



Popped Secret: The Mysterious Origin of Corn

hhmi | BioInteractive

Short Film
Student Handout

NAME _____

DATE _____

This handout supplements the short film [*Popped Secret: The Mysterious Origin of Corn*](#).

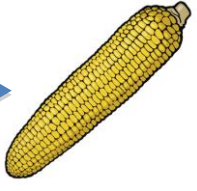



1. Which of the following statements describes domestication? _____
 - a. It is the process by which animals are trained to do tricks useful for human needs.
 - b. It is the process by which wild species have been turned into species with traits that are useful for human needs.
 - c. It is the process by which animals build nests to attract mates and raise young.
 - d. It is the process by which plants have evolved to fill in ecological niches over time.
2. To illustrate how common corn is in a typical American diet, the film narrator gives many examples, from corn-on-the-cob to foods that contain cornstarch and corn syrup. The narrator also mentions meat. What is the connection between the meat we eat and corn?
3. Dr. Beadle concluded that teosinte was the likely ancestor of maize. On what evidence did he base this conclusion? Select all that apply. _____
 - a. Teosinte looks like maize.
 - b. Teosinte and maize have nearly identical chromosomes.
 - c. A cross between teosinte and maize produces fertile hybrid offspring.
 - d. Christopher Columbus discovered written records of maize's domestication from teosinte.

4. a. Fill in the table below to compare teosinte and maize.

	Extent of branching	Number of rows of kernels per cob	Kernel type (naked or enclosed in a hard fruitcase)
Teosinte			
Maize			

- b. Pick one of the characteristics of maize from the table and explain how it makes the crop more useful to humans than teosinte?

5. Dr. Beadle conducted an experiment to determine how many genes control the differences between maize and teosinte. He crossed teosinte with maize (the two parental plants) to produce F_1 hybrids, and then crossed the F_1 plants to produce an F_2 generation (offspring). He then looked at the appearance, or phenotype of the offspring. Based on classical genetics, he predicted if just one gene was responsible for all the differences between maize and teosinte, a parental phenotype was expected in one of every four offspring—in other words $\frac{1}{4}$ of the offspring would look like maize and $\frac{1}{4}$ would look like teosinte. If two genes are involved, one out of every 16 offspring would look like maize and one out of 16 like teosinte. This relationship can be summarized by this equation: $X = (\frac{1}{4})^n$
 - a. In the equation above, X represents the proportion of offspring expected to have a parental phenotype. What does n represent?
 - b. Dr. Beadle planted 50,000 plants and discovered that 1 out of 500 offspring had the phenotype of one parent and 1 out of 500 of the other parent. Approximately how many plants had a teosinte phenotype? A maize phenotype? What phenotype(s) did the rest of the plants have?
 - c. Use the equation $X = (\frac{1}{4})^n$ to explain how Dr. Beadle came to conclude that four or five genes are responsible for the differences between maize and teosinte.
 - d. Explain how changes in a small number of genes can result in very different-looking plants.
6. The film describes two independent sources of evidence that have been used to estimate when maize was first domesticated: genetic evidence and archaeological evidence. Do these two sources of evidence support each other? Explain your answer.
7. To demonstrate how two different genes can explain the different traits in teosinte and maize, Dr. Doebley and colleagues used careful breeding to transplant each gene from one type of plant to the other. In the table below, draw and/or describe the results of each cross and explain what you can infer about the function of the genes.

Gene	Moved from	Moved into	Draw the result	What can you infer about the function of the gene?
<i>fruitcase gene</i>	Teosinte	Maize 		
	Maize	Teosinte 		
<i>branching gene</i>	Teosinte	Maize 		
	Maize	Teosinte 		

8. Humans have been selecting maize for desirable characteristics ever since domestication of the crop began. Figure 1 below describes the traits of maize cobs found in four archaeological deposits from the Tehuacán cave in Puebla, Mexico. Rachis diameter refers to the diameter of the cob at its base. Average number of rows refers to the number of rows of kernels per cob.
- Which archaeological layer contains the oldest maize remains? The youngest?
 - Use data to compare and contrast the oldest and youngest maize cobs in the archaeological record.

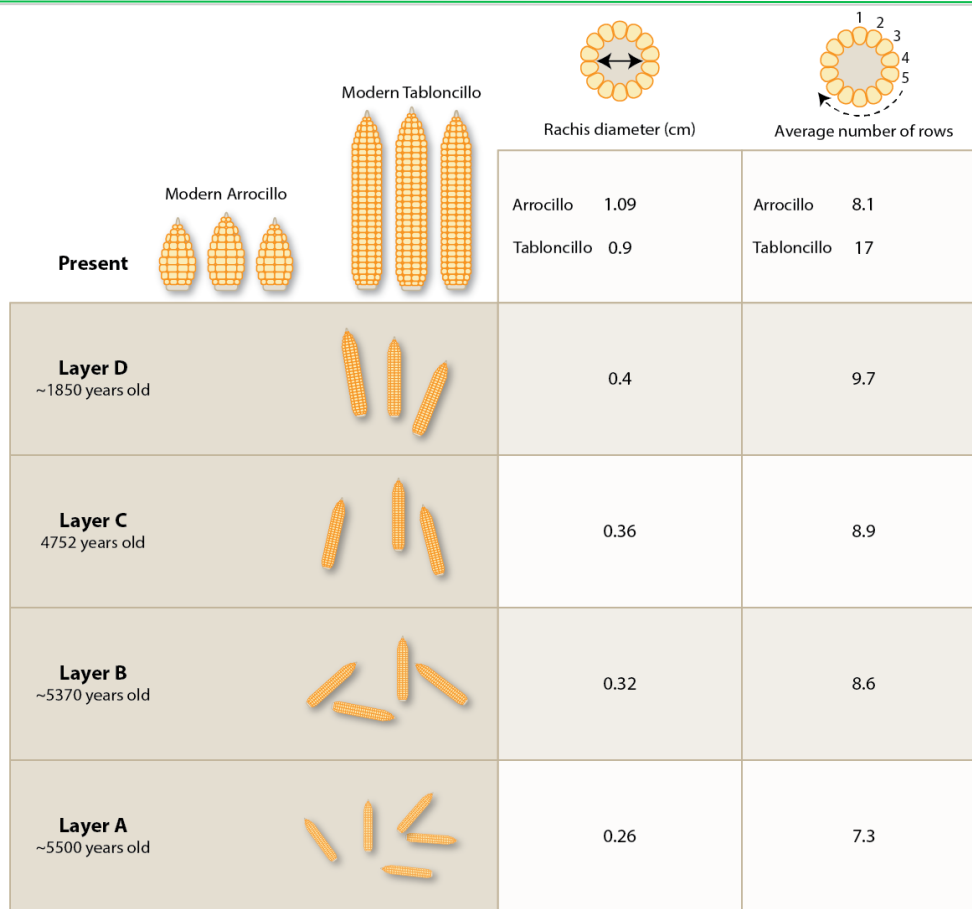


Figure 1. Corn cob fossils discovered in different layers of the Tehuacán cave in Mexico. The age of each layer is indicated. Present-day corn consists of two different varieties. For each corn sample, the average rachis diameter and row number are noted.

- c. The authors compared the ancient maize in the archeological record to two different modern maize varieties: arroccillo and tabloncillo. How do these two varieties compare to the cobs found in the archeological record? Why do you think the authors selected these two varieties to use for their comparisons?
- d. Based on these data, what can you say about the kinds of traits that farmers have been selecting for in maize over the past 5,000 years?