Grades 9-12

English Language Arts, Social Studies

Objectives

Through classroom experiences, students will learn about the research of Nobel Prize-winning plant breeder Norman Borlaug, do research, and write an essay to enter in the World Food Prize Global Youth Institute about Norman Borlaug's influence in beginning the Green Revolution, and apply concepts to current local and world events.

Vocabulary

crop failure—reduction in crop yield to a level that there is no marketable surplus or the nutritional needs of the community cannot be met

developing nation—a nation with a low level of material well-being

dwarf—an animal or plant much below normal size gene—a part of DNA or 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

plant breeder-someone who propagates plants sexually under controlled conditions

resistant—capable of withstanding the force or effect of a disease stalk—a plant stem especially of a plant that is not woody

Background

Norman Borlaug was a **plant breeder**. He used high-yield agriculture techniques to help people get more food from their land. For 50 years he worked in developing nations like Mexico, India, and Pakistan. Before he began his work, mass starvation had been predicted in many parts of the world. Since then, food production has expanded faster than human population in all parts of the world except sub-Saharan Africa. Borlaug received the Nobel Peace Prize in 1970, mostly for his work reversing food shortages in India and Pakistan during the 1960s.

Norman Borlaug was born in Cresco, Iowa, in 1914. When he was a young man, the Dust Bowl hit the Midwestern US. Some people blamed modern farming methods, but Borlaug believed just the opposite was true. He noticed that the effects of the Dust Bowl were not as bad in Iowa and other places where high-yield agriculture techniques were being tried. He decided that his life's work would be to help people grow more food in places where crop failures were regular facts of life.

Borlaug helped found the International Maize and Wheat improvement Center (CIMMYT) in Mexico. There he helped develop high-yielding semi- dwarf wheat varieties. Today this wheat feeds a large portion of the world's population.

"Civilization as it is known today could not have evolved, nor can it survive, without an adequate food supply."

- Norman Borlaug





Borlaug's leading research achievement was the development of dwarf spring wheat. He found many benefits to growing plants with shorter **stalks**. Nature favors **genes** for tall stalks because in nature, plants must compete for sunlight. 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. In addition, dwarf wheat used 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.

Borlaug also developed cereal grains that were day neutral (insensitive to the number of hours of light in a day) and could, therefore, be grown in many climates. He particularly favored growing wheat in countries where starvation was a concern because wheat grows in nearly all environments and is **resistant** to insects.

Additional Reading

Bartoletti, Susan Campbell, *Black Potatoes: The Story of the Great Irish Famine, 1845-1850,* Houghton-Mifflin, 2001.

Hesser, Leon, *The Man Who Fed the World: Nobel Prize Laureate Norman Borlaug and His Battle to End World Hunger*, Righters Mill Press LLC, 2019.

Mann, Charles C., *The Wizard and the Prophet, Penguin Random House, 2018* Smith, David J., *If the World Were a Village*, Kids Can, 2002 Vietmeyer, Noel, *Our Daily Bread; The Essential Norman Borlaug,* Bracing Books, 2012

Websites

https://www.worldfoodprize.org/en/dr_norman_e_borlaug/about_norman_borlaug/ https://allianceforscience.cornell.edu/blog/2020/04/norman-borlaug-legacy-documentary/ https://www.purdue.edu/discoverypark/food/programs/borlaug-fellows/norman-borlaug.php

REV 9/2020

Grades 9-12 Teacher Resources and Standards

Activity 1: Freedom from Famine, (Social Studies) 2 50 minute class periods

Students will watch a documentary about Norman Borlaug and complete a worksheet and notes.

Oklahoma Academic Standards

Activity 1: Freedom from Famine (Social Studies)

- WG.5.1 Examine the origin and diffusion of agriculture including the Agricultural Revolutions and the Green Revolution.
- WG.5.2 Describe and summarize the characteristics of modern commercial agriculture including major production regions, variations within major zones, and effects of markets.

Materials:

Activity 1

- Activity 1 Worksheet 1 "Video Worksheet"
- Activity 1 Worksheet 2 "Cornell Notes"

Procedures

- 1. Show "Freedom from Famine: The Norman Borlaug" documentary available at http://aboutharvest.com/2015/08/freedom-from-famine-the-norman-borlaug-story/
- 2. Have students complete the "Video Worksheet" or "Cornell Notes."

Activity 1 Worksheet 1: Video Worksheet



Name: ____

Date: _

Directions: Complete these questions while watching the "Freedom from Famine: The Norman Borlaug" documentary found at:

http://aboutharvest.com/2015/08/freedom-from-famine-the-norman-borlaug-story/

Part I (0:00-12:00)

1. "We're going to teach you to be rebels. Not with guns and daggers, but with

_____ and _____

- 2. What caused concerns over food shortages after WWII?
- 3. What major historical event happened during Dr. Borlaug's time in high school?
- 4. Name two sports Dr. Borlaug played.
- 5. Where did Dr. Borlaug go to college and what was his major?
- 6. How did Professor Statemen collect rust spores?
- 7. What major historical event happened after Dr. Borlaug took his job at DuPont?

