

Plant Research



1 Purpose and Content of Lesson:

Crop plants have a long history of domestication, with scientific research continuing now and in the future. In this lesson, each student will do extensive internet research on one crop plant and prepare a report and presentation for the class. Each student will become an expert on his or her crop plant.

At the end of the presentation sequence, whereby students are exposed to detailed information on crop plants from their peers' reports, they will decide, as a class, which seeds would be best to plant in the Tower Garden® and why.



2 Next Generation Science Standards (NGSS): <http://www.nextgenscience.org/search-standards>

Disciplinary Core Ideas

LS1.B: Growth and Development of Organisms

Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5) Middle School

LS4.B: Natural Selection

In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

LS4.C: Adaptation

Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. (HS-LS4-6)

3 Common Misconceptions About Crop Plants:

Learners are mostly unaware of the long pre-historical journey of human domestication of plants and the immense amount of research that continues to give us a reliable food supply.

4 Lesson Objective:

Learners will be able to explain the botanical and geographical origin of the plants they choose to grow in the Tower Garden®, their medical and nutritional values, and current challenges to crop plants being researched in a written report citing reliable sources of information.

Lesson Procedure— THE LEARNING CYCLE: The Five Es

ENGAGE

Ask the class:

What did you eat today?

Students make a bulleted list of individual foods.

Then ask:

“Where did each of these foods come from?”

Ask students to write the answer next to the list of the foods they wrote down. If they list a meat product, ask them to write what that animal ate.

Example:

- Hamburger: cow that ate grass
- Bun: wheat

Key question:

Where does our food come from? (plants)

EXPLORE

Have students share foods on their list, and guide them as they come to the conclusion that plants provide all animals with food. They can trace their food from the market (to the factory) and back to the farm, with all the transport in between, and then jump back through history to the scene of crop domestication, to its wild ancestor, which may still be growing in the wild. The food has taken a journey of thousands of miles and thousands of years to arrive on our plates today.

EXPLAIN

This story is different for every crop. Wild ancestors of tomatoes and potatoes grew in South America. Corn’s ancestor grew as a grain in Mexico, wheat came from the Middle East, apples from Central Asia, coffee originated in Ethiopia, oregano around the Mediterranean Sea, and squash in Central America. These foods are a gift of our ancestors, who, over generations, selected the best varieties each year as the seeds for the next year. Scientific research to improve crops continues at present and into the future. New varieties are bred to be resistant to diseases, produce tastier fruit, or be better adapted to grow in hot or dry conditions.

The Tower Garden® is a new way to grow plants. In this lesson, students carry out research about one of the plants they can grow in the Tower Garden and present their findings to the class in an informative presentation. (See the handout under **Appendices**.)

EXPAND

Students will listen to the research findings of their classmates and think about the history and current challenges of each of the plants presented. They will list a minimum of four essential facts about each plant in their notebooks as their peers present. They must include in their notes: **1) country of origin, 2) major nutrients, 3) important challenges, and 4) other facts of interest.**

At the end of all the plant presentations, the class will decide what plants they would like to grow in the Tower Garden with rationales. Twenty (twenty-eight with an extension kit) plants can be grown, but only six to seven different seed packets will be purchased. Students must consider information learned in prior lessons about wavelengths and quantity of light for each plant; size of adult plants; if there are heavy fruits, vines, or large leaves that might block light from other plants; and time from seed to harvest. These are important characteristics to consider when grouping different plants to grow together in a vertical tower.

EVALUATE

Students write the answers to these questions at the conclusion of the research presentations:

1. *Where in the world is the origin of most of the plants your class researched?*
2. *What are the most important challenges facing agriculture today? Which challenge would you be interested in researching if you were a botanist?*
3. *What are the major nutrients in green leafy vegetables?*
4. *What are the best plants for our Tower Garden® and why?*

Web Resources

General information on crop plants:

<http://plants.usda.gov/java/>

New World Encyclopedia:

http://www.newworldencyclopedia.org/entry/Info:-Main_Page

Encyclopedia Britannica online:

<http://www.britannica.com/>

Wikipedia—The Free Encyclopedia:

https://en.wikipedia.org/wiki/Main_Page

Additional Applications

Make a chart with a photo of each crop being grown in the tower and its nutritional values. The photos can be taken by students as the plants grow.

See research topics and report criteria below.

Domesticated Plants for Research and Reporting

Here is a list from which each person can choose a crop plant to research. These are plants that could be grown in the Tower Garden.* After researching reliable websites to respond to the questions below, plus any other interesting facts you may find, write a research report in an organized, typed narrative with all websites, quoted or paraphrased, cited as footnotes. Create a PowerPoint presentation that is a minimum of six slides containing images and key facts of interest about your crop plant to present to the class.

