
Food Safety Basics

The quality of food is judged by wholesomeness, its nutritional value, and our expectations of its color, flavor, odor, and texture. The quality of preserved food varies greatly and depends mostly on the quality of the fresh food and preservation methods. High quality preserved foods are free from microbial spoilage and toxins, are pleasing to eat, and are reasonably nutritious.

Causes of Food Spoilage & Deterioration

Food spoilage is the process of food becoming unsafe or unacceptable for human consumption. There are five general causes of food deterioration:

Microbial Spoilage

The most common cause of food spoilage is the growth of bacteria, molds, or yeast that are naturally occurring microscopic organisms. Thousands of species exist in nature and are widely found in the soil, water, and air.

- **Bacteria:** There is a full spectrum of bacteria from desirable to deadly. *Lactobacillus* is a desirable bacteria involved in fermentation processes to produce cheese, pickles, and sauerkraut. An example of a “bad” or pathogenic bacteria is *Clostridium botulinum*, which under the right circumstances causes botulism poisoning, a very serious and sometimes deadly illness. Proper canning of low-acid foods (vegetables, fish, meat) by using a pressure canner is required to kill this odorless, tasteless, and colorless toxin.
- **Molds:** Molds grow on most foods and are easily recognized by their masses of fuzzy growth in a variety of colors. The roots of mold can spread invisibly through soft foods, thus removing the surface mold does not eliminate mold from the food. Molds grow best at room temperature, but some can grow (slowly) at refrigerator temperatures. They are relatively tolerant of common inhibitors, acid and salt. Molds require oxygen, so wrapping food tightly will reduce the opportunity for mold growth. Molds are easily killed by heat. Most begin to die at about 140° F and almost all are dead when food temperatures reach 190° F.
- **Yeasts:** Yeasts can grow with or without air and require more water than molds. Their masses in or on food appear as slime, scum, or murkiness. Yeast fermentation in food is recognized by gas bubbles, froth, or foam which result from the fermentation activity and the production of carbon dioxide gas. Depending on the specific growth conditions, yeast produce acids (vinegar), alcohol (beer and wines), or carbon dioxide (raised bread) during fermentation. This can be desirable or result in spoiled food. Yeast grow best at room temperatures and are destroyed by heating foods to temperatures of 140° F to 190° F. They grow slowly on refrigerated foods. Yeasts grow best on or in acidified foods and fruits. Yeast growth in these foods can raise the pH, changing the conditions to be more favorable for bacterial growth.

Enzyme Action

The activity of enzymes naturally present in foods results in changes in appearance, texture and flavor, and loss of vitamins. Enzymes are easily inactivated by quickly heating raw food to temperatures of 170° F to 190° F in boiling water, in steam, or with a microwave oven. This is the purpose of blanching vegetables before freezing or drying.

Oxygen

The presence of oxygen causes oxidation, which causes many color and flavor changes, including rancidity of fats. Oxygen can also increase activity of many chemical substances in food. Good airtight packaging, careful wrapping of food to exclude oxygen and vacuum packaging machines are all good ways to exclude oxygen and improve the shelf life of stored food.

Insect Infestation

Some unavoidable insect eggs are contained in freshly harvested foods. If they are not controlled, the eggs will hatch and become larvae that will burrow through these foods to eat. Inspect food carefully, use good sanitation practices, and store food in covered containers. If insects are found, locate and discard all infested foods and clean storage areas thoroughly.

Moisture Loss

Loss of moisture changes food quality. Moisture loss proceeds more rapidly at higher temperatures. Refrigeration and proper packaging of fresh food keep these changes to a minimum.

Methods of Food Preservation

Food preservation is the maintenance of safe and nutritious food for an extended period of time. The primary methods of preserving food include the following:

Refrigeration

- Retards growth of microorganisms
- Slows action of enzymes

Freezing

- Prevents growth of microorganisms, but does not necessarily kill them.
- Kills insect eggs and larvae.
- Slows, but does not stop enzymatic activity. Therefore, enzymes present in most fresh vegetables must be inactivated by blanching before freezing.
- For highest quality, lower the food temperature to 0° F as rapidly as possible and maintain a 0° F food temperature.
- Freeze only the amount you can use before its shelf life expires.
- Use packaging that is moisture proof, sealable, and oxygen impermeable to retain quality.

Canning

- With proper canning practices, air is forced from the jars, leaving a vacuum. Processing heat destroys the most heat-resistant microorganisms capable of growing in food stored at room temperature.
- The amount and method of heat processing used depends mainly on the acidity in food. Acidity may be natural, as in most fruits, or added, as in pickled food. Low-acid canned foods contain too little acidity to prevent the growth of heat-resistant bacteria. Acid foods contain enough acidity to block their growth or destroy them more rapidly when heated.
- Molds and some yeast are unable to grow in a vacuum. However, there is a very healthy growth environment for some bacteria in sealed, low-acid home-canned foods. Such foods must be heat processed until a commercially sterile product is achieved, or they must have salts, sugars, acids, or other preservatives added.
- Yeasts and molds are destroyed when food temperatures reach about 190° F, whereas most bacterial vegetative cells are destroyed in foods heated to a boiling temperature. Bacterial spores are able to survive for a long period at the temperature of boiling water.
- Pressure enables the processing of canned foods at temperatures higher than boiling water, where kill rates of bacteria are greatly increased. Pressure canning is required to safely process low-acid foods that may support the growth of bacterial spores.

- It is the scientific study and research of these food spoilers that has resulted in different canning methods (boiling water, atmospheric steam canning, and pressure canning) that allow the home canner to safely process and store foods. A list of approved sources that base their recipes and preservation methods on research findings is included below and should be the exclusive reference for all home canners.

Dehydrating

- Removes water and prevents growth of microorganisms.
- Microorganisms require water for growth. Removal or reduction of water from a food prevents growth of microorganisms and controls enzyme activity.
- Dried foods must be packaged in oxygen and moisture proof containers to prevent oxidation of flavors and moisture gain.

Pickling and Fermenting

- These methods (and others, like canning naturally acidic fruits, jams and jellies) use either naturally produced or added acids to inhibit or prevent the growth of many microorganisms. Foods that contain enough acid to inhibit the growth of *Clostridium botulinum* are called high acid foods (pH lower than 4.6). The presence of acids in foods, however, does not kill organisms.
- Fermenting uses bacteria to produce lactic acid and lower the pH in products such as fermented pickles and sauerkraut.
- Pickling adds vinegar (acetic acid) to lower pH in fresh pack pickles and other acidified products.

Salting

- Chemically bonds water, inhibiting growth of some bacteria.

Sweetening and Acidifying Jellies and Jams

- Adds sugar and acids that tie up free water and lower the pH.

On Guard Against Spoilage

Don't taste or use canned foods that show any sign of spoilage! Look closely at all jars before opening them. A bulging lid or leaking jar is a sign of spoilage. When you open the jar, look for other signs, such as, spurting liquid, an off-odor or mold. Spoiled canned foods should be discarded in a place where they will not be eaten by humans or pets.

Don't taste or use improperly canned, low-acid foods! Low acid foods include vegetables, meat, seafood and tomatoes. Improperly canned, low-acid foods can contain the toxin that causes botulism **without showing signs of spoilage**. Jars of foods that have not been properly processed must be discarded, even if there are no signs of spoilage, or if they are unsealed, open or leaking they must be detoxified and discarded as directed below. Low-acid foods are considered improperly canned if any of the following are true:

- The food was not processed in a pressure canner.
- The gauge of the canner was inaccurate.
- Up-to-date researched processing times and pressures were not used for the size of the jar, style of pack or kind of food processed.
- Proportions of ingredients were changed from the original approved recipe.
- The processing time and pressure were not correct for the altitude at which the food was canned.

How to Detoxify Canned, Low-Acid Foods

Contact with botulinum toxin can be fatal whether it is ingested or enters through the skin. Be extremely careful not to splash or come in contact with the suspect food or liquid. Wear disposable rubber or heavy plastic gloves. Wear clothes and aprons that can be bleached or thrown out if contaminated.

