

Norman Borlaug and the Green Revolution: a New  
Frontier in Agriculture

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Junior Division

Group Exhibit

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In selecting a topic, we wanted to find a topic that appealed to us both. We're both interested in science, so we researched multiple topics relevant to science, searching for the most intriguing. We discovered Norman Borlaug and the Green Revolution. We identified that in the 1960's, the agronomist saved an estimated billion lives through new methods like shuttle breeding and development of dwarf disease resistant wheat. We asked ourselves, "Surely, people know about a guy who saved so many lives, right?" Everyone we asked knew nothing about him. We found the perfect topic. Norman Borlaug and the Green Revolution established a new frontier in agriculture, as it introduced new technology and explored new methods as a result. Despite its success, many believed it harmed the environment and created economic issues. The Green Revolution is considered controversial by some because it killed wildlife, caused salt build-ups and the wheat required inorganic fertilizer and pesticides to produce the highest yields.

We obtained information from various sources. Websites and archives were our main source for information. We obtained plenty of secondary sources from websites, and gained primary source images from archives. We used books for pictures, quotes, and for perspectives on the Green Revolution. We utilized multiple speeches, quoting especially from Borlaug's speeches. The usage of documentaries and videos was to gather information. Our best source was University of Minnesota. They wrote about Borlaug's life and the Green Revolution, providing photographs of Borlaug and graphs of the Green Revolution's impact. Borlaug attended this university, so it had a great deal of information about his work as well as primary source newspaper clippings.

We started our project by brainstorming ideas and thinking of designs for our exhibit board. We did this while researching for weeks. After completing the majority of our research, we started building our exhibit board. We began printing out our exhibit text, quotes, and images and started organizing our board. We made our title board with wheat, chalk boards, beige paint, and toy trucks on astro turf. We painted the main board green, creating a natural tone and added props in front.

Our historical argument is that an agronomist named Norman Borlaug helped impoverished people/farmers through the Green Revolution. To aid these people, Borlaug introduced new technology and high-yielding wheat, pushing farmers into a new era, establishing a new frontier in agriculture. Although a new frontier was established, it harmed the environment and created economic inequality.

Our topic is significant in history because of the various accomplishments the Green Revolution has achieved. The Green Revolution improved the world's food supply, but especially India's, Mexico's and Pakistan's. Without it, millions would die from starvation. The Green Revolution paved the way in agricultural technology due to new techniques, but also harmed the environment. The techniques used inorganic fertilizers, machines like tractors and pesticides, which polluted waterways and killed wildlife. The Green Revolution bought us time, increasing the world's food supply, but with flourishing populations, a second Green Revolution may be needed.

## Annotated Bibliography

### Primary Sources

Borlaug, Norman. "Norman Borlaug Lecture." Nobelprize.org. Last modified December 11, 1970. Accessed November 23, 2022.  
<https://www.nobelprize.org/prizes/peace/1970/borlaug/lecture/>.  
This website shares the Nobel Lecture Norman Borlaug delivered on December 11, 1970, and in this lecture he talks about food struggles in the world and solutions to those problems. We used this to quote Borlaug's Nobel Lecture.

Hanson, Haldore, Norman E. Borlaug, and R. G. Anderson. *Wheat in the Third World*. London: Routledge, 2022. Digital file.  
We used this source for quotes about the importance of wheat and in the historical context section. This book addresses the importance of wheat and Borlaug's work and helped us understand Borlaug's work and his findings, since his notes were not legible.

*The Man Who Saved a Billion Lives*. Photograph. Accessed March 8, 2023.  
<https://twin-cities.umn.edu/news-events/man-who-saved-billion-lives>.  
We used this in our main event to show Norman Borlaug holding the wheat before the Green Revolution. We also used this to show Borlaug more clearly.

1964 - 1966."Correspondence, 1954-2006. Chronological Correspondence. (Box 3, Folder 5)." University of Minnesota Libraries, University Archives., Accessed January 08, 2023.  
[https://umedia.lib.umn.edu/item/p16022coll345:4348/p16022coll345:4126?child\\_index=1&query=&sidebar\\_page=1](https://umedia.lib.umn.edu/item/p16022coll345:4348/p16022coll345:4126?child_index=1&query=&sidebar_page=1)  
We used this in our main event to show a letter from Swaminathan to Norman Borlaug. This helped us understand what they talked about in letters like about what they're going to do in the future, such as setting up programs to teach farmers new technology.

