

# Bring on the Brassica Veggies!

## Objective

Students will read about various vegetables in the *Brassica* family and answer comprehension questions. Students will test recipes using *Brassica* vegetables and determine their favorites. Students will use *Brassica* vegetables in art projects.

## Background

Broccoli, cabbage, cauliflower, Brussels sprouts—all are cultivars of the *Brassica* species, a genus of plants in the mustard family. They are also known as cruciferous vegetables because their flowers all have petals in the shape of a cross. Crops from this genus are also sometimes called cole crops—from the Latin *caulis*, meaning stem or cabbage.

The vegetables we eat from this genus are very good for us, but the genus is also known for its important agricultural and horticultural crops. *Brassica* species are native in the wild in western Europe, the Mediterranean and temperate regions of Asia, and many wild species grow as weeds, especially in North America, South America, and Australia.

Almost all parts of some species of *Brassica* have been developed for food, including the root (rutabaga, turnips), stems (kohlrabi), leaves (cabbage, collard greens), flowers (cauliflower, broccoli), buds (Brussels sprouts, cabbage), and seeds (mustard seed and canola, among others).

*Brassica* vegetables are very high in vitamin A carotenoids, vitamin C, folic acid, and fiber.

- 100 calories provide 25-40 percent of daily fiber requirement.
- 200 calories provides 20 grams of protein.
- 100 calories provide one-third to one-half gram of omega-3 fat, which serves as the basic building block for all other forms of omega-3 fats in the body.
- *Brassica* vegetables are even more renowned for their phytonutrients.

*Brassica* cover crops are known for their rapid fall growth, great biomass production and nutrient scavenging ability. They may also be useful for pest management. Most *Brassica* species release chemical compounds that may be toxic to soil-borne pathogens and pests, such as nematodes, fungi and some weeds. The mustards have unusually higher concentrations of these chemicals. Canola is one member of the *Brassica* genus. In Oklahoma canola has become an important rotation crop with wheat because of its pest management properties.

*Brassica* species are increasingly used as winter or rotational cover crops in vegetable and specialty crop production. Some *Brassica* species have a large taproot that can break through plow pans better than other crops. Those *Brassica* species that die back in winter decompose very quickly and leave a seedbed that is mellow and easy to plant in.

## Oklahoma Academic Standards

### GRADE 3

English Language Arts—  
1.R.1,2,3; 2.R.1.1; 3.R.7;  
4.R.1,3; 6.R.3,4; 7.R.1W.1,2;  
3.W.2; 6.W.2; 7.W.1,2,2.F.1,2  
Science—3.LS1.1, 3.1,2, 4.2,3,4  
Visual Art—3.1,2,3

### GRADE 4

English Language Arts—  
1.R.1,2,3; 2.R.1; 4.R.1,3;  
6.R.2,3; 7.R.1 1.W.1,2; 3.W.2;  
6.W.2; 7.W.1,2; 2.F.1  
Science—4.LS1.1  
Visual Art—3.1,2,3

### GRADE 5

Science—5.PS1.3; 5.LS1.1  
English Language Arts—  
1.R.1,2,3; 3.R.7; 4.R.1,3;  
6.R.2,3; 7.R.1; 1.W.1,2; 3.W.2;  
6.W.3,4; 7.W.1,2  
Visual Art—3.1,2,3,5

## Materials

assorted samples of vegetables from the Brassicas genus—broccoli, cauliflower, radish, cabbage, kale, etc. (See list on next page.)

## Ag Career: Vegetable Farmer

**JOB DESCRIPTION:** Vegetable farmers use their knowledge of soils and plants to determine fertilizer and irrigation needs, obtain seeds for planting, prepare the soil for planting, combat plant diseases and insect pests, harvest vegetables and sell them. A vegetable farmer has to plan carefully to have a crop through all of Oklahoma's growing seasons—spring, summer and fall. Some even grow vegetables through the winter and sell them at winter farmers markets. Keeping accurate records of supplies, purchases, sales, planting and production are another important part of the vegetable farmer's job. Most vegetable growers sell at farmers markets, through Community-Supported Agriculture and through the Oklahoma Food Cooperative.