Step-by-Step Instructions for Detoxification:

- Carefully place the jars, with their lids, on their sides in an 8-quart, or larger pot or canner.
- Wash your gloved hands thoroughly.
- Carefully, without splashing, add enough hot water to the pot to completely cover the jars with at least 1 inch of water above the containers.
- Place a lid on the pot and heat the water to boiling.
- Boil for 30 minutes to make sure the food and containers are detoxified.
- Cool and discard the containers, their lids and food in the trash or dispose in a nearby landfill.

How to Clean Up Contaminated Surfaces:

- Wear rubber or heavy plastic gloves to clean up contaminated work surfaces and equipment, including can openers and clothing that may have come in contact with suspect foods or liquids.
- Use a fresh solution of 1 part unscented, liquid, household, chlorine bleach (5 to 6% sodium hypochlorite) to 5 parts clean water.
- Spray or wet contaminated surfaces with the bleach solution and let stand for 30 minutes. Avoid inhaling bleach or contact with skin.
- Wipe treated spills with paper towels and place paper towels in a plastic bag before putting them in the trash.
- Apply the bleach solution to all surfaces and equipment again, and let stand for 30 minutes and rinse.
- Wash all detoxified counters, containers, equipment, clothing, etc.
- Discard gloves when cleaning process is complete.

A good rule to follow is: When in doubt, throw it out! If food looks or smells strange, don't take a chance by tasting it and don't give it to your pets or other animals. Throw it out!

Research-Based Sources

Research-Based Sources for Canning and Other Food Preservation:

- National Center for Home Food Preservation (<http://nchfp.uga.edu/>)
- USDA Guide to Home Canning, 2015
- So Easy to Preserve 6th Edition, September 2014 (University of Georgia)
- The Ball Blue Book Guide to Preserving, 2014
- Ball Complete Book of Home Preserving, 2012
- University of California Publications
- Cooperative Extension Offices (all 50 states)
- Package inserts included with name-brand pectins
- For more links: <http://mfp.ucanr.edu>

It is the policy of the University of California (UC) and the UC Division of Agriculture & Natural Resources not to engage in discrimination against or harassment of any person in any of its programs or activities (Complete nondiscrimination policy statement can be found at <http://ucanr.edu/sites/anrstaff/files/187680.pdf>). Inquiries regarding ANR's nondiscrimination policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Agriculture and Natural Resources, 2801 Second Street, Davis, CA 95618, (530) 750-1318.



UCCE Master Food Preservers of Amador/Calaveras County

12200B Airport Road
Jackson, CA 95642
(209) 223-6482

<http://cecentralsierra.ucanr.edu>



Freezing Basics

Basic Food Safety

Wash Hands Frequently

- Personal cleanliness is a must. Wash your hands thoroughly and frequently. E. coli resides in the human nose and intestines. Wash your hands if you rub your nose, or if you wipe your face or skin.
- Bandage any cuts or burns on hands before handling food, or use disposable gloves.

Avoid Cross Contamination

- Rinse all fresh fruits and vegetables well under running water before preparing or eating them. Dry them with a clean cloth or paper towel.
- **ALWAYS** wash your hands, knives, cutting boards, and food preparation surfaces well with soapy water before and after any contact with raw meat, fish, or poultry.
- Use a disinfecting solution of 1½ teaspoon of chlorine bleach to 1 pint of water. Dispense with a spray bottle to disinfect countertops, cutting surfaces, sinks, etc. Make a new solution daily.

When In Doubt, Throw It Out

- Never taste food that looks or smells strange to see if it can still be used.
- Most bacteria that cause foodborne illness are odorless, colorless, and tasteless.

Freezing Foods

Retains natural color, flavor and nutritive value of foods and is quick and simple to do. Freezing slows down the enzymes in fruits and vegetables that cause them to ripen and then decay.

Freezing Pointers

- Freeze foods at 0°F or lower. For rapid freezing, set the temperature to -10°F 24 hours in advance.
- Freeze foods as soon as they are packed and sealed.
- Water in food freezes and expands creating ice crystals, which rupture cell walls of fruits and vegetables, making them softer when thawed. Large ice crystals do more damage to food cells and cause softer, mushier textures. Minimize the size of ice crystals by keeping the temperature consistent and freezing the food quickly.
- Do not overload your freezer with unfrozen food. Add only the amount that will freeze within 24 hours, which is usually 2 to 3 pounds of food per cubic foot of storage space. Overloading slows down the freezing rate, and foods that freeze too slowly may lose quality.
- Place packages in contact with refrigerated surfaces in the coldest part of the freezer.
- Leave a little space between new packages so air can circulate freely. Stack after frozen.

Preparing Vegetables for Freezing

Select vegetables that are ripe and free of blemishes and prepare for freezing by blanching in boiling water or steam. See separate handout, Freezing Vegetables, for specific blanching times for each type of vegetable.

Blanching Vegetables

- Blanching (scalding vegetables in boiling water or steam for a short time) is a must for almost all vegetables to be frozen. It stops enzyme actions, which can cause loss of flavor, color and texture.
- Blanching cleanses the surface of dirt and organisms, brightens the color and helps retard loss of vitamins. It also wilts or softens vegetables and makes them easier to pack.
- Blanching time is crucial and varies with the vegetable and size. Underblanching stimulates the activity of enzymes and is worse than no blanching. Overblanching causes loss of flavor, color, vitamins and minerals. Follow recommended blanching times listed on the separate handout, Freezing Fruits and Vegetables.

Water Blanching

- Use one-gallon water per pound of prepared vegetables.
- Put the vegetables in a blanching basket and lower into vigorously boiling water.
- Place a lid on the blancher. The water should return to boiling within 1 minute, or you are using too much vegetable for the amount of boiling water.
- Start counting blanching time as soon as the water returns to a boil. Keep heat high for the time given in the directions for the vegetable you are freezing.

Steam Blanching

Heating in steam is recommended for a few vegetables. For broccoli, pumpkin, sweet potatoes and winter squash, both steaming and boiling are satisfactory methods. Steam blanching takes about 1½ times longer than water blanching.

- Use a pot with a tight lid and a basket that holds the food at least three inches above the bottom of the pot. Put an inch or two of water in the pot and bring the water to a boil.
- Put the vegetables in the basket in a single layer so that steam reaches all parts quickly. Cover the pot and keep heat high. Start counting steaming time as soon as the lid is on.

Microwave Blanching

Microwave blanching may not be effective, since research shows that some enzymes may not be inactivated. This could result in off-flavors and loss of texture and color. Those choosing to run the risk of low quality vegetables by microwave blanching should be sure to work in small quantities, using the directions for their specific microwave oven. Microwave blanching will not save time or energy.

Cooling Vegetables

As soon as blanching is complete, vegetables should be cooled quickly and thoroughly to stop the cooking process.

- Plunge the basket of vegetables immediately into a large quantity of cold water, 60°F or below.
- Change water frequently or use cold running water or ice water. If ice is used, about one pound of ice for each pound of vegetable is needed.
- Cooling vegetables should take the same amount of time as blanching.
- Drain vegetables thoroughly after cooling. Extra moisture can cause a loss of quality when vegetables are frozen.

Preparing Fruits for Freezing

Select premium fruits that are fully ripe and free of bruises and other blemishes. Carefully wash, dry, remove pits, and peel, if desired. Use one of the methods described below to prepare fruit for freezing.

Without sugar

Fruit may be frozen without sugar in a water pack or sugar-free fruit juice, such as citrus or berry juice. Small fruit such as berries, cherries, and grapes may be frozen in a single layer on a cookie sheet before packing in containers.

Syrup pack

Fruit may be frozen in a simple syrup of water and cane or beet sugar. If desired, part of the sugar may be replaced by corn syrup or honey. Allow about 2/3 cup of simple syrup for each pint of fruit; 1-1/3 cup for each quart of fruit. Dissolve sugar in hot water and cool before using.

