



**Grade Level:** 6-8

**Essential Skills:** 2, 3, 4, 5

**NGSS:** MS-LS4-5

**CCSS:** 7.SP.A.1, 6.SP.B.4

**Math:** 6.MP.1, 7.MP.1, 8.MP.1, 6.NS.2

**Time:** 60 minutes

**Materials:**

- [Wolf Barley Selection](#) Powerpoint
- [Oregon Wolfe Barley Histogram](#) online worksheet
- [Selection of Oregon Wolfe Barley](#) worksheet
- [Analyzing Results](#) worksheet
- Computer with internet access

**AITC Library Resources:**

**Lessons:**

A Recipe for Genetics:  
Selective Breeding and  
Transgenics

# Lesson to Grow

## Colors of Barley: An Introduction to Selective Breeding

**Description:**

Students will sort samples of barley based on color and hull type to create histograms. They will hypothesize and investigate the outcomes of planting barley seeds of one color and planting a random mix of different colors. Students will analyze the results of barley seeds that have been planted and harvested, constructing conclusions about trait selection.

**Background:**

Barley is an ancient grain that grows well around the world. Like its relative wheat, barley is a self-pollinated grass. Self-pollination is quite common in plants. Self-pollination allows a plant to produce seeds with the same genetics as their offspring. When the seed is planted, the plant will have the same traits as the parent plant. This is very different from most animals, where the offspring are not genetically identical to a parent. Thousands of different types of barley have been grown and selected by humans for different traits for thousands of years. The process of selection is the basis of domestication and breeding of plants and animals. Some barley are covered (has a hull), and others are naked (no hull). Seed color can range from black to white. The samples used in this experiment include covered and naked barley, and barley seeds classified as black, brown or white.

**Vocabulary:**

**Traits** are features of an organism.

**Selection** is one form of a trait being favored over another.

**Self-pollination** allows a plant to produce seeds by itself. Plants grown from these seeds will have the same traits as the parent plant.

**Directions:**

**Part I: Selection**

1. Provide each student with a copy of the [Oregon Wolfe Barley Histogram](#) online worksheet and [Selection of Oregon Wolfe Barley](#) worksheet.
2. Provide an introduction to the activity using the [Wolf Barley Selection](#) powerpoint.
3. Have students begin by sorting the barley on the [Oregon Wolfe Barley Histogram](#) online worksheet based on covered (has hull) vs. naked (no hull) barley.
4. After students have categorized the barley based on covered vs. naked, have students record the amount in each category on the chart on their worksheet.
5. Then, have students calculate the percentage of hulled vs. naked seed and record the answers in their chart.
6. Next, have students move the images to histogram two on the online worksheet sorting them by color. This is the process of selecting a trait used to artificially select or breed, plants and animals.

*Lesson developed by Barleyworld, Oregon State University in collaboration with Johannah Withrow-Robinson, Briggs Middle School [barleyworld.org/main/education](http://barleyworld.org/main/education)*

7. After students have sorted the seeds to create histogram two, they will enter the amount of seeds in each color on the data table on their worksheet.
8. Instruct students to calculate the percentage of each color in the sample and record it on the chart.
9. Next, students will reflect on the data set with a partner using the questions on their worksheet to guide their thinking.
10. Finally, facilitate a whole class discussion about the questions.
11. Have students write a hypotheses using the essential questions as a guide after thinking about the results of the data.
12. Provide time for students to share their hypothesis.

## **Part 2: Analyzing Results**

1. Provide each student with a copy of the *Analyzing Results* worksheet.
2. Explain to students that they will be looking at the results of planting sets of unselected and selected barley. On their worksheet they will see seeds that were planted and the seeds that were produced from the planting.
3. Instruct students to use the data to calculate percentages for each scenario (consider reminding students of the process or guiding them through the first few calculations).
4. Then, invite students to respond to the reflection questions at the end of their worksheet.
5. Discuss reflection questions as a class.



## Selection of Oregon Wolfe Barley

Student Name: \_\_\_\_\_

Barley is an ancient grain that grows well around the world. Like its relative wheat, barley is a self-pollinated grass. Self-pollination is quite common in plants. Self-pollination allows a plant to produce seeds with the same genetics as their offspring. When the seed is planted, the plant will have the same traits as the parent plant. This is very different from most animals, where the offspring are not genetically identical to a parent.

Thousands of different types of barley have been grown and selected by humans for different traits for thousands of years. The process of selection is the basis of domestication and breeding of plants and animals. Some barley are covered (has a hull), and others are naked (no hull). Seed color can range from black to white. The samples used in this experiment include covered and naked barley, and barley seeds classified as black, brown or white.

