



University of California
Cooperative Extension

Master Food Preserver

Vegetables: Preserve & Serve Processes

Summer & Fall 2019

Presented by UCCE Master Food Preserver Program of Central Sierra

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UC Master Food Preserver Program Mission:
**To teach research-based practices of safe home food preservation
to the residents of California.**

Funding for *Vegetables: Preserve & Serve Processes* was made possible by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service through grant AM170100XXXXG011. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

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1: Food Safety

Food Safety Basics

pH Values of Foods

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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 on page 4 of this document 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:

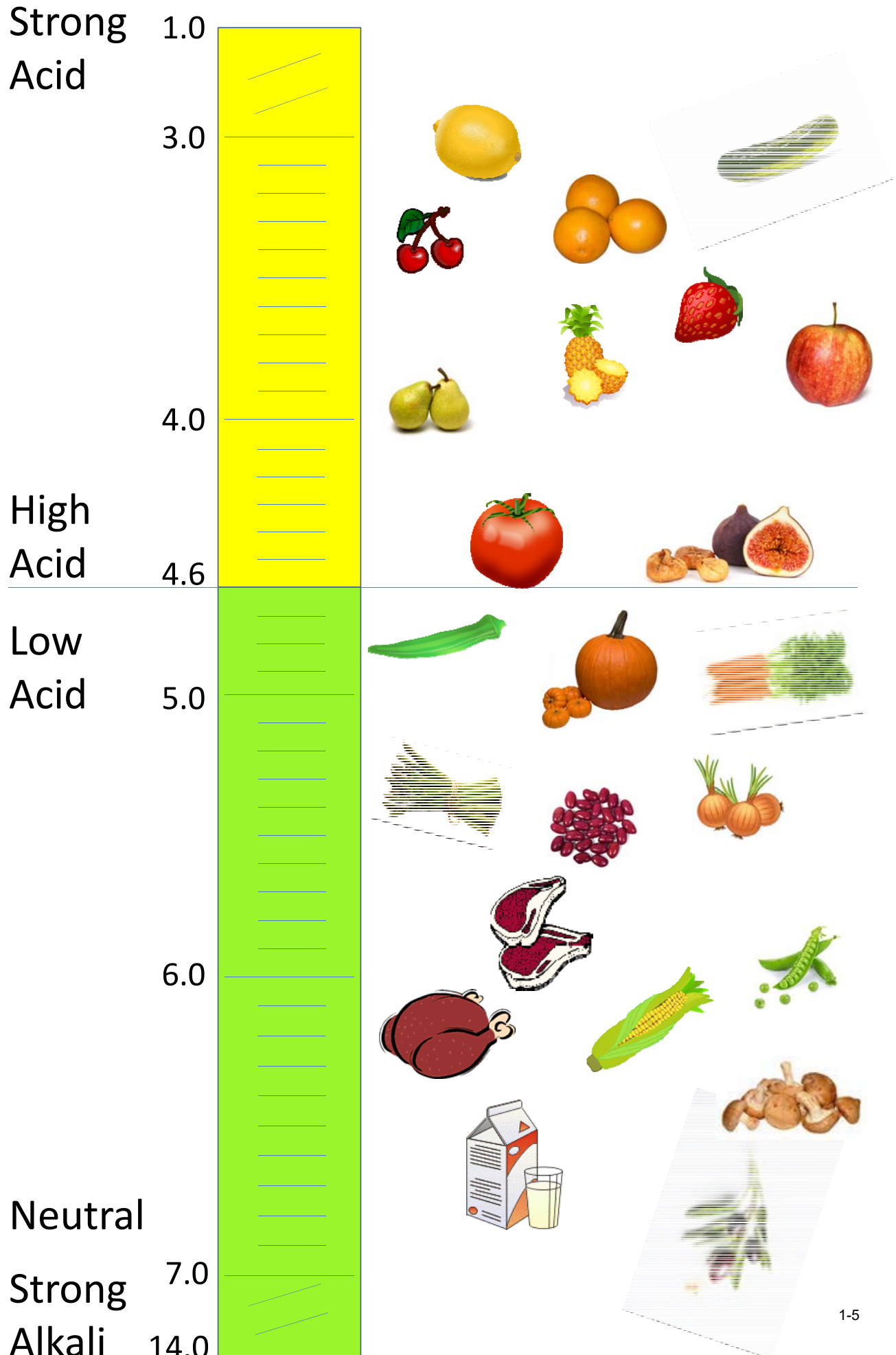
- Wear rubber or heavy plastic gloves to clean up contaminated work surfaces and equipment, including can openers and clothing that may have come in contact with suspect foods or liquids.
- Use a fresh solution of 1 part unscented, liquid, household, chlorine bleach (5 to 6% sodium hypochlorite) to 5 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

- 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)
- Ball Complete Book of Home Preserving, 2006 and 2012
- University of California Publications
- Cooperative Extension Offices (all 50 states)
- Package inserts included with name-brand pectins

pH Value of Various Foods



Temperatures for Food Preservation

Canning temperature for low acid foods in a pressure canner



Temperature needed to destroy *Clostridium Botulinum* spores.

240°F

Canning temperature for high acid foods in either a boiling water canner or atmospheric steam canner



Water boils at 212°F at sea level and at lower temperature as altitude increases. Water simmers at around 180°F. Boiling destroys most bacteria, yeasts and molds. Time needed to kill these increases as temperature decreases.

212°F

180°F

165°F

Temperature range for drying foods in a dehydrator



Warming temperatures prevent growth but may allow survival of some microorganisms.

140°F

80°F

DANGER ZONE: Temperatures in this zone allow rapid growth of bacteria, yeasts, molds and production of toxins by some bacteria and molds.

Best storage temperatures for canned and dried foods

60°F

50°F

40°F

Water Freezes



Best storage temperatures for frozen foods

32°F

Cold temperatures permit slow growth of some bacteria, yeasts and molds.

0°F

-10°F

Freezing temperatures stop growth of microorganisms, but may allow some to survive.



Cleaning & Sanitizing the Kitchen

Using inexpensive household food-safe products

TAKE A LOOK INSIDE

P2 *Common Household Products that are Effective Sanitizers on Hard Surfaces.*

P3 *Steps for Using Vinegar OR Hydrogen Peroxide to Sanitize.*

P4 *What About “Green” Sanitizers?*



Consumers can protect themselves by preventing the spread of germs by both cleaning and sanitizing surfaces where food is prepared.

Cleaning definition: removing dirt from food preparation surfaces in the kitchen. Surfaces can be counters, cutting boards, dishes, knives, utensils, pots and pans.

Cleaning steps:

1. Wash surface with soap and warm water.
2. Rinse with clean water.
3. Air dry OR dry with a clean paper towel.

Sanitizing definition: the reduction of germs to a safe level so illness is unlikely to occur. The most commonly known germs causing illness are *Salmonella*, *Campylobacter*, and *Norovirus*. Toxin-producing *E. coli* and *Listeria monocytogenes* are less common in the kitchen, but cause very serious, if not deadly, illnesses.

Sanitizing steps: (See the table on page two)

1. Spray surface with sanitizer of choice.
2. Leave sanitizer on the surface for the suggested amount of time.
3. Allow to air dry OR dry with a clean paper towel.

Effective cleaning involves both cleaning and sanitizing surfaces BEFORE and AFTER use.

Common household products effective as sanitizers on food preparation surfaces:

ITEM	CONCENTRATION	TEMPERATURE	CONTACT TIME	<i>LISTERIA MONOCYTOGENES</i>	<i>E. COLI</i>	<i>SALMONELLA</i>
Chlorine Bleach (6%)	1 scant teaspoon to 1 quart water	Room Temperature (77°F or 25°C)	1 minute	✓	✓	✓
Hydrogen Peroxide (3%)	Undiluted	130°F or 55°C	1 minute	✓	✓	✓
Hydrogen Peroxide (3%)	Undiluted	Room Temperature (77°F or 25°C)	10 minutes		✓	✓
White Distilled Vinegar (5%)	Undiluted	130°F or 55°C	1 minute	✓	✓	✓
White Distilled Vinegar (5%)	Undiluted	Room Temperature (77°F or 25°C)	10 minutes			✓
Baking Soda	Not an effective sanitizer at any temperature or time, even after 10 minutes of contact time					

✓ means that the product was effective at reducing the presence of the pathogen with more than 99.999% reduction.

Source: Yang, H., Kendall, P., Medeiros, L., Sofos, J. (2009) Inactivation of *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella* Typhimurium with compounds available in households. *J. Food Prot.* 72(6); 1201-1208

Points to remember when using household chlorine bleach:

- tip** • Diluted chlorine bleach is a **very effective sanitizer**. The amount needed is very small and no chlorine residue will be left behind using a concentration of 1 scant teaspoon of chlorine bleach to 1 quart of water.
- Chlorine reacts quickly and becomes inactive quickly. Detergents and dirt inactivate chlorine; surfaces must be cleaned first to ensure effective sanitation.

- Chlorine solutions need to be made at least weekly and must be stored in a dark place.
- Do not use chlorine with added fragrance - this is not food-safe.



Steps for using vinegar OR hydrogen peroxide to sanitize:

Both products when heated will produce an odor. This odor is not harmful to you. Test sanitizer in an unseen place to be sure hydrogen peroxide will not discolor or fade the surface.

tip Option 1:

1. Heat either 4 oz (1/2 C) white distilled vinegar **OR** hydrogen peroxide in a sauce pan to 150°F or 66°C. (Handle **CAREFULLY** when heating as the liquids will be warm but not hot.)
2. Using a funnel pour the **warm** solution into a spray bottle.
3. Immediately spray on kitchen surfaces, counter tops, sink, refrigerator interior, faucets.
4. Let sit for 1 minute then wipe with a clean paper towel.

tip Option 2: *(if warming the solution is not an option)*

1. Use either 4 oz (1/2 C) white distilled vinegar **OR** hydrogen peroxide
2. Using a funnel, pour **room temperature** solution into spray bottle.
3. Spray onto kitchen surfaces, counter tops, refrigerator interior, and faucets.
4. To be effective solution **MUST sit for 10 minutes** then wipe with a clean paper towel.

WARNING: NEVER MIX HYDROGEN PEROXIDE OR VINEGAR TOGETHER.

How often should you sanitize?

Sanitizers kill living organisms, which is why they are so important in controlling harmful pathogens. How often should the kitchen be sanitized is best determined by your personal situation. Some questions to think about when trying to decide how often the kitchen should be sanitized are:

1. Do you have elderly people living with you?
2. Do you have someone in your house that is severely ill or immune-compromised?
3. Do you have children under the age of 5 in your home?
4. Do you have indoor or outdoor pets?

You can sanitize daily. Think about your situation and decide what is right for you.



What about “GREEN” sanitizers?

“Green” is a commonly used term by the public or the media to convey a product is “safe” for the environment. Over the past 10 years there has been an increase in the number of cleaning products labeled; “environmentally friendly”, “eco-safe”, and “environmentally safe” as a result of consumer demand. These terms suggest that the product is not going to cause harm to the environment; however, there is no standard or regulation for when or how these statements can be used. The Environmental Protection Agency (EPA) has started a

program to help the consumer purchase environmentally safe products. Industries may submit their products to be reviewed by an EPA approved scientific team. Each ingredient in the product is reviewed for chemicals that are the least concern for their class; e.g. low concern to humans, biodegrades easily, degraded by-products will not produce pollutants, etc. If you would like more information about the EPA’s Design for the Environment (DfE) program, please go to the website:

http://www.epa.gov/oppt/dfe/product_label_consumer.html.