Sugar pack

Juicy fruits and those that will be used for pies or other cooked products may be packed in sugar. Use about 1 cup of sugar for each 2 to 3 pounds of fruit. Gently mix until the sugar has dissolved in the fruit's juices.

Strength of Syrup	Water (cups)	Sugar (cups)	Yield (cups)
Light	4	1	4 ¾
Medium	4	1 ¾	5
Heavy	4	2 ¾	5 ½

Retarding browning

Ascorbic acid may be used to reduce browning of light-colored fruit. For syrup or liquid packs, add ½ teaspoon ascorbic acid to each quart of cold syrup. For sugar or sugarless dry packs, dissolve ½ teaspoon ascorbic acid in 3 tablespoons cold water and sprinkle over 4 cups of fruit just before adding sugar.

Packaging and Shelf Life

Packaging and Labeling Foods

- Cool all foods and syrup before packaging to speed up freezing and help retain the natural color, flavor and texture of food. (Cool in shallow containers in the refrigerator or ice bath.)
- Pack foods in single meal quantities.
- Follow directions for each individual food (see separate handout, Freezing Fruits and Freezing Vegetables) to determine which can be packed dry and which need added liquid. Some loose foods such as blueberries may be individually "tray packed."
- Pack foods tightly leaving as little air as possible in the package.
- Most foods require headspace between the packed food and closure to allow for expansion of the food as it freezes. Foods that are exceptions and do not need headspace include loose packing vegetables such as asparagus and broccoli, bony pieces of meat, tray packed foods and breads.
- Seal rigid containers carefully. Use a tight lid and keep the sealing edge free from moisture or food to ensure a good closure. Secure loose-fitting covers with freezer tape.
- Meats may be packaged using either the "drugstore wrap" or the "butcher wrap."
- Label each package, including the name of the product, any added ingredients, packaging date, the number of servings and amount of each serving, and the form of the food, such as whole, sliced, etc. Use freezer tape, marking pens or crayons, or gummed labels made especially for freezer use.

Containers: Use proper packaging materials to protect food's flavor, color, moisture content and nutritive value from the dry climate of the freezer. The type of containers depends on the type of food to be frozen, personal preference and what you have at home. Do not freeze fruits and vegetables in containers with a capacity over one-half gallon. Foods in large containers freeze too slowly to result in a satisfactory product.

Best packaging materials:

- Moisture vapor resistant
- Not become brittle and crack at low temperatures
- Resistant to oil, grease or water
- Protect foods from absorption of off flavors or odors
- Durable and leak proof
- Easy to seal and mark

Rigid: Used with liquids or soft foods

- Plastic
- Glass: wide mouth dual purpose jars
- Straight sides (no shoulder)
- Tight fitting covers/freezer tape

Flexible: Used with irregular shapes and liquids

- Flexible freezer bags
- Plastic freezer wrap,
- Freezer paper
- Heavy-weight aluminum foil

Headspace to Allow Between Packed Food and Closure Table

Type of Pack	Container with wide top opening		Container with narrow top opening	
	Pint	Quart	Pint	Quart
Liquid Pack*	½ inch	1 inch	¾ inch	1 ½ inch
Dry Pack**	½ inch	½ inch	½ inch	½ inch
Juices	½ inch	1 inch	1½ inch	1½ inch

*Fruit packed in juice, sugar, syrup or water; crushed or pureed fruit.

**Fruit or vegetable packed without added sugar or liquid.

Freezer Shelf Life

- Freezing cannot improve the flavor or texture of any food, but when properly done it can preserve most of the quality of the fresh product. Knowing how long a particular food can be stored in the freezer is not as simple as it sounds.
- The storage times listed in the following table are approximate months of storage for some food products assuming the food has been prepared and packaged correctly and stored in the freezer at or below 0°F. For best quality use the shorter storage times. After these times, the food should still be safe, just lower in quality.

Freezer Shelf Life Table

Food	Approximate months of storage at 0°F
Fruits and Vegetables	8 – 12 months
Poultry	6 – 9 months
Fish	3 – 6 months
Ground Meat	3 – 4 months
Cured or Processed Meat	1 – 2 months

Refreezing Frozen Foods

Occasionally a home freezer stops running. The time the food will stay frozen depends on the amount of food in the freezer and the temperature of the food. A full load of food will stay for up to 2 days if the freezer is not opened. It is safe to refreeze fruits and vegetables that still have ice crystals in them. If the temperature has warmed above 40° F, foods may not be fit for refreezing.

Resources

National Center for Home Food Preservation [Internet]. University of Georgia [cited 2014 September 4]. Available from: <http://nchfp.uga.edu/>

Complete Guide to Home Canning. 2009. USDA Agricultural Information Bulletin 539. National Institute of Food and Agriculture. Available from: http://nchfp.uga.edu/publications/publications_usda.html Also available in paper copy from Purdue Extension (online store is located at https://mdc.itap.purdue.edu/item.asp?item_number=AIG-539)

Kingry, J., & Devine, L., editors. 2006. Ball Complete Book of Home Preserving. Toronto, Canada: Robert Rose Inc.

So Easy to Preserve Fifth Edition. 2006. Bulletin 989. Cooperative Extension/The University of Georgia/Athens Ball Blue Book Guide to Preserving. 2004. Altrista Consumer Products

It is the policy of the University of California (UC) and the UC Division of Agriculture & Natural Resources not to engage in discrimination against or harassment of any person in any of its programs or activities (Complete nondiscrimination policy statement can be found at <http://ucanr.edu/sites/anrstaff/files/187680.pdf>). Inquiries regarding ANR's nondiscrimination policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Agriculture and Natural Resources, 2801 Second Street, Davis, CA 95618, (530) 750-1318.

Freezing Fruits and Vegetables Guide

Freezing Fruits

Apples	Select crisp, firm fruit. To prevent browning during preparation, pretreat. Drain and pack in syrup, pack in sugar, or pack without sugar.
Applesauce	Wash apples, peel if desired, core and slice. Pretreat if desired. Cook until tender in water (1/3 cup to each quart of slices). Cool and strain if necessary. Sweeten to taste.
Apricots	Select firm, ripe, uniformly yellow fruit. Wash, halve, and pit. Pretreat to retard browning if desired. Peel and slice if desired. (to loosen skins, dip in boiling water for 15 to 20 seconds.) Pack in syrup or sugar.
Avocados	Best frozen as puree (not whole or sliced). Select avocados that are soft with rinds free from dark blemishes. Peel, halve, and remove pit. Mash the pulp. Pack in sugar (1 cup to 1 quart of puree) if using for ice cream or milk shakes or pack without sugar if using for salads, dips, or sandwiches.
Bananas	Select firm, ripe bananas. Peel and mash thoroughly. Add ½ teaspoon ascorbic acid per cup.
Blackberries	Also boysenberries, loganberries. Select firm, fully ripe fruit with glossy skins. Wash and drain. Pack in syrup, sugar, or without sugar.
Blueberries	Also huckleberries. Select ripe berries with tender skins. Wash and drain. If desired, steam for 1 minute and cool immediately to tenderize skin. Pack in syrup or sugar.
Cantaloupe	Also other melons. Select firm, well colored, ripe melons. Cut in half, remove seeds and peel. Cut into slices, cubes, or balls. Pack in syrup.
Cherries, sour	Select bright red, tree-ripened fruit. Stem and wash. Drain and pit. Pack in syrup, sugar, or without sugar.
Cherries, sweet	Select tree-ripened red varieties. Stem and wash. Remove pits if desired. Pretreat if desired. Pack in syrup or without sugar.
Currants	Select fully ripe, bright red fruit. Wash and stem. Pack in syrup, sugar or without sugar.
Figs	Select tree-ripened, soft-ripe fruit. Wash and cut off stem. Peel if desired. Slice or leave whole. Pack in syrup, sugar, or without sugar
Gooseberries	Select fully ripe (for pie) or slightly under ripe (for jelly) berries. Wash and remove stems and blossom ends. Pack in syrup or without sugar.
Grapefruit	Also oranges. Select firm tree-ripened fruit, heavy for its size and free of soft spots. Divide fruit into sections, removing all membranes and seeds. Pack in syrup (made with excess juice, add water if needed) or water without sugar.
Peaches	Also nectarines. Select firm, fully ripe, well-colored fruit. Wash and pit. Peel if desired. Cut in halves or slices. Pack in syrup, orange juice, or water without sugar. Pretreat to retard browning
Pears	Select well-ripened, firm fruit. Wash and peel. Cut in halves or quarters and remove cores. Pretreat if desired. Heat in boiling syrup for 1 to 2 minutes (depending on size). Drain, cool, and pack in syrup.
Persimmons	Select orange, soft-ripe fruit. Sort, wash, peel, and cut into sections. Press fruit through a sieve to make a puree. To each quart of puree, add 1/8 teaspoon ascorbic acid. May be packed with or without sugar.

