



# The Book Planter



## Ag in the Classroom

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### October 2020: *From Wheat to Bread*

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The reader will learn about all of the jobs associated with wheat farming and bread making. How does it start as a grain and become the soft bread we eat? The book explores wheat farming, milling, and baking, showing and describing each process. It also includes a world map of where wheat is grown, a glossary, and other resources. Please note that there are some antiquated practices featured in this book, but it is a great introduction to agriculture and the farm to table process.



#### Fun Facts

- The Egyptians were the first to discover leavened bread (bread that rises).<sup>1</sup>
- Norman Borlaug was an agronomist who worked to improve wheat varieties that helped increase agricultural production across the whole world.
- The wheat grown around the world today came from three grassy weed species that naturally hybridized around 10,000 years ago. There are no commercially-available wheat varieties in the world today that have been genetically modified. This hybridization was a naturally occurring event where wheat species changed based on growing conditions.<sup>2</sup>
- There are 6 classes of wheat grown in the United States:<sup>2</sup>
  - Hard Red Winter
  - Hard Red Spring
  - Soft Red Winter
  - Soft White
  - Hard White
  - Durum
- North Carolina farmers primarily grow Soft Red Winter Wheat which is planted in the fall, grows in the winter and is harvested in late spring.<sup>2</sup>
- The average NC wheat farmer grows 250 acres, and the average yield per acre is 68.5 bushels.<sup>2</sup>

## Wheat Vocabulary<sup>1</sup>

**Gluten:** Gluten is a protein found in grain products. It helps bread rise and expand while baking. Gluten acts as “glue” to hold food together.

**Whole Grain:** Whole grain foods are made with the entire grain kernel. The bran, germ, and endosperm are all included.

**Yeast:** Baker’s yeast is used in baking. It causes the bread to rise by converting sugars into carbon dioxide and ethanol.

**Mill:** A mill is a machine used for crushing grain into flour.

**Winter Wheat:** Winter wheat grows in the winter months. It can withstand freezing weather. It is a good way for farmers to use fields that normally would not be planted in for the cold winter months.

**Vernalization:** A process that all winter wheat varieties go through. The plant must be exposed to cooler temperatures before it flowers. The ideal temperature for this process is 40-50 degrees Fahrenheit.

**Combine:** A machine that takes the wheat seeds out of the plant.

**Elevator:** An elevator on a farm is a building where grains are stored.

**Bushel:** A unit of measurement. Wheat is harvested and sold using bushel/acre measurements.

## Activity 1: All About Wheat<sup>3</sup>

1. Divide the class into groups of 3-5 students. Print 1 copy of the *Wheat Reader* (see **Links**) for each group or individual student.
2. Pass out the *What Stuck?* (see **Links**) activity sheet to each student.
3. Instruct the students to read the *Wheat Reader* and take notes about what they are learning on the “sticky notes” of the activity sheet.
  - Increase the effectiveness of this reading strategy by first discussing with the students some of the things they will learn as they read.
  - List the following questions on the board as a guide for the notes they should take on their activity sheet:
    - What does a wheat plant look like?
    - What is wheat used for?
    - What are the parts of a wheat plant?
    - What machines are used to plant and harvest wheat?
4. When reading time is complete, review the basic information about wheat by playing the [“All About Wheat”](#) Kahoot game (full link in **Links** section). Kahoot is a game-based classroom response system. First-time users will need to sign up for a free account. Kahoot can be used in the classroom with iPads, iPods, tablets, or smart phones. If individual student access is not available, classes can participate as a group by projecting the quiz on a screen.
5. Follow the basic Kahoot instructions below or watch an online tutorial.

## Activity 2: Wheat Germ DNA Extraction<sup>3</sup>

### Materials:

- Fresh or vacuum-packed wheat germ
- Warm water (not boiled)
- Dish soap

- Isopropyl (rubbing) alcohol
  - Test tubes, 1 per student\*
  - Stir sticks, 1 per student\*
  - Pipettes, 1 per student\*
  - Microcentrifuge tubes, 1 per student\*
  - Yarn, 1 necklace length piece per student\*
  - Safety glasses
  - 1 teaspoon measuring spoon, minimum 1 per group
  - 1 tablespoon measuring spoon, minimum 1 per group
- \*These items are included in the [Wheat Germ DNA Necklace Kit](#), which is available for purchase from [agclassroomstore.com](http://agclassroomstore.com).

