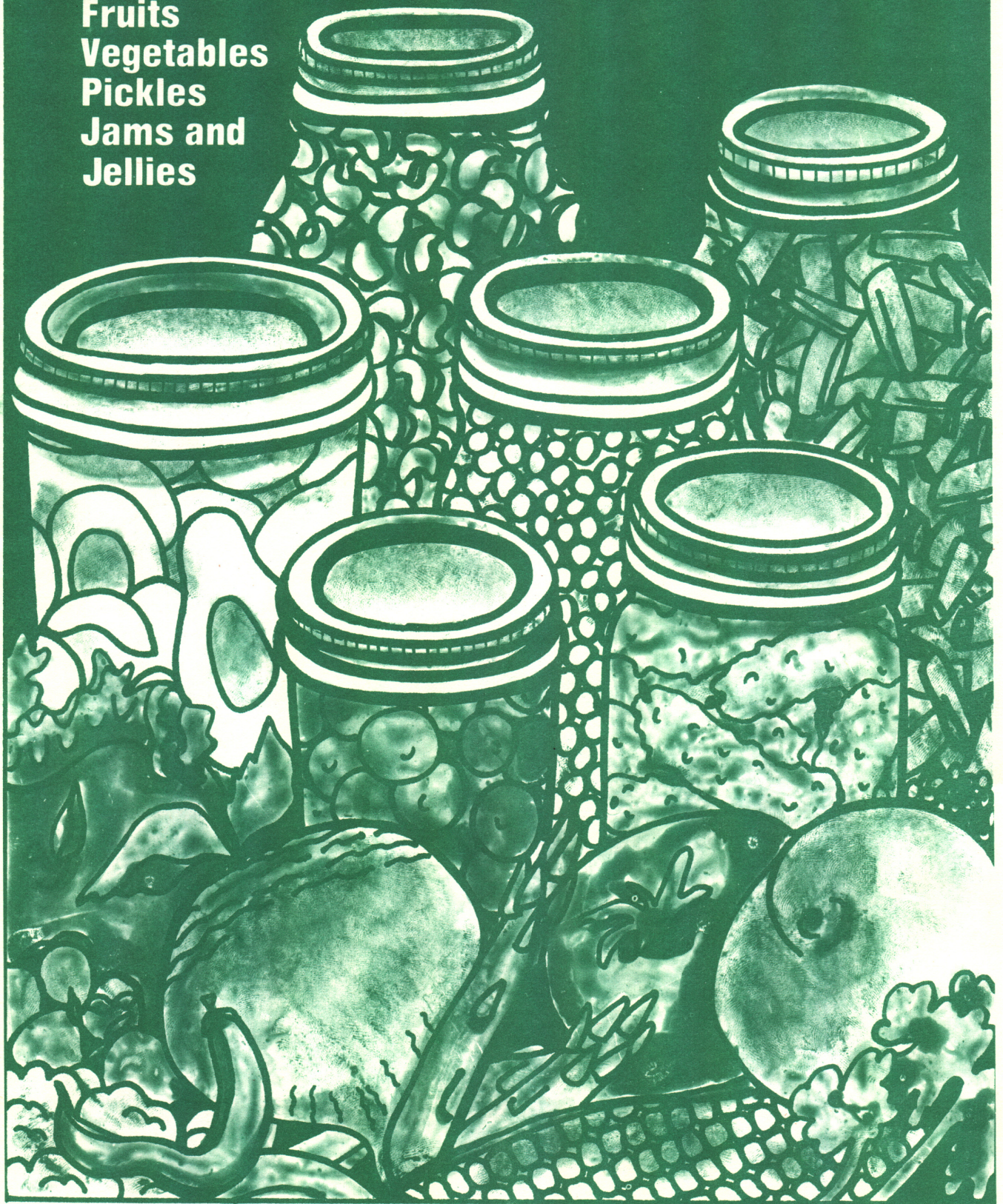


HOME CANNING

Fruits
Vegetables
Pickles
Jams and
Jellies



COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

Home Canning of Fruits and Vegetables

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HOME CANNING has long been a popular and economical way of preserving fresh fruits and vegetables. Canning is a more energy-efficient method of food preservation than either drying with artificial heat or freezing. Canning also offers good retention of vitamins A and C, the key nutrients in fruits and vegetables. Use the canning liquid whenever possible; it contains more than a third of the vitamin C and other water-soluble vitamins in canned fruits and vegetables. Add the liquid from canned vegetables to soups, sauces, or gravies.

HOW CANNING PRESERVES FOOD

Food canned at home is heated (or "processed") in a glass jar with the lid in place. Heat destroys bacteria, yeasts, and molds that spoil food. When the jar cools, the lid forms an airtight seal that prevents recontamination of the food.