*Norman Borlaug*. Photograph. University of Michigan Libraries UMedia. December 8, 2017. Accessed November 17, 2022.  
<https://umedia.lib.umn.edu/item/p16022coll175:2541?q=journal+norman+borlaug>.  
This picture shows Norman Borlaug cross pollinating wheat. We used this in our main event to show how he crossbred dwarf wheat with his genetically modified wheat. This helped us understand the process Borlaug took to crossbreed wheat.

*Norman Borlaug Examines a Shipment of Wheat Seed to India from Mexico*. Photograph. Online Library Wiley. Month 1965. Accessed December 8, 2022.  
<https://access.onlinelibrary.wiley.com/cms/asset/7ac28f73-d806-4ff9-831a-ccf5619bee01/csancsa20145931-fig-0005-m.jpg>.  
This picture shows Norman Borlaug helping and examining a shipment of wheat seeds from Mexico to India. We used this as a picture in our Main event. This helped us understand how Norman Borlaug delivered the grains to India.

*Norman Borlaug Recording Data*. 1964. Photograph. Accessed December 12, 2022.  
<https://livinghistoryfarm.org/farminginthe50s/crops-3/borlaug-beachell/>.

We used this picture for our main event section to show him recording data in Mexico. This helped us understand when and how Norman Borlaug started his research.

Norman Borlaug worked with M S Swaminathan and tested his wheat varieties in India. Photograph. Accessed January 7, 2023.

<https://spanmag.com/echoes-of-the-green-revolution/>.

We used this in our main event to show Norman Borlaug working in India with M S Swaminathan. This helped us understand things Norman did to test wheat and what he did with Swaminathan to improve the wheat.

1970-10 - 1971."Nobel Prize, 1970-1972. Nobel Prize Clippings. (Box 2, Folder 11)." University of Minnesota Libraries, University Archives., Accessed February 03, 2023. <https://umedia.lib.umn.edu/item/p16022coll345:2778>

We used this in our short term impact since this website gives us clippings of newspapers about Norman Borlaug winning the Nobel Peace prize as a result of his achievements. This helped us understand that although not everyone knew him around the world, until he got the Nobel Peace Prize.

Rickerby, Arthur. *Norman Borlaug Holding the Wheat He Created*. 1970. Photograph. Accessed December 12, 2022.

<https://thecounter.org/norman-borlaug-man-who-tried-to-feed-the-world-pbs-green-revolution/>.

We used this in our Main Event section to show the wheat he created. This showed what the wheat looked like after the Green Revolution.

Science History Publication/Watson Publishing International. "Norman Borlaug Acceptance Speech." NobelPrize.org. Last modified December 10, 1970. Accessed November 23, 2022. <https://www.nobelprize.org/prizes/peace/1970/borlaug/acceptance-speech/>.

Norman Borlaug's speech at the Nobel Peace Prize, which is about his honor in accepting the award and how the race in hunger and poverty is only temporarily won.. We quoted the speech which we used in multiple sections in our project and the speech helped us understand that Borlaug did many things to convince people that we need a second Green Revolution.

Shneider, Caroline. "Celebrating 100 Years of Norman Borlaug." Online Wiley Library. Last modified March 6, 2014. Accessed March 8, 2023.

<https://access.onlinelibrary.wiley.com/doi/10.2134/csa2014-59-3-1>.

We used this for photos with Borlaug and used it in our main event and build-up. This helped us understand what Borlaug did in Mexico and India by displaying various images of Borlaug working with others.

Steven McFadden. "The Call of the Land." The Cornucopia Institute. Last modified October 16, 2014. Accessed March 9, 2023.

<https://www.cornucopia.org/2014/04/vandana-shiva-cultivating-diversity-freedom-hope/>.

We used this website for the picture of Vandana Shiva. We used this picture in our controversy section to show Shiva, which is one of the critics who criticizes the Green Revolution.

*A Year of Momentum*. 1956. Photograph. Accessed December 6, 2022.

[https://borlaug.cfans.umn.edu/sites/borlaug.cfans.umn.edu/files/styles/folwell\\_half/public/2022-01/evangelina\\_villegas\\_overcoming.jpg?itok=bmrdKOsf](https://borlaug.cfans.umn.edu/sites/borlaug.cfans.umn.edu/files/styles/folwell_half/public/2022-01/evangelina_villegas_overcoming.jpg?itok=bmrdKOsf).

