

Enjoying the Harvest

Grades: 3–5

Purpose

Students will read about the history and science of wheat and learn why wheat varieties are bred for different growing conditions. Students will learn about the anatomy of a wheat plant and a wheat kernel. Students will grind wheat and make tortillas in a bag.

Keywords

wheat, history, plant breeding, hybrids, harvest, bread, tortilla

Materials

Variety of wheat breads (flat and leavened, white and whole wheat)

TORTILLAS IN A BAG

- 1-qt storage bag
- 1 1/2 c flour
- 1 t baking powder
- 3 T shortening
- 1/2 c hot tap water
- 1/4 t salt (or to taste)

Wheat kernels for grinding

Various grinders—mortar and pestle; coffee, pepper or spice grinder, etc.

Interest Approach or Motivator

Bring a variety of wheat breads to class (tortillas, pita, bagels, whole grain, white bread, etc.)

—Explain to students that they are all made from wheat.

—Students will sample the various breads while you share the background.

Background

Bread, in one form or another, has been an important food for humans from earliest times. Loaves and rolls made and baked over 5,000 years ago have been found in ancient Egyptian tombs. Wheat has been found in pits where human settlements flourished 8,000 years ago. In the Stone Age, people made solid cakes from stone-crushed barley and wheat. Bread provided ancient people with a reliable food source which would keep through the winter months and could be replaced in the summer.

Wheat, oats, barley and other grains are grasses. Wheat (*Triticum aestivum*) is the most important crop in the temperate zone. “Einkorn” wheat (*T. monococcum*) is the oldest form of cultivated wheat. Some wild forms still exist today.

Wheat flour is made from kernels of wheat. A wheat kernel is divided into three major parts—bran, endosperm and germ. All-purpose flour is made from only ground endosperm. Whole wheat flour is made by grinding the entire wheat kernel.

For thousands of years people used stone wheels powered by wind to grind wheat into flour for bread. In the middle of the 19th century, a Swiss engineer invented a new type of mill with rollers made of steel, which operated one above the other and was driven by steam engines. Meanwhile, in North America, immigrant farmers from Europe were planting wheat from their homelands on our North American prairies and found the land ideal for growing wheat. This discovery, together with the invention of the roller-milling system, meant

whiter flour (and therefore bread) could be produced at a price that everyone could afford.

Wheat was one of the first cereals to be domesticated, and wheat's ability to self-pollinate led to the development of many different domesticated varieties. In the US, wheat varieties are classified as either winter or spring. Winter varieties are sown in fall and usually established before cold weather arrives. Winter wheat stops growing in winter and starts growing again in the spring. Spring varieties are sown in spring. Both varieties are harvested in the fall. Farmers choose which variety to grow based on the climate and other conditions.

When farmers are making decisions about what varieties of wheat to plant, they are thinking about DNA. Each kind of wheat has DNA that gives it certain characteristics to help it grow better in a particular region, season, etc. Wheat varieties are genetically changed over time through natural selection. Some varieties might grow better in drought conditions while others might be better at resisting certain pests. The varieties best suited to survive in their particular circumstances have a greater chance of passing their traits on to the next generation. Farmers decide which varieties to use based on growing conditions in their area.

Norman Borlaug was a plant breeder who developed wheat varieties to help people get more food from their land. His work saved millions of people from starvation in Mexico, India and Pakistan. His leading research achievement was the development of dwarf spring wheat. Borlaug found that plants with stalks that were short and of equal length would receive equal amounts of sunlight when they did not have to compete with taller-stalked plants. Nature favors genes for tall stalks, because in nature, plants must compete for sunlight. Borlaug's discovery was an improvement because dwarf wheat uses more energy growing valuable grain rather than using its energy to grow tall stalks with no food value. Stout, short stalks also support wheat kernels better. Tall-stalked wheat may bend over at maturity, making it more difficult to harvest.

Procedures

ACTIVITY ONE

1. Students will make a KWL chart about wheat
 - Draw a wheat plant
 - Discuss what you know about wheat.
2. Read and discuss background and vocabulary.
3. Share the “Anatomy of a Wheat Plant” and the “Wheat Germ” diagrams included with this lesson and go over the parts of wheat as a class.
4. Students will redraw the wheat plant based on what they have learned.

