2 lemons

Materials

For the class:

- 2 hot plates
- 2 small mixing bowls
- colander
- measuring spoons
- wooden spoon
- 2 12-inch skillets
- cutting board
- knife

For each group of 4:

- 2 cutting boards
- 2 knives
- 2 peelers
- 4 napkins
- 4 forks
- 4 plates
- journals

**Preparation**

1. Have students wash their hands. Discuss proper methods of handling food.
2. Separate the broccoli, cauliflower, cilantro, and garlic into five equal portions, one for each student group.

Safety Precautions

Review safety precautions for using knives and the hot plate.

Making the Recipe

1. Provide each group of students with materials and ingredients.
2. Demonstrate how to trim the stem from the head of the broccoli, peel the stem if it is tough, and cut it into eighth-inch slices. Demonstrate breaking the heads of the broccoli and the cauliflower into small florets. Demonstrate peeling and chopping the garlic and chopping the cilantro. Have students prepare the ingredients and place them neatly on plates.
3. Collect plates of broccoli and cauliflower and place them on the demonstration table. Collect plates of chopped garlic and cilantro and place them on the demonstration table next to the skillet and the hot plate. Have students gather around the demonstration table.
4. Heat oil in the skillets over medium heat. Divide the piles of ingredients equally for the two skillets. Add all the spices and seasonings to the oil in the two skillets. Add the cauliflower and cook for 3 or 4 minutes and then the broccoli, which takes a little less time to cook. Add $\frac{1}{2}$ cup water.
5. Cook on low heat and stir the ingredients for another 10 minutes or until vegetables are tender. *Note:* Keep ingredients at a temperature at which everything is cooking but not burning.
6. Take the skillet off the hot plate. Top with cilantro and serve the vegetables on plates. Cut the lemons in half and pass around to squeeze onto vegetables. While students eat, discuss words that describe the different flavors in the dish.
7. Clean up materials. If you have a school or classroom compost or worm bin, place the food scraps there.

Calculating Farm Profit or Loss

Preparation Time: 10 minutes
Total Lesson Time: 40 to 50 minutes

Background

At the end of each season, farmers calculate how much money they made from each crop. They do this by subtracting how much it cost them to grow and harvest the crop (total expenses) from how much money they received for selling the crop (gross income). When a farmer sells to a wholesaler or to a broker, that mark-up will have to be subtracted as well. When farmers receive more money for selling their crop than it costs them to grow and harvest it, they make a profit. When farmers receive less money for selling their crop than it costs them to grow and harvest it, they lose money.

This activity looks at the costs involved in growing broccoli. The price of broccoli fluctuates. When prices are low, many farmers choose not to grow it because they do not want to lose money.

Objectives

Students will be able to:

Understand the words *expense*, *gross income*, *profit*, and *loss*.

Understand how to calculate farm costs and profits.

Materials

For the class:

Broccoli Balance Sheet student page

Coke Farm farm profile

red pencils or crayons



Preparation

Make copies of the student page and farm profile.

Doing the Activity

1. Read the Coke Farm farm profile and discuss with the class the steps involved in growing and harvesting broccoli.
2. Explain to students that they will explore how much money a farmer can make off one acre of broccoli. Explain that they will analyze profit in terms of various prices that the farmers might receive for the broccoli. Point out that the figures are based upon 20-pound boxes of broccoli.
3. Ask students what factors might affect the number of boxes that might be harvested from a particular plot of land (factors may include weather, soil fertility, water, healthiness of the transplants, and how well pests are under control).
4. Provide each student group with copies of the student page. Have them calculate the income per acre of broccoli with different prices and yields.
5. Discuss with students the process of broccoli production and the different kinds of expenses involved. Discuss buying transplants or seed, paying labor costs, and renting land and have the students think about other costs the farmer must assume. Explain that overhead costs are the general expenses involved in running a farm, such as insurance, office costs, purchase of new equipment, irrigation systems, rent of the land, labor costs, energy costs, and so on. Point out that production expenses are the same no matter how much broccoli is harvested, whereas harvesting expenses vary with the amount harvested.
6. Have students calculate the production expenses, harvesting expenses, and total expenses for each column.
7. Have students then calculate the amount of money the farmer gains or loses for each particular situation by subtracting the total expenses from the gross income. If the total expenses are more than the gross income, the result will be a loss; have students write or color losses in red. If the total expenses are less than the gross income, the result will be a profit; have students write the profits in black. (Losses are written in parentheses on the teacher answer page.)
8. As a challenge, have students figure out the exact amount farmers must charge in order to break even by dividing the total expenses by the number of boxes.
9. *Note:* Interested students can also calculate the cost per pound when the farmer sells the broccoli. If they assume a 50 percent mark-up by the time it is sold in the store, how much does it cost consumers per pound?

