The Book Planter

FARM BUREAU NORTH CAROLINA
Ag in the Classroom
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June 2020: *The Kid Who Changed the World*
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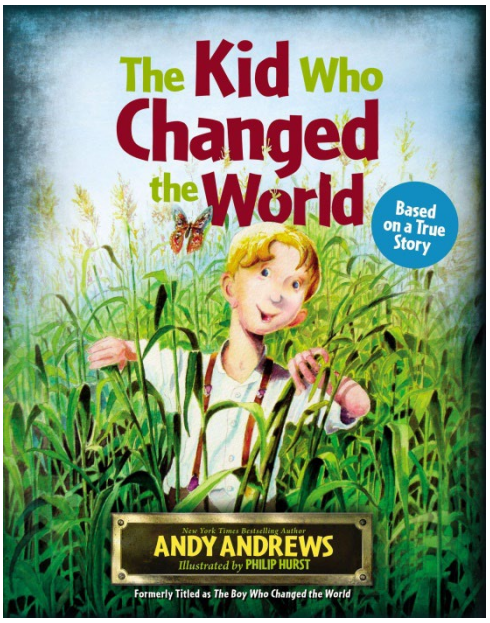


This book tells the story of Nobel Laureate, Norman Borlaug. Norman grew up as an average farm boy, but later his work as a plant scientist reached far and wide to help improve the growth of wheat, rice, and corn all over the world. It also explains the work of other important figures in the world of agriculture. This book highlights the benefits of emerging science, but also has an underlying message to teach students that, "Every choice you make, good or bad, can make the difference."

Fun Facts

- Wheat was first planted in the United States in 1777 as a hobby crop.[1]
- Today, wheat is grown in 42 states in the United States.[1]
- Besides flour and bread, other products form the wheat plant include straw particle board (wood) that is used in many kitchen cabinets, paper, hair conditioners, postage stamp adhesives, medical swabs, charcoal, and biodegradable plastic eating utensils.[2]
- Norman Borlaug's research was instrumental in the creation of faster-growing wheat varieties and other grains that withstood disease and drought. These varieties were introduced to people all over the world.[2]
- Borlaug received the Nobel Peace Prize in 1970 for his work that saved over a billion people from starvation in developing counties like Mexico, India, and Pakistan.[2]

Discussion Questions[3]

1. Why did Norman decide as a boy to "change the world?" (*He was concerned when his father told him that many people in the world were hungry because they couldn't produce enough food to eat.)*
2. How was Norman able to develop special seeds of corn, wheat and rice that grew into "super plants" that could feed more people? (*He went to school and developed the skills needed to be a good food scientist. These skills are called*

human capital. Norman also had a passion for helping people and dedicated his life to developing these seeds. He worked very hard.)

3. What are ways that you can increase your human capital? (*Get a good education. Obtain special skills, knowledge and abilities through training, learning from other people, or internship programs.)*
4. By developing special seeds, farmers were able to grow more crops from the same amount of land. What is the economic word that describes this? (*Productivity. Productivity means getting more output (in this story, crops) form the same inputs, or productive resources. For growing crops, the productive resources (inputs) that are needed are land, water, fertilizer, tools, machines, seeds, irrigation equipment, etc.)*
5. How was George Washington Carver able to help the economy—and many other people? (*He specialized in being a teacher and an inventor. He invented 266 things from the peanut that we still use today. And from the simple sweet potato, he invented 88 things that we still use today.)*
6. How were the choices of the people in the story important? (*Each choice had an impact on helping Norman develop the special seeds that grew into super plants.)*
7. If the people had made different choices, how might the story be different? (*The particular events that happened to encourage Norman to develop the seeds would not have happened. The choices we make as individuals have significance!)*

Learning about Norman Borlaug

Have students watch the following the Norman Borlaug Documentary, and answer the following questions. https://www.youtube.com/watch?v=fd6YmVnwNJ0

1. What was Norman Borlaug's nickname? Why?
2. When was Norman Borlaug born? (1914)
3. How old would he be in 2020? (106)
4. Where did Borlaug go to college? (University of Minnesota)
5. What kind of degree did he earn? (Ph.D. in Plant Pathology)
6. When did Borlaug go to Mexico? (1944)
7. What problems were Mexican farmers facing? (not able to produce enough wheat to sustain themselves or produce a surplus)
8. What were the three areas of focus of Borlaug's wheat research? (disease resistance, high yield, and semi-dwarfism)
9. What world events stopped Borlaug's research temporarily? (World War II)
10. Why is Borlaug's name rarely mentioned in the United States? (His work was instrumental in developing countries that had problems growing enough food to sustain the human population, which was not an issue in the United States.)