1. Review the six classes of wheat and their characteristics with the students. Explain that each variety of wheat has DNA (deoxyribonucleic acid) that determines its specific genetic traits or characteristics.
2. Project the [Wheat Kernel Dissection Image](#) on a large screen. Point out the germ. Explain that the germ of the wheat kernel, which is the embryo or sprouting section of the seed, contains the DNA. When the embryo sprouts and grows into a plant, the specific traits will be expressed in the plant.
3. Tell students they are going to extract (remove) DNA from wheat germ so that they can observe the DNA strands that contain the traits of the wheat.
4. Organize students into small groups. Provide each student with one test tube, one stir stick, one pipette, one microcentrifuge tube, one necklace-length piece of yarn, and a pair of safety glasses. Provide each group with warm water, dish soap, rubbing alcohol, a teaspoon measuring spoon, and a tablespoon measuring spoon.
5. Guide the students through the following instructions:
  - a. Pour 1/4 teaspoon of wheat germ into the test tube.
  - b. Add 2 teaspoons of warm water and mix with the stir stick.
  - c. Add 4 drops of dish soap and mix.
  - d. Let the solution stand for 5 minutes. Use this time for students to discuss their predictions within their groups.
  - e. After the 5 minutes are up, put safety glasses on, tip the test tube slightly and **slowly** run 1 tablespoon of rubbing alcohol down the side of the tube until it is half full. It is important that the alcohol is slowly added to the solution to avoid stirring up the wheat germ flakes. The rubbing alcohol will precipitate the DNA (cause the DNA to come out of the wheat germ solution).
  - f. Observe the line between the wheat germ solution and the alcohol. You will notice a white, thread-like cloud appearing above this line. This is the wheat germ DNA.

- g. Use the pipette to carefully collect the cloudy clumps of DNA strands and transfer them to the microcentrifuge tube.
  - h. Close the cap of the microcentrifuge tube tightly around a piece of yarn and tie the ends of the yarn to make a DNA necklace.
6. Ask the students to make observations about the wheat germ DNA. Use the following questions to guide the discussion:
- What does DNA look like? Did it match your prediction?
  - Why is it useful for scientists to be able to extract DNA from an organism?
  - Why is it important for farmers to understand the genetic traits of the crops they grow and the animals they raise?

### Activity 3: Bread in a Bag<sup>4</sup>

This activity details the instructions for making bread in a Ziploc bag. An excellent way to demonstrate bread-making and the properties of yeast within a classroom setting.

#### Materials:

- 2 cups all-purpose flour
- 2 cups whole wheat flour
- Warm water
- 2 tablespoons sugar
- 1 package yeast or 2-1/4 teaspoons (quick rise yeast will speed things along)
- 1-2 teaspoons salt
- 1 tablespoon oil
- Plastic wrap
- Cooking oil spray
- Heavy-duty Ziploc bag
- Food handler's gloves (available from restaurant supply stores or school cafeteria)
- Various measuring cups and spoons
- Cookie sheets
- Oven



1. Making bread is an art and a science. Prepare for making "bread-in-a-bag" by obtaining enough ingredients for each loaf. It is best to divide your students into groups of two, but groups of four will also work.
2. Heavy-duty Ziploc bags will ensure that you will not have rips or tears causing a mess. Also the bag keeps the process neat and fairly sanitary. If you are making bread as a microorganism experiment, vary the yeast, sugar, salt, or water