Broccoli Balance Sheet

Student Page

Gross Income per Acre of Broccoli

(From sale of broccoli to wholesaler or market)

	400 boxes	500 boxes	600 boxes
Gross Income at \$10 per box			
Gross Income at \$12 per box			
Gross Income at \$15 per box			
Gross Income at \$20 per box			

Expenses per Acre of Broccoli

	400 boxes	500 boxes	600 boxes
Production Expenses			
Lease per year	\$ 600	\$ 600	\$ 600
Broccoli transplants (40,000 transplants)	\$ 800	\$ 800	\$ 800
Compost and fertilizer	\$ 200	\$ 200	\$ 200
Water	\$ 200	\$ 200	\$ 200
Machinery: Tractor, etc.	\$ 200	\$ 200	\$ 200
Labor:			
Pre-planting	\$ 100	\$ 100	\$ 100
Planting	\$ 500	\$ 500	\$ 500
Weeding	\$ 200	\$ 200	\$ 200
Overhead (general farm expenses shared over all crops)	\$1,000	\$1,000	\$1,000

Total Production Expenses

Harvesting Expenses

Wax boxes (\$1 per box)	\$ 400	\$ 500	\$ 600
Cooling and storage (\$2 per box)	\$ 800	\$1,000	\$1,200
Labor:			
Harvesting (\$1 per box)	\$ 400	\$ 500	\$ 600
Sales commission (\$1 per box)	\$ 400	\$ 500	\$ 600

Total Harvesting Expenses

Total Expenses per Acre

Projected Profit or Loss per Acre of Broccoli

(Gross Income minus Total Expenses)

	400 boxes	500 boxes	600 boxes
If sold at \$10 per box			
If sold at \$12 per box			
If sold at \$15 per box			
If sold at \$20 per box			

Challenge Question:

How much would the farmer need to charge per box to break even (which means that gross income equals gross expenses) with 400 boxes per acre, 500 boxes per acre, and 600 boxes per acre?

**Teacher Answer Page****Gross Income per Acre of Broccoli**

(From sale of broccoli to wholesaler or market)

	400 boxes	500 boxes	600 boxes
Gross Income at \$10 per box	\$ 4,000	\$ 5,000	\$ 6,000
Gross Income at \$12 per box	\$ 4,800	\$ 6,000	\$ 7,200
Gross Income at \$15 per box	\$ 6,000	\$ 7,500	\$ 9,000
Gross Income at \$20 per box	\$ 8,000	\$10,000	\$12,000

Expenses per Acre of Broccoli

	400 boxes	500 boxes	600 boxes
Production Expenses			
Lease per year	\$ 600	\$ 600	\$ 600
Broccoli transplants (40,000 transplants)	\$ 800	\$ 800	\$ 800
Compost and fertilizer	\$ 200	\$ 200	\$ 200
Water	\$ 200	\$ 200	\$ 200
Machinery: Tractor, etc.	\$ 200	\$ 200	\$ 200
Labor:			
Pre-planting	\$ 100	\$ 100	\$ 100
Planting	\$ 500	\$ 500	\$ 500
Weeding	\$ 200	\$ 200	\$ 200
Overhead (general farm expenses shared over all crops)	\$ 1,000	\$1,000	\$1,000
Total Production Expenses	\$ 3,800	\$3,800	\$3,800
Harvesting Expenses			
Wax boxes (\$1 per box)	\$ 400	\$ 500	\$ 600
Cooling and storage (\$2 per box)	\$ 800	\$1,000	\$1,200
Labor:			
Harvesting (\$1 per box)	\$ 400	\$ 500	\$ 600
Sales commission (\$1 per box)	\$ 400	\$ 500	\$ 600
Total Harvesting Expenses	\$2,000	\$2,500	\$3,000
Total Expenses	\$5,800	\$6,300	\$6,800

Projected Profit or Loss per Acre of Broccoli

(Gross Income minus Total Expenses)

	400 boxes	500 boxes	600 boxes
If sold at \$10 per box	(\$1,800)	(\$1,300)	(\$4,800)
If sold at \$12 per box	(\$1,000)	(\$ 300)	\$ 400
If sold at \$15 per box	\$ 200	\$1,200	\$2,200
If sold at \$20 per box	\$2,200	\$3,700	\$5,200

Answer to Challenge Question:

The farmer would need to charge \$14.50 per box to break even with 400 boxes per acre ($\$5,800 \div 400$); \$12.60 per box with 500 boxes per acre ($\$6,300 \div 500$); and \$11.33 per box with 600 boxes per acre.