Wheat Kernel Dissection[1]

Materials

- Wheat stem, 1 per student (can be obtained from a local farmer or available on the National Ag in the Classroom eStore https://agclassroomstore.com/wheat-bundle/)
- Jewel bags, 1 per student (can be found at craft stores or available on NAITC eStore https://agclassroomstore.com/jewel-bags/)
- White copy paper, 1 sheet per student
- Lined paper, 1 sheet per student
- Brads, 1 per student
- Glue sticks
- Scissors
- Hole Punches

1. Show the students a loaf of white bread and a loaf of wheat bread, or use photos. Draw a Venn diagram on the board. Label one circle "White Bread" and the other circle "Whole Wheat Bread."
2. Ask the students to explain what is the same and different about the two loaves of bread, and record the responses in the appropriate spots of the diagram.
3. Show the students a bowl of wheat kernels, a bowl of white flour, and a bowl of whole wheat flour. Point out that the white flour was used to make the white bread and the whole wheat flour was used to make the wheat bread, but both types of flour were made from wheat kernels. Explain to the students that they will be exploring the process of making flour, known as milling, to understand how different types of flour are made from wheat kernels.
4. Provide each student with the *Anatomy of a Wheat Plant Diagram* (see **Links**), a wheat stem, and a jewel bag. Use the diagram to discuss the main parts of a wheat plant and have the students locate the parts on the wheat stem.
5. Tell the students to thresh their wheat to separate the seeds from the plant. This Wheat Grinding Tutorial Video can be shown for reference. https://www.youtube.com/watch?v=Rer8bszlGHc
   The students should collect the wheat seeds in their jewel bags.
6. Explain to the students that each kernel of wheat has three main parts—the bran, germ, and endosperm. All-purpose flour, used to make white bread, is made from the endosperm of the wheat kernel. The endosperm is separated from the bran and the germ and ground into flour. Whole wheat flour contains the whole kernel—the bran, germ, and endosperm.
7. Pass out a piece of paper to each student. Instruct them to fold the paper into thirds and label the sections "Bran," "Germ," and "Endosperm."

8. Read the following passage to the students. Discuss the three parts of the wheat kernel and have the students take notes about each on their paper.
   Wheat flour is made from the kernels of the wheat plant. The kernel is the seed from which the wheat plant grows. A wheat kernel contains three distinct parts—the **bran**, **germ**, and **endosperm**. The *bran* is the multi-layered, hard outer covering of the kernel. Bran consists of important antioxidants, B vitamins, and fiber. The *germ* is the embryo or sprouting section of the kernel. It 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 the flour because its fat content limits the flour's shelf-life. The germ contains B vitamins, protein, minerals, and healthy fats. The *endosperm* is the germ's food supply. In its natural state, the endosperm provides essential energy to the young wheat plant, allowing the plant to send roots down into the soil to absorb water and nutrients and shoot sprouts up for sunlight.
9. Show students the White Bread vs. Whole Wheat Bread video and have them take additional notes about the three parts of the wheat kernel. https://youtu.be/418KSrmpMwc
10. Provide each student with two copies of the *Wheat Kernel Dissection Image* (see **Links**), three pieces of lined paper, a brad, scissors, and a glue stick. Have them cut out both of the *Wheat Kernel Dissection Images*. Trace one of the images onto three pieces of lined paper, cut each lined kernel out, and number each page. Set one of the *Wheat Kernel Dissection Images* aside and cut the bran, germ, and endosperm apart from the other.

11. Glue the bran image on page 1 of the lined kernels, the germ of page 2, and the endosperm on page 3.
12. Using their notes, have the students write a description of each part of the wheat kernel on the corresponding page.
13. Layer the wheat kernel model with the jewel bag of wheat seeds on top followed by the intact Wheat Kernel Dissection image, page 1, 2, and 3. Punch a hole in the top of the packet and attach with a brad.