We used this picture of Evangelina Villegas to show someone who was essential to determine the quality of the wheat Norman Borlaug made and used it as a main event picture. This helped us visualize what one of Borlaug's essential workers are and the basic work she did which contributed to the Green Revolution as a whole.

## Secondary Sources

Borlaug Global Rust Initiative. "Our Work." Borlaug Global Rust Initiative. Accessed March 1, 2023. <https://bgri.cornell.edu/our-work/>.

We used this website to learn more about the BGRI and Borlaug's contributions. It also helped us find what their ideologies were which helped us understand the legacy Borlaug left behind.

*Celebrating the 98th Birthday of Norman E. Borlaug*. Photograph. CIMMYT. April 5, 2012. Accessed October 27, 2022.

<https://www.cimmyt.org/news/a-lasting-tribute-to-norman-borlaug/>.

This picture shows flags around his statue which is located in Mexico, Sonora, Obregón. We used this to show how many people and countries honor him. The flags represent the countries that honor him.

Elliot, Scott. "Why You Should Know the Name Norman Borlaug." U.S. Department of Agriculture. Last modified February 21, 2017. Accessed October 18, 2022. <https://www.usda.gov/media/blog/2014/03/25/why-you-should-know-name-norman-borlaug>.

This article is centered around Norman Borlaug, a man who has saved about a billion lives. But despite this, he lacks recognition. We used this to find information about how he impacted the world positively and helped us understand the reason he should be honored.

Fetch, Thomas. Stem rust on wheat. November 7, 2019. Photograph. Accessed March 1, 2023. <https://twin-cities.umn.edu/news-events/origin-deadly-wheat-pathogen-revealed>.

We used this photo to depict an image of what stem rust actually looks like to then further explain the solution to it. We used this in our build-up or Methods and Goals section.

Ganzel, Bill. "The Mexican Agricultural Program." Livinghistoryfarm.org. Last modified 2007. Accessed October 20, 2022. [https://livinghistoryfarm.org/farminginthe50s/crops\\_14.html](https://livinghistoryfarm.org/farminginthe50s/crops_14.html).

We gathered information about this showing how the new dwarf crops were made, and more about the Mexican Agricultural Program. This is the program Norman Borlaug worked for. We used it specifically for the picture of shuttle breeding and information about it.

John, D. A., & Babu, G. R. (2021). Lessons From the Aftermaths of Green Revolution on Food System and Health. *Frontiers in sustainable food systems*, 5, 644559.

<https://doi.org/10.3389/fsufs.2021.644559>

This website gives information on what the Green Revolution is and its impact all together. It includes the negatives as well as the positives, but is mostly centered around the negatives. We used this to better understand both sides of the controversy of the Green Revolution and we used it in the controversy section.

Killoran, James, Stuart Zimmer, and Mark Jarrett. *The Key to Understanding Global History*. 7th ed. Vol. 1. Ronkonkoma, NY: Jarrett Pub., 2005. JPG.

This book provided graphs that helped us prove that as years went on grain production increased and wheat grain imports decreased as a result of the Green Revolution. We used this source in our short term impact. This helped us understand our topic, since this shows how The Green Revolution affected wheat and grain production for the better in India.

Knisley, Shelby. *The Future Of Plant Breeding Depends On Sound Science-Based Policy*. June 19, 2020. Photograph. Accessed March 8, 2023.

<https://www.uswheat.org/wheatletter/the-future-of-plant-breeding-depends-on-sound-science-based-policy/>.

We used this to show someone taking out the pollen of wheat and in the historical context section. This example will help the audience visualize the process of crossbreeding.

Laura Muntean. "The Borlaug Legacy: Helping Feed the World." AgriLifetoday. Last modified October 16, 2020. Accessed October 18, 2022.