Look for the label!

The household products suggested for use as sanitizers at the recommended dilutions are safe for home use and are safe for the environment. Vinegar and hydrogen peroxide will not be found on the DfE website although these two products do meet the DfE criteria.

WANT TO KNOW MORE?

Check out these additional resources...

Government Food Safety Information:
www.foodsafety.gov

Centers for Disease Control and Prevention:
www.cdc.gov/foodsafety

Food Safety Information from OSU:
foodsafety.osu.edu

Funded by USDA, National Research Initiative under Agreement # 2004-51110-02160 and 2005-51110-03278. © 2004, Revised 2010, The Ohio State University

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Sources:

1. Environmental Protection Agency (EPA) Design for the environment: An EPA partnership program. http://www.epa.gov/dfe/product_label_consumer.html, March 2010, Accessed May 27, 2010
2. Federal Trade Commission, Sorting out “green” advertising claims. <http://www.ftc.gov/bcp/edu/pubs/consumer/general/gen02.shtm>, April 1999, Accessed May 27, 2010
3. McGlynn, W. Guidelines for the use of chlorine bleach as a sanitizer in food processing operations, Oklahoma Cooperative Extension Service, Division of

Agricultural Science and Natural Resources. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-963/FAPC-116web.pdf> Accessed May 27, 2010

4. National Restaurant Association Solutions™, ServSafe Coursebook 5th edition.
5. Office of Pollution Prevention and Toxic, Chemicals in the environment: Chlorine (CAS NO. 7782-50-5) USEPA http://www.epa.gov/chemfact/f_chlori.txt, April 1994, Accessed May 27, 2010
6. Yang, H., Kendall, P., Medeiros, L., Sofos, J. Inactivation of *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella* Typhimurium with compounds available in households. *J. Food Prot* 72(6); 1201-1208



Photography by Abigail Saxton.
Design by Margaux Baldrige, The Office of Technology and Enhanced Learning, The College of Education and Human Ecology, The Ohio State University.

2. Freezing

Freezing Vegetables Basics
Freezing Vegetables Guide

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 *Freezing Vegetable Guide* 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 1-1/2 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.

Packaging and Shelf Life

Packaging and Labeling Foods

- Cool all foods 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	1 ½ inch	1 ½ inch

*Fruit packed in juice, sugar, syrup or water; crushed or pureéd 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)
- So Easy to Preserve Fifth Edition. 2006. Bulletin 989. Cooperative Extension/The University of Georgia/Athens

Freezing Vegetables Guide

Vegetable	Pre-Treatment Instructions
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-inch thick. Blanch 2 minutes. Cool
Cauliflower	Select firm, white heads. Wash and trim. Split heads into pieces 1-inch 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-inch 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.

Vegetable	Pre-Treatment Instructions
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 1/4 to 1/2-inch 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 1/2 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 1-1/2 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 1/4-inch slices 3 minutes, 1-1/2 inch 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 papercopy 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

So Easy to Preserve Fifth Edition. 2006. Bulletin 989. Cooperative Extension/The University of Georgia/Athens

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3. Boiling/Steam Canning

Canning Basics

Checklists: Boiling and Steam Canning

Quick-Process Pickling Fundamentals

Salsas

Savory Spreads

Chutneys & Tomatoes

Canning 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.

Canning Basics

General Pressure Canning Supplies

- Boiling water or atmospheric steam canner (a pot with a rack on the bottom works well)
- 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
- Reputable recipe that follows the USDA recommended canning procedures

Get Ready ... Be Prepared!

- Read the recipe thoroughly before you begin.
- Measure out all ingredients.
- Have all of your utensils at hand.
- Wash jars in hot soapy water and rinse well. Check jars for imperfections.
- Place clean jars in the canner and heat the jars.
- Prepare lids and rings according to the manufacturer's instructions. (Current boxes of lids don't require pre-heating, older ones did.)
- Do a "dry run" of the recipe to make sure you have all of your materials.

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°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. Heat home canning jars in hot water, not boiling, in your canner until ready for use. Add water to the jars to prevent flotation, pour water into canner before filling jars. Simmer water and jars over medium heat. Keep jars hot until ready for use. 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
1,000 – 3,000	5 minutes
3,001 – 6,000	10 minutes
6,001 – 8,000	15 minutes

Using an Atmospheric Steam Canner

1. 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.
2. Add enough water to the base of the canner to cover the rack. (Follow manufacturer recommendations.)

3. 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.
4. Heat jars prior to filling with hot liquid (raw or hot pack). Do not allow the jars to cool before filling.
5. Load filled jars, fitted with lids, onto the canner rack and place the lid on the canner base.
6. 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.
7. 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).
8. 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.
9. 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.
10. At the end of the processing time, turn off the heat and remove the lid, lifting the lid away from you.
11. 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
1,000 – 3,000	5 minutes
3,001 – 6,000	10 minutes
6,001 – 8,000	15 minutes

Using a Boiling Water Canner

1. 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.
2. 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.
3. 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.
4. 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.
5. Turn heat to its highest position, cover the canner with its lid, and heat until the water in the canner boils vigorously.

6. Set the timer for the total minutes required for processing the food, adjusting for altitude.
7. 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.
8. Add more boiling water, if needed, to keep the water level above the jars.
9. 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.
10. 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.

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, ST = steam, 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)
- University of California Publications
- Cooperative Extension Offices (all 50 states)
- Package inserts included with name-brand pectins
- For more links: <http://mfp.ucanr.edu>

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Boiling Water Canning Steps

1. Use reputable recipe
2. Prep food & jars
Sterilize if <10 minutes processing
3. Heat canner water (*not boiling*)
Hot pack: 180°F, Raw pack: 140°F
4. Jars in canner
1-2" water over top of jars
5. Lid on; high heat
6. Vigorous boil? Start timing
Adjust for altitude;
7. Adjust heat; gentle boil
8. Ding! Timer off; heat off; lid off
9. Wait ≤ 5 minutes
10. Jars out
11. Cool 12-24 hours, wash & label



Atmospheric Steam Canning Steps

1. Use reputable recipe
2. Prep food & jars
Sterilize if <10 minutes processing
3. Heat canner water (*not boiling*)
Hot pack: 180°F, Raw pack: 140°F
4. Jars in canner
5. Lid on; high heat
6. Steady column of steam? Start timing
Green zone on temp gauge
Adjust for altitude; Max 45 minutes
7. Adjust heat; gentle boil, steady stream
8. Ding! Timer off; heat off
9. Wait ≤ 3 minutes
10. Lid off; jars out
11. Cool 12-24 hours, wash & label



Quick-Process Pickling Fundamentals

Start with the Right Equipment

- Follow a reputable recipe for the best results, as these recipes have been tested for quality, flavor, and *safety*.
- Use standard canning jars, lids, and rings.
- Cook in a deep, non-reactive, stainless steel, enameled, or glass pot.

Open Kettle Canning

- Open kettle canning involves heating the food to boiling, pouring it into the jars, applying lids, and allowing the heat of the jar to cause the lid to seal, without further processing.
- **The USDA does not recommend this method of canning. There is no processing step to ensure any pathogens trapped in the jar are killed.**

Getting Ready: Be Prepared!

- Read the recipe thoroughly before you begin. Measure out all ingredients and have all needed utensils at hand. Make sure your vinegar is 5% acidity (read label).
- Do not change the quantities of produce nor vinegar in any recipe, unless specified in a tested recipe.
- Check the jar for flaws. Wash jars, lids, and rings in hot soapy water and rinse well. Place clean jars into the boiling water canner and heat the jars.
- To prepare lids, follow the manufacturer's directions on the lid package.

Fill and Seal Jars Properly

- Fill hot jars with hot mixture. Leave headspace specified in the recipe.
- Wipe the rim with a clean, damp, paper towel.
- Place lids and rings on jars. Tighten the rings only fingertip tight.
- Paraffin, as a sealing agent, is not recommended.

When in doubt - throw it out

- **DANGER** - Never taste food that looks or smells strange to see if it can still be used. Just discard it.
- Generally foods that contain bacteria will look, smell, and taste normal.
- Generally speaking most bacteria that cause food borne illness are odorless, colorless, and tasteless.

Pickles

A pickle is any fruit or vegetable preserved in vinegar or brine.

- **Brine pickles** are products fermented in salt brine. Regular dill pickles and sauerkraut are fermented and cured for about 3 weeks. They may be canned or stored in the refrigerator for 4-6 months.
- **Refrigerator dills** are not heat processed and must be stored in the refrigerator for 4-6 months.
- **Fresh-pack or quick-process pickles** are not fermented; some are brined several hours or overnight, then drained and covered with vinegar and seasonings.

- **Fruit pickles** are fruits that are pickled in spicy, sweet-sour syrup.
- **Relishes** are prepared using chopped products and cooked in a spicy vinegar solution.

Be sure to remove and discard a 1/16-inch slice from the blossom end of fresh cucumbers. Blossoms may contain an enzyme which causes excessive softening of cucumber pickles.

Raw (Cold) Pack or Hot-Pack

- The raw, or cold-pack, method means packing the cold or raw food into a hot jar, then adding a boiling liquid brine. The jars are then processed in either a boiling-water or steam canner.
- The hot-pack method requires a short pre-cooking period (boiling or heating in some manner). Then the boiling-hot product is packed into clean, hot jars with a boiling liquid brine and processed immediately. The hot-pack method is more satisfactory for some vegetables and fruits and it is recommended because it is easier to have a tighter pack and, since food expels air when heated, less float. Hot packing food also helps retain the food's color.
- Use the method suggested in your tested recipe for best flavor and texture.

Salt

- Use canning or pickling salt. Table salt contains anti-caking ingredients which can cloud the brine.
- Since flake salt varies in density (grain size), it is not recommended for making pickled and fermented foods. (If you must substitute Kosher salt, it is lighter than canning salt so you need to use the same amount of salt by weight, not volume. In our class experiment, **1/2 cup pickling salt = 1 cup plus 2 Tablespoons Kosher salt.**)

Vinegar

The level of acidity in a pickled product is as important to its safety as it is to taste and texture. When pickling, always use high-quality commercial vinegars with 5% acidity or higher (also listed as 50-grain). The acidity should be listed on the label; if not, assume it is not 5%.

- Do not alter vinegar, food, or water proportions in a recipe or use a vinegar with unknown acidity. Doing so may alter its preservative effect and undermine the safety of the product.
- Use only recipes with tested proportions of ingredients.
- White distilled and cider vinegars of 5% acidity are recommended. White vinegar is usually preferred when light color is desirable. Commercial white wine vinegar often results in a smoother flavor. Champaign vinegar may also be used; it usually has a 7% acidity level.
- Do not use homemade vinegar as the acidity is unknown.

Water

- Soft water makes the best brine for pickles
- Hard water may cause cloudiness in the brine and discolor pickles. If only hard water is available, boil and let sit for 24 hours. Skim off scum and use water from the top of the container without disturbing the sediment.

Pickles with reduced salt content

In the making of fresh-pack pickles, cucumbers are acidified quickly with vinegar. Use only tested recipes formulated to produce the proper acidity. While these pickles may be prepared safely with reduced or no salt, their quality may be noticeably lower. Both texture and flavor may be slightly, but noticeably, different than expected. You may wish to make small quantities first to determine if you like them.

