



Introduction to Wheat and Plant Growth

Week 1 – Day 1

Lesson Overview

The purpose of this lesson is to introduce students to the topics of wheat and what plants need to grow. This lesson briefly covers the role of wheat in the global food system, wheat production in the inland Pacific Northwest, food and non-food products that contain wheat, and the basic components necessary for plant growth (i.e., water, sun, air, and soil). This lesson includes an overview of what students will be learning throughout the four-week curriculum and sets them up for learning more about photosynthesis, the water cycle, and specific structures and functions of wheat plants during the rest of the week.

Lesson Vocabulary

wheat, global staple foods, inland Pacific Northwest, Jan Baptist van Helmont, air, water, soil, and sunlight

Standards and Learning Targets for Lesson

Learning Targets

- I can describe the basic components that plants need for growth.

Next Generation Science Standards

- 5-LS1-1 – Molecule to Organisms
 - Support an argument that plants get the materials they need for growth chiefly from air and water.

Idaho Science Standards

- 5.S.3.2.1 – Goal 3.2 Biology
 - Communicate how plants convert energy from the sun through photosynthesis.

Common Core ELA Standards

- W.5.10 – Writing
 - Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Materials

- About 20 products that do and do not contain wheat (Use the graphic organizer “Is It Made with Wheat?” to gather items, or use the images in the PowerPoint slides.)
- PowerPoint slides (W1D1_Introduction Presentation.pptx) to use in place of the collected items (if desired) and for the mini-lesson on wheat in the global food system
- Graphic organizer “Is It Made with Wheat?”
- Graphic organizer “Is It Made with Wheat? TEACHER KEY” (This version is the answer key.)
- Graphic organizer “Was van Helmont Right?”



Fifth Grade Curriculum: Wheat Farming and Climate Change in the Inland Pacific Northwest



- Graphic organizer “Jan Baptiste van Helmont’s Science Notebook”
- Graphic organizer “What Plants Need to Grow”
- Transpiration demonstration setup materials: one baggie and one twist tie for each student pair/group and indoor or outdoor plants in sun and shade (Read setup instructions below for more details.)

Lesson Duration

Approximately 2 hours

Lesson Description

Part 1: Wheat in the World and the Inland Pacific Northwest –Short Lesson Introduction (30 minutes)

- Place about 20 products (some that do and some that do not contain wheat) on a table. Use the graphic organizer to gather products, or show students the product images provided in the PowerPoint slides. Have students gather around the table (or watch slides one at a time) and use the graphic organizer “Is it Made with Wheat?” to add each product to one of two columns (contains wheat or does not contain wheat).
- Discussion: Hold up one product at a time (or show product slides) and ask students whether they think it contains wheat or not. Ask students to explain their thinking. Share details about the products, highlighting surprising examples and the diverse uses of wheat in our daily life.
- Use the PowerPoint slides beginning with “Wheat in the Global Food Supply” to engage the class in a short discussion and highlight the main points on each slide.
- Tell the class about what they will learn in the next four weeks:
 - How plants grow and how wheat grows
 - What wheat farms in the inland Pacific Northwest look like
 - How weather and climate patterns influence wheat
 - You will get to pretend you are a wheat farmer facing a certain problem and you will work in groups to find solutions.
 - You will each write an essay about how to solve the farm’s problem and make a presentation (maybe to local farmers and/or scientists).

Part 2: What Plants Need to Grow – Engage, Explore, Explain, Elaborate, and Evaluate (5E) Lesson Structure (80 minutes)

Engage

- Distribute the graphic organizer “Jan Baptiste van Helmont’s Science Notebook” to each student. Read the text aloud while students follow along.
- Read the text a second time aloud, pausing frequently so students can draw the experiment based on what you read.
- Instruct students to use the information in the text to draw two colored lines on the graph (one green line showing the increase in plant mass and one brown line showing the maintenance of soil mass) in order to summarize van Helmont’s findings.