Part II (12:00-22:00)

- 8. What was the soil quality in Mexico when Dr. Borlaug arrived?
- 9. Describe the importance of wheat to the world's diet.
- 10. What disease is the biggest threat to wheat crops?
- 11. What traits was Dr. Borlaug searching for in his wheat crossbreeding?

Part III (22:00-31:00)

- 12. Why did Dr. Borlaug choose the Yaqui Valley to set up his second wheat breeding station?
- 13. What were the challenges to this new station?
- 14. What was the impact of the new dwarf wheat plant?
- 15. What are the "two sides to this complex human problem"?

Activity 1 Worksheet 1: Video Worksheet (Continued)

Part IV (31:00-56:00)

- 16. What world events impeded Dr. Borlaug's work from reaching needy populations?
- 17. What are two implications of the Green Revolution?
- 18. What is the impact of Quality Protein Maize?

Directions: Write a paragraph to explain your opinion to answer 19-21.

19. What impact does Dr. Borlaug's work have on your life?

20. Why is it important for countries to become self-sufficient in their food production?

21. How does the Green Revolution continue today?

Activity 1 Worksheet 1: Video Worksheet

ANSWER KEY

Name: _



_Date:

- 1. "We're going to teach you to be rebels. Not with guns and daggers, but with <u>science</u> and <u>technology</u>."
- 2. What caused concerns over food shortages after WWII? Population growth
- 3. What major historical event happened during Dr. Borlaug's time in high school? Stock market crash, Great Depression
- 4. Name two sports Dr. Borlaug played. Wrestling, Football, Baseball
- 5. Where did Dr. Borlaug go to college and what was his major? University of Minnesota, Forestry
- 6. How did Professor Statemen collect rust spores? Flypaper on airplanes
- 7. What major historical event happened after Dr. Borlaug took his job at DuPont? Pearl Harbor, US joined WWII
- 8. What was the soil quality in Mexico when Dr. Borlaug arrived? Poor, continuously cultivated without replenishing nutrients
- Describe the importance of wheat to the world's diet. Has many nutrients, 2nd most produced crop, staple in many diets
- 10. What disease is the biggest threat to wheat crops? Rust
- 11. What traits was Dr. Borlaug searching for in his wheat crossbreeding? Resistance to rust, high yield
- 12. Why did Dr. Borlaug choose the Yaqui Valley to set up his second wheat breeding station? Climate, another growing season, ample acres, irrigated land
- 13. What were the challenges to this new station? Roads, distance, rivers w/o bridges
- 14. What was the impact of the new dwarf wheat plant? Higher yields, feeding hungry over the world, Mexico self-sufficient in wheat production
- 15. What are the "two sides to this complex human problem"? Food production and population growth
- 16. What world events impeded Dr. Borlaug's work from reaching needy populations? Vietnam War, Indian/Pakistan War
- 17. What are two implications of the Green Revolution? Conservation of natural resources, producing more food with same acreage
- 18. What is the impact of Quality Protein Maize

Prevent malnutrition, complete food source

19, 20, 21: Answers may vary.

Activity 1 Worksheet 2: Cornell Notes



Name:	Date:
Main Ideas	Your Notes
Dr. Borlaug's Early Life and Education	
-How did his experiences set him up for his future work?	
-What obstacles did he have to overcome to reach his goals?	
Dr. Borlaug's Work in Mexico	
-What were the conditions in Mexico when Dr. Borlaug arrived?	
-What science was Dr. Borlaug using to help the people of Mexico?	
-What was the global impact of Dr. Borlaug's work?	
Green Revolution	
-What aspects of Dr. Borlaug's work continue today?	
-What are the ongoing challenges to feeding the world?	
-What are some of the potential solutions to world hunger?	
Summary	
-Give a synopsis of the video to someone who has never heard of Dr. Norman Borlaug.	

Grades 9-12 Teacher Resources and Standards

Activity 2: World Food Prize Essay, (ELA/SS) 3-5 50-minute class periods

Students will research and write an informative essay.

Oklahoma Academic Standards

Activity 2: World Food Prize Essay (ELA/SS)

9.6.W.1	Students will write research papers and/or texts independently over extended periods of
10.6.W.1	time (e.g. time for research, reflection, and revision) and for shorter timeframes (e.g. a
11.6.W.1	single sitting or a day or two).
12.6.W.1	

9.3.W.2 Students will compose essays and reports to objectively introduce and develop topics, 10.3.W.2 incorporating evidence (e.g. specific facts, examples, details, data) and maintaining an organized structure and a formal style. 11.3.W.2

- 12.3.W.2

Activity 2

- WG.5.1 Examine the origin and diffusion of agriculture including the Agricultural Revolutions and the Green Revolution.
- WG.5.4 Describe the impact of agricultural practices including irrigation, conservation, desertification, deforestation, organic farming, pesticides and herbicides, and genetic modification on the environment and the quality of life.

