TODAY, THE UNITED STATES grows more corn than any other crop, and produces much more corn than any other country in the world. In 2009, farmers in the United States planted 90 million acres of corn and harvested 13.2 billion bushels, worth billions of dollars. The largest percentage of this corn is for feeding to livestock. The remainder is for humans’ consumption, corn-based biofuel, and other products. The following is a list of some of the products derived from corn: corn, corn meal, corn oil, corn starch, high fructose corn syrup, fuel alcohol, beverage alcohol, and corn feed. The ups and downs of corn-crop yields from year to year have a major impact on the U.S. economy and the availability and cost of food. Growing all of this corn also has a major environmental impact.

Corn has been grown in southern Mexico for more than 6,000 years. Both anthropological and genetic evidence suggest that corn is descended from the wild grass teosinte. Teosinte is native to Mexico and parts of Central America, and produces small hard kernels that people once cooked and ate. Some scientists think that the selective (Continued on next page)
breeding of teosinte by native Mexican farmers eventually produced plants that we would recognize today as corn.

The differences between corn and teosinte are remarkable. Teosinte produces ears with a few seeds that each have a hard outer coating and are easily separated. In contrast, the corn you are familiar with produces hundreds of kernels per ear. These kernels are much larger, softer, and sweeter than teosinte kernels. Without human cultivation, current-day corn kernels would remain attached to the cob, and would not be dispersed or able to produce new plants.

At some point humans started to farm teosinte for food and other purposes. Anthropologists hypothesize that mashed dried kernels were used as a type of baby powder and as a healing substance. The leaves of teosinte have high sugar content, and may have been chewed like chewing gum. People farming teosinte began to purposefully select and breed plants with desirable traits. They cultivated plants that produced more kernels per cluster and were resistant to drought and disease. Over the centuries, farmers continued to select and breed the plants that had traits that best suited their needs. As humans took the plants throughout North America, they selected plants that grew faster in the shorter summers and could withstand drought, while farmers who carried corn to the Caribbean islands selected plants that could withstand heavy rainfall. Today, because of human manipulation,
there are hundreds of varieties of corn. One type may be 2 feet tall while another grows to 12 feet tall; ears range from 1 to 18 inches long; and while some types grow with as little as 5 inches of rain in a season, others thrive in as much as 150 inches of rain in a growing season.

Corn became a key crop in the United States in the mid-1800s as settlers’ push westward vastly increased farmlands. Farmers continued to selectively breed corn for desirable traits. Some developed plants with low moisture in their kernels so they would be less likely to rot when stored for the winter. Since each farmer owned a limited amount of land and wanted to maximize the yield from each plant, they bred plants that produced more ears per plant. In the 1920s, farmers began to control which plants pollinated each other, and to improve their selection process, allowing

(Continued on next page)
Analysis

Apply the data on Student Sheet 7.1, “Breeding Rice—Class Data,” to answer Questions 1 and 2.

1. Based on the class’s data, what is the ratio of the phenotypes expressed by the second-generation (F2) offspring?

2. What fraction and percentage of the second-generation (F2) offspring had the desired aromatic and flood-tolerance phenotype?

3. Based on what you have learned in this activity, describe and explain the procedure the university research team might follow to produce rice plants that are all aromatic and flood-tolerant.

4. In this activity, you considered breeding rice for two desired traits. Imagine that you would like to selectively breed rice for three or more traits. How would this affect your breeding efforts?

5. Look at the class’s data on Student Sheet 7.1, “Breeding Rice.” Compare the ratio of genotypes produced by the class with the ratio predicted by the Punnett square in Procedure Step 5 of Procedure Part B. Did the results follow those predicted by the Punnett square? Explain why the predicted outcome might be different from the actual outcome.
6. Examine the following table, listing the reproductive characteristics of three organisms. In the context of selective breeding, explain why a geneticist would need to understand each of these characteristics.

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>MODE OF REPRODUCTION</th>
<th>AGE OF SEXUAL MATURITY</th>
<th>TOTAL POSSIBLE NUMBER OF OFFSPRING PRODUCED PER REPRODUCTIVE CYCLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice plant</td>
<td>sexual reproduction</td>
<td>2–3 months</td>
<td>50 grains (seeds)</td>
</tr>
<tr>
<td>Corn plant</td>
<td>sexual reproduction</td>
<td>2–3 months</td>
<td>Up to 800 kernels (seeds) per ear</td>
</tr>
<tr>
<td>Cow</td>
<td>sexual reproduction</td>
<td>1 year</td>
<td>1</td>
</tr>
</tbody>
</table>

Sweet corn has been bred to produce up to 6 ears per plant.

**KEY VOCABULARY**

- allele
- gamete
- genotype
- phenotype
- Punnett square
- selective breeding
- trait