

Let's Preserve: Canning Basics

Julie A. Albrecht, Extension Food Specialist

Canning can be a safe and economical way to preserve quality food at home. Home-preserved foods can help provide a variety of nutritious meals for your family all year long.

How Canning Preserves Foods

The high water content of most fresh foods makes them very perishable. Foods spoil or lose their quality for several reasons:

- growth of undesirable microorganisms — bacteria, molds, and yeasts
- activity of food enzymes
- reactions with oxygen
- moisture loss

Microorganisms live and multiply quickly on the surfaces of fresh food and on the inside of bruised, insect-damaged, and diseased food. Oxygen and enzymes are present throughout fresh food tissues.

Proper canning practices remove oxygen, destroy enzymes, prevent the growth of undesirable bacteria, yeasts, and molds, and help form a high vacuum in jars. Good vacuums form tight seals which keep liquid in and air and microorganisms out.

Ensuring Safely Canned Foods

Growth of the bacterium *Clostridium botulinum* in home canned food may cause botulism — a deadly form of food poisoning. These bacteria exist either as spores or as vegetative cells. The spores, which are comparable to plant seeds, can survive in the soil and water for many years. When ideal conditions exist for growth, the spores produce

vegetative cells which multiply rapidly and may produce a deadly toxin within three to four days in an environment consisting of:

- a moist, low-acid food;
- a temperature between 40°F and 120°F; or
- less than 2 percent oxygen.



Photo courtesy of National Presto Industries, Inc.

Botulinum spores are on most fresh food surfaces. Because they grow only in the absence of air, they are harmless on fresh foods.

Most bacteria, yeasts, and molds are difficult to remove from food surfaces. Washing fresh food reduces their numbers only slightly. Peeling root crops, underground stem crops, and tomatoes greatly reduces their numbers. Blanching also helps, but it's vital to make sure recommended processing procedures and times are used.

Processing Methods

Whether food should be processed in a pressure canner or boiling-water canner to control botulinum bacteria depends on the acidity in the food. Acidity of foods is measured by pH.

Low-acid foods contain too little acidity to prevent the growth of botulinum bacteria. Low-acid foods have pH values higher than 4.6. They include red meats, seafood, poultry, milk, and all fresh vegetables except most tomatoes. Most food mixtures have pH values above 4.6 unless the recipes include enough lemon juice, citric acid, or vinegar to make them acid foods.

Botulinum spores are very hard to destroy at boiling-water temperatures. Therefore, process all low-acid foods using 10 to 15 pounds of pressure to attain temperatures of 240°F to 250°F. To assure that microorganisms in