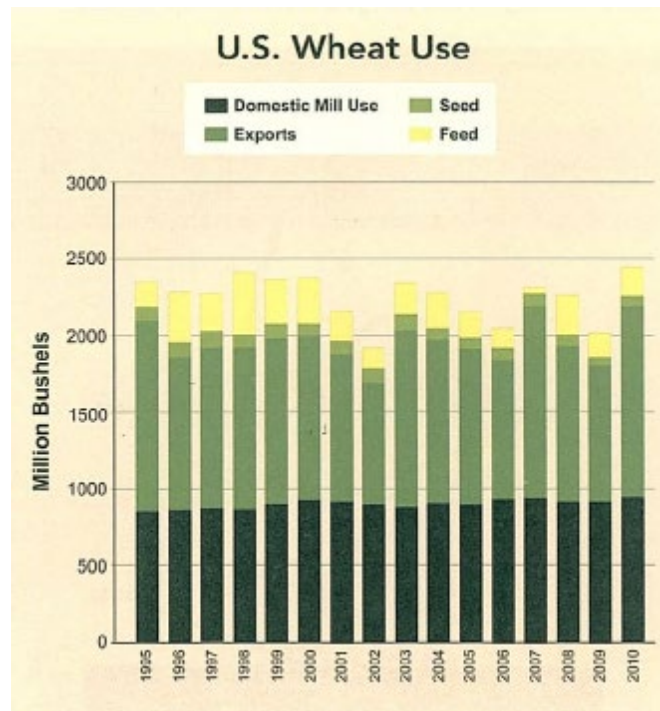
temperature for interesting results. The only time your students will touch the dough is when it is placed on the cookie sheet. (A cookie sheet is what is most readily available in school cafeterias, and kids can make different shaped loaves for identification. You won't need 15 bread pans!) Only one student needs to place the dough on the cookie sheet. Cheap food handler's gloves sprayed or coated with vegetable oil work great for this transfer.

3. The observations of the dough can be made throughout the kneading process. Doughs with extra sugar will seem quite a bit wetter, while those with extra yeast will seem quite hard. Students should record their observations while making the bread, while it rises (compare quick rise yeasts with regular yeasts), and then again after the bread is baked (texture, flavor, etc.).
4. In a one-gallon (heavy-duty) Ziploc bag, mix: 1/2 cup all-purpose flour 1 pkg. or 2-1/4 teaspoons yeast 1/2 cup warm water 2 tablespoons sugar.
5. Close the bag and knead it with fingers until the ingredients are completely blended.
6. Leave the bag closed, with the contents in the corner, and let rest 10 minutes. You can eliminate this wait by using instant yeast.
7. Then add: 2 cups whole wheat flour 3/4 cup warm water 1 tablespoon vegetable oil 1-2 teaspoons salt. Mix well. Add enough all-purpose flour to make a stiff dough, about 1 or 1-1/2 cups.
8. Close the bag and knead it (you may need to remove some air in the bag).
9. Spray hands or gloves (food handler's gloves) with oil so there will be no sticking.
10. Open the bag and allow the dough to fall out onto clean or gloved hands.
11. Form the dough into a loaf, and place in a loaf pan or onto a cafeteria cookie sheet. Remember the dough will grow larger, so leave space between loaves if baking on a cookie sheet.
12. Cover the loaves with oil sprayed plastic wrap and allow to rise 30 to 45 minutes (quick rise yeast).
13. Bake 30-35 minutes in a 350-degree oven.
14. Now that's "real world" science! Students can actually figure out what yeasts need to live and what they produce as wastes, gas bubbles, or wonderful bread aroma.

#### Activity 4: Wheat Math<sup>5</sup>

1. A bushel of wheat weighs about 60 pounds. How much do 4 bushels of wheat weigh?
  - a) 64 pounds
  - b) 120 pounds
  - c) 240 pounds
  - d) 244 pounds
2. One bushel of wheat makes 90 loaves of bread. Estimate how many loaves of bread can be made from 5 bushels of wheat.
  - a) 100 loaves
  - b) 500 loaves
  - c) 1,000 loaves
  - d) 5,000 loaves

3. The average price per bushel of wheat in 2011 was \$5.70. One bushel of wheat can make 5,000 four-inch cookies. If each cookie is sold for 50 cents, how much money could be made?
- \$5,000
  - \$5,700
  - \$2,500
  - \$5,004



4. According to the graph, which of the following years had the lowest overall wheat production?
- 2007
  - 2008
  - 2009
  - 2010
5. Which of the following years had the highest overall wheat production?
- 2007
  - 2008
  - 2009
  - 2010
6. Two bushels of wheat weigh 60 pounds each. Those two bushels can make 42 pounds of white flour and 60 pounds of whole wheat flour. What is the difference between white and wheat flour?
- 8 pounds
  - 12 pounds

- c) 18 pounds
  - d) 28 pounds
7. There are between 15,000 and 17,000 kernels of wheat in a bushel. What is the difference between 15,000 and 17,000 kernels?
- a) 200 kernels
  - b) 2,000 kernels
  - c) 20,000 kernels
  - d) 32,000 kernels