Classes of Wheat[2]

Materials:

- Re-closable, clear plastic bag
- Samples of wheat—Hard Red Winter, Hard Red Spring, Soft Red Winter, Soft White, Hard White, and Durum, 1 sample per station (available on NAITC eStore

https://agclassroomstore.com/wheat-kernel-samples/) Or you can use the *Wheat Kernels Sample images* (see **Links**) cut into vertical strips
- Hand lenses, minimum of 1 per station
- Scissors, minimum of 1 per station
- Glue sticks, minimum of 1 per station
- Clear packing tape

1. Using the instructions provided in the *How To Do It! Threshing or Removing the Seed from the Plant* handout (see **Links**), give each student the opportunity to thresh wheat by hand. When they are finished, they should have a small pile of wheat seeds, which should be put into a re-closable, clear plastic bag.
2. Prepare six stations, each representing a class of wheat—Hard Red Winter, Hard Red Spring, Soft Red Winter, Soft White, Hard White, and Durum. Each station should include:
    - A wheat kernel sample or kernel images from the attached *Wheat Kernel Sample Images* (if using kernel images, provide one image per student for each class of wheat)
    - Hand lenses
    - The corresponding *Wheat Information Card*
    - Pencils
    - Scissors
    - Clear packing tape
    - Glue sticks

3. Organize the students into six groups. Provide each student with one copy of the *Six Classes of Wheat* activity sheet (see **Links**) and one vertical strip of images from the *Products Made From Wheat* images (see **Links**).
4. Explain to the students that there are six different classes of wheat grown in the United States. Each class has characteristics (traits) that determine the hardness, shape, and color of their kernels, what time of year their seeds are planted and harvested, which climates they grow best in, and what wheat products can best be made from their flour. For example, spring wheat is planted in the spring and harvested in the late summer or early fall. Winter wheat is planted in the fall and harvested in the spring.
5. Tell the students that they are going to explore each of the six classes of wheat and record information about the traits of each class on their activity sheets.
6. Instruct students to prepare their *Six Classes of Wheat* activity sheet by cutting on the dashed lines of the title page. Glue the left side of the title page (the section with the title "Six Classes of Wheat") onto the blank space on the left side of the second page. Fold back each of the six sections of the title page and crease on the solid line.

7. Rotate the groups through the six stations. At each station, the students will complete the following steps:
    a) Read the information card.
    b) Observe the wheat kernel samples (or observe the kernel images) with the hand lenses.
    c) On the second page of the activity sheet, use clear packing tape to attach a few wheat kernels (or glue the kernel image) in the first empty box underneath the correct wheat class title strip.
    d) Record the hardness, shape, and color of the kernels.
    e) Cut out and glue the corresponding wheat product image in the second empty box. Record the products made from the wheat class.
    f) Record the US location(s) where the wheat class is grown.
8. After the groups have completed all six stations, have the students attach their completed *Six Classes of Wheat* activity sheets into their interactive notebooks and meet together as a whole group to discuss the different characteristics of the six classes of wheat. Use information from the *Background – Agricultural Connections* (see lesson plan link in **Sources** #2) and the following questions to guide the discussion:
    - Which classes of wheat are most similar and why? (*Hard Red Winter and Hard Red Spring wheat have the same hardness, shape, and color.*)
    - What is the difference between hard wheat and soft wheat? (*Hard wheat contains a higher protein percentage than soft wheat. Protein develops gluten which gives elasticity, structure, and strength to dough. This is important to the bread-making process.*)
    - Is hard wheat or soft wheat better for making bread? (*Hard wheat is better for making bread. The higher protein levels create a chewy texture.*)
    - Is hard wheat or soft wheat better for making cakes? (*Soft wheat is better for making cakes. The lower protein levels create a flaky texture.*)
    - Which wheat is best for making dried pasta? (*Due to its high protein content and gluten strength, Durum wheat is best for making dried pasta. The gluten levels make the dough firm and allows the pasta to hold its shape until it is dried.*)
    - What is the difference between spring wheat and winter wheat? (*Spring wheat is planted in the spring and harvested in the late summer or early fall. Winter wheat is planted in the fall and harvested in the spring.*)
    - Can you identify which class of wheat you threshed at the beginning of this activity? (*Note: If a Wheat Bundle was purchased from agclassroomstore, it is possible that a variety of wheat classes were mixed*

together. Students may or may not all have a wheat stem from the same class of wheat.)