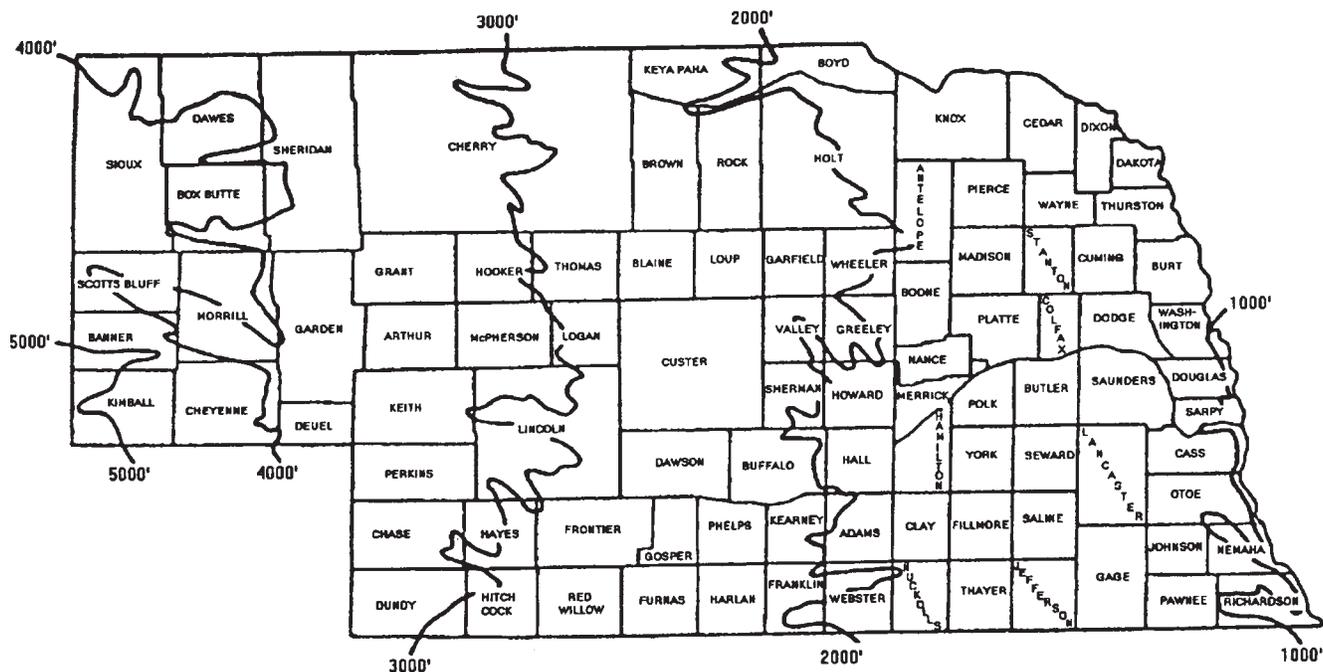


Figure 1. Altitude ranges in Nebraska.

Map was prepared by Les Howard, cartographer, UNL School of Natural Resources

low-acid foods are destroyed, use the correct time and pressure specified for your altitude.

Acid foods contain enough acidity to inhibit botulinum spores and vegetative cell growth or destroy them more rapidly when heated. The pH value of acid foods is 4.6 or lower. Acid foods include fruits, pickles, sauerkraut, jams, jellies, marmalades, and fruit butters.

Tomatoes are usually considered an acid food, although some varieties are known to have pH values slightly above 4.6. If tomatoes are to be canned as acid foods, these products must be acidified to a pH of 4.6 or lower with vinegar, lemon juice, or citric acid. To destroy microorganisms in acid foods processed in a boiling water canner, you must process jars for the correct number of minutes.

Altitude and Food Preservation

At sea level, water boils at 212°F. As the altitude increases, water will boil at a lower temperature. For altitudes above sea level, it is necessary to add additional time or pressure to processing to obtain a safe product.

The map indicates the altitudes for Nebraska (Figure 1). Publications for canning specific foods will give the processing times and pressures for various altitudes.

Equipment

Equipment for heat-processing home canned food is of two main types: boiling-water canners and pressure canners. Most are designed to hold seven quart jars or eight to nine pints. Small pressure canners hold four quart jars;

some large pressure canners hold 18 pint jars in two layers, or seven quart jars. Pressure saucepans with smaller volume capacities are not recommended for canning.

Boiling-Water Canners

These canners are made of aluminum or porcelain-covered steel. They have removable perforated racks and fitted lids. The canner must be deep enough so that at least 1 inch of briskly boiling water will be over the tops of the jars during processing. On an electric range a flat bottom canner must be used; on a gas burner either a flat or ridged bottom can be used. To ensure uniform processing with an electric range, the canner should be no more than 4 inches wider than the element on which it is heated.

Using Boiling-Water Canners

Follow these steps for successful boiling-water canning:

1. Fill the canner half full with water.
2. Preheat water to 140°F for raw-packed foods and to 280°F for hot-packed foods.
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. Turn heat to its highest position until water boils vigorously.
6. Set a timer for the time required for processing the food.

7. Cover with the canner lid and lower the heat setting to maintain a gentle boil throughout the process.
8. Add more boiling water, if needed, to keep the water level above the jars.
9. When jars have been boiled for the recommended time, turn off the heat and remove the canner lid. Wait five minutes before removing jars.
10. Using a jar lifter, remove the jars and place them on a towel, leaving at least a 1-inch space between jars during cooling.

