



CANNING: VEGETABLES

Vegetables are low in acid and require processing in a pressure canner with a weighted control or dial gauge.

SAFETY CONCERNS

A deadly form of foodborne illness, botulism can occur when low-acid foods are improperly processed. The higher temperatures of the pressure canner are necessary to ensure that any *Clostridium botulinum* spores are killed. If the organism is present in canned low-acid vegetables, botulism toxin can be produced. Even sealed containers without any visible sign of spoilage can contain botulism toxin.

- To avoid the risk of botulism, make sure your pressure canner is in good working order; check the gauge yearly for accuracy; and follow all canning recommendations exactly; make sure it has a tightfitting cover.
- Since the rate of heat penetration and acidity is affected by the combination of foods used, do not can vegetable mixtures such as vegetable soup or chili sauce unless you have a USDA approved and tested recipe.
See nchfp.uga.edu/publications/publications_usda.html
- Never thicken vegetables prior to canning. To can mixed vegetables use the processing time of 75 minutes for pints and 90 minutes for quarts.
- Always check home canned vegetables carefully for signs of spoilage before and after opening. When opening, watch for spurting liquid, an off odor, or mold.

If there is any doubt whether home-canned food is spoiled, don't use it. Boil any spoiled food for 30 minutes before disposing of it so that it will not be eaten by humans or animals. As a safety precaution, boil low-acid vegetables for 10 minutes before tasting or serving plus 1 minute for each 1,000 feet above sea level. Boil home-canned spinach or corn for 20 minutes. If the food looks spoiled, foams, or has an off odor during heating, discard it.

SELECT AND PREPARE VEGETABLES CAREFULLY

Choose only fresh, young, tender vegetables. Wash the vegetables gently and thoroughly, small amounts at a time, under running water.

The number of quarts of canned food from a given amount of fresh vegetables depends on quality, condition, maturity, and variety of the vegetable; the size of pieces packed; and the way the vegetable is packed—raw or hot pack.

Generally, the following amounts of fresh vegetables (as purchased or picked) make 1 quart when canned:

ASPARAGUS	2-3 lbs
BEANS, lima, in pods	4-5 lbs
BEANS, snap or green	½-2 lbs
BEETS, without tops	2 to 3 lbs
CARROTS, without tops	2 to 3 lbs
CORN, sweet, in husks	4-5 lbs
PEAS, green, in pods	4-5 lbs
PUMPKIN/WINTER SQUASH	1 to 3 lbs
SPINACH, other greens	2 to 6 lbs

USE STANDARD JARS AND LIDS

Use only jars and two-piece lids made especially for canning. Check jars and lids for cracks, chips, dents, and rust; these defects cause sealing failures. Commercial jars such as those for mayonnaise are not recommended for home canning because they are not designed for use with two-piece lids and because the glass is more likely to break during processing. Wash jars in hot, soapy water; rinse well. Prepare lids and bands according to manufacturer's directions.

Mineral deposits or hard water film on jars can be removed by soaking the empty jars for several hours or overnight in a solution of 1 cup vinegar per gallon of water.

FILL JARS AND ADJUST LIDS

The hot-pack method is recommended for all low-acid food, including vegetables. Some vegetables may also be packed raw. See Table 1 for specific directions.

Most raw vegetables should be packed closely because they shrink during processing. Corn, lima beans, and peas absorb liquid and expand when processed so should be loosely packed. Vegetables packed hot should be at or near boiling temperature and should be packed loosely.

Use the hot cooking liquid and add boiling water, if needed, to fill the jar and cover the food for both raw and hot packed vegetables. If the vegetables at the top of the jar are not covered, they may darken.

Salt is not needed for preservation in canned products but can be added for flavor. Use 1 teaspoon per quart or ½ teaspoon per pint. The space between the packed food and liquid and the top of jar is called headspace. The amount of headspace required is given with details for canning each vegetable. Too much or too little headspace will affect jar seals.

Slide a non-metallic spatula between food and side of jar to remove any air bubbles. Wipe jar rims to remove food particles that might interfere with sealing. Adjust lids. Screw on the band fingertip tight.