Tower Garden Crop Plants:

<http://www.towergarden.com/content/towergarden/en-us/what-can-i-grow.html#.VY7pSHv0xv4>

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|------------------------------|--------------------|
| 1. Tomato | 11. Green beans |
| 2. Cucumber | 12. Kale |
| 3. Strawberry | 13. Arugula |
| 4. Cilantro (also coriander) | 14. Mustard greens |
| 5. Sweet basil | 15. Swiss Chard |
| 6. Mint | 16. Tatsoi |
| 7. Lettuce | 17. Pakchoi |
| 8. Oregano | 18. Spinach |
| 9. Thyme | 19. Parsley |
| 10. Peas | 20. Catnip |

Research Guide for Crop Plant Report and Presentation

The following topics are to be used to guide your research. You can pose other questions that arise as you begin to do the research. Organize the information you find to write cohesive paragraphs.

1. Find the scientific (Latin) name for the plant and the meaning of this Latin name.

For example, apples come from the tree *Malus domestica*. “Malus” is Latin for apple. Note that the first word of the scientific name is the genus, which is capitalized (*Malus*). The second word of the scientific name is the species of the plant; “domestica” means the apple tree that is not wild but grows edible apples. The species name is not capitalized. The scientific name is also called the binomial (two names). It is always italicized or underlined because it is in Latin, a foreign language.

This system of naming was introduced by the Swedish botanist Linnaeus in the 17th century. Scientific names with “L” after the name indicates that this plant carries the name given to it by Linnaeus himself. An example is the Ginkgo tree, *Ginkgo biloba* L.

The scientific name may also include a subspecies or a variety name. For example, many varieties of squash are called *Cucurbita pepo*. Each variety is designated with a third word. Zucchini squash is *Cucurbita pepo zucchini*.

2. Where was this crop plant first domesticated?

Do scientists know this plant’s wild ancestor? Does the wild ancestor still grow in the wild somewhere? For example, apples were domesticated in Central Asia, what is now Kazakhstan, Tajikistan, Kyrgyzstan and Xinjiang, China. The domestic apple tree’s wild relative, *Malus sieversii*, still grows in the mountains on the border of Kazakhstan and China. Many times, the wild relative is hardier than the domestic species. Crossing or grafting the wild and the domestic species can improve the crop plants.

3. Find general information about the eating of this plant:

- a. Which part(s) of the plant are eaten? How has human activity and cuisine selected for different parts of the plant?

For example, Brussels sprouts and broccoli are both varieties of cabbage. Cabbage is the leaves, broccoli is the flower buds, and Brussels sprouts are buds that grow along the stem next to each leaf.

- b. Are any plant parts poisonous?
c. What is the nutritional value of this plant? Is it more nutritional raw or cooked?
d. Find and include two healthy recipes that you'd like to try using this plant.

4. What agricultural challenges are driving the research on your plant?

Are there GMO varieties of this plant? If so, tell what they are and for what purpose the GMOs were made? For example, purposes could include longer shelf life, different flavors or colors, disease resistance, or adaptation to use less water.

5. What are some of the important varieties of this crop, and how do they differ?

For example, most varieties of plum tomatoes are “determinate,” meaning the plant grows to its full size, and then it produces a lot of tomatoes all at once. Other tomato plants are indeterminate, meaning they grow and develop fruit throughout the season.

Cucumbers come in varieties for pickling and other varieties for slicing into salads. There are many kinds of peppers: hot, sweet, and mild. Apple varieties have different flavors and colors.

6. What nutritional benefits or medical value does this plant provide?

Many herbs have oils with health benefits. What claims to better health can you find for eating this plant? (Find reputable sources, not advertisements.)

7. Find out how your plant is typically grown agriculturally — its needs for water, sunlight, optimum temperatures, soil type, nutrients, season of growth and harvest, and other interesting growing tips.

8. Find out what diseases or pests threaten the growth of your plant.

What measures are typically taken to prevent damage done by diseases or insects that attack your plant? What measures for prevention of damage would cause the least harm to the environment or animals, including people?

9. What are the benefits for growing your plant in a soil-free system? What are the challenges that you should prepare for?

Once you have answers to these questions, plus other facts of interest, write an organized, typed narrative using footnotes for your sources of information. Write a conclusion, summarizing what you have learned about your plant and its suitability for selection for our Tower Garden®.

Create a PowerPoint presentation of at least six slides, with images and an outline about your plant focusing on history, nutritional value, and growing challenges. Do not put large blocks of text in your PowerPoint slides; instead, create a presentation outline with interesting images.