Pressure Canners

Pressure canners for home use have been redesigned in recent years. Before the 1970s, pressure canners were heavy-walled kettles with clamp-on or turn-on lids. They were fitted with a dial gauge, a vent port in the form of a petcock or counterweight, and a safety fuse. Modern pressure canners are lightweight, thin-walled kettles; most have turn-on lids. They have a jar rack, gasket, 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.

Canners with 16- to 23-quart capacity are common. The minimum volume of canner that can be used is one that will contain four quart jars. Pressure saucepans with smaller capacities are not recommended for canning.

Weighted Gauge

Weighted gauges allow the pressure to reach 5, 10, or 15 pounds. The weight maintains the pressure and temperature by releasing a small amount of air and steam each time the gauge rocks or jiggles during processing. The weighted-gauge pressure canner does not require constant watching; the sound indicates proper pressure control. The weighted gauge does not need to be checked for accuracy.

Dial Gauge

The dial gauge shows the amount of pressure and temperature in the canner. This gauge allows greater flexibility in the amount of pressure, but requires continual watching to maintain pressure. Check dial gauges for accuracy before use each year and replace if they read high by up to 2 pounds of pressure. Low readings cause over-processing and may indicate that accuracy of the gauge is unpredictable. Gauges may be checked at your local extension office.

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. Keep gaskets clean between uses. Gaskets on older model canners may require a light coat of vegetable oil once a year. Gaskets on newer model canners are prelubricated and do not benefit from oiling. Check your canner's instructions to see if the

gasket you use is prelubricated. Steam leaks around the cover indicate that the gasket needs to be replaced. Also, replace stiff or stretched gaskets.

Safety Fuse/Valve

Lid safety fuses are thin metal inserts or rubber plugs designed to relieve excessive pressure from the canner. Do not pick at or scratch fuses while cleaning lids. Use only canners that have the Underwriter's Laboratory (UL) approval to ensure their safety. If you replace the gasket, replace the rubber safety valve.

Replacement Parts

Replacement gauges and other canner parts often are available from stores selling canning equipment or from canner manufacturers. When ordering parts, give your canner model number and describe the parts needed.

Addresses and phone numbers for canner manufacturers are:

Mirro Aluminum Company
Manitowoc, Wisconsin 54220
Website: www.mirroparts.com

National Presto Industries, Inc
3925 North Hastings Way
Eau Claire, Wisconsin 54703
Phone: 1-800-877-0441
Website: www.gopresto.com

Proper Venting

To vent a canner, leave the vent port uncovered on newer models or manually open petcocks on some older models. Heating the filled canner with its lid locked into place boils water and generates steam that escapes through the petcock or vent port. When steam first escapes, set a timer for 10 minutes. After venting 10 minutes, close the petcock or place the counterweight or weighted-gauge over the vent port to pressurize the canner.

Using Pressure Canners

Follow these steps for successful pressure canning:

1. Put 2 to 3 inches of hot water in the canner. Place filled jars on the rack, using a jar lifter. Fasten canner lid securely.
2. Leave weight off vent port or open petcock. Heat at the highest setting until steam flows from the petcock or vent port.
3. Maintain high heat setting, exhaust steam for 10 minutes, and then place weight on vent port or close petcock. The canner will pressurize during the next three to five minutes.
4. Start timing the process when the pressure reading on the dial gauge indicates that the recommended pressure has been reached, or when the weighted gauge begins to jiggle or rock.

5. Regulate heat under the canner to maintain a steady pressure slightly above the correct gauge pressure. Quick and large pressure variations during processing may cause unnecessary liquid losses from jars. Weighted gauges on Mirro canners should jiggle about two or three times per minute. On Presto canners, they should rock slowly throughout the process.
6. When the timed process is completed, turn off the heat, remove the canner from the heat if possible, and let the canner depressurize. 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 will cause loss of liquid from jars and seal failures. Force-cooling also may warp the canner lid of older model canners, causing steam leaks. Depressurization of older models 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. These canners are depressurized when their vent lock piston drops to a normal position.
7. After the canner is depressurized, remove the weight from the vent port or open the petcock. Wait 10 minutes, unfasten the lid, and remove it carefully. Lift the lid away from you so that the steam does not burn your face.
8. Remove jars with a lifter, and place on towel or cooling rack, if desired.

