

Basics of Home Canning

Canning can be a fun and economical way to make fresh foods available year-round. Don't take chances with canning recipes handed down over the years. Use procedures that have been scientifically tested to ensure safe and high-quality canned products. Use this fact sheet to understand the correct procedures for canning foods at home.

Introduction

The safe methods of canning food at home are boiling water bath canning, atmospheric steam canning, and pressure canning. Whether a food is high acid or low acid indicates what type of processing method should be used (Table 1). Generally, high-acid foods can be safely canned in a water bath or atmospheric steam canner. Low-acid foods must be processed in a pressure canner.

Acidity in Foods

Low-Acid Foods

Low-acid foods include meats and vegetables (except for acidified tomatoes and pickled products). Low-acid foods lack the acidity needed to inhibit the growth of bacteria and spores that can survive the temperature of boiling water (212°F). The bacterium of greatest concern in home canning is *Clostridium botulinum* because it can produce spores that generate a dangerous toxin that causes food poisoning. Botulism spores thrive on low-acid foods in the absence of air, in the presence of moisture, and at room temperature—the conditions inside a jar of home-canned meat or vegetables. While spores of *Clostridium botulinum* may survive a boiling water bath, they are destroyed when processed in a pressure canner where the temperature can reach 240°F or higher.

High-Acid Foods

Most fruits have naturally high levels of acid. While tomatoes have some natural acids, they are borderline between high and low acid and need bottled lemon juice, citric acid, or vinegar (labeled 5 percent acidity) to increase their acidity for safe food processing. Fermented foods, such as sauerkraut, and foods to which a sufficient amount of vinegar is added, as in pickled vegetables, are also canned as high-acid foods. Jams and jellies are high-acid foods unless low-acid vegetables, such as peppers, are added. Foods in the high-acid category can be safely processed in boiling water or atmospheric steam. Consult other "Let's Preserve" fact sheets for details about canning specific foods.



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Boiling Water Processing

Heat is transferred to the food by the boiling water that surrounds the jar. Maintaining a temperature of 212°F for the time specified in an approved recipe is adequate to destroy molds, yeasts, enzymes, and some bacteria. Processing times are usually given for altitudes under 1,000 feet above sea level. At higher altitudes water boils at lower temperatures, making it necessary to process foods longer.

Atmospheric Steam Processing

When heat drives air from an atmospheric steam canner, the steam remaining is 212°F, the same as boiling water. Heat is transferred to the food by the hot steam surrounding the jar. Processing time in an atmospheric steam canner is the same as for the boiling water bath. Foods requiring more than 45 minutes of processing time cannot be processed in an atmospheric steam canner because the canner may boil dry. Process times need to be adjusted for elevations over 1,000 feet.

Pressure Processing

When heat is applied to a sealed canner, pressure builds up inside that canner. Water inside the canner forms steam, which replaces air. When the vents are closed, only pressurized steam hotter than boiling water remains in the canner. It is necessary to make adjustments to the pressure at altitudes above 1,000 feet.



Table 1. Examples of low-acid and high-acid foods and required processing methods.

Low-Acid Foods	High-Acid Foods
Pressure Canning	Boiling Water Bath Canning or Atmospheric Steam Canning
Most vegetables	Most fruits
Asparagus	Apples and applesauce
Beets	Apricots
Carrots	Berries
Green and dried beans	Cherries
Okra	Grapes
Peas	Jams and jellies (<i>fruit only</i>)
Peppers	Peaches and nectarines
Potatoes	Pears
Pumpkin cubes (<i>pumpkin puree cannot be safely canned at home</i>)	Pie fillings (<i>fruit only</i>)
Sweet corn	Plums
Meats	Acidified and fermented foods
Beef and poultry	Chutneys
Mincemeat pie filling	Pickled vegetables
Seafood	Pickles (<i>cucumbers</i>)
Wild game	Relishes
Combination Foods	Salsa
Meat sauces	Sauerkraut
Soups and stews	Tomatoes (<i>acidified</i>)*

*Directions are available for boiling water bath, atmospheric steam canning, and pressure canning methods.

Canning Procedures

Selecting Jars and Lids

Mason jars are recommended for home canning. Commercial single-use jars are less likely to seal and may break, especially in a pressure canner. Lids may not fit single-use jars. Canning jars come in a variety of sizes. Most recipes have been developed for pint and quart jars. If processing times are not specified for smaller jars, process them the same as the next larger size that is specified. Half-gallon jars are recommended only for canning apple and grape juices. If properly used, jars may be reused.

