



Principles of Pressure Canning

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Why Choose Pressure Canning to Preserve Food?

Pressure canning is a safe and economical method of preserving low acid foods which has been used for decades—especially by home gardeners and others interested in providing food storage for their families where quality control of the food is in ones' own hands. Home food preservation also promotes a sense of personal satisfaction and accomplishment. Further, the guess-work is taken out of being able to provide a safe food supply at home when guidelines for operating a pressure canner are followed exactly, scientifically tested/approved recipes are utilized, and high quality equipment, supplies and produce are used.

bacteria (such as those associated with botulism) use of pressure canning ensures the safety of the preserved produce. Foods such as red meats, sea food, poultry, milk, and all fresh vegetables, with the exception of most tomatoes, fit into the low acid group since they have an acidity, or pH level, of 4.6 or higher. The temperature which must be reached and maintained (for a specified amount of time) to kill the bacteria is 240EF. This temperature can be reached only by creating steam under pressure.

Becoming Familiar with the Parts of a Pressure Canner

(See illustration, last page)

Older model pressure canners (made before 1970) were heavy-walled kettles with clamp-on or turn-on lids fitted with dial-type gauges. A vent port, in the form of a petcock or counterweight, and a safety fuse were also present. Modern pressure canners are lightweight, thin-walled kettles and most have turn-on lids. They usually have a perforated metal rack or basket with handles, rubber gasket, a dial or weighted gauge, an automatic vent/cover lock, a vent port (steam vent) to be closed with a counterweight or weighted gauge, and a safety fuse.

Note: When purchasing a used pressure canner, make certain all parts are accounted for and in good condition. It is nearly impossible to find replacement parts for older models.



What Foods Are Typically Processed/Preserved Using a Pressure Canner—and Why?

Low acid foods require a higher temperature when processing than can be reached by placing them in jars immersed by boiling water. To kill harmful

Selecting the Correct Processing Time and Pressure

To ensure the safety of food processed in the pressure canner, use processing times listed for scientifically-tested recipes (dated 1988 or later) and adjust for altitude using the chart below. Keep in mind that failing to follow proper processing times and pressure recommendations may result in spoiled food (mold, bacteria, and other microorganisms) and possibly fatal food poisoning.

Pressure Canner and Altitude

The steam-pressure method is used for low-acid foods. Normally, the pressure given for low acid foods in canning guides is for weighted-gauge canners at altitudes at or below 1,000 feet above sea level. At altitudes of 1,001 feet or above, adjust the processing pressure according to the STEAM-PRESSURE CANNER chart for the type of steam-pressure canner being used.

Table 1. Pressure Required for Home Canning at Different Altitudes

Altitude (ft)	Pressure Required (lbs)	
	Weighted Gauge	Dial Gauge
0-1000	10	11
1001-2000	15	11
2001-4000	15	12
4001-6000	15	13
6001-8000	15	14
8001-10,000	15	15

Basic Steps in Pressure Canning

- Center the canner over the burner. When you have your jars of food ready for canning, put the rack and hot water into the canner. If the amount of water is not specified with a given food, use 2 to 3 inches of water. Longer processes required more water. Some specific products (for example, smoked fish) require that you start with even more water in the canner. Always follow the directions with USDA processes for specific foods if they require more water be added to the canner.

For hot packed foods, you can bring the water to 180°F. ahead of time, but be careful not to boil

the water or heat it long enough for the depth to decrease. For raw packed foods, the water should only be brought to 140°F.

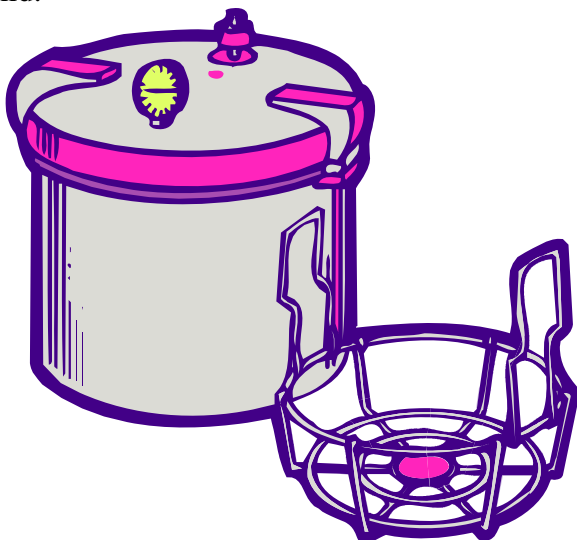
- Place filled jars, fitted with lids, on the jar rack in the canner, using a jar lifter. When moving jars with a jar lifter, make sure the jar lifter is securely positioned below the neck of the jar (below the screw band of the lid). Keep the jar upright at all times. Tilting the jar could cause food to spill into the sealing area of the lid.
- Fasten the canner lid securely. Leave the weight off the vent port or open the petcock.
- Turn the heat setting to its highest position. Heat until the water boils and steam flows freely in a funnel-shape from the open vent port or petcock. While maintaining the high heat setting, let the steam flow (exhaust) continuously for 10 minutes.