**SKILLS:** A farmer should like working outdoors with plants. He or she should have good business sense and be able to make good management decisions. The work requires knowledge of soil chemistry, plant physiology, entomology, farm management and economics.

**PREPARATION:** High school courses in agriculture and a college degree in some field of agriculture along with work experience on a farm.

### Brassica Vegetables

arugula  
bok choy  
Brussels sprouts  
cabbage  
cauliflower  
Chinese cabbage  
collard greens  
Daikon radish  
horseradish  
kale  
kohlrabi  
mustard greens  
radish  
rutabaga  
turnip

## English Language Arts

1. Read and discuss background and vocabulary.
2. Provide copies of the reading pages about common *Brassica* vegetables.
  - Students will read about the different vegetables.
  - Lead a classroom discussion about the *Brassica* vegetables
    - How many of the vegetables have you tried?
    - Which ones do you like?
    - How do you like to eat them?
  - Divide students into groups and provide copies of the “Meet the *Brassica* Vegetables” information sheets included with this lesson. Students will read the information about the *Brassica* vegetables in their groups.
  - After students have finished reading, use the clue cards included with this lesson to test student comprehension. Read the clues one at a time. Groups get points based on how many clues you read before they guess the correct vegetable.
3. Assign one of the *Brassica* vegetables to each group.
  - Groups will develop materials—posters, PowerPoint presentations, skits, etc., to promote the assigned vegetable.
  - Students will make their presentations to the class.
4. Students will use online or library resources to find simple recipes for preparing *Brassica* vegetables.
  - Students will develop a class *Brassica* cookbook from the recipes they have found. (Some recipes using *Brassica* vegetables may be found in the “Food and Fun” section of the OAITC website.)
  - Students will prepare the dishes for a *Brassica* pot luck party.

## Science

1. Bring samples of as many *Brassica* vegetables as you can. (See list at left.) Make sure you represent *Brassica* vegetables eaten as roots, leaves and flowers.
  - Students will design charts and use all their senses, including taste, to describe the vegetables. Students may also include other interesting information they have learned about the vegetables in their charts, including origins, which parts we eat, etc.
2. Provide radish seeds and potting medium for students to conduct experiments with fast-growing radishes. Students will use the Scientific Method format included with this lesson and design experiments with radish plants by changing several variables.

## Visual Art

1. Bring samples of assorted fresh *Brassica* vegetables to class.  
—Students will draw pictures of the vegetables.
2. Students will use broccoli and other samples of *Brassica* vegetables to make an edible broccoli forest.

## Extra Reading

- Blackaby, Susan, and Charlene Delage, *Plant Plumbing: A Book About Roots and Stems*, Picture Window, 2005.
- Eclare, Melanie, *A Harvest of Color: Growing a Vegetable Garden*, Ragged Bears, 2002.
- Lin, Grace, *The Ugly Vegetables*, Charlesbridge, 2009.
- Moser, Lisa, and Ben Mantle, *Perfect Soup*, Random House, 2010.
- Stevens, Janet, *Tops & Bottoms*, Harcourt Brace, 1995.
- Thurman, Kathryn K., and Lindsay Ward, *A Garden for Pig*, Kane Miller, 2010.