However, the salt used in making fermented sauerkraut and brined pickles not only provides characteristic flavor but is also vital to safety and texture. In fermented foods, salt favors the growth of desirable bacteria

while inhibiting the growth of others. **Caution: Do not attempt to make sauerkraut or fermented pickles by cutting back on the salt required.**

Sugars

White granulated and brown sugars are most often used. Corn syrup and honey, unless called for in reliable recipes, may produce undesirable flavors.

Spices

Use fresh whole spices for the best quality and flavor in pickles. Powdered spices may cause the product to darken and become cloudy. Pickles will darken less if you tie whole spices loosely in a clean white cloth or cheesecloth bag and then remove the bag from the product before packing the jars.

Firming Agents

If good quality ingredients are used in pickling and up-to-date methods are followed, lime and alum are not needed for crisp pickles. If you choose to use firming agents, alum may be safely used to firm fermented cucumbers. Alum does not have an effect on quick-processes pickles. However, since it is unnecessary, it is not included in quick pickle recipes.

- Soaking cucumber in ice water for 4 to 5 hours prior to pickling is a safe method for making crisp pickles.
- Calcium chloride granules for pickling is often sold where you buy canning supplies. It is usually added directly to the jars of pickles. Follow the instructions on the package.
- The calcium in pickling lime does improve pickle firmness. Food-grade lime may be used as a lime-water solution for soaking fresh cucumbers 12 to 24 hours before pickling them. However, **EXCESS LIME ABSORBED BY THE CUCUMBERS MUST BE REMOVED TO MAKE SAFE PICKLES.** To remove excess lime, drain the lime-water solution, rinse and then re-soak the cucumbers in fresh water for 1 hour. Repeat the rinsing and soaking steps two more times.

Other considerations:

- **Yellow crystals on pickled asparagus:** Sometimes pickled asparagus will form yellow crystals. Do not panic! When asparagus is heated with acid (such as vinegar), rutin is drawn out of the asparagus plant. It then becomes insoluble in the vinegar and crystallizes on the exterior of the asparagus stems. In commercially canned asparagus, a small amount of tin salts are added to the pickling solution, which prevents the rutin from crystallizing.
- **Blue garlic:** Garlic contains anthocyanins, water-soluble pigments that can turn blue or purple in acidic environments such as vinegar or pickling brine; the garlic is still safe to eat. Garlic should be fresh and at the peak of maturity. Immature or sprouting garlic can turn blue in the jar. Cured garlic stays white.

For Best Results ...

- Marinate refrigerator pickles in the refrigerator for at least two weeks before serving and use within 3 months.
- Store fresh-pack/quick pickles for 4-6 weeks in a cool, dry, dark place to allow the flavors to mellow and blend.

Alternative Low-Temperature Pasteurization Process

- Low-temperature pasteurization can produce a better pickle texture, but must be done very carefully to avoid spoilage and is only acceptable for certain recipes. Fill jars with room temperature pickles. Pour 165° to 180° F liquid over the product, leaving the appropriate headspace. Remove bubbles with a rubber spatula. Wipe the jars clean and adjust lids. Process at 180°F for 30 minutes. Be sure to use a thermometer.
- **Caution: Use this process only when a recipe indicates and only for cucumbers and zucchini.**

Preventing Spoilage

Pickle products are subject to spoilage from microorganisms, particularly yeasts and molds, as well as enzymes that may affect flavor, color, and texture. Processing the pickles in a boiling-water or steam canner will prevent these problems. Standard canning jars and self-sealing lids are recommended. Processing times and procedures will vary according to food acidity and the size of food pieces.

Resources

National Center for Home Food Preservation: <http://nchfp.uga.edu/>

Complete Guide to Home Canning. 2009. 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)

Canning Vegetables, 2012. Publication 8072. University of California Ag & Natural Resources, <http://anrcatalog.ucanr.edu>.

So Easy to Preserve, Sixth Edition. 2016. Bulletin 989. Cooperative Extension/University of Georgia, Athens

Ball Blue Book Guide to Preserving. 2014. Jarden Corporation.

Ball Complete Book of Home Preserving, 2006/2012. Jarden Corporation.

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Salsa

Preserving Salsas

Salsa is one of the most popular condiments in homes today. Salsas are usually mixtures of acid and low-acid ingredients; they are an example of an acidified food. In fact, for home preserving purposes, a salsa is considered a pickle because it is acidified. The specific recipe, and sometimes preparation method, will determine if a salsa can be processed in a boiling water canner, atmospheric steam canner, or a pressure canner. A process must be scientifically determined for each recipe. It is not safe to can your own original salsa recipe; refrigerate or freeze it instead. Salsa can be safely stored in the refrigerator for several weeks or frozen for months without processing.

Salsa Ingredients

Tomatoes: Use only high-quality tomatoes for canning salsa or any other tomato product. Avoid tomatoes that are overripe or from dead or frost-killed vines. These will result in a poor-quality and potentially unsafe product. Canning is never a good way to use overripe or spoiling tomatoes.

The type of tomato you use affects the quality of your salsa. For example, paste tomatoes, such as Roma, have firmer flesh and produce thicker salsas than large slicing tomatoes. Although both types make good-tasting salsas, slicing tomatoes usually yield a thinner, waterier salsa than paste tomatoes.

Where recipes call for peeled or skinned tomatoes, remove the skin by dipping tomatoes into boiling water for 30-60 seconds or until skins split. Immerse in cold water until cool enough to handle. Slip off skins and remove cores. Remove seeds if desired.

Tomatillos: Tomatillos are also known as Mexican husk tomatoes. They do not need to be peeled or seeded, but the dry outer husk must be removed. Tomatillos can be substituted for tomatoes in any tested salsa recipe.

Fruits: Some salsa recipes in this handout contain fruit. Fruits add another dimension of flavor to traditional salsas. When canning fruit salsas, you must follow the same safety rules as tomato-based salsas. This includes using a research-tested recipe, selecting fruits in the quantity and condition described, and preparing fruits according to the directions.

Peppers: Choose high-quality peppers. Peppers range from mild to fiery in taste. Very hot peppers are usually small (1-3 inches long), mild peppers are usually bigger (4-10 inches long). Anaheim, Ancho, and Hungarian yellow wax are mild varieties. Choose a mild pepper when the recipe calls for long green chilies.

Small, very hot peppers provide a distinct taste to salsas. Jalapeno is the most popular hot pepper. Other common hot varieties include Serrano, Cayenne, Habanera and Tabasco.

The terms *chilies*, *peppers*, and *chile peppers* are used interchangeably in this handout. Although there is no clear standard for naming peppers, in many instances, chile is used for a hot pepper, or a pepper containing capsaicin, the compound that gives the heat or burning sensation in the mouth. Chile peppers are generally classified as mild, medium, or hot. Sweet peppers, such as bell peppers, do not contain any capsaicin, or heat compounds.

Any combination of hot or mild peppers may be used as long as the quantity stated in any tested recipe is not changed.

Acids: The acid ingredients used in salsa help preserve it. The addition of acid to salsa recipes for canning is necessary because the natural level of acidity may not be adequate for safety. Commonly used acids in home canning are vinegar, lemon, and lime juices. Lemon and lime juices are more acidic than vinegar, but have less effect on flavor. Use only vinegar that is at least 5% acid and only bottled lemon and lime juices. Never use

homemade vinegar or freshly squeezed lemon or lime juice because the level of acidity is variable and could result in an unsafe canned product.

Salt: Pickling or canning salt is recommended when preparing salsa recipes. It contains no anti-caking agents or iodine. Non-iodized table salt can also be used in salsa recipes.

Spices: Spices add flavoring to salsas. Cilantro and cumin are often used in spicy salsas. You may leave them out or reduce the amount if you prefer a salsa with a milder taste. For a stronger cilantro flavor, add fresh cilantro after opening the jar, just before serving.

Caution about additional ingredients: Adding ingredients not listed in a salsa recipe may result in an unsafe product if done before canning. This includes thickeners as well as ingredients not listed in the recipe.

Do not thicken salsas before canning. Salsa can be thickened after you open the jar by pouring off some of the liquid or adding cornstarch, tomato paste, or other thickening agents.

The flavor can be enhanced with additional ingredients such as corn, black beans, or other additions just before serving. Addition before canning may result in an unsafe product.

Adjustments to Salsa Recipes

Some ingredients in salsa recipes can be adjusted to suit personal tastes. The changes are primarily limited to ingredient type. It is important not to change the amount of any ingredient, with the exception of dry spices. The table below summarizes the adjustments that can be made to the recipes in this handout without affecting the safety of your canned salsa.

Ingredients	Recipe Adjustments
Tomatoes	<ul style="list-style-type: none"> As long as tomatoes are in good condition, any variety can be used. Paste tomatoes, such as Romas, have more solid tissue and will produce a salsa with a thicker texture. Slicing tomatoes will produce a runny, more watery salsa. Under ripe green tomatoes or tomatillos can be substituted for ripe tomatoes. Although salsas are traditionally made with red tomatoes, any color of tomato can be used.
Peppers	<ul style="list-style-type: none"> One type of pepper can be substituted for another. Select any combination of hot and mild pepper to create a flavor you like, as long as you do not exceed the total amount specified. (For example, if the recipe calls for 2 cups of peppers, any mixture of hot and mild peppers can be used.) Bell peppers are an acceptable substitution for some or all of the long green chilies. Do not substitute the same number of whole peppers of a large size for the same number of peppers of a smaller size. (For example, do not use 6 bell peppers or long chilies in place of 6 jalapenos or serranos.) Canned chilies may be used in place of fresh.
Onions	<ul style="list-style-type: none"> Red, yellow, or white onions can be substituted for each other. Do not increase the total amount of onions. Green onions cannot be used in place of bulb onions. Do not use green onions in a canned salsa recipe unless they are specified as an ingredient.
Fruits	<ul style="list-style-type: none"> Use fruits in the condition described in the recipe. When a recipe calls for green or unripe fruits do not use ripe fruits. This will change the final acidity of the mixture, resulting in an unsafe product. It is not safe to substitute one type of fruit for another.

Ingredients	Recipe Adjustments (cont.)
Acids	<ul style="list-style-type: none"> • Any type of vinegar can be used as long as it is 5% acidity. White vinegar has a tart flavor but will not discolor the salsa. Cider vinegar has a milder flavor but may affect the color of the final product. Flavored or other specialty vinegars can be used as long as they meet acidity guidelines. • Never reduce the amount of vinegar, lemon juice, or lime juice in a recipe. An equal amount of bottled lemon or lime juice can be substituted for vinegar when the recipe calls for vinegar. The reverse is not true. When lemon or lime juice is the acid called for in the recipe, vinegar cannot be substituted. This is because vinegar is a less acidic than lemon or lime juice, and the substitution would result in an unsafe salsa. • Key lime juice should not be used as lime juice. • If prepared salsa is too tart, a small amount of sugar can be added after opening to offset the acidic taste.
Spices Herbs	<ul style="list-style-type: none"> • The amounts of dried herbs or spices can be altered. • It is not safe to add or increase the amounts of fresh herbs or garlic before canning because they affect the acidity level.

Resources

National Center for Home Food Preservation: <http://nchfp.uga.edu/>

Complete Guide to Home Canning. 2015. 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)

So Easy to Preserve, Sixth Edition. 2014. Bulletin 989. Cooperative Extension/The University of Georgia/Athens

Salsa Recipes for Canning. 2014. Publication PNW395. <https://catalog.extension.oregonstate.edu/pnw395>

Ball Complete Book of Home Preserving, 2006/2012. Jarden Corporation.