Photo: Green beans, chicken soup and carrots pressure canned at USU.

- After this venting, or exhausting, of the canner, place the counterweight or weighted gauge on the vent port, or close the petcock. The canner will pressurize during the next 3 to 10 minutes.
- 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.

7. Regulate the heat under the canner to maintain a steady pressure at, or slightly above, the correct gauge pressure. One type of weighted gauge should jiggle a certain number of times per minute, while another type should rock slowly throughout the process – check the manufacturer's directions.
8. Loss of pressure at any time can result in under-processing, or unsafe food.
9. Quick and large pressure variations during processing may cause unnecessary liquid losses from jars.
10. **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.
11. 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. (It is okay to leave the canner in place after you have turned off the burner.) While it is cooling, it is also depressurizing. Do not force cool the canner. Forced cooling may result in food spoilage. Cooling the canner with cold running water or opening the vent port before the canner is fully depressurized are types of forced cooling. They will also cause loss of liquid from jars and seal failures. Force cooling may also warp the canner lid.



Even after a dial gauge canner has cooled until

- the dial reads zero pounds pressure, be cautious in removing the weight from the vent port. Tilt the weight slightly to make sure no steam escapes before pulling it all the way off. Newer canners will also have a cover lock in the lid or handle that must release after cooling before the lids are twisted off. Do not force the lid open if the cover locks are not released. Manufacturers will provide more detailed instructions for particular models.
12. Depressurization of older canner models without dial gauges should be timed. Standard size heavy-walled canners require about 30 minutes when loaded with pints and 45 minutes when loaded with quarts. Newer thin-walled canners cool more rapidly and are equipped with vent locks that are designed to open when the pressure is gone. These canners are depressurized when the piston in the vent lock drops to a normal position. Some of these locks are hidden in handles and cannot be seen; however, the lid will not turn open until the lock is released.
13. After the canner is completely depressurized, remove the weight from the vent port or open the petcock. Wait 10 minutes; then unfasten the lid and remove it carefully. Lift the lid with the underside away from you so that the steam coming out of the canner does not burn your face.
14. Using a jar lifter, remove the jars one at a time, being careful not to tilt the jars. Carefully place them directly onto a towel or cake cooling rack, leaving at least one inch of space between the jars during cooling. Avoid placing the jars on a cold surface or in a cold draft.
15. Let the jars sit undisturbed while they cool, from 12 to 24 hours. Do *not* tighten ring bands on the lids or push down on the center of the flat metal lid until the jar is completely cooled.
16. Remove ring bands from sealed jars. Ring bands can be washed and dried and put away for using another time. Put any unsealed jars in the refrigerator and use first.
17. Wash jars and lids to remove all residues.

18. Label jars and store in a cool, dry place out of direct light.
19. Dry the canner, lid and gasket. Take off removable petcocks and safety valves; wash and dry thoroughly.

Additional Safety/Operating Tips

Gauges: Check dial gauges for accuracy before use each year and replace if they read high by more than 1-2 pound pressure. Gauges may be checked at most county Cooperative Extension offices. Replacement gauges and other parts for canners are often available at stores offering canning equipment or from canner manufacturers. When ordering parts, it will be helpful to know the model number of your canner.

Gaskets: Handle canner lid gaskets carefully and clean them according to the manufacturer's directions. Nicked or dried gaskets will allow steam leaks during pressurization of canners and should be replaced. Keep gaskets clean between uses. A lid which is difficult to remove after cooling may indicate a gummy, or dry gasket and is reason to replace it.



Photo: Getting ready to Pressure Can at the USU Home Food Preservation Workshop May 2008.