ACTIVITY TWO

1. Show students the “How Flour is Milled” diagram. Ask students how they would grind wheat without the technology available to us now.
 - Divide students into groups and provide a handful of wheat kernels for each student.
 - Students will look around the classroom and brainstorm to find methods for grinding the wheat. (One class actually used a magnifying glass to break up the wheat kernels.)
 - Provide a variety of wheat grinding tools— coffee grinder, spice grinder, pepper grinder, mortar and pestle, etc., and let students use their imaginations to find the best methods for grinding the wheat
 - Students will keep records of the methods used, the amount of time it took, etc.
 - Groups will display their finished products and report on their experiences to the class.
 - The class will vote on which group found the most effective method.

ACTIVITY THREE

Students will work in groups to make Tortillas in a Bag, using the recipe included with this lesson. (Recipe makes four tortillas.)

Enriching Activities

ACTIVITY ONE

Students will sprout wheat kernels (berries) to grow wheat grass.

1. Place wheat kernels in a colander and rinse thoroughly.
2. Place rinsed wheat kernels in the jar or other container and cover with water.
3. Soak overnight.
4. Rinse the wheat kernels again, and cover the opening of the container with a piece of cheesecloth.
5. Secure with a rubber band.
6. Lay the jar on its side in a dark place.
7. Rinse and drain the berries each morning until they sprout and grow to about 1 inch in length.
8. When the sprouts have grown to about one inch in length, place the jar in a sunny window for one day.
9. Enjoy your wheat on a sandwich, in a salad or make wheat grass smoothies.

ACTIVITY TWO

Find the gluten in wheat by chewing the kernels. Before there was chewing gum in the store, farmers made their own by chewing grains of wheat.

ACTIVITY THREE

Plant any leftover wheat kernels in your outdoor classroom or in earth boxes set indoors in classroom windows.

Vocabulary

climate—the average weather conditions of a particular place or region over a period of years

domesticate— to adapt to living with human beings and to serving their purposes

drought— a long period of dry weather

dwarf—an animal or plant much below normal size

gene—a part of DNA or sometimes RNA that is usually located on a chromosome and that contains chemical information needed to make a particular protein controlling or influencing an inherited bodily trait or activity or that influences or controls the activity of another gene or genes

grain—the edible seed or seedlike fruit of grasses that are cereals

immigrant— a person who comes to a country to live there permanently

mill— a machine used in treating (as by grinding, crushing, stamping, cutting, or finishing) raw material

natural selection— a natural process in which individuals or groups best adapted to the conditions under which they live survive and produce young and poorly adapted forms are eliminated

plant breeder—someone who propagates plants sexually under controlled conditions

pollen— a mass of tiny particles in the anthers of a flower that fertilize the seeds and usually appear as fine yellow dust

self pollination— pollination of a flower by its own pollen or sometimes by pollen from another flower on the same plant

sow—to plant seed for growth especially by scattering

stalk—a plant stem especially of a plant that is not woody

temperate zone— the area or region between the Tropic of Cancer and the Arctic Circle or the Tropic of Capricorn and the Antarctic Circle



Bread Facts

- The first bread was made in Neolithic times, nearly 12,000 years ago. It was probably made by crushing grain and mixing it with water. The dough was then baked in the sun or laid on heated stones and covered with hot ashes.

- When flour comes in contact with water and remains idle for a period of time, it begins to rise. In modern processes, yeast is added to aid in the rising, but even without yeast, dough will begin to ferment, and the resulting gases will cause the dough to rise. The Egyptians were the first to discover that this process would produce a light, expanded loaf. The Egyptians also invented a closed oven in which to bake the bread.
- The ancient Hebrews were in such a hurry to get away from their Egyptian captors that they made their bread without leavening. Today Jewish people celebrate Passover, their escape from the Egyptians, with unleavened bread—matzo. Bread without leavening also represents truth in Jewish tradition, because bread that is unleavened retains the true flavor of the grain from which it is made.
- Traditionally, people made bread from whatever grain grew best in the area where they lived. Wheat, rye, corn, barley, millet, kamut and spelt are some of the grains used around the world. Wheat flour is preferred because of its gluten content. Gluten is what gives bread its elastic quality.
- Bread is such a powerful food that ancient Egyptian governments controlled its production and distribution as a means of controlling the populace. In France the shortage of bread helped start the French Revolution.
- It takes nine seconds for a combine to harvest enough wheat to make about 70 loaves of bread.
- An acre will produce enough wheat for about 2,500 loaves of wheat bread.
- Bread is probably the one food eaten by people of every race, culture and religion.
- One family of four can live 10 years off the bread produced by one acre of wheat.