[https://agrilifetoday.tamu.edu/2020/10/16/the-borlaug-legacy-helping-feed-the-world/?\\_ga=2.248644935.1383751108.1665688537-1011715455.1665688537&\\_gl=1\\*19yuoq1\\*\\_ga\\*MTAxMTcxNTQ1NS4xNjY1Njg4NTM3\\*\\_ga\\_SJ5GMN0ZQL\\*MTY2NjA5MTU5Mi4yLjAuMTY2NjA5MTU5Mi42MC4wLjA.\\*\\_ga\\_3LYM4WJM04\\*MTY2NjA5MTU5Mi4yLjAuMTY2NjA5MTU5Mi42MC4wLjA](https://agrilifetoday.tamu.edu/2020/10/16/the-borlaug-legacy-helping-feed-the-world/?_ga=2.248644935.1383751108.1665688537-1011715455.1665688537&_gl=1*19yuoq1*_ga*MTAxMTcxNTQ1NS4xNjY1Njg4NTM3*_ga_SJ5GMN0ZQL*MTY2NjA5MTU5Mi4yLjAuMTY2NjA5MTU5Mi42MC4wLjA.*_ga_3LYM4WJM04*MTY2NjA5MTU5Mi4yLjAuMTY2NjA5MTU5Mi42MC4wLjA).

Tells us how much influence Norman Borlaug had on the world and helped us understand the legacy Borlaug has established. We used this for our long term impact by using the things that the Borlaug Institute does.

Mann, Charles C. *The Wizard and the Prophet*. S.I.: Knopf Doubleday Publishing Group, 2018. Accessed February 23, 2023.

<https://www.sciencehistory.org/distillations/where-lies-humanitys-salvation-conservation-or-innovation>.

We used this source to obtain Charles Mann's perspective on Borlaug's work and used it in our controversy section. This helped us understand that there are things Borlaug didn't consider in his work and that everyone has different perspectives on Borlaug's work.

"The Man Who Tried to Feed the World." Video, 52:17. PBS. Posted April 21, 2020. Accessed February 16, 2023.

<https://www.pbs.org/video/the-man-who-tried-to-feed-the-world-obcvcb/>.

This video was about Norman Borlaug's life and what he did to save a billion lives and his methods and ideologies to do this. This video gave us insight on how Norman Borlaug cross pollinated to create new breeds of wheat and used it in our main event and build-up section.

Mokyr, Joel. "Green Revolution Curse or Blessing?" In *The Oxford Encyclopedia of Economic History. Vol. 4: Monte Di Pietà - Spain*, by Joel Mokyr. Oxford: Oxford University Press, 2003. Excerpt from "Green Revolution: Curse or Blessing?" In *The Oxford Encyclopedia of Economic History*. Issue Brief 11. Oxford University Press, 2003. Accessed May 16, 2023. <https://doi.org/10.1093/acref/9780195105070.001.0001>.

We used this source to help us gather information about the negatives of the Green Revolution. This helped us understand that there were a lot of negatives despite still having many positives to the Green Revolution.

Molnar, Charles, and Jane Gair. *Concepts of Biology-1st Canadian Edition*. BCcampus, 2015. Accessed January 5, 2023.

<https://opentextbc.ca/biology/chapter/8-1-mendels-experiments/>.

We used this book in historical context for information and pictures to show Gregor Mendel's work. This helped us understand more about Gregor Mendel's work and how the process works.

"M.S. Swaminathan." World Food Prize Foundation. Accessed December 7, 2022.

[https://www.worldfoodprize.org/en/laureates/19871999\\_laureates/1987\\_swaminathan/](https://www.worldfoodprize.org/en/laureates/19871999_laureates/1987_swaminathan/).

We used this to show Swaminathan, who worked alongside Borlaug in India and use this as part of our main event section. We also used this for information about how they became colleges and other things as well. This helped us understand how Swaminathan and Borlaug met and came to work together.

1960 - 1999."Biographical Material, undated, 1930-2002. Biographical. (Box 1, Folder 14)."

University of Minnesota Libraries, University Archives., Accessed February 14, 2023.

<https://umedia.lib.umn.edu/item/p16022coll345:5343>

We used this magazine for information and multiple perspectives from Borlaug's work, as well as quotes challenging the Green Revolution. This helped us understand more about what was happening during the time and things he had to deal with aside from poverty and famine.

Norman Borlaug. "Dr. Borlaug and the World Food Prize." Nobel Food Prize Foundation. Last modified 2022. Accessed November 1, 2022.

[https://www.worldfoodprize.org/en/dr\\_norman\\_e\\_borlaug/dr\\_borlaug\\_\\_the\\_world\\_food\\_prize/#:~:text=In%201986%2C%20he%20founded%20The,Prize%20for%20Food%20and%20Agriculture.%E2%80%9D](https://www.worldfoodprize.org/en/dr_norman_e_borlaug/dr_borlaug__the_world_food_prize/#:~:text=In%201986%2C%20he%20founded%20The,Prize%20for%20Food%20and%20Agriculture.%E2%80%9D).