Source

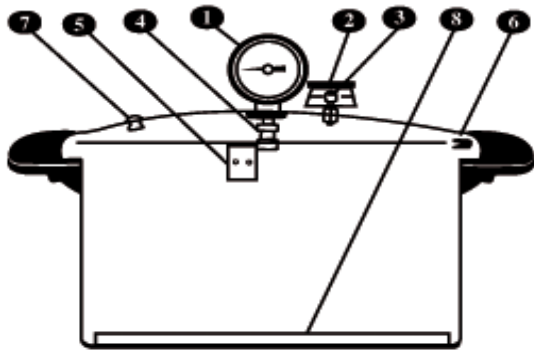
USDA Complete Guide to Canning 1994
Preserving Food: Using Pressure Canners (National Center for Home Food Preservation)

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Parts of a Pressure Canner



1. PRESSURE DIAL GAUGE

The pressure dial gauge registers pressure in both pounds (outer scale) and metric measure (inner scale). The pointer moves around the dial indicating the pressure within the unit. Pressure can be controlled and maintained by adjusting heat setting.



2. PRESSURE REGULATOR

The pressure regulator acts as a safety device to prevent pressure in excess of 15 pounds from building in the canner. Pressure readings on the pressure canner are registered only on the pressure dial gauge.



3. VENT PIPE

The pressure regulator fits over the vent pipe and allows excess pressure to be released.



4. AIR VENT/COVER LOCK

The air vent/cover lock automatically "vents" or exhausts air from the canner and acts as a visual indication of pressure in the canner. The small gasket must be in place for the air vent/cover lock to seal completely.



5. LOCKING BRACKET

The locking bracket on the inside of the canner body engages with the air vent/cover lock to prevent the cover from being opened when there is pressure in the unit.



6. SEALING RING

The sealing ring fits into the canner cover and forms a pressure-tight seal between the cover and body during canning and cooking.



7. OVERPRESSURE PLUG

The overpressure plug is located in the canner cover. It will automatically pop out and release steam in case the vent pipe becomes blocked and/or clogged and pressure cannot be released normally through the vent pipe.



8. CANNING-COOKING RACK

The canning-cooking rack is placed in the bottom of the canner to hold jars off the bottom of the unit while canning. When cooking, the rack is used for steaming foods. It can also be used to hold foods such as vegetables out of the cooking liquid which allows several foods to be cooked at the same time without an intermingling of flavors. When it is desirable to blend flavors, do not use the canning-cooking rack. The canning-cooking rack must always be used when canning.



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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Principles of Boiling Water Canning

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The USDA Cooperative Extension system has been providing safe canning recommendations for over 100 years. It has been known since those early days that heat at the temperature of boiling water can destroy “almost” all microorganisms. Yeast, molds, and most bacteria are easily killed at this temperature. The only microorganisms that survive are the bacteria that form protective spores, such as *Clostridium botulinum*.

High acid levels are used to prevent the sporeformers, especially, *Clostridium botulinum*, from growing. The measurement of how acid a food is called pH. When the pH is below 4.6 growth of sporeformers is inhibited.

Foods such as fruits, pickles, sauerkraut, jams, jellies, marmalades, and fruit butters/spreads fit into the *high acid* group since they have an acidity, or pH level, of 4.6 or lower. Most tomatoes and tomato products also fit into this category. However, some new varieties of tomatoes are borderline acid and the Cooperative Extension System now recommends adding a little extra acid as a safety measure.

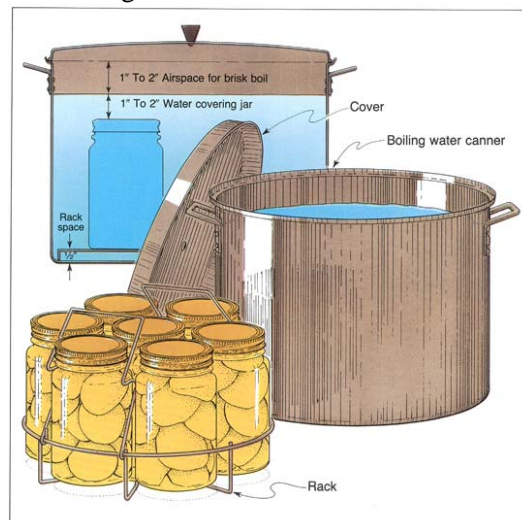
***Tomato Acidification:** Current recommendations for acidification of whole, crushed, or juiced tomatoes, are to add 2 tablespoons of *bottled lemon juice* or ½ teaspoon of *citric acid* per quart of tomatoes. For pints, use 1 tablespoon bottled lemon juice or ¼ teaspoon citric acid. Four (4) tablespoons of 5 percent acidity *vinegar* per quart may be used instead of lemon juice or citric acid.