Plums	Select firm, tree-ripened fruit. Wash. Cut in halves, quarters, or leave whole. Pretreat if desired. Pack in syrup or pack without sugar.
Raspberries	Select fully ripe, juicy berries. Wash and drain. Pack in syrup, pack in sugar, or pack without sugar.
Rhubarb	Select firm, well colored stalks. Wash and cut into 1" to 2" pieces. Pack in syrup or without sugar.
Strawberries	Select firm, ripe red berries. Wash, drain, and remove hulls. Slice if desired. Pack in syrup or pack without sugar

*Fruits may be frozen as purees for use later in jam making. Ascorbic acid may be used to prevent darkening and increase the vitamin C content.

Freezing Vegetables

Asparagus	Select young stalks with compact tips. Wash and sort by size. Leave whole or cut in 1-to-2 inch lengths. Blanch small stalks 1 1/2 minutes, medium stalks 2 minutes, large stalks 3 minutes. Cool immediately.
Beans, green	Also snap or wax. Select young stringless beans. Wash and snip off tips. Cut or break into suitable pieces or slice lengthwise into strips. Blanch 3 minutes. Cool immediately.
Beans, pinto	Also, lima or butter. Harvest beans while seeds are green. Wash, shell, and sort according to size. Water-blanch small beans 2 minutes, medium beans 3 minutes and large beans 4 minutes. cool
Beets	Select beets less than 3 inches across. Sort by size. Remove tops and wash. Cook until tender (small 25 to 30 minutes, medium 45 to 50 minutes). Cool. Peel and slice or dice.
Broccoli	Select compact, dark-green heads. Wash, trim leaves and woody ends. If necessary to remove insects, soak 30 minutes in salt brine (4 tsp salt to 1 gallon of water). Rinse and drain. Cut through stalks lengthwise, leaving heads 1" in diameter. Blanch 3 minutes. Cool.
Brussels Sprouts	Select green, firm, compact heads. Wash and trim outer leaves. Soak 30 minutes in salt brine (see broccoli). Rinse and drain. Blanch medium heads 4 minutes, large heads 5 minutes. Cool immediately.
Carrots	Select tender carrots. Remove top. Wash, and scrape. Dice or slice 1/4" thick. Blanch 2 minutes. Cool
Cauliflower	Select firm, white heads. Wash and trim. Split heads into pieces 1" across. If necessary to remove insects, soak 30 minutes in salt brine (4 tsp salt to 1 gallon water). Rinse, drain. Blanch 3 minutes. Cool
Corn	Select ears with plump kernels and thin, sweet milk. Husk ears, remove silk, and wash. <i>Whole-kernel or cream-style:</i> Blanch 4 to 5 minutes. Cool thoroughly. Drain; cut off cob. <i>On-the-cob:</i> Blanch small ears 9 minutes, large ears 11 minutes. Cool, drain and wrap each ear separately or tightly pack desired number in large freezer bags or containers.
Herbs – Fresh	Wash, drain, and pat dry. Wrap a few sprigs or leaves in freezer wrap and place in freezer bag.
Mushrooms	Select edible mushrooms free from spots or decay. Wash and remove stem base. Freeze small mushrooms whole; cut large ones into four or more pieces. When blanching, add 1/2 tsp citric acid (or 3 tsp. lemon juice or 1/2 tsp. ascorbic acid) per quart of water to prevent darkening. Blanch medium or small whole mushrooms 5 minutes, cut pieces 3 minutes. Cool. Or: slice mushrooms 1/4" thick and sauté in butter until almost done. Cool by setting pan in cold water.
Onions	Select fully mature onions. Peel, wash and cut into sections. Blanch 1 1/2 minutes. Cool. May be frozen unblanched.
Peas, edible-pod	Select young, tender pods. Wash. Remove stems, blossom ends, and any strings. Blanch small pods 1 minute, large pods 1 1/2 to 2 minutes. Cool.
Peas, green	Select firm, bright green, plump, pods. Shell. Blanch peas 1 1/2 to 2 minutes. Cool
Peppers, sweet (green)	Select firm, crisp peppers. Wash, cut out stem and remove seeds. Halve, Blanch halved peppers 3 minutes; sliced or diced 2 minutes. Cool. May also be frozen unblanched.
Peppers, hot (green chili)	Select firm, crisp peppers. Wash and dry. Broil for 6 to 8 minutes to loosen skin. (First make small slits in each to allow steam to escape.) Cool. Remove peel, seeds, and stems, may be done after freezing. Protect hands with rubber gloves. May be frozen unblanched.

Potatoes	Wash, pare; remove deep eyes, bruises, and green surface coloring. Cut in ¼" to ½" cubes. Blanch 5 minutes. Cool. <i>For French fries:</i> Pare and cut into thin strips. Fry in deep fat until light brown. Drain and cool. (To serve, bake at 400° F for 10 to 20 minutes.)
Potatoes, sweet	Select medium to large sweet potatoes. Wash and cook until almost tender. Peel, cut in halves, slice or mash. To prevent browning dip for 5 seconds into solution of 1 Tbsp. citric acid or ½ cup lemon juice to 1 quart of water. To keep mashed sweet potatoes from darkening, mix 2 Tbsp. orange or lemon juice with each quart of mashed potatoes.
Pumpkin	Also other winter squash. Select full-colored, mature pumpkin. Cut or break into fairly uniform pieces. Remove seeds, cut into pieces. Bake at 350° F or steam until tender. Cool. Scoop pulp from rind, and mash or put through a ricer. May also be frozen in chunks.
Spinach	Also other greens. Select young, tender leaves. Remove tough stems. Wash. Blanch most leafy greens 2 minutes. Blanch collards and stem portion of Swiss chard 3 to 4 minutes. Blanch very tender spinach 1 ½ minutes. Cool.
Tomatoes	Best frozen stewed or pureed. Select ripe tomatoes free from blemishes. Remove stem ends, peel and quarter. Cook until tender. Cool by setting pan in cold water.
Zucchini	Also other summer squash. Select young squash with small seeds and tender rind. Wash and slice. Blanch ¼" slices 3 minutes, 1 ½" slices 6 minutes. Cool.

Resources

- National Center for Home Food Preservation [Internet]. University of Georgia [cited 2014 September 4]. Available from: <http://nchfp.uga.edu/>
- Complete Guide to Home Canning. 2009. USDA Agricultural Information Bulletin 539. National Institute of Food and Agriculture. Available from: http://nchfp.uga.edu/publications/publications_usda.html Also available in paper copy from Purdue Extension (online store is located at https://mdc.itap.purdue.edu/item.asp?item_number=AIG-539)
- Drying Fruits and Vegetables [Internet]. Oregon State University [cited 2014 September 4]. Available from: http://extension.oregonstate.edu/fch/sites/default/files/documents/pnw_214_freezingfruitsandvegetables.pdf
- Kingry, J., & Devine, L., editors. 2006. Ball Complete Book of Home Preserving. Toronto, Canada: Robert Rose Inc.
- So Easy to Preserve Fifth Edition. 2006. Bulletin 989. Cooperative Extension/The University of Georgia/Athens
- Ball Blue Book Guide to Preserving. 2004. Altrista Consumer Products

It is the policy of the University of California (UC) and the UC Division of Agriculture & Natural Resources not to engage in discrimination against or harassment of any person in any of its programs or activities (Complete nondiscrimination policy statement can be found at <http://ucanr.edu/sites/anrstaff/files/187680.pdf>). Inquiries regarding ANR's nondiscrimination policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Agriculture and Natural Resources, 2801 Second Street, Davis, CA 95618, (530) 750-1318.