Cleaning and Storing Pressure Canners

Wash canner with detergent and hot water. Clean vent pipe with a small brush or pipe cleaner. Rinse and dry thoroughly. Place lid upside down on canner to protect the valves and gauge. Store in a clean, dry place.

Jars and Lids

Jar Selection and Preparation

Regular and wide-mouth Mason-type, threaded, home-canning jars with self-sealing lids are the best choice. They are available in 1/2 pint, pint, and quart sizes. The standard jar mouth opening is about 2 3/8 inches. Wide-mouth jars have openings of about 3 inches, making them easier to fill and empty. Regular-mouth decorator jelly jars are available in 8- and 12-ounce sizes. With careful use and handling, Mason jars may be reused many times, requiring only new lids each time. When jars and lids are used properly, jar seals and vacuums are excellent and jar breakage is rare. Commercial mayonnaise or salad dressing jars are not recommended for canning because of excessive jar breakage and seal failures.

Do not use cracked jars for processing. Carefully check the jar-sealing surface for nicks, chips, and cracks. These

will cause unsealed lids, a poor seal, or a poor vacuum. During storage, a poor seal may not maintain the vacuum and spoilage will occur.

Before every use, wash empty jars in hot water with detergent and rinse well by hand, or wash in a dishwasher. Detergents may cause unnatural flavors and colors. Scale or hard-water films on jars are easily removed by soaking jars several hours in a solution containing 1 cup of vinegar per gallon of water.

To sterilize empty jars, put them right side up on the rack in a boiling-water canner. Fill the canner and jars with hot (not boiling) water to 1 inch above the tops of the jars. Boil 10 minutes at altitudes of less than 1,000 feet. At higher elevations, boil one additional minute for each additional 1,000 feet elevation. Remove and drain hot sterilized jars one at a time. Use sterile, empty jars for all jams, jellies, and pickled products processed less than 10 minutes.

Empty jars which will be used for processing vegetables, meats, and fruits in a pressure canner need not be presterilized. It is also unnecessary to presterilize jars for fruits, tomatoes, and pickled or fermented foods that will be processed 10 minutes or longer in a boiling-water canner.

Lid Selection and Preparation

The common self-sealing lid consists of a flat metal lid held in place by a metal screw band during processing. The flat lid is crimped around its bottom edge to form a trough, which is filled with a colored gasket compound. When jars are processed, the lid gasket softens and flows slightly to cover the jar-sealing surface, yet allows air to escape from the jar. The gasket then forms an airtight seal as the jar cools.

Buy only the quantity of lids you will use in a year. To ensure a good seal, carefully follow the manufacturer's directions in preparing lids for use. Examine all metal lids carefully. Do not reuse lids because the gasket compound is only good for one canning process. Old, dented, rusted, or deformed screwbands may not hold the lids securely during processing.

Filling Jars With Food

Foods to be processed may be hot-packed into jars or raw-packed. Check the UNL Extension publications page for links to other relevant guides: <http://extension.unl.edu/publications>.

Raw-pack

Raw-packing is the practice of filling jars tightly with freshly prepared, but unheated food. Such foods, especially fruit, will float in the jars. The entrapped air in and around the food may cause discoloration within two to three months of storage. Raw-packing is more suitable for vegetables processed in a pressure canner.