Recipes have been research tested using standard Mason jars. Many specialty shops sell novelty jars in different sizes and shapes. Unusual jar shapes may not work with process times and temperatures given in the “Let’s Preserve” fact sheets.

The recommended lid consists of a flat metal disk that has a sealing compound around the outer edge and a separate metal screw band. The lid should not be reused; the bands may be reused as long as they don’t rust. Never reuse lids from commercially canned foods for home food preservation. Zinc lids or bail-type jars with rubber rings are no longer recommended for home canning.

Hot Pack or Raw Pack

When foods are raw packed the jars are filled with freshly prepared, unheated food. Raw-packed foods will often float in the jars, and the air trapped in and around the food may cause discoloration within 2 to 3 months of storage. Hot packing involves heating freshly prepared food to boiling, simmering it briefly, and promptly filling the jars loosely with the boiled food and liquid. Hot packing helps remove air from inside the food tissues, shrinks the food, and helps keep the food from floating in the jars. Preshrinking that occurs in hot packing allows more food to fit into each jar.

General Canning Guidelines

- Use tested recipes from Penn State Extension’s “Let’s Preserve” fact sheets, the USDA’s *Complete Guide to Home Canning*, or *So Easy to Preserve* (University of Georgia). All these contain research based recipes. All should be 1994 or more recent editions. Older recipes may not have adequate processing times or pressure for safety.
- Use Mason jars because they withstand the higher temperatures of a pressure canner better than single-use jars.
- Preheat jars in the dishwasher or simmering water prior to filling them. Do not heat jars in the oven.
- Use proper headspace: ¼ inch for juices, jams, and jellies; ½ inch for fruits, tomatoes, and pickles; and 1 to 1½ inches for meats and vegetables. Refer to a tested recipe. Too much headspace results in a lower vacuum and a weak seal. Too little headspace may force food under the lid, causing siphoning or breaking of the seal.
- Remove air bubbles with a plastic utensil.
- Wipe edge of jar with a damp paper towel.
- Use two-piece lids (a new flat disk and a screw band).
- Only tighten lids finger-tip tight.
- Use a jar lifter to place jars into canner and to remove jars. Be careful not to tilt jars.

- Process according to the boiling water bath, atmospheric steam canning, or pressure canning procedures that follow.
- Adjust process times or pressure for altitudes that are 1,001 feet or more above sea level.
- After processing, set jars at least 2 inches apart to cool on a wooden cutting board or towel-lined surface.
- Do not retighten bands.
- Do not turn jars upside down.

Boiling Water Bath Procedures

- Follow all the practices listed under “General Canning Guidelines” above.
- Fill the canner about half full with water.
- Preheat water to 140°F for raw-packed foods and 180°F for hot-packed foods.
- Place jars on a rack in canner.
- Add more hot water if necessary to cover jars with at least 1 inch of water.
- Place the lid on the canner and keep covered during processing.
- Turn heat to its highest position until water boils vigorously; then lower heat setting to maintain a gentle boil while processing.
- Add more hot water if necessary to cover jars with at least 1 inch of water.
- If water stops boiling at any time during the process, return to a boil and start the process time over.
- After processing for the designated time, turn heat off, set off burner, remove lid, and let jars rest in the canner for 5 minutes before removing from the canner—this will reduce siphoning (loss of liquid from the jar).

Atmospheric Steam Canning Procedures

- Follow all the practices listed under “General Canning Guidelines” above.
- Fill the base of the canner with the amount of water indicated in the instruction manual of the canner (usually 2 quarts).
- Set rack in the base of the canner.
- Heat water in the base of the canner to 140°F for raw-packed foods or 180°F for hot-packed foods.
- Place jars on rack in canner.
- When all the jars have been placed in the canner, place the cover or lid on the canner.
- Bring to boil over medium to medium-high heat until a steady column of steam at least 6 inches long escapes from the vent hole(s).
- Start processing time.
- Slowly adjust the heat to maintain a steady column of steam.
- After processing, turn off heat and remove the canner cover or lid.
- Allow jars to sit in the canner for 5 minutes before removing from the canner; this will reduce siphoning (loss of liquid from the jar).