Fifth Grade Curriculum: Wheat Farming and Climate Change in the Inland Pacific Northwest



- Select a couple of students to share their plots and thinking.
- Clarify what the two lines should look like by drawing them on the board. Have students make any corrections needed to their own plots. Ask students to clarify what van Helmont's main conclusions were (i.e., the weight of the soil remained the same [200 pounds], but the weight of the tree increased by 164 pounds).

Explore

- Distribute the graphic organizer "Was van Helmont Right?" to each student.
- Have students answer the following questions in their groups (Be sure to have them write down their responses in the first column as they will be using them again later in the lesson.):
 - *Do you think van Helmont was right? Why or why not?*
 - *What other possible explanations for the tree's growth are there?*
- Ask groups to share their answers to these questions.
- Let students know that the rest of today's lesson will be about what plants need to grow.
- Unpack the learning target: *I can describe the basic components that plants need for growth.* Write the learning target on the board or on chart paper. Discuss the meaning of key words. Discuss the purpose of the lesson in terms of what students will be able to do by the end of the lesson.
- Distribute the graphic organizer "What Plants Need to Grow." Have students work in groups to discuss their answers to the questions and fill out the graphic organizer, recording their answers on their own papers. Another option is to cut the graphic organizer into four parts (water, soil, sun, and air) with one part at each of the four stations around the room. Have students move to each of the four stations to answer the questions on the graphic organizer, taping each piece into their notebooks as they move.
- Circulate around to help groups as they work through the questions. Stop the class as needed to clarify points along the way (i.e., catch and release).

Explain

- Whole-class discussion about what plants need to grow: work through the graphic organizer, asking each group to share their responses to a question.
- Throughout the discussion, you can take notes to create an anchor chart highlighting what plants need to grow. Clarify the basic processes in which plants use these components to grow.
 - Water: hydrates
 - Soil: provides structure to hold the roots, holds and stores water, and is the source of most nutrients required by plants
 - Sun: provides light, a necessary component for plants to make their own food
 - Air: contains gases like carbon dioxide
- If needed, review the basics of elements and matter.
- Let students know that we will explore how plants use these components to grow throughout the rest of the week.

Elaborate

- Have students return to the original questions and their responses:
 - *Do you think van Helmont was right? Why or why not?*



Fifth Grade Curriculum: Wheat Farming and Climate Change in the Inland Pacific Northwest



- What other possible explanations are there for why the tree grew?

- Have students work in groups to answer these questions again, record their answers in the second column of their graphic organizers, and assess how their thinking has changed.

Evaluate

- Have students write one paragraph about the basic components plants need (i.e., water, sun, air, and soil) and how plants use each of them for growth.

Part 3: Set Up Transpiration Demonstration for Analysis on Day 3 of This Week – Set Up Only (10 minutes)

The purpose of this demonstration is to reiterate how plants contribute to the water cycle through transpiration. The results of this demonstration will be analyzed on Day 3 this week as an extension of water cycle knowledge and understanding. Teachers can decide whether to set up one demonstration for the whole class to look at together or to have student pairs/groups each set up their own demonstration. The latter option would be preferred to maximize student engagement, but it might not be possible for all classes due to time requirements or other constraints. The set-up instructions follow:

- Use either indoor or outdoor plants.
- In order to compare their transpiration rates, choose plants that receive either sunlight or shade for most/all of the day or place plants in those conditions.
- Divide students into eight groups, with four assigned to sun and four assigned to shade.
- Give each student group a baggie and a twist tie.
- Decide on a number of leaves to try to cover with the baggie so that all groups cover approximately the same number of leaves.
- Instruct the groups to find outside plants (or indoor plants) in either the sun or the shade (according to their assigned categories). Have them place their baggies over the determined number of leaves and seal tightly with the twist tie.
- Remind students not to harm the plants and to have as little impact on the plants as possible in this process.
- Have students draw the demonstration setup in their science notebooks and make a prediction about what they will be observing in two days when they look at it again.
- See “The Water Cycle” (week 1, day 3) for the analysis portion of the demonstration.

