seeds!

FEED THE WORLD

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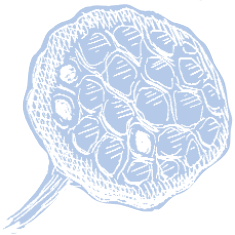
Seeds: They are the beginning and the end— miniscule miracles that can produce a cabbage, oak tree, or rose. Their protective cases range from tough shells to large, fleshy fruits. Seeds, in turn, protect the dormant young plant and contain all it needs to survive until it can produce its own food.

These energy storehouses not only have the potential for plant life, but also the ability to sustain human life. Some seeds produce plants with parts we consume, such as fruits, stems, roots, and leaves. But it is nutrient-rich seeds themselves that truly nourish the world.

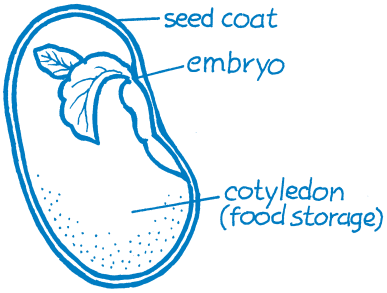
Read on for background, teaching ideas, and recipes for engaging students in exploring the history, nutritional value, and cultivation of these precious packages.

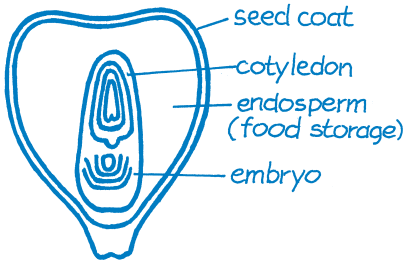
Fueling Plant Life

Why Seeds Sustain Us



Seeds may seem simple, but humans have been inextricably linked with them throughout history. Before launching into a scrutiny of seeds and their role in our sustenance, find out how savvy your students are. Chart their responses to such questions as, *What do you know about seeds? What questions do you have? How are seeds important to your life?* As youngsters dig into the material and activities in this guide, they should be able to update the chart with new insights and yet more questions to explore.





The first step in grasping how seeds nourish humans is to examine how they feed future plants. Your students have probably already examined seeds, looked inside a bean, and used seeds to grow new plants. If you asked students, *Do we eat any seeds?* they might come up with a list. But have you ever considered the connection between the nutritional role seeds serve for a young plant and the role they serve for us?

If your students soak a bean or corn seed overnight and carefully split it open and look inside, they'll see the same basic parts. The thin outer layer is the fibrous **seed coat**, which protects the tiny **embryo** (the future plant) and its food supply from injury or insects. The embryo, also known as the **germ**, is very rich in oil, which is a high energy (caloric) food source for a germinating plant. Sixty to 80 percent of the seed—the **endosperm** or **cotyledons** (seed leaves)—contains food to sustain the plant until it can produce its own through photosynthesis. This includes carbohydrates for energy and proteins to build the tiny plant body. (See the activity, Where's the Starch, page 12.) Besides containing fiber, carbohydrates, oils, and protein, seeds are rich in vitamins, minerals, and phytochemicals (protective, disease-preventing compounds).

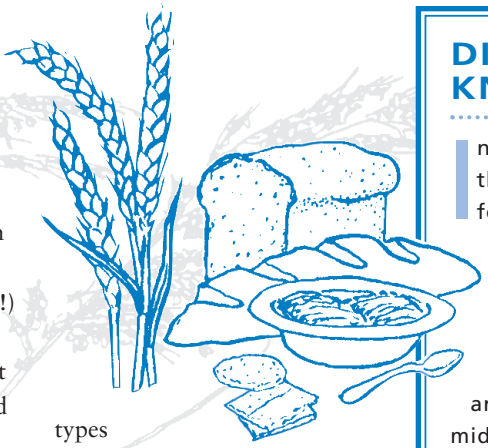
Once you have examined the inner workings of seeds or researched and discussed their contents, have students make a list of nutrients they contain. Next, have them look at the USDA food guide pyramid or other nutrition chart and list important sources of nutrients for humans. Ask students to review the lists and note patterns they observe. What generalizations can they make?