Dehydrating Basics

Basic Food Safety

Wash Hands Frequently

- Personal cleanliness is a must. Wash your hands thoroughly and frequently. E. coli resides in the human nose and intestines. Wash your hands if you rub your nose, or if you wipe your face or skin.
- Bandage any cuts or burns on hands before handling food, or use disposable gloves.

Avoid Cross Contamination

- Rinse all fresh fruits and vegetables well under running water before preparing or eating them. Dry them with a clean cloth or paper towel.
- **ALWAYS** wash your hands, knives, cutting boards, and food preparation surfaces well with soapy water before and after any contact with raw meat, fish, or poultry.
- Use a disinfecting solution of 1½ teaspoon of chlorine bleach to 1 pint of water. Dispense with a spray bottle to disinfect countertops, cutting surfaces, sinks, etc. Let sit one minute then wipe. Make a new solution daily.

When In Doubt, Throw It Out

- Never taste food that looks or smells strange to see if it can still be used.
- Most bacteria that cause foodborne illness are odorless, colorless, and tasteless.

Dehydrating Foods

The overall objective in dehydrating foods is to remove moisture before the food spoils. To maintain safety and quality, several factors must be considered when drying fruits, vegetables, and herbs. Keep in mind that specific food products often have recommendations that are unique to them. Drying removes the moisture from food so that microorganisms such as bacteria, yeasts, and molds are less likely to grow; however, drying does not effectively destroy them. Because there is not a heat treatment that effectively destroys disease-causing microorganisms, it is critical to use safe food-handling practices when growing and handling fruits, vegetables, and herbs for drying.

- The optimum drying temperature is 140°F. If higher temperatures are used, the food will develop “case hardening” and moisture will not be able to escape from the food; this, in turn, will lead to a moldy food product. Therefore, do not rush the drying process.
- Low humidity is also needed when drying foods. If the surrounding air is humid, the foods will not dry effectively. Increasing the air movement away from the food will assist in the drying process.
- Foods can be dried in the oven, under the sun, on the vine, or indoors using a dehydrator. There are several resources that provide tested methods for dehydrating vegetables, fruits, and herbs ask your County Extension office for information on specific drying methods.



Additional Food Safety

When dehydrating foods, using good sanitary practices is critical to reducing the risk of contaminating foods with pathogens and spoilage microorganisms.

1. After harvesting produce or herbs, place in containers and locations that are free from additional contamination (for example, pets and wild animals will not have access).
2. Begin the dehydration process soon after harvesting.
3. Clean and sanitize all utensils, containers, the food-contact surfaces of dehydrating equipment and work surfaces.
4. Always wash hands before handling foods—that includes harvesting.
5. Consider using disposable gloves when preparing foods for dehydrating. Dispose of gloves after use.

Dehydrating Fruits

Pretreating fruits is a personal preference; food safety is not affected. Pretreating some fruits before drying will reduce vitamin loss, flavor loss, browning, and deterioration during storage.

- Ascorbic Acid is used by dissolving 1 tablespoon of the powder in 1 quart of cold water. Dip the fruit in the solution, drain, and dehydrate.
- Crazing: Some fruits have a protective wax coating, such as plums, figs, cranberries, blueberries, grapes, etc. It is necessary to pretreat these fruit by dipping them in boiling water for 1 to 2 minutes, according to the size and toughness of the skin.
- Sodium bisulfate is used by dissolving 2 teaspoons of the powder in 1 quart of water and adding the cut fruit. Dip the fruit in the solution, drain, and dehydrate.
- Citric Acid is only one-eighth as effective as ascorbic acid. Dissolve 1 tablespoon in 1 quart of water. Dip the fruit in the solution, drain, and dehydrate.
- Citrus Juice: pineapple, lemon, and lime juice may be used, but are only one-sixth as effective as ascorbic acid. Use 1 cup of lemon or lime juice to 1 quart of water. Dip the fruit in the solution, drain, and dehydrate.
- Sulfuring means exposing fruit to fumes of burning sulfur. Some people are allergic to sulfur, especially those who suffer from asthma. Sulfuring must be done outside.

Testing for Dryness

Fruit should be pliable and leather like, without any pockets of moisture.

Dehydrating Vegetables

Just as with freezing, you must blanch vegetables to deactivate enzymes that cause flavor and color deterioration during the dehydration process. Blanch with hot water or steam for the time stated in the separate handout, Freezing Fruits and Vegetables Guide. Do not blanch green peppers, onions, garlic, mushrooms and okra.

Testing for Dryness

Vegetables may dry unevenly and some pieces may need to be removed before others. Most vegetables will be hard and brittle when dried. If using a vertical fan & heat source, rotate trays to help dry food evenly.

Finishing

Conditioning

All dried foods should be conditioned before packing. Too much moisture left in a few pieces may cause the whole batch to mold.

- Place dried foods in a tightly closed large container.
- Stir or shake each day for a week. This will equalize the moisture.
- If moisture forms on the inside of the container the food has not been dried sufficiently. Return the food to the dehydrator for a few more hours.
- Pasteurize any food products that could have been exposed to insect infestation or larva prior to handling or during the drying process by freezing it in airtight containers at 0° F for at least two days.

Storage

Moisture must be kept from dried foods when they are in storage. First, cool completely. Warm food causes sweating which could provide enough moisture for mold to grow. Pack foods into clean, dry insect-proof containers as tightly as possible without crushing. Store dried foods in clean, dry home canning jars, plastic freezer containers with tight-fitting lids or in plastic freezer bags. Vacuum packaging is also a good option. Pack foods in amounts that can be used in a recipe or all at once.

Dried foods maintain the best quality and nutritional value if they are used in less than 12 months. Dried foods may still be edible after many months or years in storage. They may not be as tasty or nutritious. Some people prefer to store dried food in the freezer because it takes up little space and there are no problems with mold or insects.

Rehydrate

There are three basic methods used to rehydrate dried foods: soak in liquid, boil in water, cook in liquid.

- Do not add salt or sugar during the first 5 minutes of rehydration as they hinder the water absorption process.
- Various fruit juices, yogurt, cordials, and fruit liqueurs may be used instead of water to reconstitute fruits. Place fruit pieces in a shallow pan and cover with the liquid.
 - The general rule is to use 2 cups of fruit to 1 cup of liquid. Add more liquid as needed.
 - Fruit will usually reconstitute in a couple of hours. Refrigerate if it takes longer.
- Vegetables may be reconstituted in consommé, bouillon, vegetable juice, water, or milk.
 - Refrigerate during rehydration.
 - Allow plenty of time - from 1 to 2 hours up to 8 hours, depending upon the vegetable.

Resources

National Center for Home Food Preservation [Internet]. University of Georgia [cited 2014 September 4]. Available from: <http://nchfp.uga.edu/>

Complete Guide to Home Canning. 2009. USDA Agricultural Information Bulletin 539. National Institute of Food and Agriculture. Available from: http://nchfp.uga.edu/publications/publications_usda.html. Also available in paper copy from Purdue Extension (online store is located at https://mdc.itap.purdue.edu/item.asp?item_number=AIG-539)

Kingry, J., & Devine, L., editors. 2006. Ball Complete Book of Home Preserving. Toronto, Canada: Robert Rose Inc.