PROCESS IN A PRESSURE CANNER

Partially fill canner with 2 to 3 inches of water. Place jar rack and sealed jars in canner. Fasten lid. Heat on high. After steam exhausts for 10 minutes, add weighted gauge or close petcock. Allow canner to reach designated pressure. Start timing when designated pressure is reached or when the weighted gauge begins to jiggle or rock. Regulate heat to maintain a constant pressure.

Process for the time recommended in Table 3. Do not reduce the processing time.

When processing is complete, remove canner from the burner, if you are able to do so safely. Allow the canner to cool at room temperature until it is fully depressurized. This will take 30 to 60 minutes depending on the type of canner. Do not rush the cooling by setting the canner in water or by running cold water over the canner. Do not open the vent or lift the weight to quicken the reduction of pressure. When the pressure has dropped to zero, carefully open the petcock or remove the weighted gauge.

Wait 10 minutes, then slowly release and remove the canner lid.

REMOVE AND STORE JARS

Take jars from canner and set upright on a rack or folded cloth away from drafts. Do not tighten the screw bands. Allow jars to cool undisturbed for 12 to 24 hours, then check for sealing failures. To test jar, press center of lid. If lid is down and will not move, jar is sealed. Remove screw bands carefully. Wash, dry, label, and store jars in a cool, dark place. If any jars have not sealed, place in refrigerator and use within two days. Vegetables can be reprocessed with fresh liquid, new lids, and clean jars, and the full processing time, but quality will be affected.

CHECK ALTITUDE

As altitude increases, water boils at a lower temperature (below 212° F). Lower temperatures are not as effective for destroying organisms. Therefore, when using a pressure canner, the pressure must be increased as altitude increases. Refer to the map below to check the altitude of your county, then follow the altitude adjustments in Table 2.