Boiling Water Canner

Most boiling water canners are made of aluminum or porcelain-covered steel. They have fitted lids and removable racks that are either perforated or shaped wire

racks. The canner must be deep enough so that at least one inch of briskly boiling water will be over the tops of jars during processing. A flat bottom must be used on an electric range. Either a flat or ridged bottom may be used on a gas burner. To ensure uniform processing of all jars with an electric range, the canner should be no more than 2 inches wider than the burner on any side.

Figure 1. Boiling Water Canner



Note: Some newer ceramic or glass top stoves prohibit the use of pots with a diameter larger than the burner and some prohibit the use of large stock pots due to the excessive weight. Check your manufacturer’s recommendations before canning on these stoves.

Selecting the Correct Processing Time

To ensure the safety of food processed the boiling water bath method, use scientifically-tested recipes (dated 1988 or later) to prepare the produce and adjust the processing time for altitude using the chart below. Keep in mind that failing to properly **lengthen** processing

times may result in short-term shelf-life or spoiled food due to the growth of mold, bacteria, and other microorganisms not detected by sight or smell. Food poisoning may result if the spoiled food is eaten.

Boiling Water Canner Altitude Chart

Normally, the processing times given for acid foods in recipes and canning guides are based on an altitude at or below 1,000 feet above sea level using the boiling-water method. At altitudes above 1,000 feet, adjust the processing time according to the chart below.

<u>Altitude (feet)</u>	<u>Increase Processing Time</u>
1,001 - 3,000	5 Minutes
3,001 - 6,000	10 Minutes
6,001 - 8,000	15 Minutes
8,001 - 10,000	20 Minutes

Steps for Successful Boiling Water Canning

1. Fill the canner halfway with water.
2. Preheat water to 140 degrees F. for *raw-packed* foods and to 180 degrees F. for *hot packed* foods. Raw- or cold-packed foods are placed directly into hot jars and covered with hot syrup; hot packed foods are partially cooked or heated through and placed hot into hot jars, and covered with hot syrup. See tested recipes for detailed instructions for various types of produce.
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, one jar at a time, with a jar lifter.
4. Add more boiling water, if needed, so the water level is at least 1 inch above jar tops.
5. Cover with the canner lid and turn heat to its highest position until water boils vigorously.
6. Set a timer for the number of minutes required for processing the food. (Check tested recipes for specific instructions for jams/jellies and pickles.)
7. Lower the heat setting to maintain a gentle boil throughout the process schedule.
8. Add more boiling water, if needed, to keep the water level to above one inch of the jar lids.
9. When jars have been boiled for the recommended time, turn off the heat and remove the canner lid.
10. Using a jar lifter, remove the jars and place them on a protected surface, leaving at least 1-inch spaces

between the jars during cooling. Keep away from air drafts and let the jars cool at room temperature.

Sources: Adapted from information in the USDA *Complete Guide to Home Canning* and *National Center for Home Food Preservation*.



Photo: Canning workshop at USU May 2008.

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Getting Crisp Home Pickled Vegetables

Brian A. Nummer, Extension Food Safety Specialist

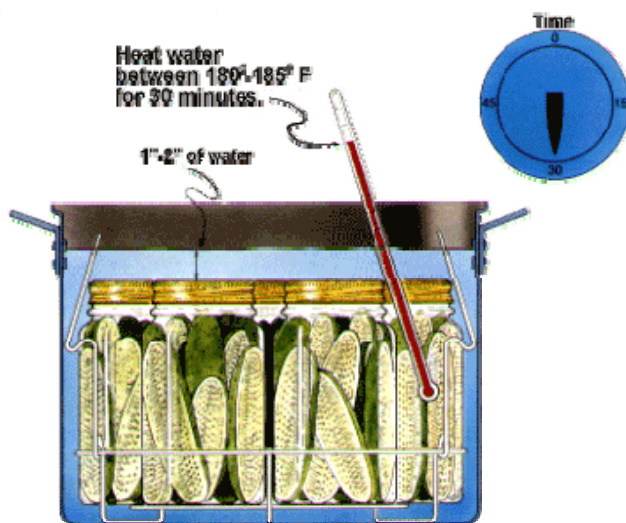
Crispness is a hallmark of a good pickled vegetable. That crispness comes from the vegetable's natural pectin--the same pectin that we extract from apples and citrus to make jams and jellies.