So Easy to Preserve Fifth Edition. 2006. Bulletin 989. Cooperative Extension/The University of Georgia/Athens Ball Blue Book Guide to Preserving. 2004. Altrista Consumer Products

Rehydrating Dried Foods

Product	Water to Add to 1 Cup Dried Food (Cups)	Minimum Soaking Time (Hours)
Fruits*		
Apples	1 1/2	1/2
Pears	1 3/4	1 1/4
Peaches	2	1 1/4
Vegetables**		
Asparagus	2 1/4	1 1/2
Beans, lima	2 1/2	1 1/2
Beans, green snap	2 1/2	1
Beets	2 3/4	1 1/2
Carrots	2 1/4	1
Cabbage	3	1
Corn	2 1/4	1/2
Okra	3	1/2
Onions	2	3/4
Peas	2 1/2	1/2
Pumpkin	3	1
Squash	1 3/4	1
Spinach	1	1/2
Sweet Potatoes	1 1/2	1/2
Turnip Greens and other greens	1	3/4

* Fruits – Water is at room temperature.

** Vegetables – Boiling water used.

Drying Fruits at Home

Fruit	Preparation	Pretreatment (Choose One)				Drying Times Dehydrator* (hours)
		Sulfur (hours)	Blanch		Other	
			Steam (minutes)	Syrup (minutes)		
Apples	Peel and core, cut into slices or rings about 1/8 inch thick.	3/4	3-5 min, depending on texture	10	-ascorbic acid mixture -ascorbic acid solution -fruit juice dip -sulfite dip	6-12
Apricots	Pit and halve. May slice if desired.	2	3-4	10	-ascorbic acid mixture -ascorbic acid solution -fruit juice dip -sulfite dip	24-36**
Bananas	Use solid yellow or slightly brown-flecked bananas. Avoid bruised or overripe bananas. Peel and slice 1/4-inch to 3/8-inch thick, crosswise or lengthwise.				-honey dip -ascorbic acid solution -ascorbic acid mixture -fruit juice dip -sulfite dip	8-10
Berries						
Firm	Wash and drain berries with waxy coating (blueberries, cranberries, currants, gooseberries, huckleberries).				-plunge into boiling water 15-30 seconds to "check" skins. Stop cooking action by placing fruit in ice water. Drain on paper towels.	24-36
Soft	Wash and drain. (boysenberries, strawberries)				-No pretreatment necessary.	
Cherries	Stem, wash, drain and pit fully ripe cherries. Cut in half, chop, or leave whole.			10 (for sour cherries)	-Whole: dip in boiling water 30 seconds or more to check skins. -Cut and pitted: No -Pretreatment necessary.	24-36
Citrus Peel	Peels of citron, grapefruit, kumquat, lime, lemon, tangelo and tangerine can be dried. Thick-skinned navel orange peel dries better than thin-skinned Valencia peel. Wash thoroughly. Remove outer 1/6 to 1/8 inch of peel. Avoid white bitter pith.				-No pretreatment necessary.	8-12
Figs	Select fully ripe fruit. Immature fruit may sour before drying. Wash or clean whole fruit with damp cloth. Leave small fruit whole, otherwise cut in half.	1 (whole)			-Whole: Dip in boiling water 30 seconds or more to check skins. Plunge in ice water to stop further cooking. Drain on paper towels.	6-12**
Grapes						
Seedless	Leave whole.				-Whole: Dip in boiling water 30 seconds or more to check skins. Plunge in ice water to stop further cooking. Drain on paper towels.	12-20
With seeds	Cut in half and remove seeds.				-Halves: no pretreatment necessary.	

Drying Fruits at Home (continued)

Fruit	Preparation	Pretreatment (Choose One)				Drying Times Dehydrator* (hours)
		Sulfur (hours)	Blanch		Other	
			Steam (minutes)	Syrup (minutes)		
Nectarines and Peaches	When sulfering, pit and halve; if desired, remove skins. For steam and syrup blanching, leave whole, then pit and halve. May also be sliced or quartered.	2-3 (halves) 1 (slice)	8	10	-ascorbic acid solution -ascorbic acid mixture -fruit juice dip -sulfiting	36-48**
Pears	Cut in half and core. Peeling preferred. May also slice or quarter.	5 (halves) 2 (slices)	6 minutes (halves)	10	-ascorbic acid solution -ascorbic acid mixture -fruit juice dip -sulfiting	24-36**
Persimmons	Use firm fruit of long, soft varieties and fully ripe fruit of round drier varieties. Peel and slice using stainless steel knife.				-may syrup blanch	12-15**
Pineapple	Use fully ripe, fresh pineapple. Wash, peel and remove thorny eyes. Slice lengthwise and remove core. Cut in 1/2-inch slices, crosswise.				No pretreatment necessary	24-36
Plums (Prunes)	Leave whole or if sulfuring, halve the fruit.	1			-Sun drying: (whole) dip in boiling water 30 seconds or more to check skins. -Oven or dehydrator drying: rinse in hot tap water.	24-36**

* Because of variations in air circulation, drying times in conventional ovens could be up to twice as long. Drying times for sun drying could range from 2 to 6 days, depending on temperature and humidity.

** Drying times are shorter for slices and other cuts of fruit.

Drying Vegetables at Home

Vegetable	Preparation	Blanching Time		Drying Time Dehydrator* (hours)
		Steam (minutes)	Water (minutes)	
Artichokes-Globe	Cut hearts into 1/8-inch strips. Heat in boiling solution of 3/4 cups water and 1 tablespoon lemon juice.		6-8	4-6
Asparagus	Wash thoroughly. Cut large tips in half.	4-5	3 1/2 - 4 1/2	4-6
Beans, green	Wash thoroughly. Cut in short pieces or lengthwise. (May freeze for 30 to 40 minutes after blanching for better texture.)	2-2 1/2	2	8-14
Beets	Cook as usual. Cool; peel. Cut into shoestring strips 1/8-inch thick.	Already cooked	no further blanching required.	10-12
Broccoli	Trim, cut as for serving. Wash thoroughly. Quarter stalks lengthwise.	3-3 1/2	2	12-15
Brussels Sprouts	Cut in half lengthwise through stem.	6-7	4 1/2 - 5 1/2	12-18
Cabbage	Remove outer leaves; quarter and core. Cut into strips 1/8-inch thick.	2 1/2-3**	1 1/2-2	10-12
Carrots	Use only crisp, tender carrots. Wash thoroughly. Cut off roots and tops; preferably peel, cut in slices or strips 1/8-inch thick.	3-3 1/2	3 1/2	10-12
Cauliflower	Prepare as for serving.	4-5	3-4	12-15
Celery	Trim stalks. Wash stalks and leaves thoroughly. Slice stalks.	2	2	10-16
Corn, cut	Husk, trim and blanch until milk does not exude from kernel when cut. Cut the kernels from the cob after blanching.	2-2 1/2	1 1/2	6-10
Eggplant	Use the same directions as for summer squash	3 1/2	3	12-14
Garlic	Peel and finely chop garlic bulbs. No other pretreatment is needed. Odor is pungent.	No blanching is needed.		6-8
Greens (chard, kale, turnip, spinach)	Use only young tender leaves. Wash and trim very thoroughly.	2-2 1/2**	1 1/2	8-10
Horseradish	Wash; remove small rootlets and stubs. Peel or scrape roots. Grate.	none		4-10
Mushrooms (WARNING, see footnote***)	Scrub thoroughly. Discard any tough, woody stalks. Cut tender stalks into short sections. Do not peel small mushrooms or "buttons." Peel large mushrooms, slice.	none		8-10

Drying Vegetables at Home (continued)

Vegetable	Preparation	Blanching Time		Drying Time Dehydrator* (hours)
		Steam (minutes)	Water (minutes)	
Okra	Wash, trim, slice crosswise in 1/8- to 1/4-inch disks.		none	8-10
Onions	Wash, remove outer "paper shells." Remove tops and root ends, slice 1/8- to 1/4-inch thick.		none	3-9
Parsley	Wash thoroughly. Separate clusters. Discard long or tough stems.		none	1-2
Peas, Green	Shell	3	2	8-10
Peppers, and Pimientos	Wash, stem, core. Remove "partitions." Cut into disks about 3/8 by 3/8 inch.		none	8-12
Potatoes	Wash, peel. Cut into shoestring strips 1/4-inch thick, or cut in slices 1/8-inch thick.	6-8	5-6	8-12
Pumpkin and Hubbard Squash	Cut or break into pieces. Remove seeds and cavity pulp. Cut into 1-inch wide strips. Peel rind. Cut strips crosswise into pieces about 1/8-inch thick.	2 1/2-3	1	10-16
Squash: Summer	Wash, trim, cut into 1/4-inch slices.	2 1/2-3	1 1/2	10-12
Tomatoes, for stewing	Steam or dip in boiling water to loosen skins. Chill in cold water. Peel. Cut into sections about 3/4-inch wide, or slice. Cut small pear or plum tomatoes in half.	3	1	10-18

* Drying times in a conventional oven could be up to twice as long, depending on air circulation.