Continued on page 8

History of Seeds That Feed

When early humans evolved in dry parts of Africa, seeds of wild grasses, such as millet, were abundant. Scientists have discovered 19,000 year old stone mortars, indicating that early humans ground the seeds (grains) of these grasses into more digestible forms. As humans spread into the eastern Mediterranean, they discovered and harvested wild forms of wheat and barley. Around 8,000 years ago, people in Asia and the Middle East began saving and replanting seeds of grains such as millet and sorghum, and growing an aquatic grass (rice!) in flooded fields, thus becoming the earliest farmers on that continent. Over in Central and South America, native Indians shifted from *harvesting* a wild grass to *cultivating* what we know as maize (corn).

Meanwhile, legumes, such as peas, lentils, and soybeans were becoming domesticated in Ethiopia, Asia, and the Eastern Mediterranean. Other types of beans (lima, black, pinto, white, and kidney), and later, peanuts, were being grown by indigenous people of South America.



Deliberately planting seeds paved the way for the growth of civilization because it meant that, on average, many more people could live per area than if the same space was used for gathering and hunting. The Chinese, in fact, considered a group of five grains sacred—soybean, rice, wheat, barley, and millet—deeming them essential for the existence of Chinese civilization.

Another important seed historically, was the sesame seed, which is rich in minerals, fiber, oil, and protein. It has long been important to the cuisines of Africa, India, China, and the Middle East (where sesame seeds are ground into a spread called *tahini*.)

One final group of seeds to acknowledge are those aromatic ones that primitive humans discovered help make food taste better. Wars have been fought and countries discovered in efforts to find, obtain, and trade spices, which at one time were so coveted that only the wealthy could afford them. Whole and ground seeds from such plants as mustard, fennel, and caraway continue to add spice and flavor to our diets.

DID YOU KNOW?

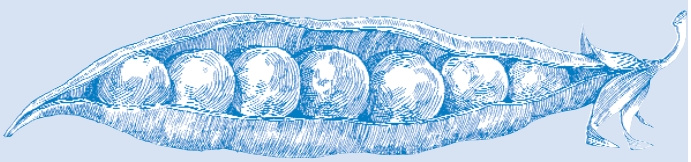
In ancient Greece, there were 72 different types of bread, including bread-plates, used as plates *and* as a side dish! Similar flat breads are used today in middle Eastern and Indian cuisines.

DIGGING DEEPER

Kitchen Seed Detectives

Have students ask permission to be kitchen seed sleuths. Encourage them to look and think creatively as they search for evidence of edible seeds in jars, boxes, fruits, garbage, and more. Once students share their findings in small groups, challenge them to decide how they want to categorize their seed-related items. If you've been studying nutrition, they might want to organize them according to the categories of the USDA food guide pyramid. Another alternative is to organize them according to how we eat them. For instance, *Do we eat them fresh or dry? Mature or immature? With or without the fruit, pod, or shell? Ground or otherwise processed? Do we eat only the oil or germ?* Or, they might classify them based on how they're processed: whole seeds, ground dry seeds, ground wet seeds (e.g. peanut butter), seeds in fruit.

As a class, discuss students' observations about seeds. Ask, *What surprised you? What statements can you make based on your kitchen research? Which of the class statements are opinions, which are inferences, and which are facts? What questions do you have? How can we try to find answers?*



Seeds! was produced by the National Gardening Association with support from the National Garden Bureau (NGB). NGB is a nonprofit organization that disseminates accurate information on gardening with seeds and bedding plants. For more information, visit *www.ngb.org*.

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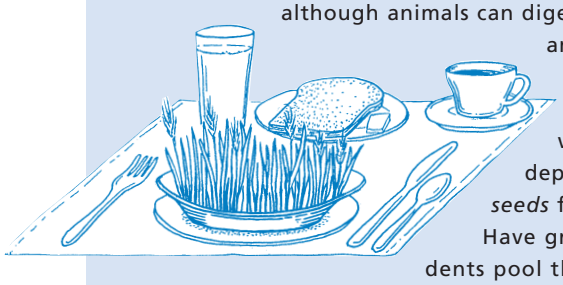
DIGGING DEEPER

Breakfast Sleuths

Ask your class: *Who eats grass for breakfast?!* Chances are that not too many hands will shoot up. You might want to respond by betting that most of them are probably early morning grass eaters. Ask students to bring in an empty box, wrapper, or container of something they ate for breakfast that week.