Links

- The Picture Book of Norman Borlaug https://www.normanborlaug.org/downloads/Borlaug%20Book%20Final.pdf
- Wheat Grinding Tutorial Video https://www.youtube.com/watch?v=Rer8bszlGHc
- Anatomy of a Wheat Plant https://naitc-api.usu.edu/media/uploads/2017/10/04/Anatomy_of_a_Wheat_Plant.pdf
- Wheat Kernel Dissection Image https://naitc-api.usu.edu/media/uploads/2017/10/09/Wheat_Kernal_Dissection_Image.pdf
- How To Do It handout https://agclassroomstore.com/wheat-kernel-samples/
- Wheat Kernel Sample images https://naitc-api.usu.edu/media/uploads/2017/11/20/Wheat_Kernels.pdf
- Six Classes of Wheat handout https://naitc-api.usu.edu/media/uploads/2017/12/01/Six_Classes_of_Wheat.pdf
- Products Made From Wheat https://naitc-api.usu.edu/media/uploads/2017/11/10/Wheat_Products.pdf

Sources

1. https://www.agclassroom.org/teacher/matrix/lessonplan.cfm?lpid=628
2. https://www.agclassroom.org/teacher/matrix/lessonplan.cfm?lpid=197
3. https://www.kidseconposters.com/the-boy-who-changed-the-world

K-5 Subject Areas

Reading, Writing, Speaking and Listening, Science, and Social Studies

Common Core/Essential Standards

Reading

- **RL.K.1** With prompting and support, ask and answer questions about key details in a text.
- **RL.1.1** Ask and answer questions about key details in a text**.**
- **RL.1.2** Retell stories, including key details, and demonstrate understanding of their central message or lesson
- **RL.2.1** Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding **of key** details in a text.
- **RL.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the **basis for** the answers**.**
- **RL.4.1** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- **RL.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- **RI.K.1** With prompting and support, ask and answer questions about key details in a text.
- **RI.K.2** With prompting and support, identify the main topic and retell key details of a text.

- **RI.1.1** Ask and answer questions about key details in a text.
- **RI.1.2** Identify the main topic and retell key details of a text.
- **RI.2.1** Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
- **RI.2.3** Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- **RI.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- **RI.3.3** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- **RI.3.7** Use information gained from illustrations and the words in a text to demonstrate understanding of the text.
- **RI.4.1** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- **RI.4.3** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- **RI.4.7** Interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the text in which it appears
- **RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Writing

- **W.K.5** Participate in shared investigation of grade appropriate topics and writing projects.
- **W.K.6** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- **W.1.5** Participate in shared research and writing project.
- **W.1.6** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- **W.2.5** Participate in shared research and writing projects.
- **W.2.6** Recall information from experiences or gather information from provided sources to answer a question.
- **W.3.2** Write informative /explanatory texts to examine a topic and convey ideas and information clearly.
- **W.3.5** Conduct short research projects that build knowledge about a topic.
- **W.3.6** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- **W.4.5** Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- **W.4.6** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- **W.5.5** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- **W.5.6** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources.

Speaking and Listening

- **SL.K.1** Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- **SL.K.2** Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
- **SL.K.3** Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- **SL.K.4** Speak audibly and express thoughts, feelings, and ideas clearly.