Foods are processed in either a water bath canner or a pressure canner, depending on their acidity. Acid foods—fruits, tomatoes, and pickled vegetables—may be safely

processed in a boiling water bath. Organisms that spoil acid foods are easily killed at 212°F., the temperature of boiling water. Low-acid foods—vegetables, tomato-vegetable mixtures like stewed tomatoes, meats,¹ poultry,¹ and fish²—must be processed in a pressure canner.

The bacteria that produce botulism toxin cannot grow in acid foods but can grow in low-acid foods. These bacteria (*Clostridium botulinum*) have spores that can survive hours of boiling. However, they are destroyed within a reasonable time at 240°F., the temperature inside a pressure canner at 10 pounds pressure. **Use of a pressure canner is, then, absolutely essential for the safe processing of low-acid foods.**

If low-acid foods are canned *improperly*, any botulinum spores on

¹ For reliable directions for canning meats and poultry at home, see *USDA Home and Garden Bulletin No. 106, Home Canning of Meats and Poultry*.

² For reliable directions for canning fish at home, see *MSU Extension Bulletin E-1180, Freshwater Fish Preservation*.



the food will survive. In the absence of air, a condition found inside a vacuum-sealed jar, the spores will germinate into living bacteria. As the bacteria grow, they produce botulism toxin. Consuming just a minute amount of this potent neurotoxin (toxic to the nervous system) can be fatal to humans or animals. Most cases of botulism poisoning have been caused by low-acid foods improperly canned at home.

To prevent bacteria, yeasts, or molds from spoiling your home-canned foods, carefully follow the canning directions given in this bulletin. Process acid foods in a water bath canner and low-acid foods in a pressure canner. There is no danger of botulism if low-acid foods are canned properly in a pressure canner.

Start with Fresh Produce

Select ripe, firm fruits and young, tender vegetables for canning. Make sure that they are free of decay. Can them as soon as possible after harvesting. If you must hold them, keep them in a cool, airy place. If you buy fruits or vegetables to can, get them fresh from local farm markets, roadside stands, or pick-your-own farms.

While it is impossible to give hard and fast equivalents, the following amounts of fresh produce (picked or purchased) will generally make 1 quart of canned food:

FOOD	POUNDS
Apples	2½ - 3
Blueberries	2¼ - 3
Cherries	2 - 2½
Grapes, Concord (juice) ...	2⅔
Peaches	2 - 3
Pears	2 - 2½
Tomatoes	2½ - 3½
Asparagus	2½ - 4
Beans, snap	1½ - 2½
Corn, sweet (in husks)	3 - 6
Squash, summer	3
Squash, winter (or pumpkin)	2½ - 3

Use Recommended Canning Equipment

● **Canning jars**—For best results, use only standard canning jars (also called Mason jars) with the manufacturer's name on the side. These jars are tempered to withstand temperature extremes, and the sealing edge is smooth and flat so lids will seal properly.

Canning jars must be in perfect condition. Check all jars, new or used, for hairline cracks or chips or nicks on the sealing edge. Such defects can result in breakage or sealing failure.

Packers' jars, such as mayonnaise, pickle, or coffee jars, are not recommended for home canning. As they are not very resistant to temperature extremes, they break easily. Also, lids may not seal because the sealing edge of packers' jars may be rounded rather than flat. Finally, the neck of the jar may be so short that the screw band will not hold the lid firmly in place during processing.

● **Canning lids**—The best way to close canning jars is with two-piece canning lids. The set consists of a flat metal lid and a screw band. The lid has a sealing compound around the edge and is enameled on the underside to prevent food from reacting with the metal. The screw band holds the lid in place during processing. A vacuum seal forms during cooling, after the jar is removed from the canner. You may reuse screw bands that are in good condition, **but always use new lids**. Do not use screw bands that are bent out of shape or badly rusted.

● **Water bath canner**—Use a water bath canner for processing acid foods—fruits, tomatoes, and pickled products. A water bath canner is a large, deep kettle that has a cover and a rack to hold jars. You can purchase a water bath canner in most department stores. However, you can also use any big, covered pot that is deep enough to allow water to extend 1 to 2 inches **over the tops of the jars** with room to boil briskly. A rack for holding jars may be purchased wherever canning supplies are sold.

● **Pressure canner**—Low-acid foods—vegetables, stewed tomatoes, meats, poultry, and fish—must be processed in a pressure canner. A pressure canner is a deep, heavy kettle that has a rack in the bottom for jars to stand on, a tight-fitting lid with a gasket, and a pressure gauge.