This is the prize website made after the prize he made for agricultural achievements. We used this source by showing the purpose Norman Borlaug wanted by creating the world food prize. This helped us understand how much Norman Borlaug wants to end world hunger and also that the world food prize is not only for people who have achieved agricultural advancements.



"Norman Borlaug: The Controversial Father of the Green Revolution." Video, 21:30. Youtube. Posted by Biographics, 2020. Accessed February 17, 2023.

<https://www.youtube.com/watch?v=tdj5Lfv1X2c>.

This video by Biographics talks about the good and bad things about Norman Borlaug and the Green Revolution. We used this for quotes and some extra information about Borlaug. This also helped us understand things Borlaug said in response to critics and lobbyists.

Obama, Barack. Letter to Julie Borlaug, April 11, 2014. Accessed December 12, 2022.

<https://www.cimmyt.org/news/president-obama-honors-norman-borlaugs-work-and-vision/>.

We used this in our long term impact to show a letter Barack Obama wrote to Julie Borlaug to honor his work. This helped us understand that he was honored by many people including the president.

Olby, R.. "Gregor Mendel." Encyclopedia Britannica, October 6, 2022.

<https://www.britannica.com/biography/Gregor-Mendel>.

We used this for our historical background for wheat breeding and to show a picture of Gregor Mendel. This helps us understand who Gregor Mendel is and how he made a contribution to wheat breeding or hybridization.

Sasakawa Africa Association. "History." Sasakawa Africa Association. Accessed March 1, 2023.

<https://www.saa-safe.org/www/history.html>.

We used this for information about the Sasakawa Africa Association which is one of the foundations Borlaug established. We used this in our short term impact section and also to show what the SAA does.

Shewry, Peter R., and Sandra J. Hey. "The Contribution of Wheat to Human Diet and Health."

*Food and Energy Security* 4, no. 3 (August 14, 2015): 178-202.

<https://doi.org/10.1002/fes3.64>.

This journal gives us information about how wheat contributes to the human diet, and this is important because it helps visualize just how significant wheat is to the human diet. We used this in our historical background which further strengthens the idea of the importance of wheat to the human diet.

Shiva, Vandana. "Acceptance Speech-Vandana Shiva." Right Livelihood. Accessed March 2, 2023. <https://rightlivelihood.org/speech/acceptance-speech-vandana-shiva/>.

We used this for the controversial section of our exhibit since Vandana Shiva an activist and ecologist goes against the Green Revolution. This is because of the harm the Green Revolution has caused to the environment. This helps us understand the negatives of the Green Revolution and how Shiva sees the Green Revolution.

Virginia Tech. "Revisiting the Impacts of the Green Revolution in India." Virginia Tech Institute for Policy and Governance. Last modified 2022. Accessed November 1, 2022.

<https://ipg.vt.edu/DirectorsCorner/re--reflections-and-explorations/Reflections101520.html#:~:text=India%20faced%20two%20severe%20droughts,U.S.%20Food%20for%20Aid%20Program>.

We used this by providing information about what caused India's food shortages. This gives us an understanding about how India had food shortages and that the US had to provide them a lot of food before the Green Revolution.

*Wheat Yields in Selected Countries.* Image. University of Minnesota. 2022. Accessed November 22, 2022.

[https://borlaug.cfans.umn.edu/sites/borlaug.cfans.umn.edu/files/2022-01/wheat\\_yields\\_borlaug\\_web\\_resize\\_0.jpg](https://borlaug.cfans.umn.edu/sites/borlaug.cfans.umn.edu/files/2022-01/wheat_yields_borlaug_web_resize_0.jpg).

We used this picture to show how much crop yields have increased in India, Pakistan and Mexico. This helped understand how much the Green revolution has increased crop yields over the years for these countries.

World Food Prize Foundation. "2000: Vasal and Villegas." The World Food Prize. Last modified 2023. Accessed February 14, 2023.

[https://www.worldfoodprize.org/en/laureates/20002009\\_laureates/2000\\_vasal\\_\\_villegas/](https://www.worldfoodprize.org/en/laureates/20002009_laureates/2000_vasal__villegas/).

We used this source to give us more knowledge of Evangelina Villegas and where she worked. We also used this to find more information about her background and her professions.