



PRESERVING THE HARVEST



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Preserving the Harvest

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Food spoils because bacteria contaminate food and start the decaying process. For this reason humans have sought ways to preserve their food for generations. The earliest records of food preservation date back to the ancient Egyptians who dried grains and stored them in sealed silos. This grain could then be used for years as insurance against a famine if there should be a flood. Some grains were fermented to create beverages. Ancient people also developed the techniques of salting, pickling and smoking.



Methods of preservation changed as progress was made in industrial and technological processes. Before refrigeration was available, foods were salted and dried in the sun or hung in cold water wells to preserve freshness longer than one day. Beans and herbs for use in winter cooking were normally dried in the hot air of attics in colonial times. Brined and sun-dried meats were a staple of the “Wild West” in 19th century North America. Root vegetables were stored in sand and buried in a covered cold hole in the ground to extend their storage life beyond the final harvest.

While some of these methods of food preservation could be included in a history lesson, they are not the most practical ways to preserve the harvest from the school garden. Even modern methods - canning, pickling, fermenting, drying and freezing - are best taught using demonstrations since a school garden is unlikely to produce the quantities of produce needed for the work of preservation. Still, there is a great deal of satisfaction in eating something from the summer garden during the middle of winter so it is good to know how to preserve the harvest! This manual is meant to introduce you and your students to some of the most common preservation processes mentioned in the previous paragraph.

Cleanliness is vital to the success of all preservation methods. Be sure to sanitize all surfaces, utensils, jars, covers, and pots before and during the processing. This can be done on the hottest setting of a dishwasher if you have access to kitchen facilities at your school. Alternatively, all items used in the canning process can be immersed in boiling water and left in the boiling pot until ready to use. The goal is to eliminate the opportunity for bacteria to contaminate any food or surfaces. Because boiling liquids are an essential, but dangerous part of the canning process, projects requiring preservation with heat are not recommended for children in the younger grade levels.

When food is heated at a certain temperature and that temperature is maintained for a specific length of time, the natural decomposition process is interrupted. Processing times vary according to the type of food being canned. The *Ball Blue Book Guide of Home Canning* is an excellent resource for how to use the boiling water bath or pressure cooker method of canning. Anyone who intends to can fruits and vegetables should use it as a reference and guide. It includes the proper amount of time to process a wide variety of fruits and vegetables,

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equipment needed, safety precautions, definitions of canning terms, descriptions of acid and low acid foods and recipes. Even though canning with heat is not recommended with students, many of the preparation procedures are the same even when using other methods. Most vegetables will need to be blanched (immersed briefly in boiling water) and then cooled in ice water to stop enzyme growth within the vegetable. Correct times are listed in all recipes.

Inspect all glass jars for nicks, cracks or uneven surfaces. Use only perfect canning jars and discard any that do not meet your inspection standards. Most purchased canning jars have two-part covers, a lid edged with a rubber ring, and a screw-on rim. Rims may be reused if free of rust or discoloration, but the center lid with a rubberized seal must be new for each use.

Choose only the highest quality fruits and vegetables for preservation using any method. This is not the time to use bruised or blemished produce that may already have begun to decay. Wash all produce well to eliminate invisible mold, yeasts, bacteria, or enzymes that may be present on the surfaces and start the decaying process. Starting with the most perfect produce will assure the best result.

Pickling is a good process to use in the classroom. When pickling, follow the same procedures of cleanliness preparation as you would for hot water canning. Be sure to gather all supplies before starting. For long term preservation, pickles should be treated in a hot water bath. Some pickles, however, can be preserved using a salt and vinegar brine and curing in the refrigerator for short term storage. While the jars and other equipment still need to be sterilized in hot water, the liquids used in some dill pickling recipes can be cold. The flavors in pickles intensify when allowed to sit in the refrigerator for days or weeks, but must be consumed within a few weeks.