### Essential Questions:

What will happen if we plant barley seeds of one color?

What will happen if we plant a random mix of different colors of barley seeds?

### Directions:

1. Open the *Oregon Wolfe Barley Histogram* online worksheet provided by your teacher.
2. Sort the pictures of each seed into the correct category (naked/covered) on the first histogram.
3. After you have made your histogram, fill in the number of covered and naked seeds on your data table below. Then, calculate the percentage for each hull type in the sample.

Remember, here's how to calculate the percentage:

$$\text{number of naked or covered seeds} \div \text{total number of seeds} = \underline{\hspace{2cm}} \times 100$$

Hull Type	Number of Seeds in Sample	Percentage of Sample in Hull Type
Covered		
Naked		

4. Move onto the second histogram. Re-sort the same seeds by color.
5. After you have made your histogram, fill in the number of seeds for each color on the data table on the next page.
6. Then, calculate the percentage of each color in the sample.

Color	Number of Seeds in Sample	Percentage of Sample in this Color
Black		
Brown		
White		

**Compare your results with a classmate. Discuss and answer the following questions:**

1. If you plant a brown seed, what color of seeds will the plant produce when it grows? Why?

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2. If you plant a naked seed, what type of hull will the plant produce when it grows? Why?

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3. If you plant all 20 of your seeds, will the barley that grows from your plot have the same percentages of colors and hulls as the seeds you planted? Why?

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4. If you could only plant one color of seeds, what color would you plant? Why?

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5. If you could plant only covered or naked seeds, what type would you plant? Why would you choose that hull type?

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6. Why do you think a farmer might choose one color of seed, or one hull type, over another?

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**7. After you have an opportunity to discuss these questions with a classmate and as a class, write a hypothesis to the essential questions, listed below.**

What will happen if we plant barley seeds of one color or one hull type?

What will happen if we plant a mix of different colors and hull types of barley seeds?



## Analyzing Results

Student Name: \_\_\_\_\_

The samples of barley pictured below have been planted, grown and harvested. These are the results from different selection strategies. Fill in the data tables with the percentages.

Here are the results of planting a **random mix** of all the seeds:



Complete the charts below based on the planted barley seeds and harvested barley seed pictures above.

To calculate percentages:

$$\text{number of seeds of one type} \div \text{total number of seeds} = \text{_____} \times 100$$

Color	Number of Seeds in Planted Sample	Percentage of Planted Sample in each Color	Number of Seeds in Harvested Sample	Percentage of Harvested Sample in each Color
Black	6		315	
Brown	1		53	
White	13		683	

Hull Type	Number of Seeds in Planted Sample	Percentage of Planted Sample in Hull Type	Number of Seeds in Harvested Sample	Percentage of Harvested Sample in Hull Type
Covered	11		578	
Naked	9		473	

Here are the results from selecting for seed that is **covered** and **black**:



Complete the charts below based on the planted barley seeds and harvested barley seed pictures above.

To calculate percentages:

$$\text{number of seeds of one type} \div \text{total number of seeds} = \text{_____} \times 100$$

Color	Number of Seeds in Planted Sample	Percentage of Planted Sample in each Color	Number of Seeds in Harvested Sample	Percentage of Harvested Sample in each Color
Black	3		98	
Brown	0		0	
White	0		0	

Hull Type	Number of Seeds in Planted Sample	Percentage of Planted Sample in Hull Type	Number of Seeds in Harvested Sample	Percentage of Harvested Sample in Hull Type
Covered	3		98	
Naked	0		0	

Here are the results from selecting for seed that is **brown** and **naked**:



Complete the charts below based on the planted barley seeds and harvested barley seed pictures above.

To calculate percentages:

$$\text{number of seeds of one type} \div \text{total number of seeds} = \text{_____} \times 100$$

Color	Number of Seeds in Planted Sample	Percentage of Planted Sample in each Color	Number of Seeds in Harvested Sample	Percentage of Harvested Sample in each Color
Black	0		0	
Brown	1		127	
White	0		0	

Hull Type	Number of Seeds in Planted Sample	Percentage of Planted Sample in Hull Type	Number of Seeds in Harvested Sample	Percentage of Harvested Sample in Hull Type
Covered	0		0	
Naked	1		127	

**Compare your results to the original sample:**

1. Using the data, write an observation about the seeds that were harvested after we planted seeds of just one color or of just one hull type. Include percentages in your answer.
2. Using the data, write an observation about the seeds that were harvested after we planted seeds that were a mix of different colors and hull types of barley seeds. Include percentages in your answer.
3. How do the percentages for each color and hull type compare between the planted and harvested seed?
4. Are the results what you predicted would happen? Explain.
5. Why did we get these results?