Materials:

- Computer/laptop •
- "High School Research Graphic Organizer"
- "World Food Prize Essay Grading Rubric"

Procedures

- 1. Students will choose one of the World Food Prize Global Youth Institute topics (plants, water scarcity, renewable energy, animal health, climate volatility, sustainable agriculture, animal agriculture, spoilage and waste, water and sanitation, dietary disease, malnutrition, infectious diseases, populations, conflicts, human rights, education, policy and governance, international trade, foreign aid, and infrastructure) to research and write an informative essay.
- Have students use the "High School Research Graphic Organizer". 2.
- More resources and information about submission to the Youth Institute can be found here 3. https://www.worldfoodprize.org/index.cfm?nodeID=87704&audienceID=1
- 4. See "World Food Prize Essay Grading Rubric".

Activity 2 Worksheet 1: HS Research Graphic Organizer





For more lessons and resources, please visit <u>www.agclassroom.org/ok</u>

World Food Prize Essay Rubric

	Α	В	С	D	F
Content	-Well organized -Evidence of original thought -Fully supported thesis	-Well organized -Some original thought -Thesis mostly supported	-Somewhat organized -Little original thought -Thesis needs support	-Organization is lacking -Restates sources -Thesis needs support	-Not organized -Missing or incorrect information -No support given to thesis
Introduction	-Grabbed attention -Strong thesis	-Grabbed attention -Good thesis	-Needs better attention getter -Weak thesis	-No attention getter -Very weak thesis	-No attempt to introduce thesis
Conclusion	-Restated thesis and main supporting ideas -Left reader with memorable idea	-Restated thesis -Left reader with memorable idea	-Restated thesis -Needs stronger conclusion	-Didn't restate thesis -Not memorable	-No attempt at conclusion
Spelling/ Grammar	2 or fewer mistakes	3-4 mistakes	5-6 mistakes	7-8 mistakes	9+ mistakes

Comments:

Overall Grade:

Grades 9-12 Teacher Resources and Standards

Activity 3: World Hunger Debate, (ELA, SS) 2-4 50-minute class periods

Students will research a topic and propose a solution to world hunger.

Oklahoma Academic Standards

Activity 3

Activity 3: World Hunger Debate (ELA/SS)

9.1.R.3 10.1.R.3 11.1.R.3 12.1.R.3	Students will engage in collaborative discussions about appropriate topics and texts, expressing their own ideas clearly while building on the ideas of others in pairs, diverse groups, and whole class settings.
9.1.W.1 10.1.W.1 11.1.W.1 12.1.W.1	Students will give formal and informal presentations in a group or individually, providing textual and visual evidence to support a main idea
WG.5.4	Describe the impact of agricultural practices including irrigation, conservation, desertification, deforestation, organic farming, pesticides and herbicides, and genetic modification on the environment and the quality of life.

Materials:

- Computer/laptop
- "High School Research Graphic Organizer"
- "World Hunger Debate Rubric"

Procedures:

- 1. Group students into groups of 2-4.
- 2. Assign solutions to world hunger (birth control, GMO food production, plant based diets, food donations, access to education, immigration, etc.).
- 3. Have students use the "**High School Research Graphic Organizer**" to research and create a presentation to propose their solution to world hunger.
- 4. Supervise student debate and discussion over solutions.
- 5. See this link for tips on using debates in the classroom <u>https://blogs.shu.ac.uk/shutel/2014/09/02/debate-an-approach-to-teaching-and-learning/</u>
- 6. See "World Hunger Debate Rubric"

World Hunger Debate Rubric

	Α	В	С	D	F
Content	-Well organized -Evidence of original thought -Fully supported thesis	-Well organized -Some original thought -Thesis mostly supported	-Somewhat organized -Little original thought -Thesis needs support	-Organization is lacking -Restates sources -Thesis needs support	-Not organized -Missing or incorrect information -No support given to thesis
Introduction	-Grabbed attention -Strong thesis	-Grabbed attention -Good thesis	-Needs better attention getter -Weak thesis	-No attention getter -Very weak thesis	-No attempt to introduce thesis
Conclusion	-Restated thesis and main supporting ideas -Left reader with memorable idea	-Restated thesis -Left reader with memorable idea	-Restated thesis -Needs stronger conclusion	-Didn't restate thesis -Not memorable	-No attempt at conclusion
Response to Questions	-Addressed question -Responded with information from research	-Addressed question -Answers not grounded in research	-Partially addressed question -Answers not grounded in research	-Didn't address question -Answers not grounded in research	-No answers or incorrect answers

Comments:

Overall Grade: