

Preserving the Harvest

Canning Vegetables

Organisms that cause food spoilage—molds, yeasts and bacteria—are present everywhere in the air, soil and water. Enzymes that may cause undesirable changes in flavor, color and texture are present in raw vegetables.

When vegetables are canned, they are heated hot enough and long enough in the jar to destroy organisms that can make people sick in addition to spoilage organisms. This heating (or processing) also stops the action of enzymes that can spoil food quality.

Pressure canning is the only safe method of canning all vegetables (except tomatoes). Jars of food are placed in a pressure canner which is heated to an internal temperature of at least 240°F. This temperature can be reached only in a pressure canner.

The *Clostridium botulinum* microorganism is the main reason pressure canning is necessary. Though the bacterial cells are killed at boiling temperatures, the spores they form can withstand boiling. In the soils, these bacteria are naturally found in the spore form. The spores grow out well in moist, low-acid foods in the absence of air, such as in canned low acid foods (vegetables and meats). When this happens, the spores change to growing bacterial cells which produce the deadly botulinum toxin (poison). This growth and toxin formation can occur without any noticeable signs of spoilage in the sealed jar.

These spores can be destroyed by canning the food at a temperature of at least 240°F. This temperature is above the 212°F. boiling point of water, so it can only be reached in a pressure

canner at the appropriate pressure (10 pounds at sea level). Because most people do not can at sea level, use the pressure given with the directions for canning vegetables. The pressures are different for dial and weighted gauge canners, because the weighted gauge canners operate in a manner that provides some additional safety margin over dial gauges. Recommended pressures are different for different altitudes; be sure to check altitude corrections if canning at altitudes over 1000 feet.

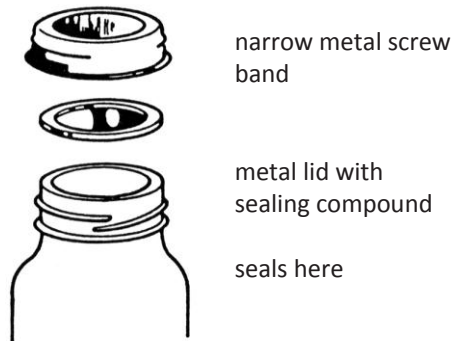
Equipment

A *pressure canner* is necessary for home canning of vegetables. It must have a rack in the bottom, a tight-fitting cover, exhaust vent (or petcock), safety valve and an accurate pressure gauge. The pressure gauge may be a weighted gauge that fits over the vent or a dial gauge on which a needle indicates the pressure inside the canner. Newer canners may also have an extra cover lock as an added safety feature.

Canning jars should be checked closely for cracks or chips. Use jars specifically designed for home canning. Commercial food jars such as mayonnaise or coffee jars break easily, especially in pressure canners, and may not seal with home canning lids. Use only half-pint, pint and quart sizes, and as specified for individual food processing directions.

Before using the jars, check closely for cracks, nicks or chips. Wash jars in hot soapy water and rinse well. Keep the jars hot until they are filled and placed in the canner. This will help prevent jar breakage.

Two-piece metal canning lids need to be prepared for use. The flat lids can be used only once for sealing new products, but the ring bands can be reused as long as they are in good condition. Pretreat the new flat lids as directed by the manufacturer. Do not reuse lids from commercially canned foods for home canning.



Preparing the Vegetables

Select only fresh, young, tender vegetables for canning. The sooner you can get them from the garden to the jar, the better. If you buy vegetables to can, try to get them from a nearby garden or farm market.

For ease of packing and even cooking, sort the vegetables for size and maturity. Wash all vegetables thoroughly, whether or not they will be peeled. Dirt contains some of the bacteria hardest to kill. Do not let vegetables soak; they may lose flavor and nutrients. Handle them gently to avoid bruising.

Filling the Jars

Vegetables may be packed raw into jars or pre-heated and packed hot. Read the directions for each vegetable to determine which method may

be used. If given a choice, the hot pack produces a higher quality product. Remember, have the jars hot to prevent breakage as they are filled.

To raw pack - Put raw vegetables into jars and cover with boiling water. Most raw vegetables (except for starchy ones) should be packed firmly into the jars. Starchy vegetables such as corn, peas and lima beans should be packed loosely, because they expand during processing.

To hot pack - Heat vegetables in water or steam before packing. See directions for specific vegetables. Then cover with the boiling cooking liquid. Pack the hot food loosely.

For either pack, use enough liquid to fill around the solid food in the jar and to cover the food. See directions for each vegetable for the correct amount of headspace to leave between the top of the food and the top of the jar. This headspace is important for obtaining a good seal.

Salt may be added to each jar, if desired. The salt is only for seasoning and does not help to preserve the food. If salt is used, canning salt is recommended to prevent the liquid from turning cloudy. Usually 1/2 teaspoon salt per pint is adequate.

Closing the Jars

To remove any trapped air bubbles, slide a non-metallic (eg., plastic) spatula between the food and the sides of the jar. Add more liquid if necessary to obtain the proper headspace. Wipe the jar rim with a clean damp paper towel to remove any food particles or liquids.

Place the flat lid prepared according to the manufacturer's directions on the filled jar. Screw the metal ring band down fingertip tight.

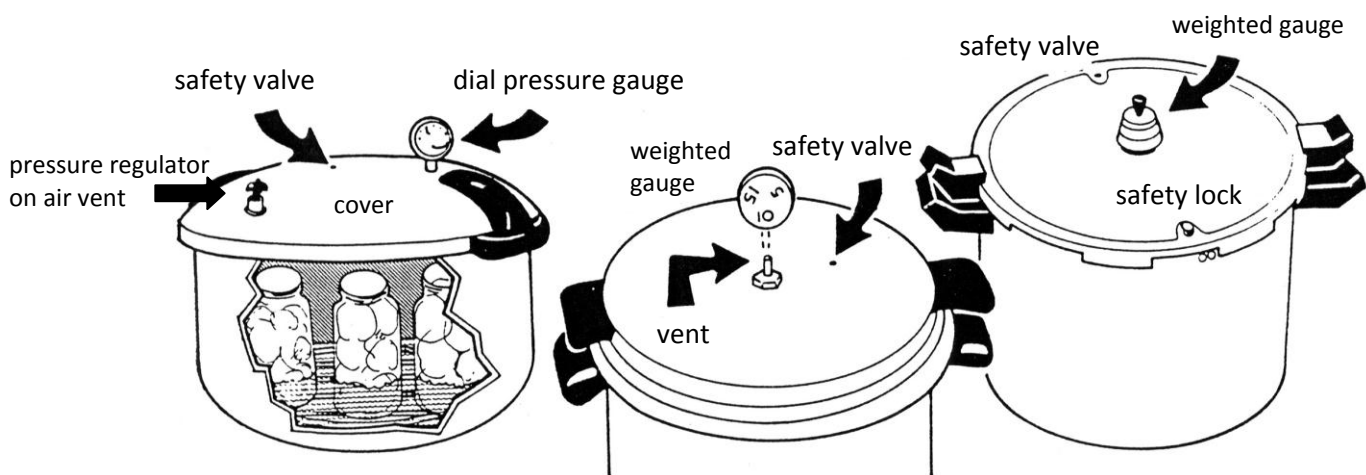
Processing Vegetables

Read the manufacturer's instructions on the use of your pressure canner. The following are general instructions:

- * Place the rack in the bottom of your pressure canner. Preheat two to three inches of water in your canner. The water should be hot but not simmering if you are canning raw pack foods. For hot pack foods, the water should be simmering or 180°F.
- * Using a canning jar lifter, place filled jars on a rack in the canner containing hot or simmering water. Make sure the jar lifter is securely positioned below the neck of the jar and ring band and keep the jar upright at all times. Tilting the jar could cause food or covering liquid to spill into the sealing area of the lid. Space the jars evenly around the canner.
- * Fasten the canner lid securely. Leave the weight off the vent pipe or open the petcock.
- * Turn heat to high so it boils and steam flows freely in a funnel shape from the open vent pipe. Let the steam escape (vent) continuously for 10 minutes with the heat on the high setting.
- * Close the vent, using a weight, or close the petcock, depending on the type of canner. If you have a weighted gauge canner that has a

weight of varying pressures, be sure you are using the correct pressure setting. The canner will begin to pressurize.

- * For a dial gauge canner, let the pressure rise quickly to eight pounds of pressure. Adjust the burner temperature down slightly and let the pressure continue to rise to the correct pressure. (If the burner was left on high, the pressure would be hard to regulate when the correct pressure is reached.)
- * Start counting the processing time as soon as the pressure is reached. For weighted gauge canners, let the canner heat quickly at first and then reduce the heat slightly until the weight begins to rock gently or "jiggle" two or three times per minute, depending on the type of canner you have. Start counting the processing time as soon as the weight indicates the canner is at pressure, according to manufacturer's directions.
- * Keep the pressure constant by regulating the heat under the canner. **Do not lower the pressure by opening the vent or lifting the weight.** Keep drafts from blowing on the canner. If the pressure ever drops below the recommended setting, bring the canner back to pressure and begin timing of the process over, from the beginning. This is important for the safety of the food.



Pressure Canners

- * When processing time is completed, turn off the heat. The canner may be removed from the heat of the electric burner if possible to do so without causing jars to tilt. If the canner is too heavy, simply turn off the heat and leave it in place. It is not necessary to move a canner from a turned off gas burner.
- * Let the pressure in the canner drop to zero through natural cooling. This can take 30 to 45 minutes in a 16-quart canner and nearly an hour for a 22-quart canner; the actual time will vary by the type of canner and the amount of hot food in the canner. Do not rush the cooling by setting the canner in water or by running cold water over the canner. Never lift the weight or open the vent to hasten the reduction of pressure.
- * When the gauge on a dial gauge canner registers zero or when a gentle nudge to the weight on a weighted gauge canner does not produce steam or resistance, wait two minutes, and then open the vent or remove the weight. Wait ten more minutes and then open the canner. Unfasten the lid, and tilt it so the steam escapes away from your face. Do not leave the canner unopened to cool completely, or the food inside could begin to spoil and the canner could be difficult to open.
- * Using a jar lifter, carefully remove the jars from the canner being careful not to tilt them. Carefully place the jars right side up on a rack or dry towels to prevent jars from breaking on contact with a cold surface. Leave at least one inch of space between jars during cooling.
- * Allow the jars to cool undisturbed, away from drafts, for 12 to 24 hours. Do not tighten ring bands on the lids or push down on the center of the lid until the lid is completely cooled. Even if a popping sound is heard as lids seal, leave the jar and lid untouched until completely cool.

Day-After Canning Jobs

Test the seal on the jar lids. Press flat metal lids at the center of the lid. They should be slightly concave and should not move. Ring bands should be removed from thoroughly cooled jars; wash and dry them so they will be in good condition after storing.

Wash food residue from the jars and rinse. Label sealed jars with contents and date.

Store the canned food in a cool, dry place. Stored properly, canned vegetables should retain their high quality for about one year.

Unsealed jars of foods need to be treated as fresh. The food can be eaten immediately, refrigerated, frozen or reprocessed. If you reprocess the food, the whole processing time must be repeated.

On Guard Against Spoilage

Do not taste or use canned vegetables that show any signs 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.

All spoiled canned foods should be discarded in a place where they will not be eaten by humans or pets. Spoiled low acid vegetables can contain botulism toxin. Also, if not properly processed, canned vegetables can contain botulism toxin without showing signs of spoilage. Vegetables 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 jar, style of pack and kind of food being processed.
- * Ingredients were added that were NOT in an approved recipe or the proportions of ingredients were CHANGED.
- * The processing time and pressure were NOT correct for the altitude at which the food was canned.

Because improperly canned vegetables may contain botulism toxin without showing signs of spoilage, they should also be detoxified before being discarded if the seals are broken. Spoiled or suspect jars of vegetables that are still sealed should be wrapped securely in a heavy plastic garbage bag. Close and place the bag in trash or dispose in a nearby landfill. Be sure to discard in a manner so they will not be eaten by humans or pets. If the jars are unsealed or opened, they should be detoxified before discarding. Be extremely careful not to splash or come in contact with the suspect food or any liquid. Contact with botulinum toxin can be fatal whether it is ingested or enters through the skin. Wear disposable rubber or heavy plastic gloves. To detoxify these products, place the jar(s) with lid(s) on their sides in a large stockpot or boiling water canner. Wash your hands and gloves thoroughly. Carefully add water to the pot, avoiding splashing, being sure that the water completely covers the jars with at least 1-inch of water above them. Heat the water to a vigorous boil and boil for 30 minutes. Cool and discard all contents, although the jar may be re-used if desired and care is exercised in cleaning it up.

Surfaces that come in contact with spoiled or questionable canned vegetables or their liquid should also be cleaned up, taking care to avoid contact with suspect foods or liquids. Wear rubber or heavy plastic gloves while cleaning up. A freshly made solution of 1 part unscented liquid household chlorine bleach (5 to 6% sodium hypochlorite) to 5 parts clean water should be used to treat work surfaces, water faucet and handles, equipment, or other items, including can openers and clothing, that may have come in contact with suspect food or liquid. Spray or wet contaminated surfaces with this bleach solution and let stand for 30 minutes. Wearing gloves, wipe up treated spills with paper towels, being careful to minimize the spread of contamination. Dispose of these paper towels by placing them in a plastic bag before putting them in the trash. Next, apply the bleach solution to all surfaces, let stand for 30 minutes and rinse. As a last step, thoroughly wash all detoxified countertops, containers, and other surfaces. Discard gloves when the cleaning process is complete. (Note: Bleach is an irritant itself and should not be inhaled or allowed to come in contact with the skin.)

Directions for Canning Vegetables

Caution! Altitude Adjustments: The processing times and pressures given here are those recommended by the U.S. Department of Agriculture. DO NOT DECREASE the processing times or pressures given. At varying altitudes, the PROCESSING TIMES STAY THE SAME, but you must make the following adjustments:

In a Dial Gauge Pressure Canner

- * At altitudes of 0 - 2000 feet, process at 11 pounds pressure.
- * At altitudes of 2001 - 4000 feet, process at 12 pounds pressure.
- * At altitudes of 4001 - 6000 feet, process at 13 pounds pressure.
- * At altitudes of 6001 - 8000 feet, process at 14 pounds pressure.

In a Weighted Gauge Pressure Canner

- * At altitudes of 0 - 1000 feet, process at 10 pounds pressure.
- * At altitudes above 1000 feet, process at 15 pounds pressure.

There are NO safe boiling water processing times for any of the vegetables in this publication.

Vegetable	Pack	Preparation	Processing Time (Minutes)	
			Pints	Quarts
Beans: Green Snap, Wax, Italian	Hot	Wash; trim ends. Leave whole or break or cut into 1 inch pieces. Cover beans with boiling water and boil 5 minutes. Pack hot beans into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling cooking liquid. Wash; trim ends. Leave whole or break or cut into 1		20 25

	Raw	inch pieces. Pack beans tightly into hot jars, leaving 1 inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling water.	Pints Quarts	20 25
Beans: Lima, Butter, Soy	Hot	Shell and wash young tender beans. Cover beans with boiling water; bring to a boil and boil 3 minutes. Pack hot beans loosely in hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling cooking liquid.	Pints Quarts	40 50
	Raw	Shell and wash young tender beans. Pack beans loosely in hot jars, leaving 1-inch headspace for pints. For quarts, leave 1 ½ inches if beans are small; 1 ¼ if large. If desired, add ½ teaspoon salt per pint. Fill jar with boiling water, again leaving 1-inch headspace.	Pints Quarts	40 50
Beets	Hot	Cut off tops leaving 1 inch of stem and tap root. Wash. Cover with boiling water; boil until skins slip easily – 15 to 25 minutes, according to size. Skin, trim tap root and stem. Can baby beets whole; cut medium and large beets in ½ inch cubes or slices. Halve or quarter large slices. Pack hot beets into hot jars leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill to 1 inch from top with boiling water.	Pints Quarts	30 35
Carrots	Hot	Wash, peel and re-wash carrots. Baby carrots can be left whole; slice or dice larger ones. Cover with boiling water, bring to a boil, boil 5 minutes. Pack hot carrots into jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill 1 inch from top with boiling cooking liquid.	Pints Quarts	25 30
	Raw	Wash, peel and re-wash carrots. Baby carrots can be left whole; slice or dice larger ones. Pack carrots tightly into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill to 1 inch from top with boiling water.	Pints Quarts	25 30
Corn: Cream-Style (use pint jars only)	Hot	Shuck, silk and wash corn. Blanch ears 4 minutes in boiling water. Cut from cob at about center of kernel; scrape cobs. Add 1 cup boiling water to each 2 cups of corn. Boil 3 minutes. Pack hot corn into jars, leaving 1-inch headspace. If desired add 1 teaspoon salt per pint.	Pints	85
Corn: Whole Kernel		Note: Some sweet corn varieties will turn very dark after canning. Do not reduce the processing time or		

		pressure. Ask your seed company or farmer if the corn you have is a variety recommended for canning.		
	Hot	Shuck, silk and wash corn. Blanch 3 minutes in boiling water. Cut from cob at about 2/3's depth of kernel. Do not scrape cobs. Add 1 cup boiling water to each 4 cups of corn and bring to a boil. Simmer 5 minutes. Pack hot corn into jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling cooking liquid.	Pints Quarts	55 85
	Raw	Shuck, silk and wash corn. Blanch 3 minutes in boiling water. Cut from at about 2/3's depth of kernel. Do not scrape cobs. Pack corn into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill to 1 inch from top with boiling water.	Pints Quarts	55 85
Greens: Spinach, Turnip, Mustard	Hot	Wash thoroughly and cut out tough stems. Blanch 1 pound of greens at a time, until well wilted (about 3 to 5 minutes). Pack hot greens loosely into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling cooking liquid.	Pints Quarts	70 90
Mixed Vegetables	Hot	Select your favorite mixture of vegetables, except leafy greens, dried beans, cream-style corn, winter squash or sweet potatoes. (Equal portions of carrots, whole kernel sweet corn, green beans, lima beans, tomatoes and diced zucchini make a good mix). Prepare each vegetable as for canning and cut into the desired sizes. Mix together, cover with boiling water and bring back to a boil. Boil 5 minutes. Pack hot vegetables into jars, leaving 1-inch headspace. Add ½ teaspoon salt to each pint jar, if desired. Fill jar to 1 inch from top with boiling liquid.	Pints Quarts	75 90
Okra	Hot	Wash and trim pods. Cut in 1 inch pieces or leave whole. Pre-cook okra for 2 minutes in boiling water. Drain. Pack into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill to 1 inch from top with boiling water.	Pints Quarts	25 40
Peas: Blackeye, Crowder, Field	Hot	Shell and wash peas. Cover peas with boiling water; boil 3 minutes. Pack hot into jars, leaving 1-inch headspace for pints, 1 ½ inch for quarts. If desired, add ½ teaspoon salt per pint. Fill jar with boiling cooking liquid, leaving 1-inch headspace.	Pints Quarts	40 50
	Raw	Shell and wash peas. Pack loosely in hot jars, leaving		

		1-inch headspace for pints, 1 ½ inches for quarts. Do not shake or press down. If desired, add ½ teaspoon of salt per pint. Fill jar with boiling water, leaving 1-inch headspace.		
Peas: Green or English	Hot	Shell and wash peas. Cover with water and bring to a boil. Boil 2 minutes. Pack hot into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling cooking liquid.	Pints Quarts	40 40
	Raw	Shell and wash peas. Pack into hot jars, leaving 1-inch headspace. Do not shake or press down. If desired, add ½ teaspoon salt per pint. Fill to 1 inch from top with boiling water.	Pints Quarts	40 40
Potatoes: White	Hot	Select small or medium-size potatoes. For packing whole, choose potatoes 1 to 2 inches in diameter. Wash; pare, cut potatoes into ½ inch cubes, if desired. Place cubes in solution of 1 teaspoon (3000 mg) ascorbic acid and 1 gallon of water to prevent darkening. Drain. Cook whole potatoes for 10 minutes, cubes for 2 minutes in boiling water. Drain. Pack hot into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with fresh boiling water.	Pints Quarts	35 40
Pumpkin: Cubed (It is not safe to can strained or mashed pumpkin)	Hot	Wash pumpkin, remove seeds and pare. Cut into 1 inch cubes. Add to a saucepot of boiling water, boil 2 minutes. Pack hot cubes into hot jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling cooking liquid.	Pints Quarts	55 90
Squash: Winter (Acorn, Butternut, Golden Delicious, Hubbard, etc.)		Follow preparation procedures and processing times for cubed pumpkin. DO NOT CAN spaghetti squash. Its flesh does not stay cubed during processing. Spaghetti squash can be frozen.		
Sweet Potatoes	Hot	Wash small or medium potatoes; boil or steam until partially soft (15 to 20 minutes). Cool slightly and remove skins. Cut medium potatoes, if needed, so that pieces are uniform in size. Pack hot potatoes in hot	Pints Quarts	65 90

		jars, leaving 1-inch headspace. If desired, add ½ teaspoon salt per pint. Fill jar to 1 inch from top with boiling water or syrup made from 1 to 1 ¾ cups sugar and 4 cups water.		
Tomatoes		See Extension Publication FDNS-E-43-2, <i>Preserving Food: Canning Tomatoes and Tomato Products</i> .		
Vegetable Soup	Hot	<p>Choose your favorite vegetable ingredients. Prepare each as you would for a hot pack in canning. Cooked meat or poultry can also be added, if desired. Combine ingredients with hot water, broth, or tomatoes and juice to cover. Boil 5 minutes. If dried beans or peas are used, they MUST be rehydrated first. CAUTION: DO NOT THICKEN OR ADD MILK, CREAM, FLOUR, RICE, BARLEY OR OTHER GRAINS, NOODLES OR OTHER PASTA. These ingredients can slow down the rate of heating and these process times have not been tested for use with soups containing these ingredients.</p> <p>Add salt to taste, if desired. Fill hot jars halfway with solid mixture. Continue filling with hot liquid, leaving 1-inch headspace.</p> <p>NOTE: Cooked seafood can also be added. If it is, additional processing time will be needed.</p>	<p>Pints Quarts</p> <p>Pints Quarts</p>	<p>60 75</p> <p>100 100</p>

Authors: Elizabeth L. Andress, Ph.D., and Judy A. Harrison, Ph.D., Extension Foods Specialists, The University of Georgia Cooperative Extension. Reprinted with permission from the University of Georgia. Revised 07-10

Education programs of Texas A&Ms AgriLife Extension Service are open to all people without regard to race, color, sex, disability, religion, age or national origin.