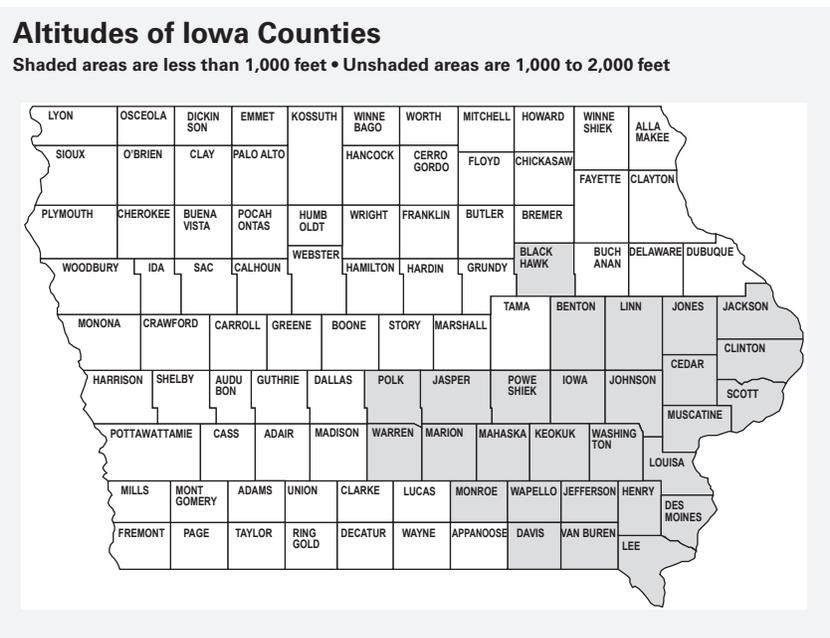


Table 1. Directions for Preparing and Packing Vegetables

VEGETABLE	PACK	PREPARATION
ASPARAGUS	Raw	Wash, trim, cut in 1-inch pieces. Pack tightly without crushing, leaving 1-inch headspace. Cover with boiling water, maintaining 1-inch headspace.
	Hot	Wash, trim, cut in 1-inch pieces. Cover with boiling water. Boil 2 or 3 minutes. Loosely fill jars with hot asparagus, leaving 1-inch headspace. Add salt. Cover with boiling liquid, maintaining 1-inch headspace.
BEANS, lima	Raw	Shell, sort, and wash beans. For small beans, allow 1-inch headspace for pints and 1½ inches for quarts. For large beans, allow 1-inch headspace for pints and 1¼ inches for quarts. Do not press or shake beans down. Pack raw beans loosely into jars. Cover with boiling water, maintaining headspace.
	Hot	Shell, sort, and wash beans; cover with boiling water and bring to boil. Fill jars loosely, leaving 1-inch headspace. Cover with boiling water, maintaining 1-inch headspace.
BEANS, snap, green, wax, Italian	Raw	Wash, trim, leave whole or cut in 1-inch pieces. Pack tightly, leaving 1-inch headspace. Cover with boiling water, maintaining 1-inch headspace.
	Hot	Wash, trim, leave whole or cut in 1-inch pieces. Cover with boiling water; boil 5 minutes. Pack hot beans loosely, leaving 1-inch headspace. Cover with boiling hot cooking liquid, maintaining 1-inch headspace.
BEETS	Hot	Cut off tops; leave 1-inch of stem. Leave roots to minimize color loss. Wash beets. Cover with boiling water. Boil until skins slip off easily (15 to 25 minutes). Cool, remove skins, and trim off stems and roots. Discard cooking liquid. Leave small beets whole; cut larger beets in ½-inch cubes or slices. Halve or quarter larger slices. Pack hot beets in jars, leaving 1-inch headspace. Cover with fresh boiling water, maintaining 1-inch headspace.
CARROTS	Raw	Wash, peel, and rewash carrots. Slice or dice. Baby carrots can be left whole. Pack tightly, leaving 1-inch headspace. Cover with boiling water, maintaining 1-inch headspace.
	Hot	Wash, peel, and rewash carrots. Cover with boiling water; bring to boil and simmer 5 minutes. Fill jars, leaving 1-inch headspace. Cover with boiling cooking liquid, maintaining 1-inch headspace.
CORN, cream style	Hot	Husk, remove silk, wash ears. Cut corn from cob at center of kernel; scrape cobs. To each 4 cups of corn and scrapings in saucepan add 2 cups boiling water. Heat to boiling. Use pint jars only; fill with hot corn mixture, leaving 1-inch headspace. Do not shake or press down. Cover with fresh boiling water, maintaining 1-inch headspace.
CORN, whole kernel	Raw	Husk, remove silk, wash ears. Blanch 3 minutes in boiling water. Cut from cob about ¾ depth of kernel. Do not scrape cob. Pack corn in jars, leaving 1-inch headspace. Do not shake or press down. Add fresh boiling water, leaving 1-inch headspace.
	Hot	Husk, remove silk, wash ears. Blanch 3 minutes in boiling water. Cut from cob about ¾ the depth of kernel. Do not scrape cob. To each 4 cups of corn in a saucepan add 1 cup hot water. Heat to boiling and simmer 5 minutes. Fill jars with corn, leaving 1-inch headspace. Cover with cooking liquid or fresh boiling water, maintaining 1-inch headspace.
GREENS, beet, Swiss chard, spinach	Hot	Can only freshly picked, tender greens. Wash thoroughly, remove tough stems (beet, Swiss and midribs. Place 1 pound greens in blancher or cheesecloth bag, steam 3 to chard, spinach) 5 minutes or until well wilted. Pack hot greens loosely, leaving 1-inch headspace. Cover with boiling water, maintaining 1-inch headspace.
PEAS, fresh green	Raw	Shell and wash peas. Fill jars with raw peas, leaving 1-inch headspace. Do not shake or press down. Cover with boiling water, maintaining 1-inch headspace.
	Hot	Shell and wash peas. Cover with boiling water. Bring to boil and boil for 2 minutes. Pack hot peas loosely, leaving 1-inch headspace. Cover with boiling water, maintaining 1-inch headspace.
PEAS, sugar snap, Chinese edible pods		Do not can; freezing gives better quality.
PEPPERS, hot or sweet	Hot	Select firm yellow, green, or red peppers. Do not use soft or diseased peppers. If you are using hot peppers, wear plastic gloves while handling them or wash hands thoroughly with soap and water before touching your face. Small peppers may be left whole. Large peppers may be quartered. Remove cores and seeds. Slash two to four slits in each pepper and either blanch in boiling water or blister skins by placing the peppers in a hot oven (400° F) or broiler for 6 to 8 minutes. Allow peppers to cool. Place in a pan and cover with a damp cloth to make peeling the peppers easier. After several minutes, peel each pepper. Flatten whole peppers. Fill pint or half-pint jars loosely with peppers. Add fresh boiling water, maintaining 1-inch headspace.
POTATOES	Hot	Wash and peel potatoes. Dip potatoes into solution of ½ teaspoon ascorbic acid per quart of water to prevent darkening. Drain. Place potatoes in saucepan. Cook small, whole potatoes (1- to 2½-inches in diameter) in white boiling water for 10 minutes. Larger potatoes can be cut into ½-inch cubes and cooked for 2 minutes in boiling water. Drain and pack hot, leaving 1-inch headspace. Cover with fresh boiling water, maintaining 1-inch headspace.
PUMPKIN	Hot	Wash, remove seeds, cut into 1-inch wide slices and pare. Cut flesh into 1-inch cubes and place in saucepan. Add enough water to prevent scorching and boil 2 minutes. DO NOT MASH OR PUREE. Fill jars with cubes and cooking liquid, leaving 1-inch headspace.
SWEET POTATOES	Hot	Wash potatoes and boil or steam until partially soft (15 to 20 minutes). Remove skins. Cut potatoes, if necessary, so pieces are uniform in size. DO NOT MASH OR PUREE. Fill jars, leaving 1-inch headspace. Cover with fresh boiling water or boiling sugar syrup (½ to 1 cup sugar per quart of water heated until sugar dissolves), maintaining 1-inch headspace.
WINTER SQUASH, Acorn, Banana, Buttercup, Butternut, Hubbard	Hot	Prepare and process according to instructions for pumpkin. NOTE: Spaghetti squash should not be canned because its flesh does not stay cubed during heating.