Use only just-picked vegetables for pickling

The most important factor in getting crisp pickled vegetables is to start with fresh, just-picked vegetables. Vegetables become soft as their pectin structure changes due to microbial activity, excess heat or improper handling. As each day passes, vegetables lose crispness. *Once a vegetable is soft it cannot be made firm again.*

Use only top quality vegetables for pickling

For cucumber pickles, use cucumbers intended for pickling that are no more than 2 inches in diameter. Remove the blossom end. The blossom harbors microbes that can cause softening. Start with crisp raw vegetable varieties to get crisp pickled vegetables.



Use only safe, research-based recipes to pickle foods

It is important to have the proper acidity level to produce safe pickles. Only research-based recipes such as those found in the USDA Complete Guide to Canning, the National Center for Home Food Preservation Web site www.homefoodsafety.com, or the Utah State University Extension Web site should be used.

Use low-temperature pasteurization

Cucumber pickles may be processed for 30 minutes at 180-185°F. Check with a thermometer to be certain that the water temperature remains above 180° during the entire 30 minutes. Keep the temperature

below 185° to avoid breaking down the pectin, which will cause softening of the pickle.

Making refrigerator pickles

Instead of heat treating pickled foods, some recipes call for keeping them at refrigeration temperatures. For many years this method was thought to be safe. However, recent evidence that *Listeria monocytogenes* can survive in these foods has led to a recommendation against this method until further studies are performed on its safety. Until those studies are completed, it is recommended to use the low-temperature pasteurization method above, even if the foods are placed in the refrigerator.

Use of alum

If good-quality ingredients are used and up-to-date methods are followed, firming agents are not needed for crisp pickles. If you choose to use firming agents, alum (aluminum potassium sulfate) may be used to firm fermented pickles, but has little crispness effect on quick-process pickles. Alum will increase firmness when used at levels up to 1/4 teaspoon per pint. Addition of greater than 1/4 teaspoon alum per pint will decrease firmness.

Use calcium to firm pickles

Lime (calcium hydroxide) can 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. 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. Drain and rinse again.

Ball Calcium Chloride Pickle Crisp. This product is a food grade calcium chloride salt. It provides the calcium to help firm pectin, but does not have the hydroxide component that can lower the acidity of pickled foods. Follow the manufacturer's directions.

Use of ice to firm pickles

Soak cucumbers or other vegetables in ice water for 4 to 5 hours before pickling.

Use of grape leaves to firm pickles

Historically, grape leaves are sometimes added to pickle products. The tannins in grape leaves were found to inhibit the pectinase enzyme (a chemical that would break down and soften the pectin structure). However, this enzyme is located at the blossom end of

the cucumber and if that is removed this process is redundant.

References

- USDA Complete Guide to Canning. 1994. USDA Bulletin No. 539. Available online at: <http://extension.usu.edu/files/foodpubs/canguil.pdf>.
- J. Kim, E. M. D'Sa, M. A. Harrison, J. A. Harrison, and E. L. Andress. 2004. *Listeria monocytogenes* survival in refrigerator dill pickles. IFT Annual Meeting Poster. <http://www.uga.edu/nchfp/papers/2004/04ift-picklesabstract.pdf>.
- Here are some of the original research publications that became the foundation for the USDA Cooperative Extension System recommendations mentioned in this publication.*
- Sweeney, J.P., N.E. Liming, A. Beloian, and E.H. Dawson. 1965. Effect of household processing and storage on quality of pickled vegetables and fruits. Home Economics Research Report No. 28. Agricultural Research Service: USDA.
- Etchells, J.L. and T.A. Bell. 1972. Influence of Alum on the firmness of fresh-pack dill pickles. *J. Food Science*. V 37. 442-445.
- Bell, T.A., and J.L. Etchells. 1958. Pectinase inhibitor in grape leaves. *Bot. Gaz.* 119 (3):192-196.
- Etchells, J.L., Bell, T.A., Jones, I. D., 1955. Cucumber blossoms in salt stock mean soft pickles. *Research and Farming (N. C. Agric. Expt. Sta.)* 13 (1-4):14-15
- Etchells, J.L. et al. 1944. Procedure for Pasteurization pickle products. *Glass Packer* 23(7):519.