## Vocabulary

- agricultural**—of, relating to, or used in the science or occupation of cultivating the soil, producing crops, and raising livestock
- biennial**— growing stalks and leaves one year and flowers and fruit the next before dying
- biomass**— biological material derived from living, or recently living organisms
- Brassica***—a genus of plants in the mustard family
- carotenoids**— organic pigments that are found in the chloroplasts and chromoplasts of plants and some other photosynthetic organisms, including some bacteria and some fungi
- cole**— any of several closely related crop plants (as broccoli, kale, brussels sprouts, and cabbage) related to the mustards
- fiber**— mostly indigestible material in food that stimulates the intestine to move its contents along
- follic acid**— a crystalline vitamin of the B complex used especially in the treatment of anemia resulting from inadequate intake of nutrients
- genus**— a category of classification in biology that ranks between the family and the species, contains related species, and is named by a capitalized noun formed in Latin
- helical**— a curve that is formed by a point rotating around a straight line and moving forward in a direction parallel to that line
- horticultural**— the science of growing fruits, vegetables, flowers, or ornamental plants
- scavenging**— collecting usable things from what has been discarded
- species**— a category of living things that ranks below a genus, is made up of related individuals able to produce fertile offspring, and is identified by a two-part scientific name
- temperate**— having or associated with a climate that is usually mild without extremely cold or extremely hot temperatures

# Meet the Brassica Vegetables

Thomas Jefferson made very careful records of what was planted in his garden. He loved trying out new things to see if they would do well in our new nation. He was the first to report planting BROCCOLI in the US, on May 27, 1767. Although broccoli has been grown in the US for over 200 years, it did not become a popular food until the 1920s, when Italian immigrants began planting and selling it. For Italians, broccoli had been a popular vegetable since the time of the ancient Romans. Ancient Romans gave broccoli its name. It comes from the Latin word *brachium*, which means “branch,” or “arm.” Roman farmers called broccoli “the five green fingers of Jupiter.”

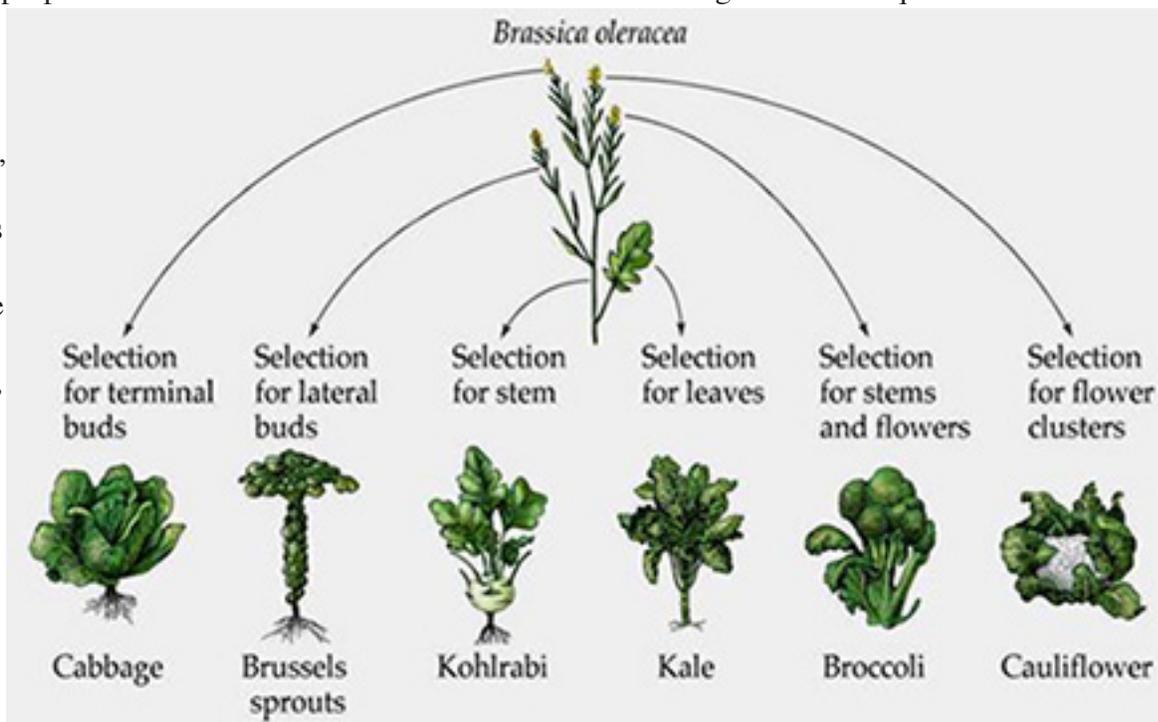
Broccoli grows best in cool weather. In Oklahoma gardens it grows well if planted early in the spring or late in the summer for a fall garden.