Pickling as a preservation method lends itself well to a classroom situation because students can safely fill jars, taste tests of a sample jar can determine the flavor readiness of the product, and each person can take one jar home at the end of the project. One challenge of refrigerator pickles is to keep the vegetables crunchy. Be sure to use only pickling or Kosher salt in all recipes and cut off 1/16" of the blossom end of cucumbers. This end could be the source of enzymes that soften pickles. Vegetables should be packed tightly and then covered with liquid. Choose the proper size jars for your class. Cut vegetables smaller and use smaller jars to produce a greater quantity. (See Half Sour Pickle recipe.)



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Fermentation is defined in the dictionary as “a chemical decomposition of an organic substance (as in the souring of milk or the formation of alcohol from sugar) by enzymatic action in the absence of oxygen, often with the formation of gas.”(Merriam-Webster Dictionary) Vegetables, fruit or milk that are fermented change their taste and appearance as part of the chemical process as acid develops naturally in the food. If you have tasted sauerkraut, kimchee, wine or yogurt, you have tasted a fermented food. The flavors in a fermented food develop over time. Each type of food must be prepared within its own timeframe and at a specific temperature. If your school garden has grown cabbage, then sauerkraut is your fermentation experiment of choice. Students can keep detailed records of the changes during fermentation, make charts and report on their findings. Usually the process of fermentation creates gas as a byproduct. Be aware that allowing these products to fully ferment in the classroom can add some odors to the room. This problem can be addressed by allowing students to take a portion of the kraut, continue to weigh it down, and finish the fermenting at home. (See Sauerkraut recipe.)

The refrigerator/freezer jam method is a way to store berries or fruits if those plants are growing in your school garden. Traditional recipes for jam require boiling the fruit, skimming off any foam that appears on the surface and then filling jars and processing in a hot water bath. The refrigerator/freezer method does not require cooking the fruit or hot water processing making it a safe project for younger students. The finished jam must be stored in the refrigerator and consumed within three weeks. Jam is made from crushed or chopped fruits, the juice of the fruit, sugar and pectin. Pectin occurs naturally in fruits and is a substance that forms a gel in the right combination with acid and sugar. Because berries have less natural pectin than other fruits, they need the addition of commercial pectin products like Ball Fruit Jell or Sure-Jell brand in order to thicken. Choose good quality berries and process them within 24 hours of harvest. It is best to make jam in small batches. If each student will receive their own jar of jam at project’s end, it may be necessary to plan multiple jam making sessions or purchase smaller canning jars. (See Strawberry Jam recipe.)

Drying is a historical method of food preservation that is gaining popularity once again. When moisture is removed from a fruit or vegetable, microbial growth (bacteria, yeasts and molds) is slowed or stopped. Drying also slows down the action of enzymes in the food. Some nutritional value is lost in the process, but dried food can be stored in very little space and is easy to reconstitute to normal size by soaking in water.

Drying outside using sunshine as a heat source is an old drying method that can be fun to try with students. Because most vegetables are low in sugar and acid, they spoil rapidly and should not be dried in the sun. Fruits can be safely sun-dried out of doors because their high amounts of sugar and acid. This is best done on a hot breezy day. Lay out thin slices of fruit on a screen raised off the ground and cover it with another screen to keep birds and insects away. The drying rack should be taken indoors at night to avoid condensation from cooling temperatures. Screens should be made of stainless steel, Teflon coated fiberglass or plastic. Other metals can leave harmful chemical residues on the food. If conditions are right - low humidity and a gentle breeze - fruit will dry in two to four days. Foods that have been dried outside should be heat treated (pasteurized) in an oven

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to kill any insects or insect eggs. Set the oven on a temperature of 175 degrees F. Bake dried food in a single layer on a cookie sheet for 10 to 15 minutes. Cool on clean dish towels, then package for storage.

Some vegetables need to be blanched before being dried in order to stop enzyme action. Those that do NOT need blanching include herbs, peppers, onions, beans and peas that have been removed from their pods.