Standards

NATIONAL AG LITERACY

3. Food, Health and Lifestyle

- Diagram the path of production for a processed product, from farm to table

4. Science, Technology, Engineering and Math

- Describe how technology helps farmers/ranchers increase their outputs (crop and livestock yields) with fewer inputs (less water, fertilizer, and land) while using the same amount of space
- Identify examples of how the knowledge of inherited traits is applied to farmed plants and animals in order to meet specific objectives (i.e., increased yields, better nutrition, etc.)
- Compare simple tools to complex modern machines used in agricultural systems to improve efficiency and reduce labor
- Provide examples of science being applied in farming for food, clothing and shelter products

5. Culture, Society, Economy & Geography Outcomes

- Explain the value of agriculture and how it is important in daily life
- Explain how agricultural events and inventions affect how Americans live today

CONTENT STANDARDS

Life Science.3, 4.2

COMMON CORE

Math—Measurement and Data.A.1, 2

Source/Credits

“Celebrate Wheat,” “Wheat Germ DNA,” Kansas Ag in the Classroom

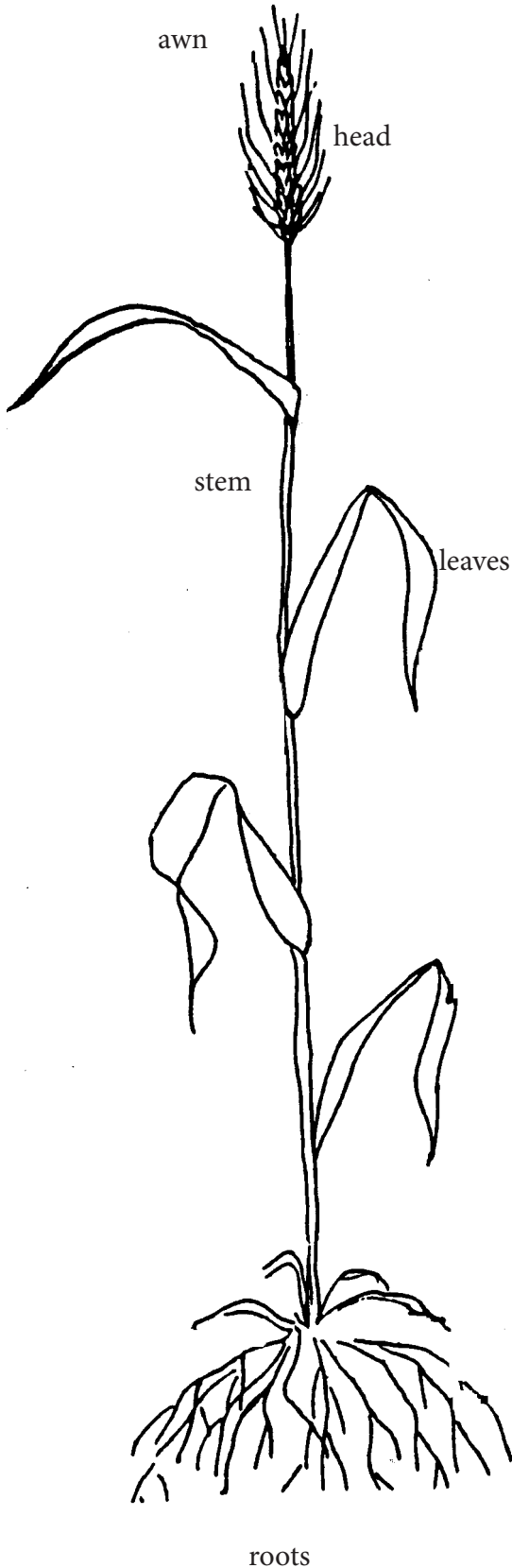
DNA Experiment, St. Louis Science Center and Kansas Foundation for Agriculture in the Classroom