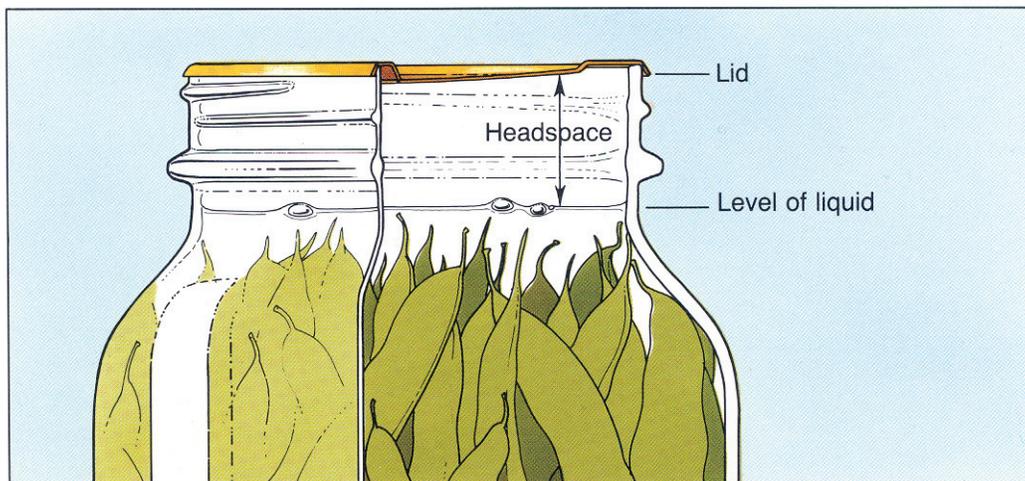


Figure 2. Proper way to process produce.

Hot-pack

Hot-packing is the practice of heating freshly prepared food to boiling, simmering it two to five minutes, and promptly filling jars loosely with the boiled food. This practice helps remove air from food tissues, shrinks food, helps keep the food from floating in the jars, increases vacuum in sealed jars, and improves shelf life. Preshrinking food permits filling more food into each jar. Hot packing is the preferred method for foods processed in a boiling-water canner. At first, the color of hot-packed foods may appear no better than that of raw-packed foods, but within a short storage period, both color and flavor of hot-packed foods will be superior.

Whether food has been hot-packed or raw-packed, the juice, syrup, or water to be added to the foods should also be heated to boiling before adding it to the jars.

Headspace

The unfilled space above the food in a jar and below the lid is termed headspace. This space is needed for expansion of food as jars are processed, and for forming a vacuum in cooled jars. The extent of expansion is determined by the air content in the food and by the processing temperature. Air expands greatly when heated to high temperatures; the higher the temperature, the greater the expansion. Foods expand less than air when heated.

For correct headspace for the food you are processing, check the appropriate UNL extension publication.

Fill jars with food, leaving appropriate headspace, and add liquid to cover food. Release air bubbles by inserting a flat plastic (not metal) spatula between the food and the jar. Slowly turn the jar and move the spatula up and down to allow air bubbles to escape. Add additional liquid, if needed, to obtain the proper headspace. Clean the jar rim (sealing surface) with a dampened paper towel. Place the lid, gasket down, onto the cleaned jar-sealing surface and fit the metal screw band over the flat lid (uncleaned jar-sealing surfaces may cause seal failures). Follow the manufacturer's guidelines for tightening the jar lids properly.

Process as directed for your specific food. Consult the appropriate publication for processing times.

After Processing

Do not retighten lids after processing jars. As jars cool, the contents contract, pulling the self-sealing lid firmly against the jar to form a high vacuum.

Cool the jars at room temperature for 12 to 24 hours. Jars may be cooled on racks or towels to minimize heat damage to counters. The food level and liquid volume of raw-packed jars will be noticeably lower after cooling. Air is exhausted during processing and food shrinks. If a jar loses excessive liquid during processing, do not open it to add more liquid.

Check for sealed lids by following one of these three methods:

1. Press the middle of the lid with a finger or thumb. If the lid springs up when you release your finger, the lid is unsealed.
2. Tap the lid with the bottom of a teaspoon. If it makes a dull sound, the lid is not sealed. If food is in contact with the underside of the lid, it will also cause a dull sound. If the jar is sealed correctly, it will make a ringing, high-pitched sound.
3. Hold the jar at eye level and look across the lid. The lid should be concave (curved slightly down in the center). If the center of the lid is either flat or bulging, it may not be sealed.