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Savory Spreads

Jams, jellies, and other soft spreads are foods with a variety of textures, flavors, and colors. They all consist of fruits or vegetables or herbs, preserved mostly by means of sugar, and thickened or jellied to some extent. Most of the time soft spreads are made with fruit, but vegetables and herbs can give them a savory taste that livens up meats, burgers, and more.

Jams are made by cooking crushed or chopped produce with sugar. They are thick, sweet spreads that tend to hold their shape but are less firm than jelly. The shape of produce pieces are not retained when making jam. Jam has a uniform consistency and is thick enough to spread.

Jellies are usually made by cooking juice with sugar and prepared in a way that keeps the juice crystal clear and shimmering. It should be firm enough to hold its shape when turned out of the container but should quiver when the container is moved. When cut, it should be tender yet retain the angle of the cut. Jelly should have a flavorful fresh taste that is not too tart and not too sweet.

Marmalades are soft jellies containing small pieces or slices of produce or fruit peel evenly suspended in the transparent jelly. They usually include citrus.

Butters are soft spreads made by cooking fruit pulp (sometimes mixed with vegetables) with sugar to a thick spreadable consistency. They are thick enough to mound on a spoon. Spices are often added.

Basic Ingredients

For an acceptable jam or jelly, the proper proportions of produce, sugar, acid and pectin are needed.

Produce - The produce gives each spread its unique flavor and color. It also supplies the liquid to dissolve the rest of the necessary ingredients and furnishes some or all of the pectin and acid. High-quality, flavorful fruits make the best jellied products.

Sugar - Sugar serves as a preserving agent, contributes flavor, and aids in gelling. Cane and beet sugar are the usual sources of sugar for jelly or jam. Corn syrup and honey may be used to replace part of the sugar in recipes, but too much will mask the fruit flavor and alter the gel structure. Use tested recipes for replacing sugar with honey and corn syrup. Do not try to reduce the amount of sugar in traditional recipes. Too little sugar prevents gelling and may allow yeasts and molds to grow.

Acid – Acid adds flavor. The proper level of acidity is critical to gel formation. If there is too little acid, the gel will never set; if there is too much acid, the gel will lose liquid (weep). For fruits low in acid, add lemon juice or other acid ingredients as directed. Commercial pectin products usually contain acids which help to ensure gelling. If making a product with vegetables, the recipe will call for additional acid, usually in the form of commercial lemon or lime juice, which has a known 5% acidity.

Pectin - Pectin is a substance found in fruits that forms a gel if it is in the right combination with acid and sugar. All fruits contain some pectin. When making savory spreads the recipe will most likely require added pectin.

Commercial Pectin by Type and Other Thickeners

Commercial pectin is extracted from apple cores or the white layers of citrus fruit and usually contains added acid to ensure jelling. With commercially available pectin, quality jams and jellies may be made with all produce, including those low in natural pectin. For successful products, use pectin as directed and do not exchange one type of pectin for another. Measure ingredients exactly and prepare one batch at a time. Doubling a recipe may prevent proper jelling. Purchase fresh pectin each year. Old pectin may result in poor gels. Preservatives may be included in commercial pectin to prevent microbial spoilage of the finished products.

The gelling ability of various pectins differs. To make uniformly gelled products, be sure to add the quantities of commercial pectin to specific fruits as instructed on each package. Overcooking may break down pectin and prevent proper gelling.

Make one batch at a time according to the recipe. Increasing the quantities often results in soft gels. Stir constantly while cooking to prevent burning. Recipes are developed for specific jar sizes. If jellies are filled into larger jars, excessively soft products may result. To use 4-ounce jars or 12-ounce jars for soft spreads, follow the same processing time as given for 8-ounce jars.

Commercially available pectin is categorized by type: regular or modified pectin. Included below are several different brands that are available locally or on the Internet.

Regular pectin is available in both liquid and powdered forms and is used primarily to make full-sugar jams and jellies. Follow the directions that come with the package and do not reduce the sugar or substitute the sugar with other types of sweeteners. Some regular pectin includes special recipes that have been formulated so that no added sugar is needed. However, each package of commercial regular pectin does contain some sugar as noted below. Artificial sweetener is often added in the recipe. The shelf life for regular pectin is one year for best results.

Modified pectin is available in powdered form and may be used to make low- and no-sugar jams and jellies and other fruit spreads with sugar substitutes or no sweeteners that are lower in calories than products made with regular pectin.

Regular Pectin

Certo® Premium Liquid Fruit Pectin is a liquid pectin which contains lactic acid and citric acid to help form a gel. Certo liquid pectin may be used for cooked or no-cook freezer jams and jellies. Do not reduce the amount of sugar or substitute artificial sweeteners. Sodium benzoate is an added preservative. One box (6 fluid ounces/two pouches) typically makes one to two batches of jam or jelly. For more information, check www.kraftfoods.com/surejell/.

Ball® RealFruit Liquid Pectin is a liquid pectin for making homemade jams and jellies which contains citric acid and lactic acid to assist in gel formation, potassium citrate to control acidity, and sodium benzoate is an added preservative. This product is formulated for less foam formation. One box (6 fluid ounces/two pouches) typically makes one to two batches of jam or jelly. For more information, check www.freshpreserving.com.

Sure-Jell® Premium Fruit Pectin (Yellow Box) is a powdered pectin for use in making cooked and no-cook freezer jams and jellies. Fumaric acid is added to assist in gel formation. No preservatives are added. Do not reduce the amount of sugar or use artificial sweeteners. One 1.75 ounce box typically makes one batch of jam or jelly. For more information, check www.kraftfoods.com/surejell/.

Ball® RealFruit Classic Pectin is a powdered pectin that can be used to make cooked jams and jellies and no-cook freezer jams. Citric acid is added to assist in gel formation and dextrose as an added sweetener. Use the amount of sugar specified in the recipes included in the package. One 4.7 ounce jar makes approximately 22 half-pints of jam or jelly. For more information, check Ball's website www.freshpreserving.com.

MCP® Premium Fruit Pectin is a powdered pectin that contains citric acid to aid in forming a gel and dextrose as an added sweetener. No preservatives are added. MCP powdered pectin may be used for cooked and no-cook freezer jams and jellies. Sugar should not be reduced or artificial sweeteners substituted. One 2 ounce box typically makes one batch of jam or jelly. For more information, check www.kraftfoods.com/surejell/.

Mrs. Wages® Fruit Pectin Home Jelly is a powdered pectin that can be used for cooked jams and jellies and for uncooked freezer jams. Fumaric acid is added to ensure gel formation. Preservatives are not added. Use the exact amount of sugar required in the recipe provided with the pectin. For more information, check www.mrswages.com.

Modified Pectin

Two types of modified pectins are available for home use to make reduced calorie jams and jellies. One type will form a gel with one-third less sugar. The other type, low-methoxyl pectin, requires a calcium source for gel formation.

Sure-Jell® Premium Fruit Pectin (Pink Box) is a *modified* pectin that can be used for making cooked jams and jellies and no-cook freezer jams and jellies with at least 25% less sugar than traditional recipes, or Splenda can be added to make jam and jelly with no added sugar. Dextrose is an added sweetener and fumaric acid and sodium citrate are added to help with gel formation. For more information, check www.craftfoods.com/surejell/.

Mrs. Wages® Light Home Jelly is a *low-methoxyl* powdered fruit pectin. Jams and jellies can be made with or without sugar or with artificial sweeteners using this pectin. Calcium phosphate is added to provide the calcium necessary to form a gel without added sugar. Fumaric acid is the added acid, and potassium sorbate is included as a preservative. For more information, check www.mrswages.com.

Ball® RealFruit Low or No-Sugar Needed Fruit Pectin is a *low-methoxyl* powdered pectin that can be used to make cooked jams and jellies and no-cook freezer jams and jellies. This pectin includes dextrose as an added sweetener, citric acid to assist in gel formation, and calcium ascorbate to help retain color. Products may be sweetened with any type of sugar, honey, or artificial sweeteners or no sweetener. One 4.7 ounce jar makes approximately 22 half-pints of jam or jelly. For more information, check www.freshpreserving.com.

Pomona's Pectin® is a *low methoxyl* powdered citrus pectin with no dextrose or preservatives. Cooked jams and jellies, including freezer jam, may be sweetened with sugar, honey, agave, xylitol, fruit juice concentrate and stevia. One 1.1 ounce box typically makes two to four batches of jam or jelly. According to the manufacturer, Pomona's Pectin keeps indefinitely. For more information, check www.pomonapectin.com.

Gelatin

Gelatin, a protein substance derived from collagen, may be used in refrigerator soft spreads. Products made with gelatin should not be processed and must be refrigerated and used within one month.

Knox Unflavored Gelatin® contains gelatin, not pectin. Gelatin is used in some jam and jelly recipes as a thickener. These products need to be refrigerated to remain thickened and to prevent mold growth. Artificial sweeteners can be used with jam and jelly recipes made with gelatin.

Canning Jams, Jellies and Other Soft Spreads

Jams, jellies and other soft spreads are considered high-acid foods and may be safely canned using either a boiling water canner or atmospheric steam canner. Follow recipe directions for canning your product for long-term storage. As a general guideline, full-sugar jams, jellies and other soft spreads should be placed in sterilized jars and processed in a boiling water or atmospheric steam canner for 5 minutes at altitudes of 0-1,000 feet. Processing time should be increased to 10 minutes if jars have not been sterilized. Add 1 minute to the processing time for each 1,000 feet of additional altitude. The basic processing time for low- or reduced-sugar jams, jellies and other soft spreads should be increased by an additional 5 minutes to a total of 10 minutes and, again, adjusted for altitude differences by adding 1 minute to the processing time for each 1,000 feet of altitude in excess of 1,000 feet.

Chutneys and Tomatoes

Chutney

Chutney is a relish-type condiment; its increasing popularity reflects the inclusion of ethnic world cuisines in the Western diet.

The term chutney includes several different varieties of sauce-type foods, drawn from traditional East Indian cuisine. The main ingredient may be an herb such as cilantro or mint; a flavoring ingredient such as coconut, onion, ginger, tamarind; or, in the most common form, chopped fruit or vegetables, simmered with spices, onion, sugar and vinegar. Fruit-based chutneys are usually cooked, then canned or refrigerated. Other chutneys like cilantro, onion, coconut, etc. are usually eaten fresh, with minimal, if any, cooking.

Fruit chutneys are most commonly available and varieties include mango, apple, apricot, cranberry, date, papaya, peach, pear, pineapple, plum, tomato and mixed fruit, to which raisins and nuts may be added to complement the texture. The result is a sweet-sour-spicy-hot versatile blend—an adventure for the taste buds.

Several different factors contribute to the ‘preserved’ nature of this product:

1. The acidity (low pH) of the chutney prevents growth of several spoilage and pathogenic bacteria, molds and yeasts. This acidity is derived from the added vinegar and the natural acids of the fruit.
2. Cooking the mixture to concentrate it lowers available moisture that is needed for microbial growth. The cooking step also kills most microorganisms that may be present.
3. Processing the filled jars in a canner uses additional heat to kill spoilage organisms that might contaminate the product as jars are filled and to produce a vacuum seal for later storage. If the two-piece canning lid is applied correctly, air is driven out of the headspace while the jars are in the canner and a vacuum seal is formed upon cooling. For most chutneys, a boiling water or steam canning process is adequate, but other foods may require a pressure process.
4. During storage in the sealed jar, oxygen and additional microbial contamination is kept from the product. Too much oxygen left in the jar will cause interactions with food components that lead to quality losses (for example, undesirable changes in color, texture, and flavor).