Table 2. Typical Vegetable Canning Problems

If there is any doubt whether canned food is spoiled, don't use it. Burn any spoiled food or dispose of it so that it will not be eaten by humans or animals.

CONDITION	CAUSES	PREVENTION
Food darkens at top of jar	<ol style="list-style-type: none"> 1. Liquid did not cover food. 2. Food not processed long enough to destroy enzymes. 3. Air was sealed in the jars either because headspace was too large or air bubbles were not removed. 	<ol style="list-style-type: none"> 1. Cover food with liquid before capping jars. 2. Process each food by recommended method and for correct time. 3. Use specified amount of headspace. Remove air bubbles with a non-metal spatula.
Black spots on underside of metal lid (may denote spoilage)	<ol style="list-style-type: none"> 1. Natural compounds in some foods cause a black or brown deposit on the underside of the lid. This deposit does not mean the food is unsafe to eat. 2. If jar has been sealed and then comes open, spoilage is evident. Do not use. 	<ol style="list-style-type: none"> 1. None 2. Use recommended processing and times; wipe jar rim before capping.
Cloudy liquid (may denote spoilage)	<ol style="list-style-type: none"> 1. Spoilage (do not use). 2. Minerals in hard water. 3. Starch in vegetables. 4. Fillers in table salt. 	<ol style="list-style-type: none"> 1. Process each food by recommended method and for recommended time. 2. Use soft water. 3. Select products at desirable stage of maturity. Do not use over-mature vegetables. 4. Use a pure, refined canning salt.
Loss of liquid during processing (Food may darken but will not spoil. Do not open jars to replace liquid)	<ol style="list-style-type: none"> 1. Improper seal for closure 2. Jars packed too tightly or too full. 3. Air bubbles not removed before capping the jar. 4. Pressure canner not operating correctly; pressure fluctuating 5. Pressure lowered suddenly. 6. Starchy foods absorb liquid. 	<ol style="list-style-type: none"> 1. Follow manufacturer instructions for the lids 2. Pack food more loosely. Leave recommended headspace. 3. Remove air bubbles by running non-metal spatula between food and jar. 4. Pressure should not fluctuate during canning process. Keep heat constant during processing time. 5. Allow pressure to drop to zero naturally; wait 2 minutes before opening lid. 6. None.
Jar seals, then comes open. Spoilage evident (do not use)	<ol style="list-style-type: none"> 1. Underprocessed. 2. Particles of food left on the sealing surface. 3. Hairline crack in jar. 	<ol style="list-style-type: none"> 1. Process each food by recommended method and for specified time. 2. Wipe rim and threads of jar with clean, damp cloth before capping. 3. Check jars prior to packing; discard ones unsuitable for canning.
Jars of food fail to seal	<ol style="list-style-type: none"> 1. Failure to follow instructions for using jar and lid. 2. Lifting jars by tops or inverting while hot 3. Sealing compound defective. 4. Edge of lid or rim of jar bent or chipped. 5. Food particles on jar rim. 	<ol style="list-style-type: none"> 1. Carefully follow instructions. 2. Use jar lifter for removing jars from canner, gripping below lid. Leave in upright position. 3. Use new lids. 4. Check lids and jars prior to use. 5. Wipe jar edge before putting on lid.
Jars break	<ol style="list-style-type: none"> 1. Hairline crack in jar. 2. Rack not used in bottom of canner. 3. Screw bands applied too tightly so air could not escape during processing. 	<ol style="list-style-type: none"> 1. Check jars prior to processing. Be careful when packaging and processing jars. 2. Use rack and recommend amount of water. 3. Apply screw bands more loosely.
Corn is brown	<ol style="list-style-type: none"> 1. Minerals in water. 2. Jars were processed at too high a temperature. 	<ol style="list-style-type: none"> 1. Use soft water. 2. Keep pressure in canner at recommended pounds; gauge may be faulty and should be checked.
Green vegetables losing their bright color	<ol style="list-style-type: none"> 1. Heat breaks down chlorophyll, the green pigment in plants. 2. Vegetables were too mature for canning. 	<ol style="list-style-type: none"> 1. None. 2. Select young, tender vegetables.
Yellow crystals on canned green vegetables	Glucoside, a harmless substance, naturally present in vegetables.	None.
White crystals in canned spinach	Calcium and oxalic acid in spinach combine to form harmless calcium oxalate.	None.
White sediment in bottom of jars of vegetables (may denote spoilage)	<ol style="list-style-type: none"> 1. Starch from the food. 2. Minerals in hard water. 3. Bacterial spoilage—liquid is usually murky, food soft. Do not use. 	<ol style="list-style-type: none"> 1. Select products at desirable stage of maturity. Do not use over-mature vegetables. 2. Use soft water 3. Process each food by recommended method and for specified time.