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Vegetable Canning Methods in the Pressure Cooker

Georgia Lauritzen, Food and Nutrition Specialist
Edited and Updated by *Kristine Saunders*, M.S.

The Basics

Canning never improves the quality of the food you are preserving. Follow the general guidelines below for best results when canning vegetables.

ALL VEGETABLES MUST BE PROCESSED IN A PRESSURE CANNER.

- Select the best quality vegetables at the peak of maturity for best results.
- Process as soon as possible after picking.
- Sort vegetables for size, and remove any that are under ripe, over ripe, bruised, or blemished.
- Wash thoroughly.
- Check jars to make sure there are no cracks or chips and check closure bands for dents or rust.
- Wash jars and bands in hot, soapy water and rinse well.
- Follow manufacturer's directions for correct preparation of lids.

Read and follow manufacturer's directions for the canner you are using. If your pressure canner uses a dial gauge, have the gauge tested annually for accuracy. Generally, correct pressure canner methods include:

- Add two (2) inches of water to the bottom of cooker.
- Exhaust steam for 10-12 minutes.
- Start to increase pressure by closing petcock or by placing weight on vent pipe and bring pressure to that recommended for your altitude.

- Start processing time as soon as correct pressure is reached.
- Check gauge often to make sure adequate pressure is maintained. If using a weighted gauge canner, listen for the jiggle or rocking of the weight that indicates correct pressure.
- Remove canner from heat at end of processing time.
- Allow canner to cool naturally. A pressure canner may take 30-45 minutes to cool. Do not force cool a pressure canner.
- Wait an additional two minutes before opening your pressure canner after the cooker has cooled sufficiently to decrease the pressure inside. Then, remove the weight or open the petcock to make sure there is no more pressure inside.
- Carefully remove the canner lid by lifting the far side first. Using this method allows any remaining steam to vent away from the user.
- Remove jars and place away from cold drafts on a rack or folded cloth where air can freely circulate.

NOTE: An accurate pressure gauge is necessary to get the processing temperatures needed to make food safe to eat. The accuracy of the pressure gauge should be determined by having the gauge tested before the canning season, or more often if the canner is used a number of times during the season. Ask your county extension agent, dealer or manufacturer about checking the dial gauge on your pressure canner for accuracy.

Canning Vegetables

When canning vegetables, salt is an optional ingredient that is only used for flavor. If using salt, add 1 teaspoon

to each quart or ½ teaspoon to each pint. Less or no salt can be used without affecting the safety or quality of canned vegetables.