Uses for Chutney

Chutney is a perfect accompaniment to East Indian food; however, it can also be used as a side dish, sandwich spread, dip, an accompaniment to cheese and crackers, or as an ingredient to enhance the flavor of everyday dishes like chicken salad, casseroles, omelets and grilled fish.

Chutney Ingredients

- **Tomatoes:** Use only high-quality tomatoes for canning chutneys. Avoid tomatoes that are overripe or from dead or frost-killed vines. These will result in a poor-quality and potentially unsafe product. Canning is never a good way to use overripe or spoiling tomatoes.

Use the type of tomato specified in the chutney recipe as this will determine the final flavor profile.

Where recipes call for peeled or skinned tomatoes, remove the skin by dipping tomatoes into boiling water for 30-60 seconds or until skins split. Immerse in cold water until cool enough to handle. Slip off skins and remove cores. Remove seeds if desired.

- **Fruits:** Always select fruits in the quantity and condition described in the chutney recipe, and prepare fruits according to the directions. Common fruits used in chutneys include: Apples, apricots, cranberries, dates, prunes, bananas, cherries, kiwi, limes, lemons, oranges, rhubarb, papaya, peach, pear, nectarines, plums, raisins, mangos* as well as candied fruits or candied fruit peels.

Caution: Handling green mangoes may irritate the skin of some people in the same way as poison ivy. (They belong to the same plant family.) To avoid this reaction, wear plastic or rubber gloves while working with raw green mango. Do not touch your face, lips or eyes after touching or cutting raw green mangoes until all traces are washed away.

- **Peppers:** Choose high-quality peppers. Always select peppers in the quantity and condition described in the chutney recipe, and prepare peppers according to the directions.
- **Acids:** Vinegar is the acid ingredient used in some chutneys to ensure a safe level of acidity. Use only vinegar that is at least 5% acid. Never use homemade vinegar because the level of acidity is variable and could result in an unsafe canned product.

Common vinegars used in chutney are white vinegar, cider vinegar, malt vinegar, white wine vinegar and red wine vinegar. Use the flavor vinegar specified in the chutney recipe as this will determine the final flavor profile.

- **Salt:** When specified by the chutney recipe use pickling or canning salt. It contains no anti-caking agents or iodine.
- **Pickling Spice:** Some chutney recipes call for the use of pickling spice. Use homemade or store bought pickling spice.
- **Spices:** Common spices in chutneys are: Chili powder, red pepper flakes, ginger, garlic, turmeric, curry powder (a mixture of ground spices like cardamom, cinnamon, cloves, coriander seed, cumin, fenugreek, mustard seed, nutmeg), dry mustard, salt, pepper, allspice and cayenne pepper.
- **Herbs:** Cilantro and mint are common in these recipes.
- **Other:** In addition to the above recipes may call for granulated sugar, brown sugar, molasses, coconut, tamarind paste and nuts. Vegetables may be included such as onions, carrots and cucumbers.

Adjustments to Chutney Recipes

Unless specified by the recipe no adjustments or additions of ingredients should be made to chutney recipes to avoid adversely affecting the safety of your canned product.

Tomatoes

Contrary to popular belief, tomatoes are not a high acid food. They are borderline high acid with a pH of approximately 4.5. This is too close to the dividing line between high and low acid foods. As a result, you must acidify homemade tomato products by adding bottled lemon juice, citric acid or vinegar before they are heat processed in a boiling water, steam or pressure canner. For this reason, it is important to use a recipe from a reputable source and to acidify your tomato products correctly, for all heat processing methods. (*See below for acidification instructions.*) Note that the maximum amount of processing time in a steam canner is 45 minutes.

Today's tomato hybrids are developed to be less acidic. This is especially true for Roma-type tomatoes, which are popular for sauces. Once you add other vegetables, such as peppers, onions, celery and herbs, the acidity is lowered even further. Therefore, one needs to either follow a tested recipe from a safe source, or pressure can tomato sauces. Boiling water and steam canning is only used for high acid foods. If your tomato products are not correctly processed your product could be unsafe for consumption. Mold, *E. coli*, or botulism are real food hazards if the product is not processed correctly.

There are some tomato products in the USDA canning procedures that only have a pressure process listed (for example, tomatoes with okra or zucchini, spaghetti meat sauces, Mexican tomato sauce, etc.). If a pressure canning process is the only listed option, then it is the required processing method; do use a boiling water or steam canner if not specifically listed as a process option. These products made according to the stated recipes and procedures are low-acid food mixtures.

Acidifying Tomatoes

Most of today's tomatoes have been bred for sweetness versus acidity. For this reason, additional acid must be added to canned tomatoes, tomato puree, tomato sauce and tomato juice in the form of either bottled lemon juice, citric acid or vinegar that has an acidity of at least 5%. Most recipes call for the acidity product to be added directly to each jar.

Acidification Chart	
Bottled Lemon Juice	1 Tablespoon per Pint 2 Tablespoons per Quart
Citric Acid	¼ Teaspoon per Pint ½ Teaspoon per Quart
Vinegar, 5% acidity	2 Tablespoons per Pint 4 Tablespoons per Quart

Choosing Tomatoes

Use the best quality, vine ripened tomatoes whenever possible. Green (unripe) tomatoes are more acidic than ripe tomatoes and can be canned safely by the boiling water method. Do NOT use tomatoes from dead or frost-killed vines as the tomatoes may be lower in acid.

Sort tomatoes, picking out any that are spoiled or green. Rinse with cool water. To peel tomatoes, dip tomatoes in boiling water long enough to crack the skins (about 1 minute). Cutting a shallow X in the blossom end of the tomato speeds this process. Dip in cold water. Peel and remove cores. Save any juice to add to the hot liquid in which you boil the tomatoes. If using frozen tomatoes, run them under warm water and slip the skins off.

Both round and oblong tomatoes are suitable for canning. Oblong (plum or paste) tomatoes are meatier and less juicy than round tomatoes and often preferred by home canners as they create thicker sauces in a shorter period of time. Tomatillos may also be canned in a boiling water or steam canner but must be acidified the same as tomatoes.

The following chart shows the approximate yield by tomato type and preparation method.

Tomato Type	Purchase Unit	Purchase Weight	Preparation	Yield (Volume)
Round or Globe	3 medium	1 pound	Chopped	2-1/2 to 3 cups
	3 medium	1 pound	Peeled and crushed	1-1/2 cups
Oblong, Plum or Paste (Roma)	5 medium	1 pound	Chopped	2 cups
	5 medium	1 pound	Crushed or pureed	1-1/2 cups

Tomatoes that work well for canning

Amish	Jersey Devil	Polish Linguisa	Saucy
Amos Coli	Juliet	Pozzano	Sausage
Big Mama Paste	Mama Leone	Principe Borghese	Ten Fingers of Naples
Black Prince	Martinos Roma	Roma	Tiren
Gilberti	Opalka	Russian Big Roma	Verona
Granadero	Paisano	Salvaterres	Viva Italia
Italian Gold (Yellow)	Plum Regal	San Marzano	

Canning Tomatoes

Water levels in canners: Many tomato recipes have long processing times. You can use a steam canner only if the maximum processing time (including altitude adjustments) is no more than 45 minutes. The canner may boil dry if you process jars for longer periods of time. If using a boiling water canner, start with 2-inches of water above the jars if the processing time is 30 minutes or longer, to allow room for the boiling water to evaporate but still leave at least 1-inch of water above the jars during the entire processing 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)
- For more links: <http://mfp.ucanr.edu>

4. Pressure Canning

Pressure Canning Basics
Pressure Canner Parts
Burning Issues
Checklist: Pressure Canning
Checklist: Soups
Pressure Canning Vegetables Chart
Avoiding Common (Major & Minor) Canning Mistakes

Pressure Canning 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.

Canning Basics

General Pressure Canning Supplies

- Pressure canner (either dial or weighted gauge, big enough to hold four quart jars on a rack)
- 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
- Reputable recipe that follows the USDA recommended canning procedures

Get Ready ... Be Prepared!

- Read the recipe thoroughly before you begin.
- Measure out all ingredients.
- Have all of your utensils at hand.
- Wash jars in hot soapy water and rinse well. Check jars for imperfections.
- Place clean jars in the canner and heat the jars.
- Prepare lids and rings according to the manufacturer's instructions. (Current boxes of lids don't require pre-heating, older ones did.)
- Do a "dry run" of the recipe to make sure you have all of your materials.

Canning Processes

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

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°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 & Lids

Check jars, lids and bands for high quality. Wash jars, lids and bands in hot, soapy water. Rinse well. Heat home canning jars in hot water, not boiling, in the pressure canner until ready for use. Add water to the jars to prevent flotation, pour water into canner before filling jars. Bring to a simmer over medium heat. Keep jars hot until ready for use. Keeping jars hot prevents them from breaking when hot food is added. Leave lids and bands at room temperature for easy handling.

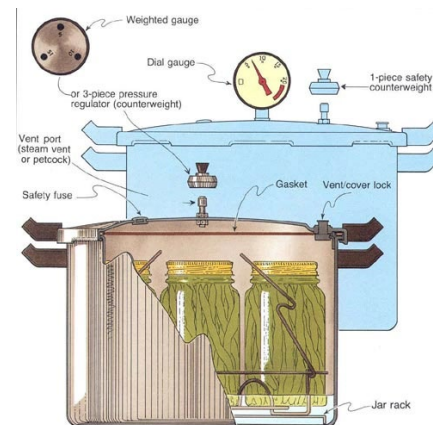
Headspace

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.

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 – 2,000 ft.	11 lb.
2,001 – 4,000 ft.	12 lb.
4,001 – 6,000 ft.	13 lb.
6,001 – 8,000 ft.	14 lb.
8,001 – 10,000 ft.	15 lb.

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 for a raw pack, 180°F for a hot pack) 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.



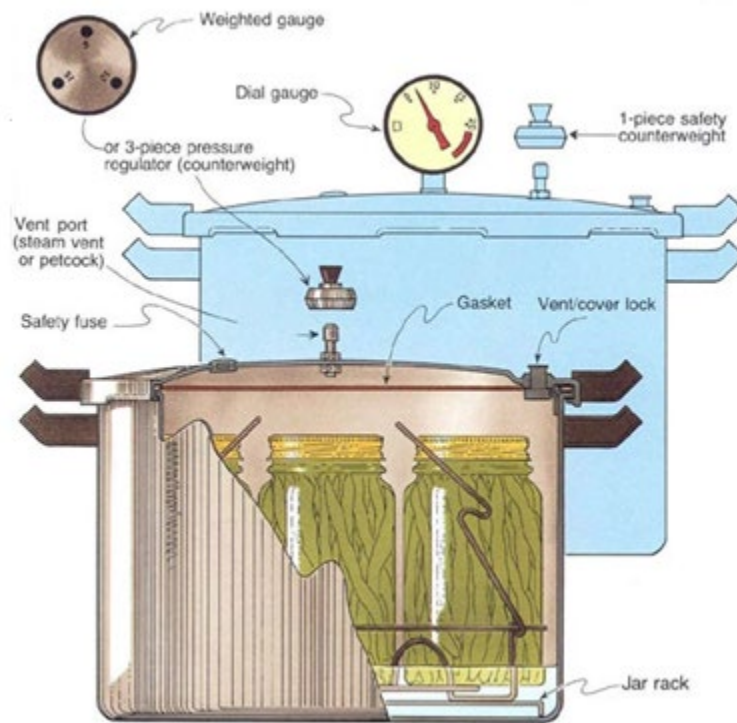
Resources

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)
- University of California Publications
- Cooperative Extension Offices (all 50 states)
- Package inserts included with name-brand pectins
- For more links: <http://mfp.ucanr.edu>

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Pressure Canner Parts



Sample Pressure Canner Models



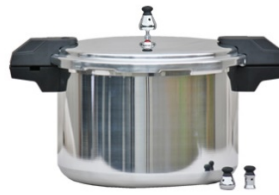
All American



*Presto
(induction
burner models
available)*



T-Fal



Mirro



*Fagor (induction
burner compatible)*

Pressure Canner Size

- Rated by volume of water they will hold, not the number of jars.
- Example: 16 quart model holds 16 quarts of water, not 16 quart jars.