The gasket keeps steam from leaking out around the cover. If the gasket is worn, stretched, or hardened, it should be replaced.

There are two types of pressure gauges, the dial gauge and the weighted gauge. A **dial gauge** has a needle that registers the pressure inside the canner. Because dial gauges do get out of adjustment, they should be tested for accuracy before each canning season. Ask your county Extension Home Economist where the testing can be done locally. If it cannot be done locally, send the gauge to the manufacturer for testing. Package it carefully to avoid damage during shipping. Allow several weeks for testing.

A **weighted gauge** (sometimes called a pressure control or pressure regulator) fits over the vent. It permits pressure in the canner to rise to the desired point (10 pounds) and then releases excess steam—by “jiggling” or “rocking”—to keep the pressure from going higher. Weighted gauges do not get out of adjustment and do not need testing for accuracy, but they do need to be kept clean.

● **Pressure cooker**—A small 4- or 6-quart pressure cooker (sometimes called a pressure saucepan) equipped with a rack may be used for canning food in pint jars. Because of its small size, a pressure cooker heats up and cools down more rapidly than a large pressure canner. To compensate for the faster heating and cooling, it is necessary to use longer processing times when canning low-acid foods in a pressure cooker. The timetable on page 14 includes times for processing pints in a pressure cooker.

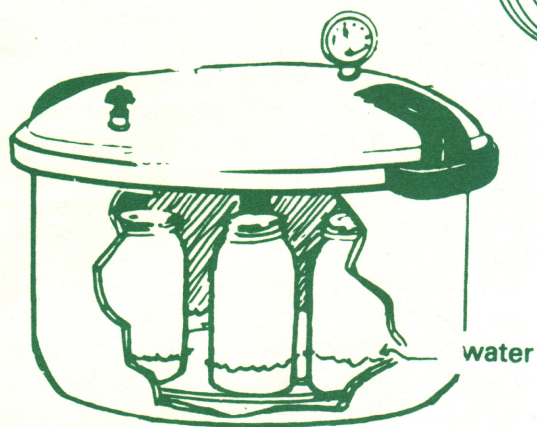




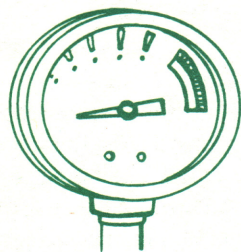
**Canning jar and
two-piece lid**



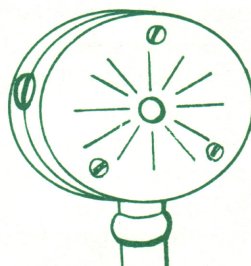
Water bath canner



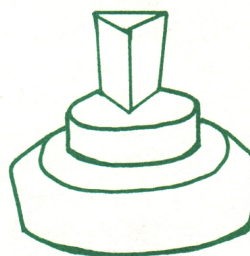
Pressure canner



Dial gauge



Weighted gauge



Weighted gauge



Getting Produce and Equipment Ready

Even if fruits or vegetables will be peeled, wash them thoroughly before canning. Garden soil contains some of the bacteria hardest to kill. Wash only small amounts of food at one time under cold running water or in several changes of water. Lift the food out of the water so that the soil that has been washed off won't settle back on the food. Do not soak fruits or vegetables; they may lose flavor and nutritive value. Quickly peel, pit, and slice only as much food as you can process at one time.

Wash canning jars in a dishwasher or in hot, soapy water, and rinse well. Keep the jars hot by leaving them in either hot water or the dishwasher until you are ready to fill them. Jars do not need to be sterilized, as this will be accomplished during processing in a water bath canner or pressure canner.

Wash and rinse canning lids and screw bands. Follow the manufacturer's directions for preparing lids. They may need boiling or holding in boiling water for a few minutes.

Sugar Does More Than Sweeten

Sugar helps canned fruits hold their color, shape, and texture. The sugar moves into the fruit tissue and makes it firmer.

Sugar is usually added to fruits as a syrup. To make syrup, pour 4 cups of water into a saucepan and add:

- 2 cups of sugar for 5 cups of *thin* syrup;
- 3 cups of sugar for 5½ cups of *medium* syrup;
- 4¾ cups of sugar for 6½ cups of *heavy* syrup.

Heat the mixture until the sugar dissolves. Allow about 1 to 1½ cups of syrup for each quart of fruit.

Thin syrup adds fewer calories and costs less to make than heavier syrups.

Also, fruits packed in thin or medium syrup are less likely to float than those packed in heavy syrup.

You can replace as much as half the sugar used in making syrup with light corn syrup or mild-flavored honey. Contrary to popular belief, honey offers no nutritional advantage over ordinary sugar. It contains vitamins and minerals in amounts too small to be nutritionally significant.