Coke Farm



In 1980, Dale Coke, who had enjoyed a successful career repairing fuel-injection engines, decided that he wanted to become a farmer. “I had a turning point in life when I was diagnosed with cancer,” Dale explains. “I started looking around. I was interested in organic food.” Dale took that interest and turned it into a new career in organic farming.

When Dale started out, there were very few organic farms. “I knew there were other ways to do things,” he says. “My neighbor kept telling me that what I was doing was impossible. So that gave me another reason to try harder.”

Starting with just a quarter of an acre of strawberries at his home in Aromas, near Watsonville, Dale has expanded the farm by making it a family business and buying and renting additional growing fields. Dale, his wife, Christine, and his sister Madeline grow about 30 different crops on about 200 acres. A few years ago the farm was twice as big and employed 70 people.

“The size of the farm and the crop mix are right for us just now,” says Christine. In addition to the home farm in Aromas, Coke Farm has land in the San Juan Valley, a small valley surrounded by a ring of low mountains. Aromas has a cool, coastal climate—perfect weather for growing crops such as lettuce and broccoli year-round and strawberries all summer. The warmer climate of San Juan is well suited to tomatoes, apricots, and strawberries that start early in the season.

Diversity, Dale believes, is good for the farm. “Having lots of different crops is hard,” he says. “You can’t water all at once, plant all at once, harvest all at once, or sell all at once because different crops all have different needs and different schedules. But you also don’t have the same growing or selling problems all at once.”



One of the most harmful pests for Coke Farm’s broccoli is the flea beetle. “This is just a little black beetle that hops around like a flea. They build up in the summer as it gets hotter,” Dale explains. “Each beetle takes only a small bite, but together they can ruin the whole plant.”

Dale has found that the best way to keep down pests such as the flea beetle is to rotate crops. This means that he never grows the same crop in the same place twice in a row. Where he plants broccoli one year, he might plant lettuce the next. Dale also believes in growing diverse crops next to each other. “Here, you’ll never look out and see just fields and fields of broccoli,” he explains. “You will see lettuce and fennel, then a few rows of chard, and then some cauliflower and onions.”

At times the broccoli harvest has been a very profitable one. Dale, an expert machinist, has special farm equipment that makes the harvesting, handling, and packing efficient. When it is time to pick the broccoli, a trailer with a wide table attached to it is driven through the fields. Workers walk behind the trailer, cutting off broccoli stalks and throwing them onto the table. Other workers riding on the trailer take the stalks and drop them in a machine that wraps rubber bands around the broccoli and cuts off the ends so that they are even. The bunches of broccoli are then put in boxes, and the boxes filled with crushed ice. The ice

keeps the broccoli cold and fresh. Piled high, the boxes are stored in a giant cooler awaiting trucks to deliver them to stores and restaurants in San Francisco, Oakland, Los Angeles, and even outside California.

This year Coke Farm is not growing broccoli. “There are more big organic growers coming in,” says Christine, who manages the day-to-day farming operation. “They grow so much, they can afford to sell it a lot more cheaply than we can.” As the market for organic produce grows, these bigger growers along with consolidated big buyers are bringing down the price of organic crops such as broccoli. Bigger quantities allow these farmers to have smaller profit margins so that they can charge less. That is good for consumers. However, it does not work for farmers with small- and medium-sized farms who do not have lots of money or other kinds of income that can help balance out low-profit crops.

Harking back to their beginnings, the Cokes have once again made strawberries one of Coke Farm’s key crops. Since the farm began in 1980, the number of people wanting to buy organic produce has grown. This trend is part of what has made the farm so successful. “But we’ve also paid a lot of attention to figuring out the crops we can grow well in rotations and sell profitably,” Dale says. “Success is due to a lot of hard work, perseverance, and flexibility.”