Indoor drying can be done in an oven set at 140 degrees F, or in a purchased dehydrator. Oven drying will take from 4 to 12 hours. Trays need to be positioned so that air can circulate from the bottom as well as the top. They should be similar, but smaller than those used outside. The oven door should be left slightly open to release excess heat. A fan blowing in front of the door will help with air circulation. Foods must be stirred and turned every half hour. Kale chips are a popular recipe for drying foods in the classroom. Kale leaves coated with oil dry very quickly in an oven and provide a crispy, healthy snack without the use of a fan or the need to turn the leaves.

A purchased dehydrator is an easy and practical way to dry freshly harvested vegetables in the classroom. Dehydrators have multiple shelves layered above one above the other and are available in a variety of styles and prices. All rely on electricity to heat and circulate the air. Drying should take 6 to 12 hours, but foods will not need much stirring. Shelves can be rearranged during the process for the best results.

Since so much of the harvest was stored as dried foods in colonial times, processing foods by drying can be used as part of a history lesson with your students. *Much* of a family's meal planning was based on what had been stored for future use during the winter months. Drying herbs was a very common practice that continues to this day. Your students might like to try a historical recipe for dried apple rings. (See Dried Apple Rings recipe.)

Freezing is a modern, quick and easy preservation method that retains the natural color, flavor and nutrition of foods. Freezing does require blanching for most vegetables and ascorbic acid/citric acid treatment for many fruits. Some foods like berries, peppers, and onions can be frozen without pre-treatment.

Blanching stops most enzyme action that continues as vegetables ripen. After blanching for a prescribed number of minutes (See resources on freezing.), food should be quickly cooled in an ice water bath for the same number of minutes to stop the cooking process. Acid treatments prevent the interaction with oxygen that turns fruit brown. Oxidation does not harm or decay fruit, but makes it less appetizing in appearance. This process must be carried out with extremely clean utensils and containers to prevent the introduction of bacteria. Vegetables from the freezer should be cooked while still frozen.

Freezing is more popular for home preservation than for classroom use, but is an important method of food processing that should be introduced to students. Vegetables and herbs are packed dry. They can be frozen in a single layer on a cookie sheet and then placed in freezer bags or other food storage containers. The single layer

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method of freezing allows you to remove the amount you wish to use and not more. After food has been put into freezer bags, remove as much air as possible by sucking it out with a drinking straw. Then seal and label each bag with date and name of the food. If you use freezer containers instead of freezer bags, leave about an inch of headroom between the food and the cover of the container. This allows for expansion of the food during freezing. Be sure all containers are suitable for freezing, moisture/vapor resistant, and have airtight seals to prevent “freezer burn.” Freezer burn is a drying and toughening of the food that occurs when it is not tightly wrapped. Place containers in the coldest part of freezer and keep multiple packages separated. . Once frozen solid, packages may be stacked tightly together. Most frozen vegetables maintain their quality for 8 to 10 months when stored at 0 degrees F.

Teachers who have access to a school garden can connect the time their students spend working in the garden to their core curriculum. Working in the school garden gives students a special appreciation for how much work growing food requires. Learning that what grows in the garden as a result of their work can be preserved and consumed long after the garden has stopped production enlivens interest in gardening and inspires students to come up with new ways to grow more and better produce. Food spoils, but spoilage can be prevented simply by preserving the harvest as our ancestors did.

Keep on planting and start preserving what you and your students grow!

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Recipes



Half-Sour Pickles

For this recipe you will need:

cutting boards
sharp knives (small knives work better with students)
pot of boiling water deep enough to cover jars

5 to 6 cups cold water

$\frac{3}{4}$ cups white vinegar at 5% acidity

$\frac{1}{4}$ cup Kosher or pickling salt

2 teaspoons sugar

Kosher salt
white vinegar with an acidity of at least 5%,
clean kitchen towels

1 $\frac{1}{2}$ teaspoons dried dill

1 $\frac{1}{2}$ teaspoons pickling spices (optional)

2 garlic cloves , sliced thin

small cucumbers, blossom end removed and cut
into narrow spears

Clean and cut cucumbers. With tongs, remove jars from hot water and place on towels. Pack spears tightly upright in jars. Add dill and garlic to each jar. Pour in brine and cover. Use chopstick to carefully remove any air bubbles. Let marinate 1 to 2 days at room temperature, then refrigerate for several days before eating. During curing, colors and flavors change and acidity increases. Store in refrigerator and use within 3 weeks.