Ask: *What part of the plant do you think we eat when we eat grasses?* Consider offering a hint by passing around some familiar items that come from grasses—popcorn and rice, for example. Ask: *What plant parts have you observed that also look like these?* Explain that, although animals can digest the leaves and stems of grasses, humans worldwide depend on grass *seeds* for survival.



Have groups of students pool the breakfast items they brought in. Each group should list all the ingredients they find that come from grasses, then share its list with the class. Suggest that students also identify ingredients that indirectly depend on grass—for example, milk products, because cows depend on grass and other grains; eggs, because most chickens are fed corn and other grass seeds.

Try making this grassy recipe, but first identify all of the grasses, direct and indirect in it (there are eight in all). It helps to know that sugar and molasses come from the crushed, boiled, and crystallized stems of sugarcane, one of the largest grasses. You may also want to have students bring in some recipes from home and sleuth out the grasses in those. Challenge students to find another seed-related ingredient in the recipe below that comes from something other than a grass plant. (Vanilla comes from the seed pod and seeds of a type of orchid!)

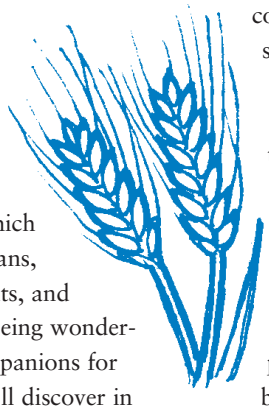
Five-Grass Cookies

- 1/2 cup butter
- 1 tablespoon milk
- 1/2 cup brown sugar
- 1/4 cup white sugar
- 2 tablespoons molasses
- 1 egg
- 1 teaspoon vanilla
- 1 cup flour
- 1/2 teaspoon baking soda
- 1/2 teaspoon baking powder
- 1/2 teaspoon salt
- 1 cup rolled oats

Cream first 4 ingredients. Beat in next 3. Mix together dry ingredients and then add them to the others. Drop cookies 2 inches apart on a well-greased cookie sheet. Bake in a preheated 350°F oven for 10 to 12 minutes.

Humble Seeds:
The Staff of Life

The rise and evolution of civilization could not have been possible if humans had not discovered and cultivated two important categories of edible seeds: **grains** (cereals), which are grass family plants such as rice, wheat, barley, corn, and oats, and **legumes**, which include peas, beans, soybeans, peanuts, and lentils. Besides being wonderful nutrient companions for humans (as you'll discover in Seed Nutrition, 101, page 4), these groups are also great soil companions. Legumes restore nitrogen to the soil (through a symbiotic relationship with nitrogen-fixing bacteria on their roots) and grasses use that nitrogen. Each of the major regions where agriculture originated were built on these important plant partners.