## Links

- Wheat Reader (from **Activity 1**)  
[https://cdn.agclassroom.org/media/uploads/2015/04/28/clr\\_wheatnews.pdf](https://cdn.agclassroom.org/media/uploads/2015/04/28/clr_wheatnews.pdf)
- What Stuck? (from **Activity 1**)
- “All About Wheat” Kahoot game (from **Activity 1**)  
<https://create.kahoot.it/share/1244bc47-6d92-4274-973d-22e15cd3e5f8>
- North Carolina Small Grain Growers Association (NCSGGA) Myths vs. Facts Brochure  
<https://secureservercdn.net/198.71.233.47/004.28f.myftpupload.com/wp-content/uploads/2020/02/NCSGGA-Myth-vs.-Fact-Brochure.pdf>
- NCSGGA The Truth About Gluten reader  
<https://secureservercdn.net/198.71.233.47/004.28f.myftpupload.com/wp-content/uploads/2020/02/The-Truth-About-Gluten-Print-Out.pdf>
- NCSGGA Wheat Facts  
<https://secureservercdn.net/198.71.233.47/004.28f.myftpupload.com/wp-content/uploads/2020/02/NCSGGA-Consumer-Handout.pdf>
- *The Thing about Luck* by Cynthia Kadohata (chapter book)  
<https://www.agfoundation.org/recommended-pubs/the-thing-about-luck>
- *The Kid Who Changed the World* by Andy Andrews (book)  
<https://www.agfoundation.org/recommended-pubs/the-kid-who-changed-the-world>

## Sources

1. American Farm Bureau Foundation for Agriculture. Wheat Ag Mag (2019). Print.
2. <http://ncwheat.com/resources/>
3. <https://agclassroom.org/matrix/lesson/197/>
4. <https://agclassroom.org/matrix/resource/50/>
5. <http://www.agintheclassroom.org/TeacherResources/TerraNova/Wheat.pdf>

## K-5 Subject Areas

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

### NC Standard Course of Study

#### Reading

- **RL.K.1** With prompting and support, ask and answer questions about key details in a text.
- **RL.K.2** With prompting and support, retell familiar stories, including key details.
- **RL.K.3** With prompting and support, identify characters, settings, and major events in a story.
- **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.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.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- **RI.3.2** Determine the main idea of a text; recount the key details and explain how they support the main idea.
- **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.4.2** Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- **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.6** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question
- **W.1.6** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- **W.2.6** Recall information from experiences or gather information from provided sources to answer a question.
- **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.

#### 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.1.1** Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups. a. Follow agreed-upon rules for discussions. b. Build on others' talk in conversations by responding to the comments of others through multiple exchanges. c. Ask questions to clear up any confusion about the topics and texts under discussion.
- **SL.1.2** Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
- **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. a. Follow agreed-upon rules for discussions. b. Build on others' talk in conversations by linking their comments to the remarks of others. c. Ask for clarification and further explanation as needed about the topics and texts under discussion.
- **SL.2.2** Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.



- **SL.2.4** Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent and complete sentences.
- **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.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly in complete sentences at an understandable pace.
- **SL.4.2** Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **SL.4.4** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; adjust speech as appropriate to formal and informal discourse.
- **SL.5.2** Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **SL.5.4** Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; adapt speech to a variety of contexts and tasks.

#### 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.P.2** Understand the structure and properties of matter before and after they undergo a change.
- **3.P.3** Recognize how energy can be transferred from one object to another.
- **3.L.2** Understand how plants survive in their environments.
- **5.P.3** Explain how the properties of some materials change as a result of heating and cooling.

#### Social Studies

- **K.G.2** Understand the interaction between humans and the environment.
- **2.G.2** Understand the effects of humans interacting with their environment.

#### Math

- **K.MD.1** Describe measurable attributes of objects; and describe several different measurable attributes of a single object.
- **NC.1.MD.4** Organize, represent, and interpret data with up to three categories.
- **NC.3.MD.3** Represent and interpret scaled picture and bar graphs:
- **NC.4.MD.4** Represent and interpret data using whole numbers.
- **NC.5.MD.2** Represent and interpret data