Vegetable	Dial Gauge Pressure Canner*					
	2001–4000 ft 12 lbs		4001–6000 ft 13 lbs		6001–8000 ft 14 lbs	
	pints	quarts	pints	quarts	pints	quarts
ASPARAGUS: Wash asparagus. Remove scales and tough ends; cut into 1-inch pieces. Hot Pack: Cover asparagus with boiling water. Boil 2–3 minutes. Loosely fill jars with asparagus, leaving 1-inch headspace. Add boiling water, leaving 1-inch headspace. Adjust lids. Process. Raw Pack: Fill jars with raw asparagus, packing as tightly as possible without crushing, leaving 1 inch headspace. Add boiling water, leaving 1-inch headspace. Adjust lids. Process.	30	40	30	40	30	40
BEANS, GREEN: Wash beans, trim ends and cut into 1-inch pieces. Hot Pack: Cover beans with boiling water; boil 5 minutes. Fill jars, leaving 1-inch headspace. Add boiling water, leaving 1-inch headspace. Adjust lids. Process. Raw Pack: Fill jars tightly with raw beans, leaving 1-inch headspace. Add boiling water, leaving 1-inch headspace. Adjust lids. Process.	20	25	20	25	20	25
BEETS, WHOLE, CUBED OR SLICED: Wash beets and trim, leaving on root and 1-inch of the tops. Cover beets with boiling water and boil until skins slip off easily, 15–25 minutes, depending on size. Remove skins and trim. Cut medium or large beets in cubes or slices, halves, or quarters. Leave baby beets whole. Pack hot beets into jars leaving 1-inch headspace. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process.	30	35	30	35	30	35
CARROTS, SLICED OR DICED: Wash, peel or scrape carrots, and re-wash. Slice or dice. Hot Pack: Cover carrots with boiling water, simmer 5 minutes. Pack carrots into jars, leaving 1-inch headspace. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process. Raw Pack: Fill jars tightly with raw carrots, leaving 1-inch headspace. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process.	25	30	25	30	25	30
CORN, WHOLE KERNEL: Blanch corn 3 minutes in boiling water and cut from cob at three-fourths depth. CAUTION: Do not scrape cob. Hot Pack: Add 1 cup hot water per quart of corn, heat to boiling and simmer 5 minutes. Add 1 tsp salt per quart, if desired. Fill jars with corn and cooking liquid, leaving 1-inch headspace. Adjust lids. Process. Raw Pack: Pack corn loosely into hot jars, leaving 1-inch headspace. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process.	55	85	55	85	55	85
CORN, CREAM STYLE: Blanch corn 4 minutes in boiling water and cut from cob at about the center of kernel. Scrape remaining corn from cobs with a table knife. Use pint jars, only. Add 2 cups boiling water per quart of corn and scrapings in a saucepan. Heat to boiling. Fill jars with hot corn mixture, leaving 1-inch headspace. Add fresh boiling water, leaving 1-inch headspace. Adjust lids. Process.	85	-	85	-	85	-
PEAS, GREEN OR ENGLISH—SHELLED: Shell and wash peas. Add 1 tsp salt per quart, if desired. Hot Pack: Cover peas with boiling water. Bring to a boil in a saucepan, and boil 2 minutes. Fill jars loosely with hot peas and add cooking liquid, leaving 1-inch headspace. Adjust lids. Process. Raw Pack: Fill jars with raw peas, add boiling water, leaving 1-inch headspace. Do not shake or press down peas. Adjust lids. Process.	40	40	40	40	40	40

Vegetable	Dial Gauge Pressure Canner*					
	2001–4000 ft 12 lbs		4001–6000 ft 13 lbs		6001–8000 ft 14 lbs	
	pints	quarts	pints	quarts	pints	quarts
POTATOES, WHITE—CUBED OR WHOLE: Wash and peel potatoes. Place in solution of 1 teaspoon ascorbic acid per gallon of water to prevent darkening. If desired, cut into ½ inch cubes. Drain. Cook 2 minutes in boiling water and drain again. For whole potatoes, boil 10 minutes and drain. Fill jars with hot potatoes and fresh hot water, leaving 1-inch headspace. Adjust lids. Process.	35	40	35	40	35	40
PUMPKIN AND WINTER SQUASH— CUBED: Wash, remove seeds, cut into 1-inch wide slices, and peel. Cut flesh into 1-inch cubes and boil 2 minutes in water. CAUTION: Do not mash or puree. Fill jars with cubes and cooking liquid, leaving 1-inch headspace. Adjust lids. Process.	55	90	55	90	55	90
SPINACH AND OTHER GREENS: Wash only small amounts of greens at one time. Drain water and continue rinsing until water is clear and free of grit. Cut out tough stems and midribs. Place 1 pound of greens at a time in cheesecloth bag or blancher basket and steam 3 to 5 minutes or until well wilted. Fill jars loosely with greens and add fresh boiling water, leaving 1-inch headspace. Adjust lids. Process.	70	90	70	90	70	90
SOUPS—Vegetable, Dried Bean or Pea, Meat or Poultry: Select, wash, and prepare vegetables and meat as described for the specific foods. Cover meat with water and cook until tender. Cool meat and remove bones. Cook vegetables. For each cup of dried beans or peas, add 3 cups of water, boil 2 minutes, remove from heat, soak 1 hour, and heat to boil. Drain and combine with meat broth, tomatoes, or water to cover. Boil 5 minutes. CAUTION: Do not thicken. Salt to taste, if desired. Fill jars halfway with solid mixture. Add remaining liquid, leaving 1-inch headspace. Adjust lids. Process.	60	75	60	75	60	75

Sources

This document was adapted from the following publications:

"Complete Guide to Home Canning," Agriculture Information Bulletin No. 539, USDA, revised 1994 and reviewed June 2006.

Vegetable Canning Methods in the Pressure Cooker, Georgia Lauritzen, Food and Nutrition Specialist, July 1994.

The National Center for Home Food Preservation, http://www.uga.edu/nchfp/how/can_04/soups.html

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