** Steam until wilted.

*** WARNING: The toxins in poisonous varieties of mushrooms are not destroyed by drying or by cooking. Only an expert can differentiate between poisonous and edible varieties.

Core Canning Techniques

Basic Food Safety

Wash Hands Frequently

- Personal cleanliness is a must. Wash your hands thoroughly and frequently. *E. coli* resides in the human nose and intestines. Wash your hands if you rub your nose, or if you wipe your face or skin.
- Bandage any cuts or burns on hands before handling food, or use disposable gloves.

Avoid Cross Contamination

- Rinse all fresh fruits and vegetables well under running water before preparing or eating them. Dry them with a clean cloth or paper towel.
- **ALWAYS** wash your hands, knives, cutting boards, and food preparation surfaces well with soapy water before and after any contact with raw meat, fish, or poultry.
- Use a disinfecting solution of 1½ teaspoon of chlorine bleach to 1 pint of water. Dispense with a spray bottle to disinfect countertops, cutting surfaces, sinks, etc. Let sit one minute then wipe. Make a new solution daily.

When In Doubt, Throw It Out

- Never taste food that looks or smells strange to see if it can still be used.
- Most bacteria that cause foodborne illness are odorless, colorless, and tasteless.

Canning Basics

Get Ready ... Be Prepared!

- Read the recipe thoroughly before you begin.
- Measure out all ingredients.
- Have all of your utensils at hand.
- Wash jars, lids and rings in hot soapy water and rinse well. Check jars for imperfections.
- Place clean jars into the boiling water canner and heat the jars.
- Prepare lids and rings according to the directions on the lid and ring packages. (Newer boxes of lids don't require pre-heating, older ones do. You may still pre-heat newer lids.)
- Do a "dry run" of the recipe to make sure you have all of your materials.

General Canning Supplies

- Standard canning jars, rings, self-sealing one-time use lids ; no paraffin wax as a sealing agent
- Funnel
- Headspace measurer
- De-bubbler
- Jar lifter
- Tray/towel for hot jars
- Lid lifter
- Reputable recipe that follows the USDA recommended canning procedures

Canning Processes

- Use an **atmospheric steam canner** or a **boiling water canner** for high acid foods: fruits, pickled and fermented products, jams and jellies.
- Use a **pressure canner** for low acid foods: meats, vegetables, and mixtures of high and low acid foods

Why two different processes? Low acid foods must be pressure canned because *Clostridium botulinum*, the bacteria that causes botulism, is a spore former. When conditions are not favorable for the organism to grow (high heat, dryness, etc.), the bacterial cell forms a protective structure called a spore. It takes a higher temperature than boiling to destroy the spores: 240° - 250°F. If you do not destroy the spores in low acid foods they will germinate and produce fatal toxins in the food when it is stored on the shelf. High acid foods have enough acidity to destroy spores.

The USDA does not recommend the open kettle method of canning because it does not prevent all risks of spoilage.

Raw-Pack vs. Hot-Pack Methods

Filling jars with raw, unheated food prior to heat processing is called the raw-pack method. The preferred method, filling jars with preheated, hot food prior to heat processing, is called the hot-pack method. Benefits include a tighter pack and, because food expels air when heated, less float.

Jars

Check jars, lids and bands for high quality. Wash jars, lids and bands in hot, soapy water. Rinse well. Dry bands. Heat home canning jars in hot water, not boiling, until ready for use. Fill a large saucepan or stockpot half-way with water. You may also place them in your canner. Place jars in water (filling jars with water from the saucepan will prevent flotation). Bring to a simmer over medium heat. Keep jars hot until ready for use. You may also use a dishwasher to wash and heat jars. Keeping jars hot prevents them from breaking when hot food is added. Leave lids and bands at room temperature for easy handling.

Headspace

Headspace is the completely empty space left in the jar underneath the lid and above the food. Headspace allows for food to expand during canning without being forced out from under the lid during processing. Recommended amounts also allow for good vacuums to be formed for holding lids in place and good food quality to be maintained during storage.

Atmospheric Steam Canning Essentials

Atmospheric Steam Canning Equipment

- Shallow base pan to hold water with a fitted rack that sits on the base, with a high domed cover. The cover has one or more vent holes near the bottom.
- Some models have a temperature sensor that indicates when the steam is at the correct temperature to start timing the process.

Adjusting for Altitude

All recipes are developed using sea level as the criteria for processing times. At sea level, water boils at 212°F. At higher altitudes water boils at a lower temperature. Adjustments have to be made to ensure safe canning. Canning at any altitude higher than 1,000 ft. requires adjusting the processing time, refer to the Altitude Chart for these times.

Altitude Chart	
Altitude in feet	Increase processing time
1000 - 3000	5 minutes
3001 - 6000	10 minutes
6001 - 8000	15 minutes

Using an Atmospheric Steam Canner

- Use a research tested recipe and processing time developed for a **boiling water** canner when using an atmospheric steam canner. An atmospheric steam canner may be used with recipes approved for half-pint, pint, or quart jars.
- Add enough water to the base of the canner to cover the rack. (Follow manufacturer recommendations.)

- Preheat water to 140°F for raw-packed foods and to 180°F for hot-packed foods. Food preparation can begin while this water is preheating. Do not have the water boiling when you add the jars.
- Heat jars prior to filling with hot liquid (raw or hot pack). Do not allow the jars to cool before filling.
- Load filled jars, fitted with lids, onto the canner rack and place the lid on the canner base.
- Turn heat to its highest position to boil the water until a steady column of steam (6-8 inches) appears from the vent hole(s) in the canner lid. Jars must be processed in pure steam environment.
- If using a canner with a temperature sensor, begin processing time when the temperature marker is in the green zone for your altitude. If using a canner without a temperature sensor, begin processing time when a steady stream of steam is visible from the vent hole(s).
- Set the timer for the total minutes required for processing the food, adjusting for altitude. Processing time must be limited to **45 minutes or less, including any modification for elevation**. The processing time is limited by the amount of water in the canner base. When processing food, **do not** open the canner to add water.
- Monitor the temperature sensor and/or steady stream of steam throughout the entire timed process. Regulate heat so that the canner maintains a temperature of 212°F. A canner that is boiling too vigorously can boil dry within 20 minutes. If a canner boils dry, the food is considered under-processed and therefore potentially unsafe.
- At the end of the processing time, turn off the heat and remove the lid, lifting the lid away from you.
- Using a jar lifter, remove the jars without tipping and place them on a towel, leaving at least 1 inch spaces between the jars during cooling. Let jars sit undisturbed to cool at room temperature for 12 to 24 hours.

Boiling Water Canning Essentials

Boiling Water Canning Equipment

- Deep, non-reactive kettle, stainless steel or enamel with a bottom rack.