Table 3. Recommended Processing Times for Pressure Canning Vegetables

VEGETABLE	PACK	JAR SIZE	MINUTES OF PROCESSING TIME	CANNER PRESSURE AT ALTITUDES OF		
				0-2,000 FT	0-1,000 FT	ABOVE 1,000 FT
				DIAL GAUGE (LBS)	WEIGHTED GAUGE (LBS)	
ASPARAGUS	Raw or Hot	Pints	30	11	10	15
		Quarts	40	11	10	15
BEANS, lima	Raw or Hot	Pints	40	11	10	15
		Quarts	50	11	10	15
BEANS, snap, green, wax, Italian	Raw or Hot	Pints	20	11	10	15
		Quarts	25	11	10	15
BEETS	Hot only	Pints	30	11	10	15
		Quarts	35	11	10	15
CARROTS	Raw or Hot	Pints	25	11	10	15
		Quarts	30	11	10	15
CORN, cream style	Hot only	Pints only	85	11	10	15
CORN, whole kernel	Raw or Hot	Pints	55	11	10	15
		Quarts	85	11	10	15
GREENS: beet, swiss chard, spinach	Hot	Pints	70	11	10	15
		Quarts	90	11	10	15
PEAS, fresh green	Raw or Hot	Pints	40	11	10	15
		Quarts	40	11	10	15
PEPPERS, hot or sweet	Hot	Half-pints	35	11	10	15
		Pints	35	11	10	15
POTATOES, white	Hot	Pints	35	11	10	15
		Quarts	40	11	10	15
PUMPKIN	Hot	Pints	55	11	10	15
		Quarts	90	11	10	15
SWEET POTATOES	Hot	Pints	65	11	10	15
		Quarts	90	11	10	15
WINTER SQUASH, acorn, banana, buttercup, butternut, hubbard	Hot	Pints	55	11	10	15
		Quarts	90	11	10	15

FOR MORE FOOD PRESERVATION INFORMATION

- Call AnswerLine (800) 262-3804 (voice) or (800) 735-2942 (telecommunications device for deaf)
- Download ISU Extension and Outreach fact sheets from store.extension.iastate.edu
- Access the U.S. Department of Agriculture's *Complete Guide to Home Canning* at nchfp.uga.edu

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Map prepared by Iowa Department of Natural Resources, Geological Survey Bureau

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