Resources Used in Lesson Development

David Hershey. (2003). *Misconceptions about Helmont’s Willow Experiment*. Plant Science Bulletin. The Botanical Society of America. 49:3. [Text for van Helmont’s science notebook activity was adapted from this source, which cites the original source as: Helmont, J.B. van. (1662). *Oriatrike or Physick Refined*. London: Lodowick Loyd. (translated by John Chandler).

Global Wheat Statistics. International Development Research Center, Canada. <https://www.idrc.ca/en/article/facts-figures-food-and-biodiversity>

U.S. Wheat Statistics. United State Department of Agriculture. Search for “U.S. wheat statistics” at this website: <http://www.usda.gov/wps/portal/usda/usdahome>

Map of Wheat Producing Regions of the World. University of Minnesota Institute on the Environment. Accessed from: https://en.wikipedia.org/wiki/International_wheat_production_statistics



**Fifth Grade Curriculum:
Wheat Farming and Climate Change in the
Inland Pacific Northwest**



Is it Made with Wheat?

	Yes	No
Bread		
Pretzels		
Pasta		
Flour Tortillas		
Trash Bags		
Ketchup		
Chewing Gum		
Metal		
Licorice		
Eggs		
Flavored Potato Chips		
Salad Dressing		
Soy Sauce		
Laundry Soap		
Canned Soup		
Popcorn		
Hot Dogs		
Paper		
Kitty Litter		
Housing Insulation		
Paste		
Play-Doh		
Golf Tees		
Cosmetics		
Pet, Livestock, & Fish Food		
Clothes		
Shampoo & Conditioner		
Sunscreen		
Pencils		
Hot Chocolate		
Vegetables		
Meat and Fish		



**Fifth Grade Curriculum:
Wheat Farming and Climate Change in the
Inland Pacific Northwest**



Is It Made with Wheat? (TEACHER KEY)

	Yes	No
Bread	X	
Pretzels	X	
Pasta	X	
Flour Tortillas	X	
Trash Bags	X	
Ketchup	X	
Chewing Gum	X	
Metal		X
Licorice	X	
Eggs		X
Flavored Potato Chips	X	
Salad Dressing	X	
Soy Sauce	X	
Laundry Soap	X	
Canned Soup	X	
Popcorn		X
Hot Dogs	X	
Paper	X	
Kitty Litter	X	
Housing Insulation	X	
Paste	X	
Play-Doh	X	
Golf Tees	X	
Cosmetics	X	
Pet, Livestock, & Fish Food	X	
Clothes		X
Shampoo & Conditioner	X	
Sunscreen	X	
Pencils		X
Hot Chocolate	X	
Vegetables		X
Meat and Fish		X