Screw bands can be removed after jars are cooled. Wash, dry, and store screwbands for future use. If left on stored jars, screwbands become difficult to remove, often rust, and may not be reusable. Before storing jars, wipe them with a clean, damp cloth. To remove mineral deposits, use a cloth that has been dipped in a solution containing 1 cup vinegar per gallon of water.

Reprocessing Sealed Jars

If a lid fails to seal on a jar, remove the lid and check the jar-sealing surface for tiny nicks. If necessary, change the jar, add a new, properly prepared lid, and reprocess within 24 hours using the same processing time. Headspace in unsealed jars may be adjusted to 1-1/2 inches and jars can be frozen instead of reprocessed. Foods in single unsealed jars can be stored in the refrigerator and consumed within several days.

Do not taste food from a stored jar with an unsealed lid or food that shows signs of spoilage.

Destroying Spoiled Canned Food

Growth of spoilage bacteria and yeast produce gas which pressurizes the food, swells lids, and breaks jar seals. Examine each jar before use. Lids should have a good seal. Look at the contents for rising air bubbles and unnatural color. While opening the jar, smell for unnatural odors and look for spurted liquid and cotton-like mold growth on the top surface of the food and underside of the lid.

Spoiled low-acid foods, including tomatoes, may exhibit different kinds of spoilage evidence or very little evidence. Treat all spoiled low-acid canned foods as having produced botulinum toxin.

Carefully handle spoiled, low-acid canned foods, including tomatoes, in one of two ways:

1. If the swollen metal can or suspect glass jars are still sealed, place the can or jar in a heavy garbage bag. Close and place the bag in a trash container or bury it in a nearby landfill.
2. If the suspect cans or glass jars are unsealed, open or leaking, they should be detoxified before disposal. Use rubber gloves to handle suspect containers.

Detoxification Process

Wear disposable rubber or heavy plastic gloves. Carefully place the containers, lids, and contents in a large stock pot (8 quarts or larger) or boiling water canner. Wash your gloved hands thoroughly. Carefully add water to the pot. The water should completely cover the contents of the pot and extend at least 1 inch above the contents. Avoid splashing the water. Place a lid on the pot and heat the water to boiling. Boil 30 minutes to ensure detoxifying the food and all container components. Cool and discard the container, lids, and food in the trash or bury in a landfill.

Cleaning Up the Area

Contact with botulinum toxin can be fatal whether it is ingested or enters through the skin. Take care to avoid contact with suspected food or liquid. Wear rubber or heavy

plastic gloves when handling suspected food or cleaning up contaminated work surfaces and equipment. Mix a fresh solution of one part unscented liquid household chlorine bleach (5 to 6 percent sodium hypochlorite) to five parts clean water to clean surfaces, equipment, or other items, including can openers and clothing that has come into contact with the suspected food. Spray or wet the contaminated surfaces with the bleach solution and let stand for 30 minutes. Wearing gloves, wipe up the treated areas with paper towels being careful to minimize the spread of contamination. Dispose of the paper towels by placing them in a plastic bag before putting them in the trash. Reapply the bleach solution to surfaces and equipment and let stand for 30 minutes and rinse. Thoroughly wash all detoxified counters, containers, equipment, and clothing. Discard gloves when the cleaning process is completed.

Storing Canned Foods

Label and date the jars and store them in a clean, cool, dark, dry place. Do not store jars above 95°F or near hot pipes, a range, a furnace, in an uninsulated attic, or in direct sunlight. Under these conditions, food will lose quality in a few weeks or months and may spoil. Dampness may corrode metal lids, break seals, and allow recontamination and spoilage. For best results, store canned foods at 50°F to 70°F.

References

Complete Guide to Home Canning. Agriculture Information Bulletin 539, 2009. http://www.uga.edu/nchfp/publications/publications_usda.html.

So Easy to Preserve. Georgia Cooperative Extension Service, 2006.

For more tested recipes, check the website for the National Center for Home Food Preservation, <http://www.uga.edu/nchfp/index.html>

This publication has been peer reviewed.

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