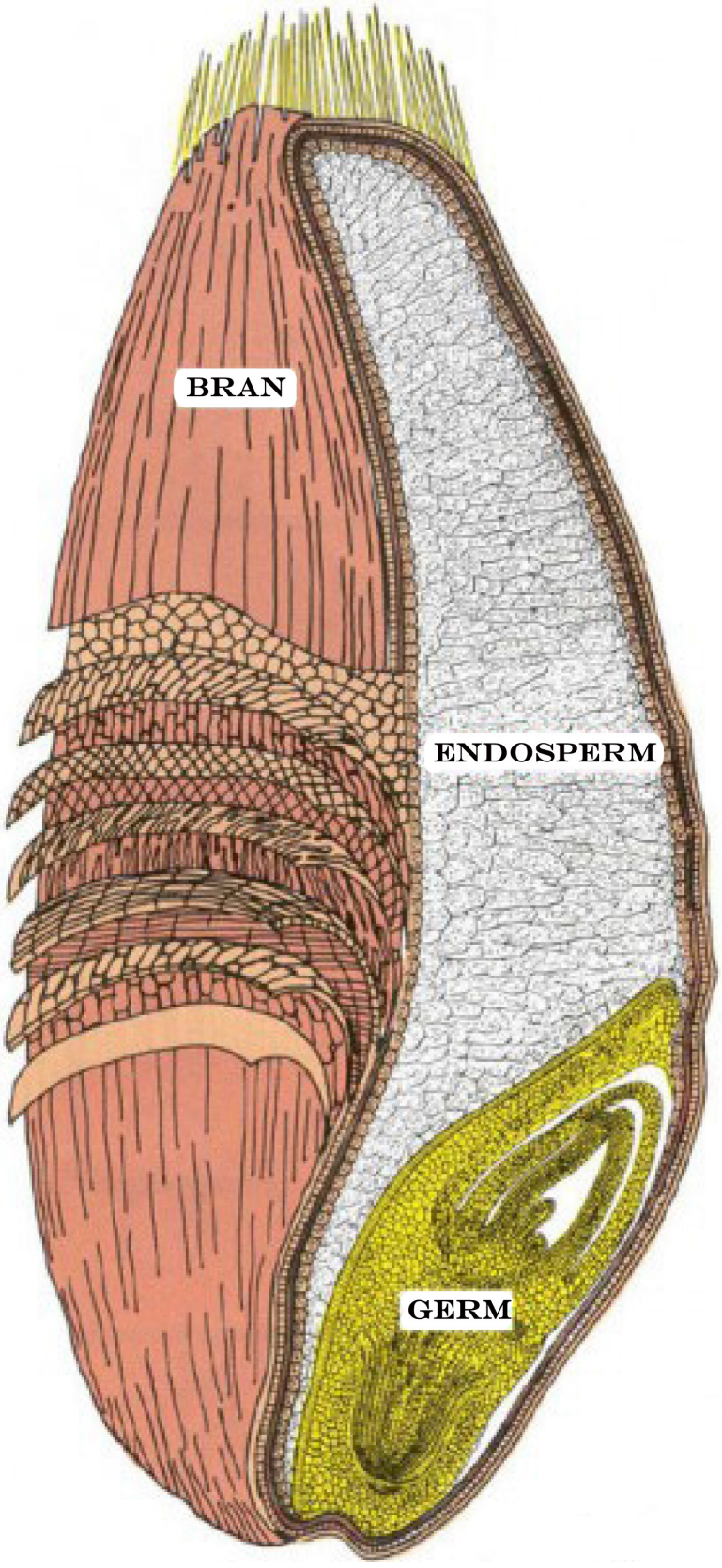
- SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional detail.
- **SL.1.2** Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
- **SL.1.3** Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
- **SL.1.5** Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- **SL.2.1** Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- **SL.2.2** Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
- **SL.3.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly
- **SL.3.2** Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **SL.4.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly
- **SL.4.2** Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **SL.5.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly
- **SL.5.2** Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Science