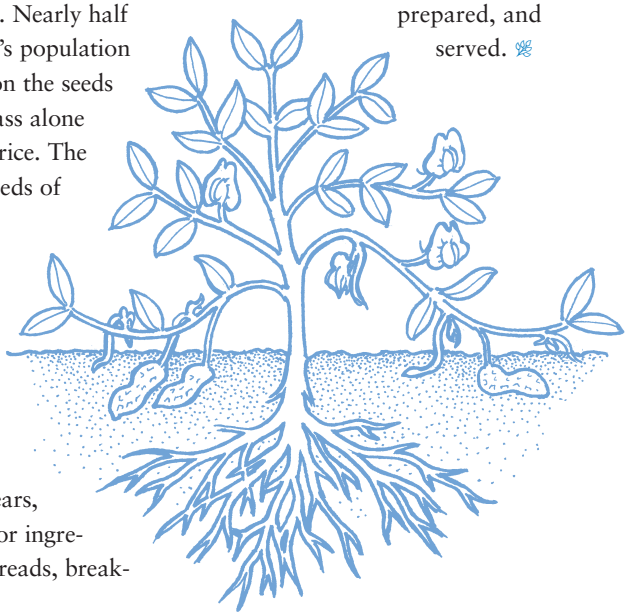


Grass seeds alone make up the most important basic food group of nearly all people in the world. Nearly half the world's population depends on the seeds of one grass alone for food: rice. The ground seeds of wheat, believed to have been grown for more than 10,000 years, are a major ingredient in breads, breakfast cereals, noodles, and a host of other products. Corn, also cultivated for thousands of years, is used for animal feed, cereals, and breads, and not to mention corn syrup, corn oil, paint, plastics, soaps, whiskey, and many other products.

When you factor in the indirect ways we depend on grass for food—via grass- and grain-eating cows, chickens, pigs, and other animals whose products we rely on—it becomes even more evident how important grasses are to our survival.

Activity:
Getting to Know Staples

Have individual students or small groups choose a particular staple food and conduct research to find out about its origins and history; where and how it's grown; how it's processed; and how and where it's eaten, prepared, and served.

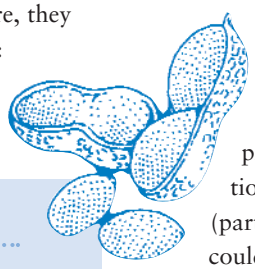


Seed Nutrition, 101

Tasty yes, and nourishing, too. Here are some ways in which seeds nourish us:

Grains, such as corn and wheat, consist of a store of starch (endosperm), which takes up from 60 to 80 percent of the seed; the embryo plant (germ), which is rich in protein, oils, and vitamins; and the seed coat (bran), where fiber and most of the B vitamins are. Although they pack a nutrient punch, these seeds are relatively low in protein and they are missing an important amino acid to make them "complete."

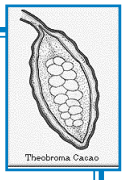
Legumes, such as peas, beans, and peanuts, have relatively large embryos, making them good protein sources. (Many are also rich in oil.) What's more, they have the missing link: the amino acid that grains lack. So eating the two together makes good sense and good nutrition. It's no coincidence that rice and beans are commonly found in Central and South American dishes or that rice and lentils are a favorite combination in India.



Although grains contain carbohydrates and protein, only a fraction of the nutrients (particularly protein) could be digested even if you *could* manage to chew the seeds. Cooking grains make the nutrients more available, and grinding *and* cooking grass seeds (e.g., making and baking flour) makes them even more useable.

Sesame seeds, pumpkin seeds, and sunflower seeds are protein-rich. Nuts, which are fruits that have a hard outer shell that encloses a kernel, are important protein sources for some cultures. (They are, in fact, included with meats and dairy products on the USDA food guide pyramid because of the protein they contain.) Many nuts are processed to make butters and oils. Other seeds that are used for oils are peanuts, sunflower, cotton, coconut, rapeseed (canola oil).

DID YOU KNOW?



A seedless life would mean no chocolate. The cacao bean, an important ingredient in chocolate, grows inside large pods (20 to 60 seeds per pod!) on a tree in tropical forests. The ancient Mayans raised the trees and then crushed the seeds into a powder (similar to our cocoa) for a ceremonial drink. Columbus brought the beans back to Europe where they became a hit as a drink source. Swedish botanist, Linnaeus, who probably drew on the Aztec belief that the tree had divine origins, gave the genus the name *Theobroma* meaning *food of the Gods.*

DIGGING DEEPER

Whole Grain to White Flour

Historically, people raising grains in rural areas ground the seeds into flour as they needed it. All parts of the seed, including the protein- and oil-rich embryo (germ), fibrous outer coat (bran), rich in vitamin B, and the carbohydrate-filled endosperm, were part of the final product. As cultures became more industrialized, flour had to be stored in bulk to feed massive city populations. But since the oils in the germ can become rancid over time and ruin the flour, processors began removing the seed coat, separating out the embryo, and keeping just the endosperm. The white flour that resulted lasted longer in storage, but was less nutritional than flour made from whole grains.