Adjusting for Altitude

All recipes are developed using sea level as the criteria for processing times. At sea level, water boils at 212°F. At higher altitudes water boils at a lower temperature. Adjustments have to be made to ensure safe canning. Canning at any altitude higher than 1,000 ft. requires adjusting the processing time, refer to the Altitude Chart for these times.

Altitude Chart	
Altitude in feet	Increase processing time
1000 - 3000	5 minutes
3001 - 6000	10 minutes
6001 - 8000	15 minutes

Using a Boiling Water Canner

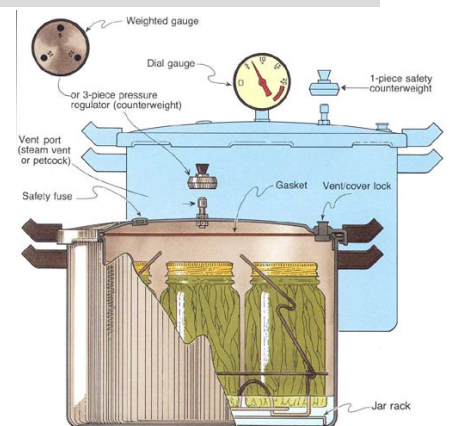
- Before you start preparing your food, fill the canner halfway with clean water. This is approximately the level needed for a canner load of pint jars. For other sizes and numbers of jars, the amount of water in the canner will need to be adjusted so it will be 1 to 2 inches over the top of the filled jars.
- Preheat water to 140°F for raw-packed foods and to 180°F for hot-packed foods. Food preparation can begin while this water is preheating. Do not have the water boiling when you add the jars.
- Load filled jars, fitted with lids, into the canner rack and use the handles to lower the rack into the water; or fill the canner with the rack in the bottom, one jar at a time, using a jar lifter. When using a jar lifter, make sure it is securely positioned below the neck of the jar (below the screw band of the lid). Keep the jar upright at all times. Tilting the jar could cause food to spill into the sealing area of the lid.
- Add boiling water, if needed, so the water level is at least 1 inch above jar tops. Pour the water around the jars, not on them. For process times over 30 minutes, the water level should be at least 2 inches above the tops of the jars.

- Turn heat to its highest position, cover the canner with its lid, and heat until the water in the canner boils vigorously.
- Set the timer for the total minutes required for processing the food, adjusting for altitude.
- Keep the canner covered and maintain a boil throughout the process schedule. The heat setting may be lowered a little as long as a complete boil is maintained for the entire process time. If the water stops boiling at any time during the process, bring the water back to a vigorous boil and begin the timing of the process over, from the beginning.
- Add more boiling water, if needed, to keep the water level above the jars.
- When the jars have boiled for the recommended time, turn off the heat and remove the canner lid. Wait no more than 5 minutes before removing jars.
- Using a jar lifter, remove the jars without tipping and place them on a towel, leaving at least 1 inch spaces between the jars during cooling. Let jars sit undisturbed to cool at room temperature for 12 to 24 hours.

Pressure Canning Essentials

Pressure Canning Equipment

- Pressure canner with the following features:
 - Flat rack in bottom
 - Pressure regulator or indicator
 - ✓ Dial or weighted gauge
 - ✓ Vent pipe (port) for pressurizing
 - Safety valves or overpressure plugs
 - Safety locks when pressurized
 - Flexible gasket/sealing ring in lid or metal to metal seal
 - Optional: jar stacking rack
- Please note that a pressure cooker is NOT a pressure canner, but a pressure canner can be used as a pressure cooker. A pressure cooker must be able to hold **4 quart** jars on a rack to be considered a pressure canner.



Adjusting for Altitude: Pressure Canner

Processing times for all recipes are at sea level. At sea level to 2,000 feet, 11 pounds of steam pressure will produce 240°F. Above 2,000 feet you must increase the steam pressure to reach this temperature. At altitudes above sea level adjust the pressure according to the altitude chart.

Altitude Chart	
Altitude in feet	Required Pressure
Sea Level – 2000ft.	11lb.
2001 – 4000ft.	12lb.
4001 – 6000ft.	13lb.
6001 – 8000ft.	14lb.
8001 – 10,000ft.	15lb.

Using a Pressure Canner

1. Clean lid gaskets and other parts according to the manufacturer's directions; make sure all vent pipes are clear.
2. Put 2 to 3 inches hot water (140°F) into the canner.
3. Place filled jars on the jar rack in the canner, using a jar lifter.
4. Fasten the canner lid securely. Leave the weight off the vent pipe or open the petcock.
5. Turn the heat setting to high; heat until the water boils and steams. **Always** vent for 10 minutes.
6. Place the counterweight or weighted gauge on the vent pipe, or close the petcock.
7. Start timing the process when the pressure reading on the dial gauge indicates that the recommended pressure has been reached, or, for canners without dial gauges, when the weighted gauge begins to jiggle or rock as the manufacturer describes.
8. Regulate the heat under the canner to maintain a steady pressure at, or slightly above, the correct gauge pressure. **IMPORTANT:** If at any time pressure goes below the recommended amount, bring the canner back to pressure and begin the timing of the process over, from the beginning using the total original process time. This is important for the safety of the food.

9. When the timed process is completed, turn off the heat, remove the canner from the heat (electric burner) if possible, and let the canner cool down naturally. Do not force cool the canner. Pints take about 30 minutes to cool; 45 minutes for quarts.
10. After the canner is completely depressurized, remove the weight from the vent pipe or open the petcock. **Wait 10 minutes**; then unfasten the lid away from you to remove.
11. Remove the jars from the canner by lifting them upright and placing them on a rack or folded towel away from drafts.
12. Do not retighten the rings. Leave the ring bands on the jars until they have cooled thoroughly (approximately 24 hours). Do not try to dump or wipe up any water on the lids.
13. Dry the canner, lid and gasket. Take off removable petcocks and safety valves; wash and dry thoroughly. Follow maintenance and storage instructions that come from your canner manufacturer.

Finishing

Removing and Cooling Jars

Be careful when moving and lifting filled jars. Do not tilt. Do not be tempted to try to pour off the water on the top when lifting them out of the canner. The water on top of the hot jars will evaporate very rapidly. If the jars are tilted, food may become lodged between the glass rim and the sealing compound preventing proper sealing. Do not leave the jars in the hot water until cooled as the jars will fail to seal, which will result in spoilage.

The Next Day ...

- After cooling the jars for 12 to 24 hours, remove the screw bands.
- Check each jar for a seal; press the middle of the lid with your finger. If the lid springs up when you release your finger, the lid is unsealed.
- Clean the jars with a damp cloth. Thoroughly dry ring bands may be replaced on the jars, if desired.
- Label the jars with the product name, date, processing method (WB = Boiling Water/Water Bath, PC = pressure canner), and store in a cool, dark, dry area.
- If a jar did not seal, check the jar for flaws. Refrigerate and use the product within a few days, freeze the jar, or reprocess it within 24 hours using a new lid and if necessary, a new jar. Process by the method originally advised for the full length of time.



Resources

Research-Based Sources for Canning and Other Food Preservation:

- National Center for Home Food Preservation (<http://nchfp.uga.edu/>)
- USDA Guide to Home Canning, 2015
- So Easy to Preserve 6th Edition, September 2014 (University of Georgia)
- The Ball Blue Book Guide to Preserving, 2014
- Ball Complete Book of Home Preserving, 2012
- University of California Publications
- Cooperative Extension Offices (all 50 states)
- Package inserts included with name-brand pectins
- For more links: <http://mfp.ucanr.edu>

It is the policy of the University of California (UC) and the UC Division of Agriculture & Natural Resources not to engage in discrimination against or harassment of any person in any of its programs or activities (Complete nondiscrimination policy statement can be found at <http://ucanr.edu/sites/anrstaff/files/215244.pdf>) Inquiries regarding ANR's nondiscrimination policies may be directed to John I. Sims, Affirmative Action Compliance Officer/Title IX Officer, University of California, Agriculture and Natural Resources, 2801 Second Street, Davis, CA 95618, (530) 750- 1397.