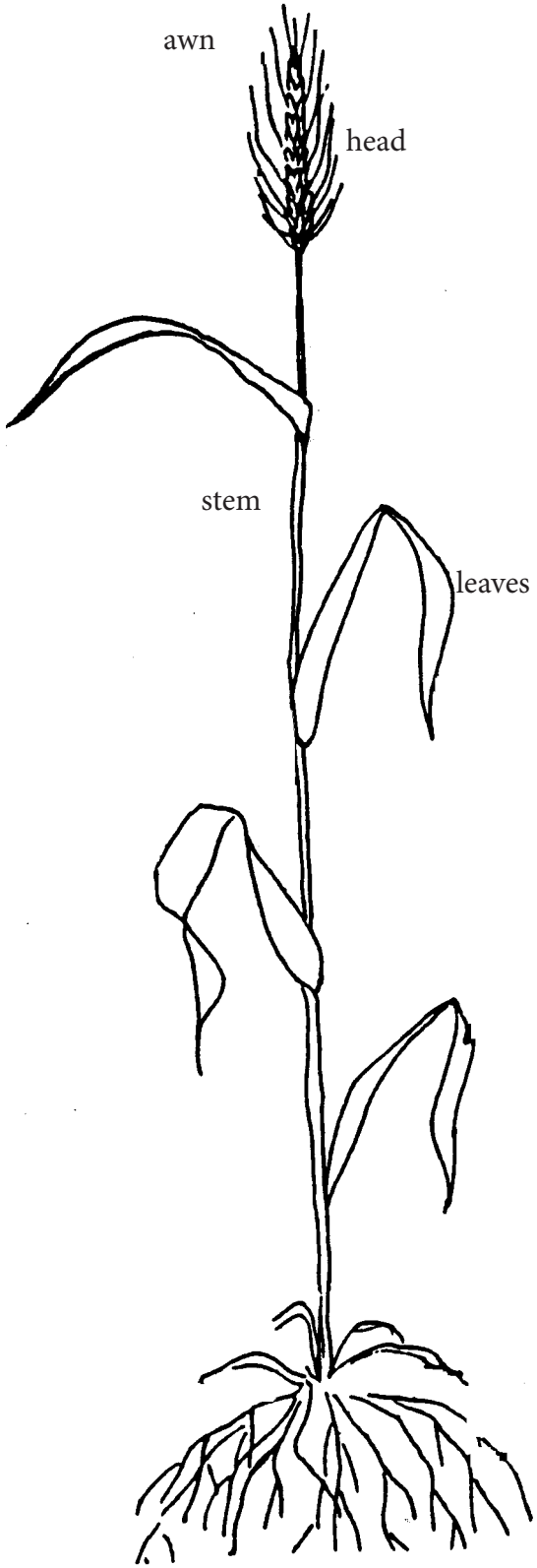
- **1.L.1** Understand characteristics of various environments and behaviors of humans that enable plants and animals to survive.
- **1.L.2** Summarize the needs of living organisms for energy and growth.
- **3.L.2** Understand how plants survive in their environments

Social Studies

- **K.G.2** Understand the interaction between humans and the environment.
- **1.H.1** Understand that history tells a story of how people and events changed society over time.
- **2.G.2** Understand the effects of humans interacting with their environment.
- **3.H.1** Understand how events, individuals and ideas have influenced the history of local and regional communities.
- **5.G.1** Understand how human activity has and continues to shape the United States.


BRAN
ENDOSPERM
GERM

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.