Pressure Canner Parts:

- Flat rack in bottom.
- Pressure regulator or indicator.
 - Dial or weighted gauge.
 - Older: petcocks.
 - 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 stacking rack.

Weighted Gauge

- Regulates pressure inside the canner.
- Releases air/pressure from canner during process to keep pressure at maximum set by the number on the weighted gauge.
- Altitude adjustment requires increase of 5 psig pressure.
- One piece weighted gauge
 - Fitting for 5, 10 or 15 psig.
 - Do not use dead- or counter-weight from dial gauge canner or pressure cooker.
 - Mirro: “jiggles” 3 to 4 times per minute at correct pressure.
- Three piece weighted gauge
 - Number of pieces used determines 5, 10 or 15 psig.
 - Presto: rocks gently throughout entire process at correct pressure.
 - Mirro: “jiggles” 3 to 4 times per minute.

Dial Gauge

- Indicates pressure inside the canner.
- Must be checked for accuracy annually.
- More flexibility in altitude adjustments – small psig increments.
 - Has dead- or counter-weight to close open vent for pressurizing. Counter-weight not to be used for indicating pressure. Releases pressure at 15 psig.
- Read the manual! All American models are considered a weighted gauge canner; the dial is only used as a reference.

Pressure Canners vs. Cookers

- To be considered a combination pressure cooker/canner for USDA processes, the cooker must be big enough to hold at least **4** quart-size jars on a bottom rack.
- Pressure cookers with smaller volume capacities are not recommended for use in canning. Enough heat may not be delivered during the pressurizing and the cool-down periods.

Regular Maintenance

- Test dial gauges annually.
 - Pressure adjustments can be made if the gauge reads up to 2 pounds high or low.
 - Replace gauges that differ by more than 2 pounds.
 - Test replacement gauges upon arrival.
- Handle gaskets (sealing rings) carefully and clean according to manufacturer’s directions.
 - Keep clean and dry after using. Putting soapy water on a stiff new gasket helps installation.
 - Older models may require a light coat of vegetable oil annually.
 - Newer models are pre-lubricated and do not benefit from oiling.
 - Inspect; normally replace every 2 years.
- Rubber overpressure plugs: Keep clear.
 - Do not pick at or scratch during cleaning.
 - Replace every 2 years.
- Vent pipes; replace if clogged.
- Store canner with lid on loosely.
- To remove internal canner discoloration
 - Place 1 Tblsp cream of tartar per quart of water in canner.
 - Place lid on canner, boil water.
 - Bring to 5 pounds pressure, turn off heat, let pressure drop to zero.
 - Loosen lid, let sit on canner for 45-60 minutes.
 - Drain, rinse, dry.



Burning Issue: Canning in Electric Multi-Cookers

Should I can in my electric multi-cooker appliance?

Even if there are instructions for pressure canning in the manufacturer's directions, we do not support the use of the USDA canning processes in the electric, multi-cooker appliances now containing "canning" or "steam canning" buttons on their front panels. Our pressure process directions have not been developed for that type of appliance, and the canner being used does matter. Our recommendations were determined for stovetop pressure canners which hold four or more quart-size jars standing upright.

We do not know if proper thermal process development work has been done in order to justify the canning advice that is distributed with these pressure multi-cooker appliances. What we do know is that our canning processes are not recommended for use in electric pressure multicookers at this time.

Some of the major reasons we cannot recommend using electric multi-cookers for pressure canning:

1. Thermal process canning work relates the temperatures in the jars to the temperature inside the canner throughout the processing. No USDA thermal process work has been done with jars inside an electric pressure cooker, tracking the actual temperatures inside the jars throughout the process. It is ultimately the temperature and heat distribution inside the jars that matters for the destruction of microorganism in the food product. The position of jars in the canner and flow of steam around them also impacts the temperature in the jars. For example, there would be expected differences in jars piled together on their sides from those standing upright on the canner base.
2. What matters is temperature, not pressure. One manufacturer says its cooker reaches the pressure required for canning, that alone does not prove the food in the jars is heated throughout at the same rate as in the canner used for process development. A manufacturer should do process development work to document temperatures throughout the unit at a given pressure and throughout the whole process time. Just producing an interior pressure is not sufficient data for canning recommendations. For example, if air is mixed in the steam, the temperature is lower than the same pressure of pure steam. That's why a proper venting process is so important in pressure canning – to obtain a pure steam environment inside the canner. Also, one has to know how to make adjustments in pressure readings at higher altitudes. The same pressure and process time combination cannot be used at all altitudes.

3. In order to ensure the safety of the final product, the temperature in the canner must stay at minimum throughout the process time. Do power surges or drops with an electric canner cause the temperature to drop too low? How will you the user know if that happens with your cooker?
4. One of the big concerns is that the USDA low-acid pressure process times rely on a combination of heat from the time the canner is coming to pressure, during the actual process time, and then during the early stages of cooling the canner and jars. Even after the heat is turned off under the canner, at the end of the recommended process time, the food remains at high enough temperatures for another period of time that can still contribute to killing of bacteria. This retained heat while the canner has to cool naturally to 0 pounds pressure before opening is used to advantage in calculating the total sterilizing value of the process to preserve some food quality. If anything is done to shorten the cooling period, including using a very small cooker, then the food could cool down more quickly, and be under-processed. (That is why we recommend using only pressure cookers that hold four or more quart-size jars.) Bacteria are not killed in the food only during the process time; the time it takes the canner to come up to pressure, the process time, and the cool-down time all matter. There is no way at this point in time to know exactly the percentage of contribution from cooling for each of the canning recommendations.

Please note: This statement about electric cookers does NOT include the Ball Automatic Home Canner for acid foods only, which is electric, but (1) is not a "multi-cooker", but a dedicated canner, (2) comes with its own instructions and pre-set canning options for specific food preparations, and (3) has had proper thermal process development done to support the recommendations with it. Jarden Home Brands also sells an electric boiling water canner, but it is not a pressurized appliance and for canning purposes operates similar to a traditional boiling water canner. Directions from the manufacturer for this Ball canner, as well as for the Weck non-pressurized electric boiling water canners, should be followed to get them assembled and for managing temperature settings to achieve a boiling process.

May 12, 2016

National Center for Home Food Preservation

nchfp.uga.edu

Burning Issue: Canning on Portable Burners

Can I can on portable gas or electric burners?

If you have a smooth cooktop and the manufacturer says not to can on it, then you might find yourself looking for an alternative. The alternatives for canning (if you have one of these no-canning recommended smooth cooktop ranges) are either to purchase and install a permanent set of electric coil or gas burners as a range top (without an oven) or to purchase a portable electric coil or gas burner.

And that is where important decisions come in to play. An installed range top requires the utilities to support it and can be quite expensive as a second range top. As for portable burners, they are not all alike and not all portable burners are appropriate for canning. First of all, check the burner manufacturer's specifications and directions or contact their customer service department for more specific information about the appropriate use of a particular burner for canning.

We cannot endorse a particular brand, but here are a few basic guidelines for you to keep in mind when selecting a portable burner for canning purposes:

- The burner must be level, sturdy, and secure. Look for enough height to allow air to flow under the burner, but not such that it will become unsteady with a full, heavy canner resting on it. One we have tested was about 4 inches high off the counter top, on short legs that allowed air circulation underneath but was plenty stable.
- Look for a burner diameter that is no more than 4 inches smaller than the diameter of your canner. In other words, the canner should not extend more than 2 inches from the burner on any side. This is a common recommendation, but also make sure this is the recommendation for your canner brand.
- For electric burners, you want the wattage to be about equal to that of a typical household range large burner. We have been successful bringing a boiling water canner to boiling with one that is 1500W/120V, but household range burners are more typically 1750W or higher and this kind of wattage may actually be a better choice if you can find it. We have not yet tried using a pressure canner on a portable electric burner.
- You want the burner to have housing that will hold up to the high heat under the canner for long heating periods, and not damage counter tops with reflected heat. We contacted a foodservice supply store to help us identify one like this; it cost us about \$155. We used it successfully a few times to bring water to a boil, but have not used one repeatedly for canning.
- At least one pressure canner manufacturer advises not to can on any outdoor heat source. Your pressure canner can be damaged if the gas burner puts out too much heat. Higher BTU burners could also produce so much heat that the recommended come-up time for canning could be altered, potentially producing an unsafe final product.
- Again, *check manufacturer's directions and/or contact their customer service for more information about appropriate burners.* When you are asking manufacturers about canning, specify whether you are asking about pressure canning (much more heat concentration) or boiling water canning. If the manufacturer's directions have been followed, and canning problems occur, then you must take it up with the manufacturer.

November 7, 2014

National Center for Home Food Preservation

Burning Issue: Canning in Pressure Cookers

What are the process times for canning in my pressure cooker?

USDA does not have recommended processes for canning in a small pressure cooker. The recommendation for using USDA pressure processes for low-acid foods is to use a canner that holds at least four (4) quart-size jars standing upright on the rack, with the lid in place. The research for USDA pressure processes for vegetable and meat products was conducted in pressure canners that are most similar to today's 16-quart or larger pressure canners.

Pressure cookers have less metal, are smaller in diameter, and will use less water than pressure canners. The result is that the time it takes a canner to come up to processing pressure (that is, the come-up time) and the time it takes the canner to cool naturally down to 0 pounds pressure at the end of the process (known as the cool-down time) will be less than for the standard pressure canner. The come-up and cool-down times are part of the total processing heat that was used to establish USDA process times for low-acid foods. If the heat from the come-up and cool-down periods is reduced because these times are shortened, then the heat from the process time at pressure alone may not be enough to destroy targeted microorganisms for safety. That is, the food may end up underprocessed. Underprocessed low-acid canned foods are unsafe and can result in foodborne illness, including botulism poisoning, if consumed.

During earlier years of canning research, pressure saucepans were considered an alternative for home canning and it was thought that adding 10 minutes to the process times for standard canners would keep food safe. That proved not to be the case for a general, across-the-board recommendation, as there are several sizes of pressure saucepans and they were not all adequately tested. In addition, the way heat transfers (penetrates) through food during the process is affected partly by the composition of the food and not all foods and styles of preparation were tested. Later research published in journals has not resulted in an absolute recommendation either. Therefore, in the late 1980s the USDA published its recommendation to not use pressure saucepans (small cookers) for home canning.

Some manufacturers may offer process directions for smaller pressure cookers. Consumers using this equipment will need to discuss processing recommendations with those manufacturers; the USDA and National Center for Home Food Preservation recommendation is to not use them for canning with our processes.