Thompson, Pat, “Tortillas in a Bag,” Oklahoma Ag in the Classroom

“Wheat,” Terra Nova, Illinois Ag in the Classroom, University of Arizona Cooperative Extension

Wheat Ag Mag, Montana Ag in the Classroom, <http://agr.mt.gov/agr/Programs/AgClassroom/Publications/>

Anatomy of a Wheat Plant



The wheat plant has four basic parts: the head, stem, leaves and roots. Wheat plants grow to be about 2-4 feet tall.

The **awn** is a slender, bristle-like attachment of a wheat plant, such as those found at the tips of the spikelets in many grasses.

The **head** contains kernels or the wheat seeds.

The **stem** supports the head and helps transport nutrients and water throughout the plant.

The **leaves** are responsible for photosynthesis, the process in which green plants produce simple carbohydrates by using carbon dioxide, hydrogen and a light source, usually the sun.

The **roots** anchor the plant in the soil and absorb water and nutrients from the soil and transport them to the stem.

Wheat Kernel

Sometimes called the wheat berry, the kernel is the seed from which the wheat plant grows. The kernel grows in the head of the wheat plant. Each tiny seed contains three distinct parts that are separated during the milling process to produce flour.

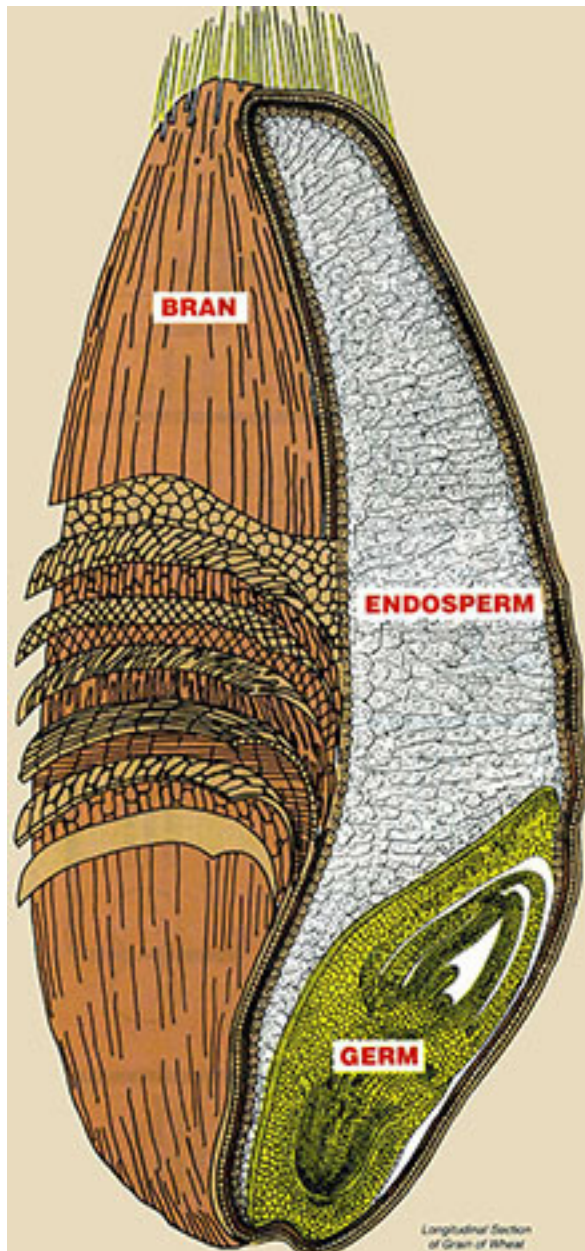
Endosperm—Comprising about 83 percent of the kernel weight, the endosperm is the germ's food supply. It is also the source of white flour. In its natural state, the endosperm provides essential energy to the young wheat plant, allowing the plant to send roots down for water and nutrients and shoot sprouts up for sunlight.

Bran—About 14.5 percent of the kernel weight, the bran is the multi-layered, hard outer covering of the wheat kernel. Bran is included in whole wheat flour and can be purchased as a stand-alone grain. Bran consists of important antioxidants, B vitamins and fiber.