Current nutritional guidelines stress eating more whole grain and fewer "refined" products. Consider having your class conduct taste tests of food products made from both whole grains and seeds that have been processed.

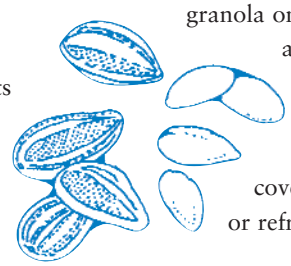
Activity: Nutrient Connections

Invite students to uncover the nutrients found in a variety of seeds packaged for foods (sunflower seeds, dry beans, rice, popcorn) and/or foods made from seeds (wheat germ, whole wheat and white flour, bean soup mix, cereal). They might use package information to determine nutrient content or conduct research. What patterns do they notice? How can they link their findings to their growing understanding of how seeds feed the world?

Seed Recipes

Nutty Granola

Nuts are seeds, too. Combining nuts with rolled oats (flattened oat grains) gives you double the seeds! How many do you count in this recipe?



Ingredients

3 cups rolled oats
1/3 cup each:
- untoasted wheat germ,
- sunflower seeds,
- sesame seeds,
- nuts (e.g., slivered almonds, chopped pecans, or walnuts)

1/4 cup brown sugar
1/2 teaspoon cinnamon
1/4 cup honey or maple syrup
1/3 cup vegetable oil (made from pressing seeds!)
1/2 cup raisins

Preparation

Place oats, wheat germ, and nuts in a 2-quart bowl and microwave on high for 2 minutes. Add brown sugar and cinnamon to mixture. Stir to blend. Add oil and honey or maple syrup, and toss until ingredients are coated. Cook in microwave on medium for another 6 minutes, or until heated through. Add raisins, and cook in microwave on high for 1 to 2 minutes. Press granola onto a baking sheet and allow to cool completely. Break into pieces and store in a tightly covered container or refrigerator.

Toasted Pumpkin Seeds

Save the seeds from pumpkin carving at Halloween, wash them well to remove the "goop," and soak seeds in salted water overnight (2 teaspoons salt to each cup water). Drain and pat dry.

Spread seeds on a cookie sheet and bake in a 300°F oven for 25 minutes or until golden. You can sprinkle s eeds with salt or garlic salt.

If you grow a type of pumpkin with shell-less seeds ('Lady Godiva', 'Snack Jack', or 'Triple Treat', for example), there's no need to soak them before roasting. Try sautéing these seeds in olive oil or sprinkling them with garlic salt before roasting.

Mexican Rice and Beans

The proteins in the rice and corn complement those supplied by beans in this traditional Mexican combination.

Ingredients

3 cups cooked brown rice
1/3 cup cooked kidney or pinto beans
1 10-ounce package frozen corn, thawed
1 medium onion, chopped
3 cloves garlic, minced
2 1/2 teaspoons ground cumin
1 teaspoon each: chili powder and oregano
1 teaspoon salt
2 cups mild cheese, grated
fresh cilantro

Preparation

Preheat oven to 350°F. Combine all ingredients except the cheese and cilantro. Mix thoroughly and put into a greased 11"x7" casserole dish. Sprinkle the cheese evenly over the top. Bake for 1/2 hour. Serve with fresh cilantro as a garnish. *Serves 4.*

DIGGING DEEPER

Sprouts

Five thousand years ago, Chinese nobles ate sprouted seeds for rejuvenation and healing. Why all the fuss? When seeds are germinated, their nutrients become more available. You can easily make edible sprouts in the classroom and introduce students to a healthy snack to eat with sandwiches, tacos, or salads. Consider starting with alfalfa, lentils, mung beans, radishes (spicy!), and/or lettuce. Purchase seeds for sprouting in a supermarket or health food store. (Vegetable garden seeds may be treated with fungicides.)

The easiest method is to put 1 to 4 tablespoons of seeds into a wide-mouth jar covered with cheesecloth or a plastic mesh lid. Soak them in water for 12 to 24 hours, dump the water, rinse them with cool water, and tilt the jar in a container or sink to drain. Repeat the rinsing process two to three times a day. If you keep them in the dark, they will remain white and sweeter tasting. If you put them in the light, they will turn green and taste stronger. They should be ready to eat in 3 to 6 days. (Consider "greening" them by putting them in the light for half a day at the end.)