To be considered a pressure canner for USDA processes, the canner must be able to hold at least four quart-size jars, standing upright on the canner rack, with the lid in place. It is also important to realize the canner should have a way to follow recommended venting procedures to remove air from inside the canner before it is pressurized, and to indicate that the canner remains at least at the target pressure throughout the entire process time. (Also see: *Using Pressure Canners*)

We cannot convert processes intended for use with regular pressure canners to ensure safety when canning in other types of equipment.

September 2015

National Center for Home Food Preservation

Burning Issue: Canning on Smooth Cooktops

Can I can on my smooth cooktop?

We have to say to follow manufacturer's advice because styles of smooth cooktops being manufactured differ in ways that influence suitability for canning. Some smooth cooktop manufacturers say do not can on them, while others who say it is okay still put stipulations on the diameter of the canner compared to the diameter of the burner. Boiling water or pressure canners may not be available that meet the maximum diameter pot they allow. There are several issues:

1. There can be damage to the cooktop from the excessive heat that reflects back down on the surface, especially if the canners used are too large of a diameter than is intended for the burner being used. The damage can range from discoloration of white tops to actual burner damage to cracking of the glass tops to fusion of the metal to the glass top.

And by the way, even if a manufacturer says a burner/cooktop can be used for canning, people should also be aware the scratching can occur if the aluminum canner is slid or pulled across the cooktop. This often happens with large, heavy filled canners, so people need to be careful.

2. Many of these cooktops have automatic cut-offs on their burners when heat gets excessive. If that option is built in, and the burner under a canner shuts off during the process time, then the product will be underprocessed and cannot be salvaged as a canned food. The process time must be continuous at the intended temperature, or microorganisms may survive. Also, if the pressure drops quickly, most likely liquid and maybe even food will be lost from the jar (it will spill over from the area of higher pressure inside the jar to the lower pressure now in the canner around the jar).
3. Even if boiling water canning is approved by the manufacturer, it may be necessary to fashion your own canner out of a flat-bottomed stockpot with a bottom rack inserted. Many canners do not have flat enough bottoms to work well on a smooth cooktop to be able to maintain a full boil over the tops of the jars. The pot used as a canner must also be large enough to have lots of water boiling freely around the jars, and at least 1 inch over the tops of jars. If the canner is too small, then it starts boiling faster than expected and the total required heat the jars receive in the canner even before the process time begins can be too short.
4. Some manufacturers of pressure canners do not recommend using them on a smooth cooktop. Follow the advice of your canner manufacturer.

Our recommendation, therefore, is to contact or consult information from the manufacturer of your smooth cooktop and your pressure canner, if interested in pressure canning, before making your decision to can (or not) on it. They are the recommended sources of this information and may also have up-to-date alternatives or suggestions for equipment that you can use. We also caution that you might have to be sure they understand how large your boiling water or pressure canner is, how long it must be heated at high heat, how long the hot canner may stay on the burner until it cools after the process time, and that the canner is made from aluminum (if it is).

Reviewed February 27, 2018

National Center for Home Food Preservation

Pressure Canning Processing Steps

1. Use reputable, research-based recipe
2. Prep food & jars
3. Heat 2-3" canner water (*not boiling*)
Hot pack: 180°F, Raw pack: 140°F
4. Jars in canner
5. Lid on; weight off; high heat
6. **Vent** 10 minutes
7. Weight on
8. Pressurize; lower heat
9. Start timer
10. Process; adjust heat as needed
11. Ding! Timer off; heat off
12. **Wait** until pressure drops to 0
13. Weight off
14. Cool 10 minutes **more**
15. Lid off; jars out; cool 12-24 hours

Canning Soup

No Reputable Canning Recipe?

Prep Food:

1. Select, wash, and prepare vegetables, meat and seafood.
2. Cover meat with water, cook until tender. Cool meat, remove bones.
3. Cook vegetables as described for a hot pack.
4. For each cup of dried beans or peas, add 3 cups of water, boil 2 minutes, remove from heat, soak 1 hour, heat to boil and drain.

Heat Soup:

1. Combine solid ingredients; cover with broth, tomatoes, or water.
2. Do not add thickening agents before canning (noodles or other pasta, rice, flour, cream, milk, etc.) Do not puree.
3. Boil 5 minutes. Salt to taste, if desired.

Process Soup:

1. Fill jars with half solid mixture and half soup liquid, leaving 1-inch headspace.
2. Place lids and rings on jars and process, adjust for altitude.

<i>Soups in a dial-gauge pressure canner at altitudes of:</i>						
Style of Pack	Jar Size	Process Time	0 - 2,000 ft	2,001 - 4,000 ft	4,001 - 6,000 ft	6,001 - 8,000 ft
Hot	Pints	60* min	11 lb	12 lb	13 lb	14 lb
	Quarts	75*	11	12	13	14

<i>Soups in a weighted-gauge pressure canner at altitudes of:</i>				
Style of Pack	Jar Size	Process Time	0 - 1,000 ft	Above 1,000 ft
Hot	Pints	60* min	10 lb	15 lb
	Quarts	75*	10	15

** Contains seafood? Process 100 minutes, adjust for altitude.*

Table 1. Preparing and canning vegetables

Canner type	0-1,000'	1,001-2,000'	2,001-4,000'	4,001-6,000'	over 6,000'	Processing time (minutes in pressure canner at 10 psi [weighted gauge] or 11 psi [dial	
						Pint	Quart
Dial gauge	11	11	12	13	14		
Weighted gauge	10	15	15	15	15		
Vegetable	How to prepare*					Pint	Quart
asparagus	Use 4- to 6-inch long, tender, tight-tipped spears. Wash and cut off scales (bracts). Cut into 1-inch pieces or leave whole.						
	Hot pack: Cover asparagus with boiling water and boil for 2 to 3 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					30	40
	Raw pack: Pack asparagus tightly into hot jars, leaving a 1-inch headspace. Add salt if desired. Fill with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					30	40
beans: dried kidney, etc.	Use mature dry beans or peas. Sort and remove defective or discolored beans.						
	Hot pack: Soak in cold water for 12 to 18 hours in a cool place. Drain and add fresh water. Boil 30 minutes. Pack into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Raw pack is not recommended.					75	90
beans: dried navy, etc., with tomato or molasses	Use mature dry beans. Sort and remove defective or discolored beans. Wash beans and boil 2 minutes (use 3 cups of water for 1 cup of beans). Remove from heat and soak for 1 hour. Drain and reheat to boiling using fresh water. Use this cooking liquid to make sauce.						
	Tomato sauce recipe 1: Mix 1 quart tomato juice, 3 tablespoons sugar, 2 teaspoons salt, 1 tablespoon chopped onion, and ¼ teaspoon each of ground cloves, allspice, mace, and cayenne. Add 3 cups of cooking liquid from beans. Heat to boiling.						
	Tomato sauce recipe 2: Mix 1 cup tomato catsup with 3 cups cooking liquid from beans (or plain water). Heat to boiling.						
	Molasses sauce: Mix 4 cups water or cooking liquid from beans, 3 tablespoons dark molasses, 1 tablespoon vinegar, 2 teaspoons salt, and ¾ teaspoon powdered dry mustard. Heat to boiling.						
	Hot pack: Fill hot jars three-quarters full with hot beans. Add one ¾-inch cube of pork, ham, or bacon to each jar if desired. Fill jars with heated sauce, leaving a 1-inch headspace. Remove air bubbles, wipe jar rims, adjust lids, seal, and process. Do not add any more meat or bacon than directed. Raw pack is not recommended.					65	75
beans: fresh green (snap, wax, string, or Italian)	Use tender, crisp pods. Discard diseased or rusty pods. Wash and trim ends. Cut into 1-inch pieces or leave whole.						
	Hot pack: Cover beans in boiling water and boil for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from top. If beans are left whole, pack beans standing on ends. Remove air bubbles, wipe jar rims, adjust lids, and process.					20	25
	Raw pack: Pack beans tightly into hot jars, leaving a 1-inch headspace. Add salt if desired. Fill jars with boiling water to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.					20	25
beans: fresh lima	Use young, tender, well-filled pods. Discard damaged beans. Shell and wash beans thoroughly.						
	Hot pack: Cover beans with boiling water and boil for 3 minutes. Pack loosely in hot jar, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50
	Raw pack: Pack beans loosely in hot jars, leaving a 1-inch headspace for pints or 1½-inch (small beans) or 1¾-inch (large beans) headspace for quarts. Add salt if desired. Fill jars with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50

Note: Research on food preservation is ongoing—recommendations may change. Make sure your food preservation information is always current. Always follow up-to-date, tested guidelines and recipes from reliable sources. 12/2002

Table 1. Preparing and canning vegetables, cont.

Canner type	0-1,000'	1,001-2,000'	2,001-4,000'	4,001-6,000'	over 6,000'	Processing time (minutes in pressure canner at 10 psi [weighted gauge] or 11 psi [dial gauge]) [†]	
Dial gauge	11	11	12	13	14		
Weighted gauge	10	15	15	15	15		
Vegetable	How to prepare*					Pint	Quart
beets: sliced or cubed	Use beets with a diameter of 1 to 2 inches. Beets larger than 3 inches in diameter are often fibrous. Scrub well.						
	<p>Hot pack: Leave roots and 1 inch of stems on beets. Boil until skins slip off (about 15 to 25 minutes). Dip in cold water. Peel, trim root and stem, and slice. Discard woody beets. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack is not recommended.</p>					30	35
carrots	Select small carrots, preferably 1 to 1¼ inches in diameter. Wash, peel, and rewash carrots. Slice or dice.						
	<p>Hot pack: Cover carrots with water, bring to a boil, and simmer for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack: Tightly pack sliced or asparagus-style carrots, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling water to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p>					25	30
corn: cream style	Select slightly immature ears. Blanch ears 4 minutes in boiling water. Cut corn from the cob at the middle of the kernel. Scrape remaining corn from the cob with a table knife.						
	<p>Hot pack: Add 1 cup boiling water to 2 cups corn. Heat to boiling and simmer for 3 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add ½ teaspoon salt to pints if desired. Remove air bubbles, wipe jar rims, adjust lids, and process. Quart jars are not recommended.</p> <p>Raw pack is not recommended.</p>					85	Don't use
corn: whole kernel	Select slightly immature ears. Blanch ears 3 minutes in boiling water. Cut corn from cob at about three-quarters of the depth of the kernel. Do not scrape cob.						
	<p>Hot pack: Add 1 cup of boiling water to 4 cups corn. Heat to a boil and simmer for 5 minutes. Pack hot corn into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack: Pack corn into hot jars, leaving a 1-inch headspace. Add ½ teaspoon salt if desired. Fill jars with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p>					55	85
						55	85
mixed vegetables	Select your favorite mixture of vegetables, excluding greens, dried beans, cream style corn, winter squash, and sweet potatoes. Carrots, whole corn kernels, green and lima beans, crushed tomatoes, and zucchini make a good mix. Wash and prepare vegetables as described in this table.						
	<p>Hot pack: Combine all vegetables in a large pot and add enough water to cover. Boil 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack is not recommended.</p>					75	90
mushrooms	Use fresh, small to medium-sized domestic mushrooms. Mushrooms should have short stems, unopened caps, and no discoloration. Do not can wild mushrooms.						
	<p>Hot pack: Trim stems and soak in cold water for 10 minutes to remove dirt. Wash in clean water. Leave small mushrooms whole; cut larger ones into halves or quarters. Cover in water and boil for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (¼ teaspoon to half-pints, ½ teaspoon to pints). For better color add ⅛ teaspoon (375 mg) ascorbic acid per pint. Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Quart jars are not recommended.</p> <p>Mushrooms will be overcooked if processed long enough to be safe in quart jars.</p> <p>Raw pack is not recommended.</p>					45	Don't use
okra	Use young, tender pods. Discard diseased or rust-spotted pods.						
	<p>Hot pack: Wash and trim. Leave whole or cut into 1-inch pieces. Boil for 2 minutes and drain. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack is not recommended.</p>					25	40

Note: Research on food preservation is ongoing—recommendations may change. Make sure your food preservation information is always current. Always follow up-to-date, tested guidelines and recipes from reliable sources. 12/2002

Table 1. Preparing and canning vegetables, cont.