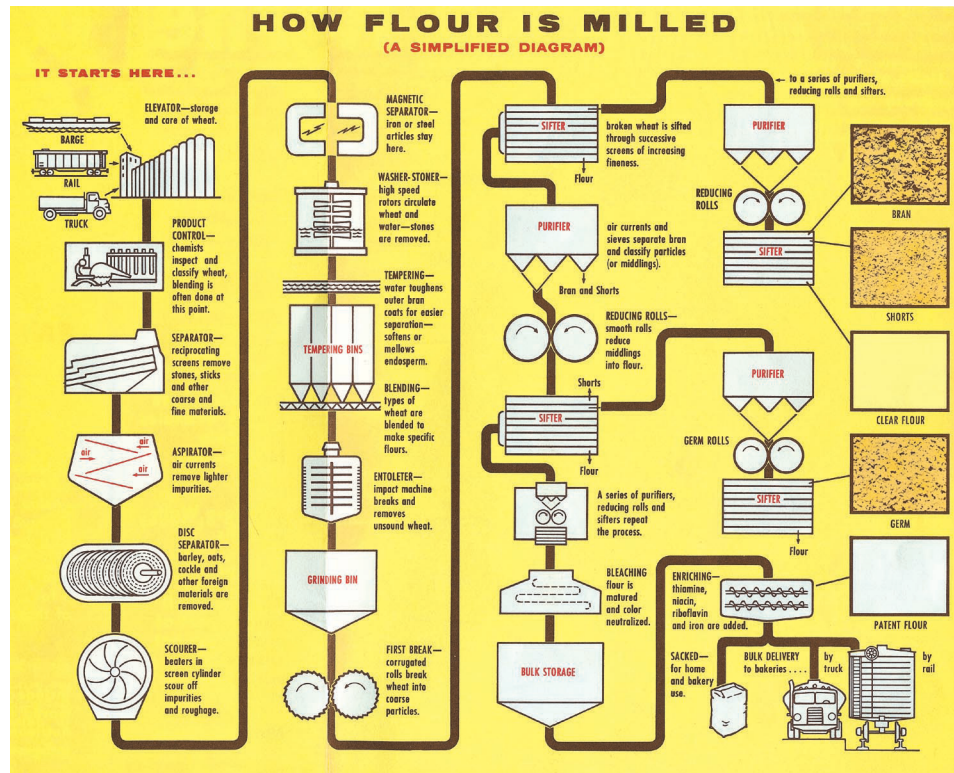
Germ—Comprising only 2.5 percent of the kernel weight, the germ is the embryo, or sprouting section of the kernel. The germ is the part of the wheat kernel that will sprout and grow into a new wheat plant. During the milling process, the germ is often separated from flour because the fat content limits the flour's shelf-life. It is stabilized and then put back in to keep the flour "whole." Like the bran, the germ contains many B vitamins. It also consists of protein, minerals and healthy fats.

These three parts are protected by an inedible husk that shields the kernel from potential hazards such as sunlight, pests, water and disease. Wheat kernels vary in both texture and color, from white to red to sometimes even purple.

Source: Wheat Foods Council



How Flour is Milled



Tortillas in a Bag

Makes four tortillas

1-qt storage bag
1 1/2 c flour
1 t baking powder
3 T shortening
1/2 c hot tap water
1/4 t salt (or to taste)

1. Place flour, salt and baking powder in bag. Close and shake just a few shakes to mix.
2. Add shortening and reclose the bag. Work bag with hands until the mixture looks crumbly and there are no large pieces of shortening visible.
3. Open the bag, and add the hot tap water. Knead in the bag until the dough is one large piece and the sides of the bag come clean.
4. Take the dough out of the bag, and divide into four pieces. Put the pieces of dough on the table, and lay the bag on top of them. Let the dough rest for 15 minutes.



5. After resting time, roll or pat the dough into eight- to 10-inch circles. If dough is too sticky you may add a little more flour.



6. Place the circles on a griddle or frying pan heated to medium or medium high, and cook until dark brown spots appear. Turn and cook on the other side until brown.