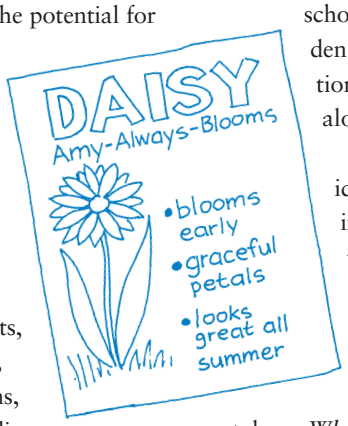
DIGGING DEEPER

Waves of Grain

Consider letting your students try to grow some grains and discover for themselves that many of those we eat are, in fact, grasses. Bring in, or have students bring in, different types of grain seeds: popcorn, oats, rye, and wheat, for instance. If you want a shot at growing success, find whole (unprocessed) grains from a health food, feed, or hardware store. (Hardware stores and nurseries often carry rye, oat, and wheat seeds for cover crops.) Students can sow the seeds in large, shallow flats, or separate containers filled with potting mix, and put them under fluorescent lights or on a windowsill. They can also sow them outdoors and mix the seeds or keep them separate and label each type. As their crops germinate and grow, ask students to describe and compare the plants. What observations and inferences can they make?

Digging into Garden Seeds

We are, no doubt, voracious seed eaters, but we are also seed cultivators. After all, they offer the promise of thriving edible gardens. If your students plan to grow food in containers or a schoolyard garden, consider the potential for learning and exploration that seed catalogs and packets hold. They often contain information on the history of plants, plant breeding, gardening terms, soil types, hardiness zones, and much more.



Students can contact seed companies via mail, e-mail, or phone to request catalogs. Some will be free and others might cost a few dollars. An Internet search can yield contact information as can visiting the National Gardening Association's online Buyer's Guide and searching by category (*http://www.garden.org/buyersguide/search.asp*). Also consider approaching parents, school staff, and garden centers for donations of old seed catalogs and packets.

Here are some ideas for challenging students once they've amassed their materials:

• Compare different regional seed catalogs. *What observations can you make about the types or varieties of vegetables recommended for different parts of the country?*

• Individually or in small groups, select one or several types of food plants you intend to grow. Mine the catalogs for information that will help you decide which varieties to select, when to plant them, and how to raise them successfully in your region. Groups should prepare and present their findings to the class and then work together to use crop information to create a planting and maintenance calendar. Use spacing information from seed packets to sketch out a garden plan.

As an extra challenge, uncover the origins of your selected crops. *What relationships do you notice, if any, between where a plant originated and the outdoor conditions it can handle?*

• Generate a list of some of the specialty characteristics for which crops are selected or bred, such as fruit size, early ripening, or disease resistance. (Consider extending this by doing the activity, Designer Crops, page 4.)

• Examine seed packets. List the types of information you find and explain why each might be important to a gardener. Choose a plant you like from a catalog and design a seed packet for it that includes appropriate how-to information.

• Peruse seed catalogs to try to understand the meaning of the terms *hybrid*, *open-pollinated*, and *heirloom*. Conduct further research, if necessary. Explain to the class your understanding of each term.

DIGGING DEEPER

Seed Preferences

At some point in your seed unit, ask students to name three seeds they like and three seeds they don't like. How about foods that are made from seeds? Foods made from products of animals that eat seeds? Consider having students discuss or write responses to the question, *What would my life be missing if there were no seeds?*

Rice Dreams

"A reading unit on China prompted my second graders to ask whether we could try growing rice," reports Norfolk, MA, teacher Simone Favaloro. "We successfully germinated some rice seeds in big pots and set them in trays of water in the GrowLab®, but we noticed that growth slowed once the grass was about 5 inches." After discussing how their classroom conditions might differ from those in more tropical rice paddies (e.g., temperature, water, light, and so on), the class brainstormed shifts they could make—increasing the light, for instance—and then revised some growing conditions.