Pressure Canning Procedures

- Follow all the practices listed under “General Canning Guidelines” above.
- Put 2 to 3 inches of water in the bottom of the pressure canner.
- Place filled jars on a rack at bottom of the canner.
- Heat to boiling to exhaust steam from the canner for 10 minutes before adding the weight or closing the petcock.
- Add weight or pressure regulator.
- Allow pressure to rise and maintain at level called for in the tested recipe by adjusting the heat. If pressure goes below recommended pressure at any time during processing, reset your timer to zero and restart the process time.
- After processing, remove canner from heat and allow canner to cool naturally to 0 pounds pressure. Wait 2 minutes and remove weighted gauge or pressure regulator. Wait 10 more minutes before removing lid—this will reduce siphoning (loss of liquid from the jar).

Testing for a Vacuum Seal

Allow jars to cool for 12 to 24 hours. Press the center of the lid to see if it is concave. If the center does not flex up and down and you cannot lift the lid off after the band has been removed, the lid has a good vacuum seal

Storing Canned Goods

- Remove screw bands from jars and wash jars before storing. Properly sealed jars do not need the bands on to hold the lids in place. Screw bands can rust if left on the jars in storage, causing the seals to break.
- Label with contents, date, and lot number if you canned several canner loads that day.
- Store in a cool, dry place; 50 to 70°F is an ideal temperature for storing canned goods.
- Store in a dark place. Place cooled jars in boxes if closed cupboards are not available.



Food Spoilage

When good-quality produce is used and correct canning procedures are followed, canned foods should be safe and of high quality. However, sometimes there are canning failures. A common reason for food spoilage is inadequate processing times or temperatures needed to destroy or control microorganisms. These microorganisms are molds, yeasts, and bacteria.

Molds and yeasts are easily destroyed by the heat used in processing. However, if the product is underprocessed or the lid seal is broken during storage, fuzzy masses of mold may grow inside the jar. Yeasts may react with sugars in the food, causing fermentation. You can recognize yeast activity by slime, scum, murkiness, or gas bubbles.

While some bacteria can be beneficial, as in making sauerkraut, others can be extremely dangerous, as in botulism poisoning as discussed earlier. Bacteria can multiply rapidly with millions growing on a gram of food in just a few hours. Bacteria are too small to see with the human eye. Food can be spoiled without any visual evidence. Therefore, use proper canning procedures. Never taste a food you suspect is spoiled. If in doubt, throw it out.

Enzymes are naturally occurring substances in foods that promote the normal ripening process. If they continue to work after the fruit or vegetable is harvested, they can cause undesirable changes in color, texture, flavor, and nutrition. Adding ascorbic acid or commercially available antibrowning products to the holding water reduces color changes when peeling light-colored fruits. Enzymes are quickly inactivated when heated to between 170 and 190°F. For this reason, heat process foods as soon as possible after preparing them for canning.

Preventing Spoilage

- Use top-quality produce that is free of disease and mold.
- Can immediately after harvest.
- Wash produce thoroughly.
- Discard overripe produce.
- Use proper canning methods and equipment.
- Use clean equipment and work surfaces.
- Sterilize jars that will be processed less than 10 minutes.
- Pressure can low-acid vegetables and meats.
- Acidify tomatoes.
- Follow a scientifically tested recipe and process for specified time.
- Adjust time and pressure for higher altitudes.

For additional information about food preservation, visit the Penn State Extension Home Food Preservation website at extension.psu.edu/food/preservation or contact Penn State Extension in your county.

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Important Temperatures

240°F	Temperature needed in a pressure canner to destroy bacterial spores in low-acid foods
212°F	Boiling point of water and processing temperature for acid foods in boiling water bath and atmospheric steam canner
180–212°F	Temperature at which molds, yeasts, and some bacterial cells are destroyed
170–190°F	Temperature needed to inactivate enzymes
140–180°F	Temperature at which growth of bacteria, molds, and yeasts is slowed, but some microorganisms can survive
40–140°F	Active growing range of molds, yeasts, and bacteria
50–70°F	Best storage temperature for home-canned foods

Pressure Canner Dial Gauge Testing

Pressure canner dial gauges should be tested for accuracy each year. Contact your local Penn State Extension office to determine locations and times for testing. There is no charge for testing dial gauges, and it only takes a few minutes.

**Never taste a food you suspect is spoiled.
If in doubt, throw it out.**

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