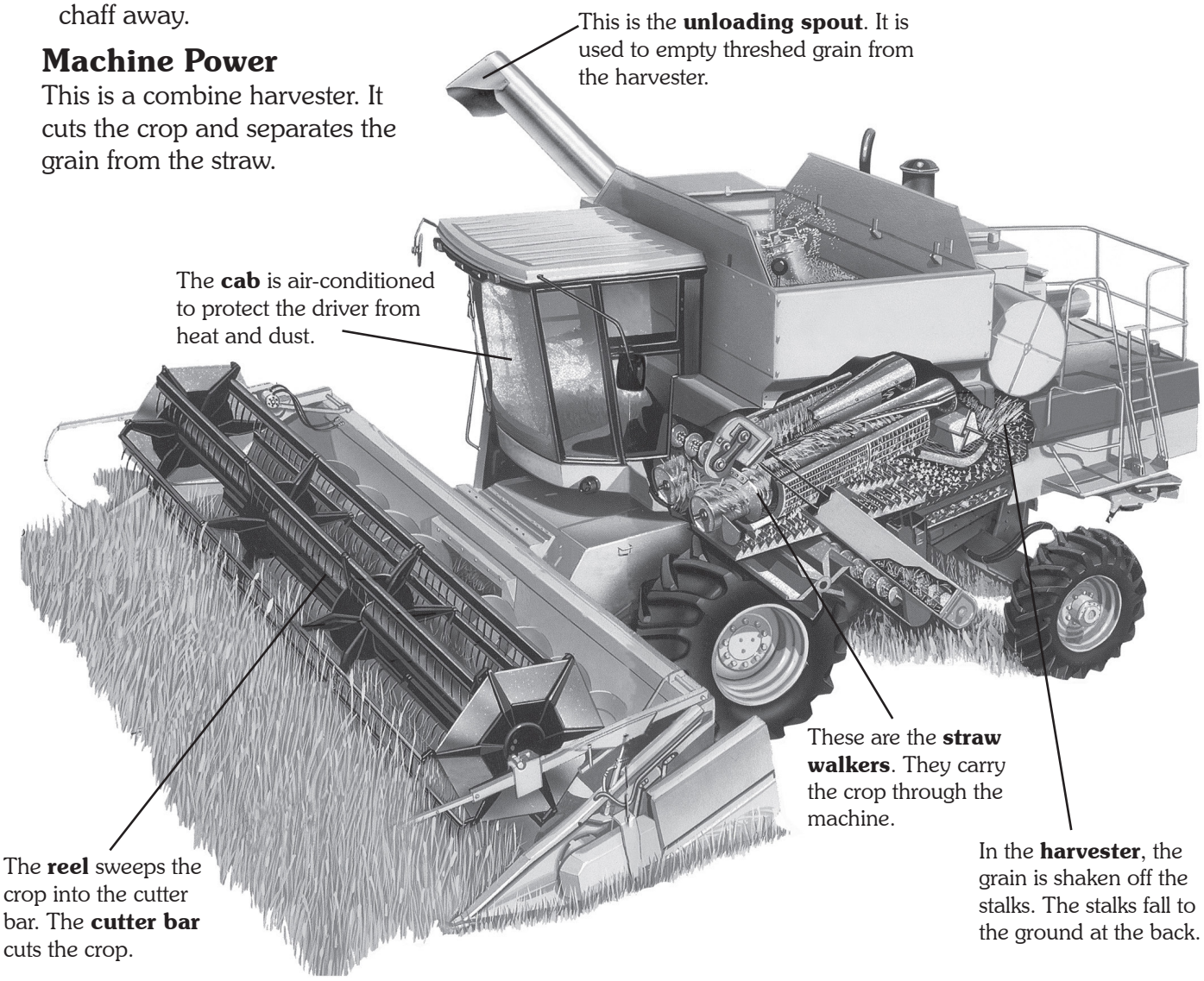
How To Do It!

Threshing or Removing the Seed from the Plant

1. Working over a table or desktop, place the seed head between both hands with the palms flat and pressed together. Move your hands backward and forward repeatedly while applying pressure. This is similar to the threshing action in a combine.
2. Pull your hands apart and the threshed wheat will fall to the table. The stalk is easy to separate. Does it look like straw? Straw is made from the stalks of harvested, mature grains (you may only have a small piece of the stalk with your seed head).
3. Gather the remaining seeds and debris in the cup of your hands. Shake your hands and notice how the bigger, lighter parts of the seed head float to the top and the heavier seeds settle to the bottom. Now skim what you can off of the top and discard (careful not to discard the seeds!). This is similar to the separating action of the combine by the straw walkers and sieves.
4. Next, clean the remaining debris (chaff) from the seeds (grain) in your hand. A combine completes this job by blowing air through the grain and chaff, removing the lighter chaff and blowing it out of the rear of the combine. Standing near a garbage, pour the grain from one hand to the other while blowing lightly on the material as it drops through the air from one hand to the other.
5. The seed head's trip through the combine only takes about 15 seconds, and there are thousands of heads going through the combine at the same time. Historically, farmers would have had livestock walk on the wheat heads on a hard surface to thresh the grain out of the heads. Then they would separate the stalks by hand and throw the grain and chaff up into the air for the wind to blow the chaff away.

Machine Power

This is a combine harvester. It cuts the crop and separates the grain from the straw.



Six Classes of Wheat

Hard Red Winter

Hard Red Spring

Soft Red Winter

Soft White

Hard White

Durum

	Hardness:		Products:	Grown in:
	Shape:			
	Color:			
	Hardness:		Products:	Grown in:
	Shape:			
	Color:			
	Hardness:		Products:	Grown in:
	Shape:			
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Wheat Kernels

Hard Red Winter						
Hard Red Spring						
Soft Red Winter						
Soft White						
Hard White						
Durum						

Wheat Products

Hard Red Winter						
Hard Red Spring						
Soft Red Winter						
Soft White						
Hard White						
Durum