"We're not sure what had an impact, but the rice is now 1 foot tall and thriving," says Simone. "Most of the students don't know where the actual rice comes from on the plant," she explains, "so we're eager to see how the adventure unfolds."

INDOOR RICE-GROWING TIPS

Here are some tips we've gleaned for raising rice under lights in GrowLabs® or on classroom windowsills. If you try your hand at it, please share your experiences with us. Add moist soilless mix to pots that are at least 6 inches in diameter. Plant three seeds per pot, evenly spaced.

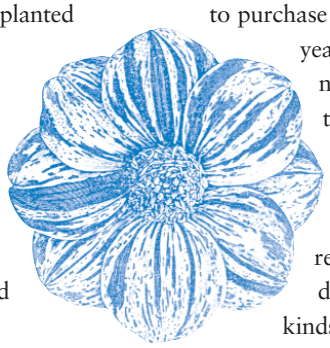
Place the pot in a shallow container with 2 to 3 inches of warm water. Keep the water level to at least 1 inch at all times. Leave the lights on for at least 12 hours per day, or keep plants on a warm windowsill that gets maximum light. Watch for signs of seed heads in two to three months.

Note: If your classroom rice seems sluggish or stops growing, consider checking farm and garden stores for a source of "chelated" iron to add when you fertilize.

You can request small quantities of rice seed from Garrett Farms via phone: (979) 922-8405 or e-mail: tgharvey@garrettfarms.com.

Designer Crops

Will tomatoes be large or small, juicy or dry? Those are the kinds of factors the genes in a seed determine. For centuries, farmers and gardeners repeatedly saved and replanted seeds from plants that had qualities they valued. Then, in the late 1800s, a horticulturist named Luther Burbank launched the field of plant breeding when he worked to speed up the process by crossing two specific lines to create new seed varieties (**hybrids**) that had the best characteristics of two parents. His "inventions" included more than 800 new flowers, fruits, and vegetables. (Although he wasn't allowed to patent his unique creations, Congress later changed laws allowing new plant varieties to be patented.)



Today, seed companies continue to create new hybrid varieties to meet the needs of farmers, shippers, and gardeners. However, gardeners and farmers can't use the seeds produced by these hybrids to get the same plants, so they have to purchase new seeds each year. Most companies also continue to carry open-pollinated varieties, which can be saved and replanted to produce the same kinds of plants. Some carry or encourage swapping of heirloom seeds: those that, because of their desirable qualities, have been saved and passed down over time.

Unlike plant breeding, which speeds up the natural process of plant selection, genetic engineering involves inserting genes from one organism into another organism to create a new variety that is disease resistant, more nutritious, or otherwise "improved." This most often involves crossing genes from different species altogether—something that is not possible under natural conditions.

Activity: Sorting Out Seeds

As students read through seed catalogs, ask them to identify some of the "specialty" characteristics for which different varieties were selected or bred. *Which qualities are most important to them based on their tastes and garden conditions? What can they learn from catalogs or Internet research about hybrid, open-pollinated, or heirloom seeds?* Consider having youngsters conduct research and stage a debate about the relative merits of each seed category. (Older students might want to tackle the question of genetically engineered seeds.) Make sure students present and support their opinions with data from a variety of sources.

DIGGING DEEPER

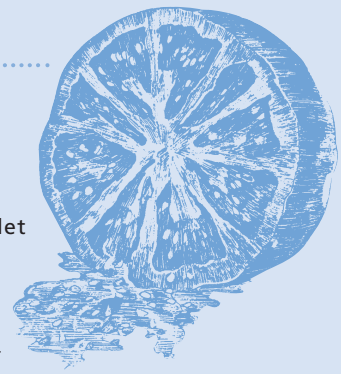
All-America Selections® Award Winners

Every year, seed companies breed new and improved varieties of food and ornamental plants and submit them to be evaluated by judges. Those deemed to be superior to other varieties in existence receive AAS Awards. The 2003 vegetable award winners are the melon variety 'Angel,' and the summer squash 'Papaya Pear.' Why not keep your eyes peeled in catalogs on racks for these "stars," then decide for yourselves how they compare with others. Why do students think they won special acclaim?