Green beans can be pickled with this same recipe. Add 1 teaspoon dried oregano.

(Family Recipe)

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Sauerkraut

For this recipe you will need:

5 lbs. of cabbage

Yield: about 9 qts.

$\frac{3}{4}$ cup canning or pickling salt

Use firm heads of fresh cabbage harvested from the garden within 24 to 48 hours. Choose your fermenting container carefully. Cabbage must be kept 1-2 inches under the brine for the whole process. A cover, like a dinner plate, should be slightly smaller than the opening of the container but large enough to cover the vegetables. To keep the plate under the brine, weight it down with several sealed quart jars filled with water. Covering the top of the opening with a clean, heavy bath towel helps to prevent contamination from insects and molds while the vegetables are fermenting. Wash cabbage well, drain, and discard tough outer leaves.

Cut heads into quarters and remove cores. Work with about 5 lbs. of cabbage at a time.

Shred or slice cabbage about $\frac{1}{8}$ " thick (about the thickness of a quarter coin).

Place in fermentation container and add 3 tablespoons of salt.

Firmly squeeze and knead the cabbage with your clean, gloved hands and pack it down until the salt draws juices from the cabbage.

Repeat shredding, salting, and packing until all cabbage is in the container.

There should be a space of about 4 to 5 in. at the top of the container.

If juice does not cover the cabbage, add boiled and cooled brine to cover (1 $\frac{1}{2}$ tablespoons of salt per quart of water.)

Weight down the cabbage with the plate and jars. Keep lowering the plate as sauerkraut ferments. Maintain liquid over cabbage at all times. Cover with a clean bath towel.

Store at temperatures of 70 to 75 degrees F while fermenting. At this temperature, kraut should be fully fermented in about 3 to 4 weeks. Lower temperatures will slow down fermentation..

Temperature is important. Over 75 degrees F, kraut may become soft; lower than 60 degrees F, kraut may not ferment.

Check the kraut 2 to 3 times a week to remove any scum that forms on the top.

Sauerkraut may be kept tightly covered in the refrigerator for several months.

(Recipe National Center for Home Food Preservation, http://nchfp.uga.edu/how/can_06/sauerkraut.html)

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Strawberry Freezer Jam



For this recipe you will need:

clean, sanitized jars
potato masher
measuring spoons

2 bowls, 1 large and 1 medium
measuring cups (for liquid & dry)
small saucepan

Clean strawberries should be at room temperature to help sugar dissolve.

Do not reduce sugar or use sugar substitutes. The exact amounts of sugar, fruit and pectin are necessary for a good set.

Do not double recipe or mixture may not set properly.

Ingredients:

1 quart strawberries	4 cups sugar
1 box (1 $\frac{3}{4}$ oz. pectin)	$\frac{3}{4}$ cup water

Remove stems and crush strawberries with potato masher in large bowl.

Precisely measure 4 cups of sugar by leveling off top of measuring cup and place into medium bowl.

Mix fruit and sugar and set aside for 10 minutes. Stir occasionally.

Stir 1 box Sure-Jell pectin & $\frac{3}{4}$ cup water in small saucepan. (It may look lumpy.)

Bring to boil on high heat, stirring constantly. Boil and stir for 1 minute. Remove from heat.

Stir pectin mixture into fruit mixture. Stir constantly until sugar is completely dissolved and no longer grainy, about 3 minutes.

Pour quickly into containers to within $\frac{1}{2}$ inch of tops.

Wipe top edges to remove any drips. Cover with lids.

Let stand at room temperature for 24 hours to set. Even if not set after 24 hours, refrigerate.