Ounce for ounce, boiled broccoli has more vitamin C than an orange and as much calcium as a glass of milk. One medium spear has three times more fiber than a slice of wheat bran bread. Broccoli is also one of the richest sources of Vitamin A. Researchers have found that, among other benefits, eating broccoli can help prevent several kinds of cancer, strokes and cataracts.

Mark Twain called CAULIFLOWER “a cabbage with a college education.” Cauliflower probably originated in Asia Minor, but, like broccoli, it was mostly only eaten in Italy until the 16th century. Then it was introduced to France and eventually to other parts of Europe. It was first grown in North America in the late 1600s.

Cauliflower is formed from the natural flowers of a variety of cabbage plant. The flowers gather together, unopened, to create a mass which becomes a large head over time. Depending on type, the heads can be pale green, white or even purple. The cauliflower has been described as resembling a bridal bouquet.

**CABBAGE** is a leafy green or purple biennial plant, grown as an annual vegetable crop for its dense-leaved heads. Cabbage heads range in size from 1 to 9 lbs and can be green, purple and white. Smooth-leaved firm-headed green cabbages are the most common, with smooth-leaved red and crinkle-leaved savoy cabbages of both colors seen more rarely. It is a multi-layered vegetable.



Cabbage was most likely domesticated somewhere in Europe before 1000 BC, although savoy cabbages were not developed until the 16th century. By the Middle Ages, it had become a prominent part of European cuisine.

The French trader Jacques Cartier brought cabbage to the Americas in 1541–42. Cabbage was probably planted by the early English colonists. By the 18th century, it was commonly planted by both colonists and natives.

The BRUSSELS SPROUT is grown for its edible bud. The plant is a leafy green vegetable, but the edible part is the bud, which is about 1-1 1/2 inch in diameter and looks like a miniature cabbage. Like broccoli and cauliflower, the forerunners to modern Brussels sprouts were probably first cultivated in ancient Rome. The vegetable as it is known now may have been grown as early as the 13th Century in what is now Belgium. During the 16th century they were popular in southern Netherlands and eventually spread throughout the cooler parts of Northern Europe.

Brussels sprouts are cool weather plants and grow best in a temperature range of 45-75 degrees. In Oklahoma they are most often grown and harvested from fall to early winter. The edible sprouts grow like buds in helical patterns along the side of the long, thick stalks, maturing over several weeks from the lower to the upper part of the stalk. Sprouts may be picked by hand or by cutting the entire stalk at once. Each stalk can produce 2.4 to 3.1 lb. Sprouts are considered to be sweetest after a frost.

Production of Brussels sprouts in the US began in the 18th century when French settlers brought them to Louisiana. Thomas Jefferson grew them at Monticello.

The RADISH was domesticated in Europe in pre-Roman times. Radishes are grown and consumed throughout the world. They are mostly eaten raw as a crunchy salad vegetable. There are numerous varieties, varying in size, color, shape and the length of time to maturity. Radishes germinate quickly and grow rapidly.

Scientists believe the radish originated in southeast Asia, since that is the only region where truly wild radishes have been discovered. The first historical record of radishes is from the 3rd Century BC. Greek and Roman agriculturalists of the 1st Century AD describe several varieties. The radish may have been one of the first European crops introduced to the Americas.

Radishes are annual or biennial crops grown for their swollen tap-roots which can be globular, tapering or cylindrical. The skin color ranges from white to pink, red, purple, yellow and green to black, but the flesh is usually white. The flesh of radishes is crisp and sweet when harvested early but becomes bitter and tough if left in the ground too long. Like the other Brassicas, radishes grow best in cool weather, in full sun.