At the end of your school growing season, have students select and promote their own award winners. Ask, *What types of criteria should we use (e.g., flavor, fruit or flower color, plant vigor)?*

DIGGING DEEPER

Tackling Tomato Tastes



Invite students to consider some of the reasons for human intervention in plant reproduction. Start by passing around some tomato slices for students to eat while you play a game called What Bugs Us About Tomatoes? Encourage students to let their imaginations go wild as they brainstorm a list of complaints people could have about tomatoes. For instance, *They're not salty enough. They take too long to get ripe. They make a mess when they're sliced. They're too small to fit on a burger. They taste like cardboard. They're too seedy.*

Explain that plant breeders are scientists who respond to the needs of growers and consumers by developing new varieties of crops with specific characteristics such as disease resistance or the ability to ripen quickly. In the near future, scientists may even produce a new tomato variety that will deliver immunizations!

Consider having students set up a taste test of different tomato varieties. Be sure to time the activity so you can include homegrown tomatoes. Individuals or small groups can describe and compare flavors, textures, and other factors, and then rank their preferences and explain their choices to the class. Ask, *How do homegrown tomatoes compare to those bought in the store? Why do you think these differences exist? How could we find out?*

DID YOU KNOW?

Early immigrants to this country carried precious seeds of their favorite crops with them. Since it was too expensive to buy more from Europe, they saved seeds each year, choosing those from the hardiest and best-tasting plants. By the mid-1800s, companies were selling seeds in bulk to farmers and gardeners, but it was the Shakers, a religious group in New York, who were the first to put seeds in small paper packets called "papers," to sell.

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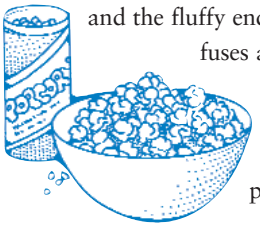
Popcorn Physics

Although many early Americans believed that popcorn (the ancestor of all corn) popped because a tiny angry spirit who lived inside the kernel wanted to escape, today's scientists think otherwise. They've learned that the strong hull (outer covering) on a popcorn kernel seals in water that forms in the moist, pulpy center. When the kernel is heated, the water boils and turns to steam and expands. Finally, the pressure builds high enough for the kernel to explode, and the fluffy endosperm fuses and fills with air. Imagine the exploratory potential in a unit on popcorn. For instance:

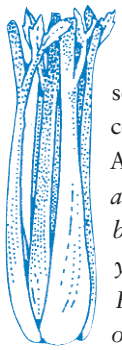


- Experiment to determine how moisture content affects the kernels' popping ability (dry some kernels, freeze some, soak some, and so on).
- Research the different ways in which early Americans popped corn: For instance, on a stick over the fire, or in sand in clay pots. Write fictional stories detailing how popcorn's ability to pop might have originally been discovered.
- To see how well students understand popcorn physics, challenge them to prevent a popcorn kernel from popping (e.g., they might puncture the outer covering or dry it out first).

Fuel, *continued from page 1*

Activity: Where's the Starch?

To help older students further examine the connection between plant food and human food, consider having them use iodine to do a simple chemical test for starch. (You can purchase iodine tincture from a pharmacy, dilute it in a 5:1 ratio with water, and put it into dropper bottles. Caution students not to ingest or touch the solution because it is poisonous and will stain.) Bring in a variety of foods to test including starchy foods, such as crackers and bread, and plant parts such as bean seeds, raw peanuts, potato, celery, and an apple. Give student groups small Styrofoam or plastic plates on which to test each item. Direct them to place several drops of iodine solution on each item and record changes that occur. It may take several minutes for certain starchy items to turn color. Encourage students to test or note changes in different parts of the seeds they test: shell, seed coat, cotyledon, embryo. Ask, *What do you notice about the items that turn blue/black? How would you explain your data? How does it relate to our other studies of seeds?*



Note: The sugar produced during photosynthesis is transported from the leaves to other parts of the plant where it is converted to starch for storage and to cellulose for cell walls. It is also used in respiration and in making proteins and fats.