**Fifth Grade Curriculum:
Wheat Farming and Climate Change in the
Inland Pacific Northwest**



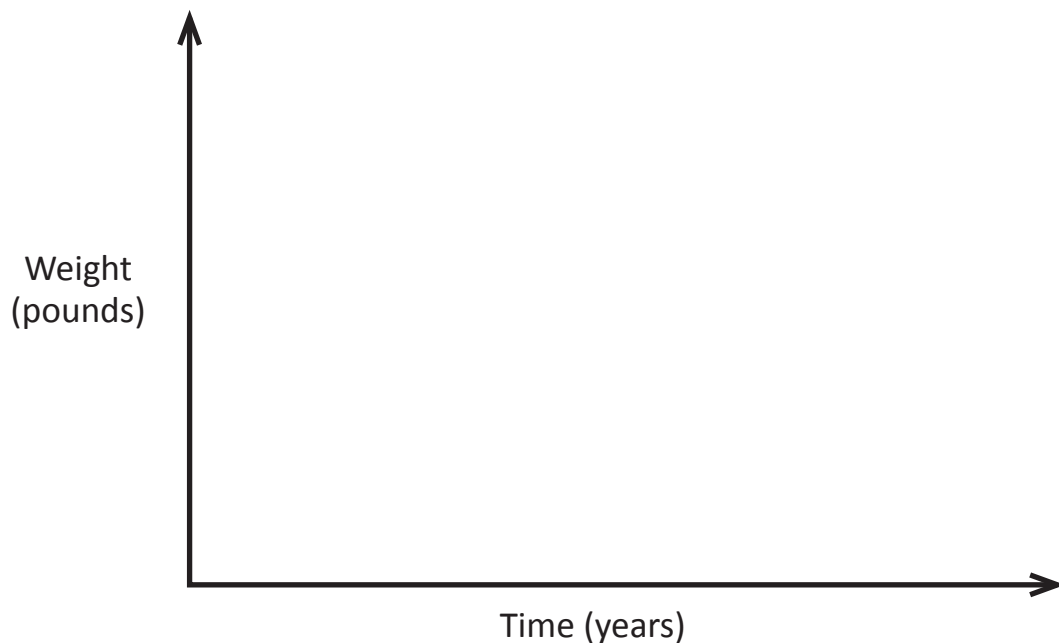
Jan Baptiste van Helmont's Science Notebook

I have learned that all plants do grow from water only. In a clay vessel I put 200 pounds of soil that had been dried in a furnace. In that soil I planted a small willow tree weighing five pounds. I covered the soil with a tin plate full of holes to allow rainwater to enter. For five years I allowed rainwater to fall onto the soil and I also watered the tree myself. After five years, the tree weighed 169 pounds. However, I did not weigh the leaves that fell off the tree in the four autumns that passed. After drying the soil, I found that it weighed nearly the same 200 pounds as five years ago. Therefore, 164 pounds of wood, bark and roots arose out of water only.

Text adapted from: Helmont, J.B. van. (1662). *Oriatrike or Physick Refined*. London: Lodowick Loyd. (translated by John Chandler). Referenced in: David Hershey. (2003). *Misconceptions about Helmont's Willow Experiment*. Plant Science Bulletin. The Botanical Society of America. 49:3.

Based on this entry from van Helmont's science notebook, draw the following two lines on the graph below. Be sure to draw them in two different colors.

1. Plot the change in weight of the willow tree over the five years of his experiment.
2. Plot the change in weight of the soil over the five years of his experiment.