Radishes are rich in ascorbic acid, folic acid and potassium. They are a good source of vitamin B6, riboflavin, magnesium, copper and calcium.

We eat both the roots and the leafy parts of TURNIPS. Turnips can vary in size and shape tremendously, with some reaching 50 pounds. Some have reddish rings around the crown of the vegetable root. Others are purple. Turnips were the original jack-o-lanterns. The Irish brought the tradition to the US but later found that pumpkins were easier to carve and more plentiful.

Experts believe RUTABAGAS may be the offspring of the wild cabbage and the turnip. They have a firm, yellow-orange flesh similar to that found in yellow-flesh potatoes. They are also more dense and sweeter than turnips, and contain less moisture. To add to their shelf life most rutabagas are waxed. This wax must be peeled or removed prior to cooking. Rutabagas, known also as "swedes," can be purple, white or yellow in colour with white or yellow flesh. Turnips and rutabagas are considered winter vegetables because they are available all through the winter. They are mashed or used to thicken stews and casseroles. Turnips are also great eaten raw, when peeled and sliced as chips or sticks; or shredded into a green salad or coleslaw.

KALE is a vegetable with green or purple leaves, in which the central leaves do not form a head. It is considered to be closer to wild cabbage than other domesticated forms of vegetables. During World War II, the cultivation of kale in the U.K. was encouraged by the Dig for Victory campaign. The vegetable was easy to grow and provided important nutrients to supplement those missing from a normal diet because of rationing.

Oklahoma Ag in the Classroom is a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education.

# Comprehension Clues

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1. This Brassica vegetable grows best in cool weather.
2. We eat the roots of this Brassica vegetable.
3. This Brassica vegetable is not a turnip but it is similar. Some experts believe it is the offspring of turnips and wild cabbage.

1. This Brassica vegetable grows best in cool weather.
2. We eat the roots and leaves of this Brassica vegetable.
3. This Brassica vegetable was the original jack-o-lantern.

1. This Brassica vegetable grows best in cool weather.
2. We eat the leaves of this Brassica vegetable.
3. This Brassica vegetable comes in many colors—green, purple and red.

1. This Brassica vegetable grows best in cool weather.
2. We eat the flower of this Brassica vegetable.
3. Benjamin Franklin called this Brassicas vegetable a cabbage with a college education.

1. This Brassica vegetable grows best in cool weather.
2. We eat the flower of this Brassica vegetable.
3. Thomas Jefferson was the first American president to report planting this Brassica vegetable in his garden.

1. This Brassica vegetable grows best in cool weather.
2. We eat the buds of this Brassica vegetable.
3. The buds look like tiny cabbages.

1. This Brassica vegetable grows best in cool weather.
2. We eat the root of this Brassica vegetable.
3. The flesh of this Brassica vegetable is crisp and sweet when harvested early but becomes bitter and tough if left in the ground too long

1. This Brassica vegetable grows best in cool weather.
2. We eat the leaves of this Brassica vegetable.
3. During World War II people were encouraged to grow this Brassicas vegetable because it was easy to grow and provided important nutrients.

Name \_\_\_\_\_

# Scientific Method Format

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Title of Experiment or Study:

I. Stating the Problem:

What do you want to learn or find out?

II. Forming the Hypothesis:

What is known about the subject or problem, and what is a prediction for what will happen?

III. Experimenting (Set up procedures):

This should include: materials used; dates of the experimental study; variables, both dependent and independent (constant and experimental); how and what was done to set up the experiment; fair testing procedures.

IV. Observations:

Includes the records, graphs, data collected during the study.

V. Interpreting the Data:

Does the data support/defend the hypothesis?

VI. Drawing Conclusions:

Justify the data collected with concluding statements about what has been learned. Discuss any problems or concerns. Use other studies to support the conclusion. give alternative ideas for testing the hypothesis.