Store in refrigerator for up to 3 weeks for immediate use. Can be frozen for up to 1 year.

(If freezing, use plastic containers, not glass canning jars and thaw in refrigerator.)

Yield: 5 cups

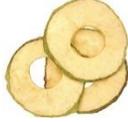
Recipe from Sure-Jell Fruit Pectin

Recipes for other Freezer Fruit Jams are included in box directions.

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Dried Apple Rings

For this recipe you will need:

2 apples (Granny Smith apples work well.)
vegetable peeler
corer

knife
cutting board
kitchen string

Instructions:

1. Wash and peel apples using a vegetable peeler.
2. On a cutting board, use a corer to cut out a cylinder through the center of the apple, removing stem and seeds.
3. Place apples on their sides and slice into $\frac{1}{4}$ inch rings (about 12 per apple depending on size).
4. Cut a 1 yard length of kitchen string and run it through the hole in the center of each apple ring.
5. Tie a knot to keep each slice separated.
6. Hang the apple rings in a cool dry place. Make sure slices have room between them for air to circulate.
7. Once the apples are wrinkled and dried, usually in two weeks, take them down and eat them. Store leftovers in a covered container.

Source: The U.S. History Cookbook

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Any Kind of Fruit Leather

For this recipe you will need:

- 1 ½ lbs. of fruit (Berries should be hulled or stemmed. Stone fruits should be pitted.)
- ½ cup unsweetened applesauce
- honey
- 2 large sheet pans lined with silicone baking mats
- parchment paper
- offset spatula

1. Heat oven to 170 degrees F. and line 2 large sheet pans with silicone baking mats. (Parchment may work, but also may stick.)
2. In a food processor, puree 1 ½ lbs. fruit and ½ cup unsweetened applesauce until completely smooth. Taste puree. If more sweetening is needed, add a little honey.
3. Pour puree down center of each sheet pan. Using an offset spatula, spread evenly across pan, leaving 1” border. Make edges slightly thicker since they dry out faster and this may keep them from cracking.
4. Transfer to oven and cook until puree looks leathery and feels firm, but slightly tacky. This will take about 4-6 hours, depending on the moisture in the fruit. When ready, turn off heat and let fruit leather remain in oven to cool to room temperature.
5. Top with a sheet of parchment paper and turn over onto a counter. Carefully remove baking mat. Roll up parchment and fruit leather together. Using kitchen shears, cut rolls into 1” segments. Keep parchment within roll-up to separate layers. Store in an airtight container at room temperature up to 2 weeks.

Use organic fruit at the peak of its season. These roll-ups will be full of flavor and so much better than those you can buy at the store.

Yield: about 20 - 1” strips

(Recipe from Rodale’s Organic Life, Sept-Oct. 2016, p.20)

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Resources

National Center for Home Food Preservation, http://nchfp.uga.edu/how/can_06/sauerkraut.html;
<http://nchfp.uga.edu/how/dry/sun.html>

Food History, <http://www.world-foodhistory.com/2011/08/food-preservation-during-ancient-times>

University of Mass Extension, <http://extension.umass.edu/nutrition/recipes/dried-apple-rings>; The U.S. History Cookbook

USDA Complete Guide to Home Canning, <https://www.extension.purdue.edu/usdacanning>. 2015 Revision.

Home Dried Vegetables fact sheet; We Can Vegetables fact sheet ; Freeze Fresh Vegetables fact sheet- of West Virginia University Extension Service Families and Health Programs in cooperation with the U.S. Department of Agriculture. July, 2011 and August 2011

Ball Blue Book Guide to Home Canning, Freezing & Dehydration, Volume 1, published by Alltrista Corporation, Muncie, IN, copyright 1995, 1997

Sure-Jell Fruit Pectin, recipes

Rodale's Organic Life, Sept-Oct. 2016, p.20

Photos:

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Canned Dill Beans, Tamara Leclerc, Massachusetts Agriculture Calendar, 2014

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Strawberries, eskipaper.com, fruits-images

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