Canner type	0-1,000'	1,001-2,000'	2,001-4,000'	4,001-6,000'	over 6,000'	Processing time	
						(minutes in pressure canner at 10 psi [weighted gauge] or 11 psi [dial gauge]) [†]	
Dial gauge	11	11	12	13	14		
Weighted gauge	10	15	15	15	15		
Vegetable	How to prepare*					Pint	Quart
onions	Use onions that are 1 inch diameter or less. Wash and peel onions.						
	Hot pack: Cover onions in boiling water, bring to a boil, and boil for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Raw pack is not recommended.					40	40
peas: fresh green	Use well-filled pods containing young, tender peas. Shell and wash peas.						
	Hot pack: Cover with water and bring to a rolling boil for 2 minutes. Loosely pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	40
	Raw pack: Loosely pack peas into hot jars, leaving a 1-inch headspace. Add salt if desired. Fill jars with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	40
peas: fresh black-eyed	Shell and wash peas. When packing the peas, do not shake the jar or press down on the contents.						
	Hot pack: Cover with boiling water and boil for 3 minutes. Loosely pack hot into hot jars, leaving a 1-inch headspace for pints, 1½-inches headspace for quarts. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50
	Raw pack: Loosely pack peas into hot jars, leaving headspace as specified above. Add salt if desired. Fill jars with boiling water, leaving headspace as above. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50
peppers: bell, pimento, and chilies	Use firm peppers. Wash and drain. Peel peppers by heating in a gas flame, on the barbecue, or roasting under the broiler until the skins blister. Put peppers in a covered bowl for 5 to 10 minutes. Skins will easily slip off. Remove stem and seeds. Flatten whole chili peppers to remove air. For other peppers, cut into strips or other convenient pieces.						
	Hot pack: Pack loosely into hot jars, leaving a 1-inch headspace. Fill jars with boiling cooking liquid to 1 inch from the top. Add 1 tablespoon bottled lemon juice to each pint jar. Add ½ teaspoon salt to each pint jar if desired. Remove air bubbles, wipe jar rims, adjust lids, and process. Quart jars are not recommended. Raw pack is not recommended.					35	Don't use
potatoes: new	Use small to medium-sized mature potatoes. Potatoes stored below 45°F (7°C) may discolor when canned. For packing whole, choose potatoes that are 1 to 2 inches in diameter. Wash and peel potatoes.						
	Hot pack: Cut into ½-inch cubes if desired. Soak in a solution of 1 teaspoon (3 g) ascorbic acid in 1 gallon of water. Drain and place potatoes in hot water and boil (10 minutes for whole, 2 minutes for cubes). Drain and pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Raw pack is not recommended.					35	40
potatoes: sweet	Use small to medium-sized potatoes. Can within 1 to 2 months after harvest.						
	Hot pack: Wash and boil until partially soft (15 to 20 minutes), cool until you can remove skins. Peel, cut into pieces, and pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid or sugar syrup (1 part sugar to 2 parts water) to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Do not mash or puree pieces. Raw pack is not recommended.					65	90
pumpkin or winter squash (acorn, banana, buttercup, butternut, or Hubbard): cubed	Use squash with hard rind and mature pulp. Small pumpkins are better for canning than large pumpkins.						
	Hot pack: Wash, remove seeds, and peel. Cut into 1-inch cubes. Add enough water to cover and boil for 2 minutes. Pack hot cubes into hot jars, leaving a 1-inch headspace. Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Do not mash or puree. Spaghetti squash should be frozen because its flesh does not stay cubed on heating. Raw pack is not recommended.					55	90

Notes:

*Metric conversions: 1 teaspoon = 5 milliliters; 1 tablespoon = 15 milliliters; 1 cup = 0.24 liter; 1 pint = 0.47 liter; 1 quart = 0.95 liter; 1 gallon = 3.8 liters; 1 inch = 2.5 centimeters; 1 pound per square inch (psi) = 6.9 Pascals (Pa).

[†]Times are given for altitudes of 0 to 1,000 feet. For higher altitudes, see table 2.

Note: Research on food preservation is ongoing—recommendations may change. Make sure your food preservation information is always current. Always follow up-to-date, tested guidelines and recipes from reliable sources. 12/2002



Avoiding Common (Major and Minor) Canning Mistakes

Kathleen Riggs, Family and Consumer Sciences Agent, Iron County

Major Canning Mistakes – Potentially Deadly

***Making up your own canning recipe.** Without scientific testing, you will not know how long the product needs to be processed to be safe.

***Adding EXTRA starch, flour or other thickener to recipe.** This will slow the rate of heat penetration into the product and can result in undercooking.

***Adding EXTRA onions, chilies, bell peppers, or other vegetables to salsas.** The extra vegetables dilute the acidity and can result in botulism poisoning.

***Using an oven instead of water bath for processing.** The product will be under-processed since air is not as good a conductor of heat as water or steam. The jars also may break or explode.

***Not making altitude adjustments.** Since boiling temperatures are lower at higher altitudes, the products will be under-processed. Pressure canning requires adding more pounds of pressure while water-bath canning requires more processing time.

***Not venting pressure canner.** Lack of venting can result in air pockets (cold spots) which will not reach as high a temperature as is needed.

***Not having dial-type pressure canner gauges tested annually.** If the gauge is inaccurate, the food may be under-processed and therefore unsafe.

***Failure to acidify canned tomatoes.** Not all tomatoes have an adequate acid level (pH), especially if the vine is dead when tomatoes are harvested. This can result in botulism poisoning.

***Cooling pressure canner under running water.** Calculations as to processing time include the residual heat during the normal cool-down period as part of the canning process. Hurrying this process will result in under-processed food; siphoning of liquid from the jars and jar breakage may also occur.

***Letting food prepared for “hot pack” processing cool in the jars before placing them in the canner for processing.** The heat curves are based on the food being hot at the beginning of the processing. The product could be under-processed.

NOTE: Canned meat, vegetables, or salsa which is under-processed can cause botulism.

Minor Canning Mistakes – Economic Loss, But Results Not Deadly

***Use of mayonnaise jars.** The thinner walls of the glass may break, especially if used in a pressure canner, and it may be more difficult to obtain a good seal. However, if it seals, it is safe to use.

***Use of paraffin on jams & jellies.** Small air holes in the paraffin may allow mold to grow. Also, paraffin can catch on fire if overheated during preparation. If preserves do have mold growth, the recommendation is not to eat the product, but discard it.

***Cooling too slowly after removing from canner.** (Example: stacked jars close together.) There is a group of harmless organisms called thermophiles that can survive canning. If bottles are held hot for long periods, they can produce acid (fermentation). This results in the defect known as “flat-

sour.” This is harmless, but produces an undesirable flavor.

****Storing food longer than recommended.***

Keeping foods longer than recommended or storing them at temperatures above 70° F for an extended period of time will decrease the quality and the value of some nutrients, but the product will be safe to eat. A darkening of fruits and change in texture is often a result as well.

The general guidelines for safe food preservation really are not difficult to follow. Just make certain to always use an up-to-date, scientifically-tested recipe, follow it exactly and make the altitude adjustments for time or pressure. If you have specific questions, contact your local USU Extension office. If you cannot find your local office listed in the phone directory under USU, look under the county government listings.

Cautions Issued for Specific Foods

- **Butter** — For now, canning butter using any method is not recommended. Some methods are dangerous at best; others are not backed by science.
- **Hydrated wheat kernels (berries)** — Starch in wheat may interfere with the heat penetration during canning. Insufficient processing can result in botulism food poisoning. Wheat should be stored dry until use or refrigerated up to several days if hydrated for use in the near future.
- **Quick Breads (e.g. , banana, zucchini, pumpkin)** — Baking quick breads in canning jars and then placing a lid and ring on the jar to create a vacuum seal as it cools does not kill botulism-forming organisms that grow in warm, moist, anaerobic conditions. These items should be either baked fresh and served or frozen.
- **Dried Beans (pinto, kidney, etc.)** — To safely can dried beans, they must be hydrated first (usually 12 to 18 hours) and then brought to a boil for 30 min. Hot beans are then placed into hot jars for processing.

General Rules

1. Always use up-to-date, scientifically tested canning recipes.
2. Only use approved, up-to-date canning methods (boiling water-bath or pressure).
3. Follow canning directions exactly.
4. Make altitude adjustments by adding more time to water bath canning or increasing pressure for pressure canned products.

5. Make certain canned products have a proper lid seal.

Note: Unless you are sure that the above general rules were followed, boil low acid foods for 10 minutes before eating them to inactivate botulism-causing organisms (*Clostridium botulinum*).

Exceptions to the General Rules

- **Changing salt level in anything except pickles.** Salt acts as a preservative and adds flavor and crispness to pickles. In other foods, it is mainly used as a flavoring agent and is *added as a personal preference*.
- **Changing sugar level in syrup used for canned fruit.** Sugar helps fruit retain a bright color and firm texture, but is not necessary for safety.
- **Add EXTRA vinegar or lemon juice.** Bottled acids help obtain required pH (acid levels) in tomatoes and pickles. If a more tart or sour flavor is desired, more vinegar, lemon or lime juice may be added.
- **Decrease any vegetable except tomatoes in salsas.** Salsa recipes have been tested to ensure that they contain enough acid to be safely processed in a boiling water-bath canner. This acid is provided by the correct amount of tomatoes. The addition of vegetables has also been calibrated to balance the acid level. While it is dangerous to add more vegetables to salsa recipes, fewer may be used for a milder flavor.
- **Substitute bell peppers, long green peppers or jalapeño peppers for each other in salsa recipes.** So long as the total amount of peppers remains the same (or fewer) as what is listed in the tested recipe, peppers may be interchanged.

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This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Noelle E. Cockett, Vice President for Extension and Agriculture, Utah State University.

4. Dehydrating

Dehydrating Vegetables Basics

Drying Vegetables Chart

Dehydrating Vegetables 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.

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, food-contact surfaces of dehydrating equipment and work surfaces.
4. Always wash hands before handling foods—that includes harvesting.

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 at the end of this handout. Work in small batches; the water should return to a boil within a minute after you add the vegetables. 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.
- Prevent insect infestation of any food products that could have been exposed to insects 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, or cook in liquid.

- Do not add salt or sugar during the first 5 minutes of rehydration as they hinder the water absorption process.
- 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)

So Easy to Preserve Fifth Edition. 2006. Bulletin 989. Cooperative Extension/The University of Georgia/Athens

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Rehydrating Dried Foods

Product	Water to Add to 1 Cup Dried Food (Cups)	Minimum Soaking Time (Hours)
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

** Vegetables – Boiling water used.

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.