**Fifth Grade Curriculum:
Wheat Farming and Climate Change in the
Inland Pacific Northwest**



What Plants Need to Grow

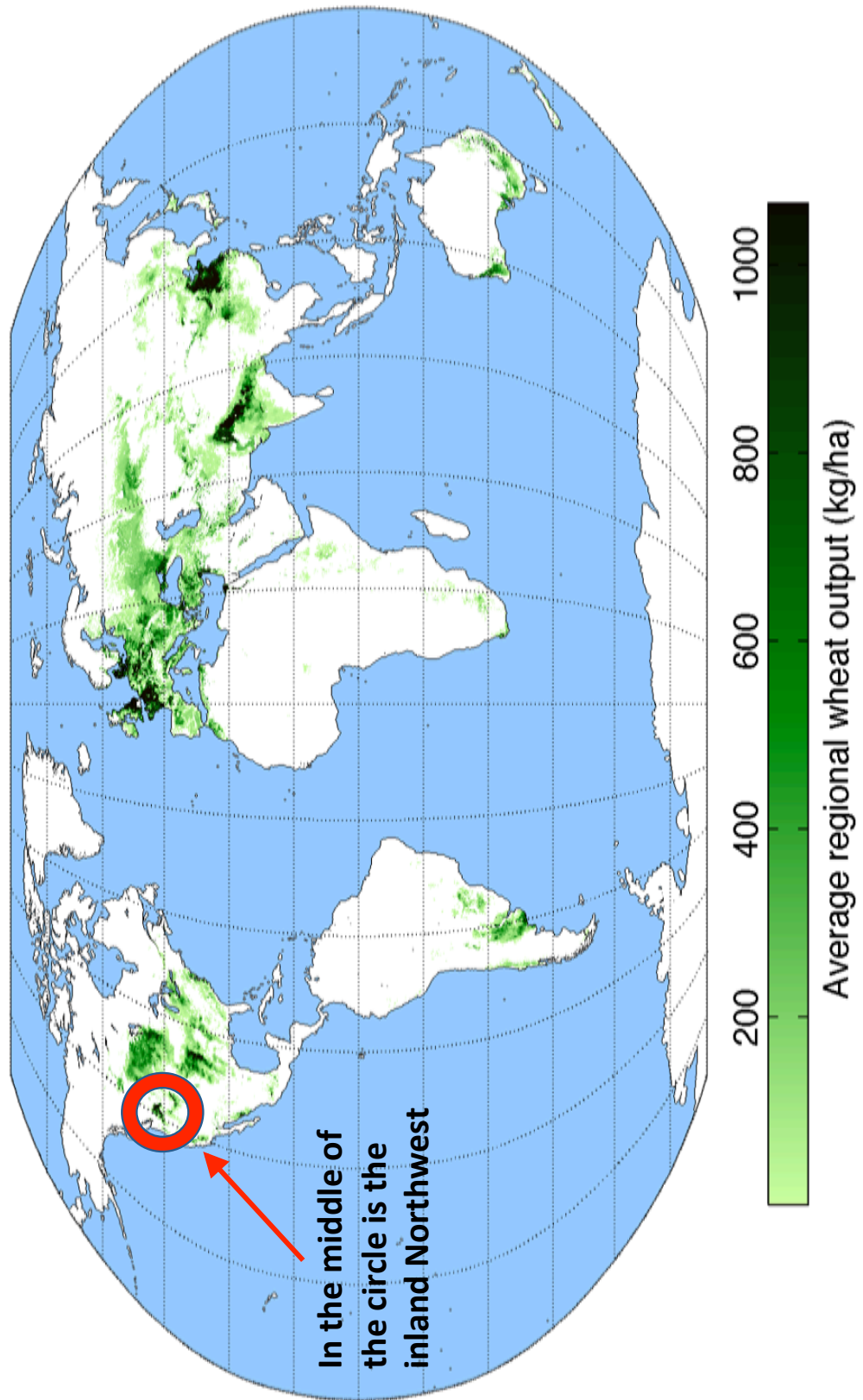
Water	<p>Can you survive on water alone?</p> <p>Besides water, what else do you need to grow?</p> <p>Do you think that plants can survive on water alone?</p> <p>Where do you think the willow got its food?</p>
Soil	<p>Did soil contribute to the mass of the willow growth?</p> <p>Do you think the willow got its food from the soil?</p> <p>How do you know?</p>
Sunlight	<p>Do you think the willow got its food from sunlight?</p> <p>How do you think the sun helps plants grow?</p>
Air	<p>What is air made of?</p> <p>How do you think air helps plants grow?</p>

The Global Food Supply

- The three major crops that feed the world are **wheat, rice, and corn**.
- In total, wheat, rice, and corn are the staple diet for more than 50% of the world's population (that's almost 4 billion people).
- According to the United States Department of Agriculture, the United States produces about 10% of the world's wheat supply.
- About 15% of all U.S. wheat comes from the inland Northwest.

Color images available for download at reacchpna.org/education/elementary-curriculum

Wheat Producing Regions in the World



Color images available for download at reacchpna.org/education/elementary-curriculum



Color images available for download at reacchpna.org/education/elementary-curriculum