You may add sugar directly to very juicy fruits that will be packed hot. Use about ½ cup of sugar for each quart of raw, prepared fruit and heat to boiling. Pack fruit in the juice that cooks out.

You may safely can fruits **without**

sugar. Pack the fruit in extracted juice, in juice from another fruit (for example, bottled apple juice, pineapple juice, or white grape juice) or in water. To extract juice, crush very ripe, sound, juicy fruit and heat to simmering over low heat. Then strain the juice through a jelly bag or a double layer of damp cheesecloth.

Processing times are the same for both unsweetened and sweetened fruits.

Use Salt for Flavor Only

Salt may be added to vegetables and tomatoes before canning. However, it is used only for flavor and can be safely omitted.

Canning Procedures

Pack Food into Jars

There are two methods of packing food into canning jars, raw pack and hot pack. For **raw pack**, pack raw, prepared food into clean, hot jars. Fruits and most vegetables should be packed tightly because they will shrink during processing. However, raw corn, lima beans, and peas should be packed loosely, as they will expand.

For **hot pack**, heat prepared food to boiling or partially cook it. Pack it boiling hot into clean, hot jars. It should be packed fairly loosely.

Although this bulletin gives both raw pack and hot pack directions for most foods, hot pack is recommended for tomatoes and large fruits such as apples, peaches, pears, and plums. Preheating tomatoes or fruits drives air out of the plant tissue and as a result:

- Liquid is less likely to be lost from the jars during processing.

When tomatoes or fruits are packed raw, air is slowly released from the plant tissue during processing. As this air escapes from the jars, liquid is carried with it.

- Tomatoes or fruits are less likely to float to the top of the jar. Raw-packed tomatoes or fruits often float because they still contain air.
- Fruits at the top of the jar are less likely to turn brown. Fruits tend to darken when they are not covered by liquid because they are floating or the liquid level in the jar is too low. Darkening is harmless but unattractive.

Cover raw- or hot-packed food with **boiling-hot** water, cooking liquid, syrup, or juice.

Leave the amount of **headspace**—room at the top of the jar—specified for the product. If too little headspace is allowed (by filling jars too full), the contents of the jars may boil out dur-

ing processing. As a result, liquid will be lost from the jars and food particles may lodge on the jar rim, causing sealing failure. If way too much headspace is allowed, a vacuum may not form so lids may not seal.

Adjust Lids

As soon as the food is packed into jars, wipe the jar rims clean. Put on the lid (prepared according to the manufacturer's directions) with the sealing compound next to the jar rim. Screw the band down firmly so that it is hand-tight. Do not use a jar wrench to tighten screw bands. There must be enough "give" for air to escape from the jars during processing.

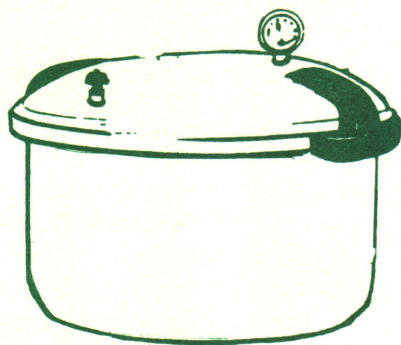
Process food promptly after packing it into jars and adjusting lids.

Process Acid Foods in a Water Bath Canner

Use a water bath canner for processing fruits and tomatoes.³

Here are a few tips for using a water bath canner:

1. Fill the canner half full with water; then cover and heat. For raw-packed food, have the water hot but not boiling. For hot-packed food, have the water boiling.
2. Using a jar lifter, place jars filled with food on rack in canner. If necessary, add boiling water to bring water 1 to 2 inches over the tops of the jars. Do not pour boiling water directly on jars.
3. Place cover on canner.



³ A safe, alternative method for processing hot-packed fruits and tomatoes is in a pressure canner at 5 pounds pressure (228° F.). The time-table on page 10 includes processing times at 5 pounds pressure.

4. When water comes to a rolling boil, start counting the processing time. Keep water at a rolling boil for the entire processing time. For most foods, processing times are given for pints and quarts. If you are using half pint jars, use processing times for pints. For one-and-one-half pint jars, use processing times for quarts.

5. If necessary, add more boiling water to keep water 1 to 2 inches above jars.

6. As soon as the processing time is up, remove jars from canner. Use a jar lifter for this. If liquid boiled out of the jars during processing, do not open them to add more. **Do not retighten screw bands.**

7. Place hot jars upright on a rack, a towel, or folded newspaper to cool. Leave space between them for air to circulate. Keep them out of drafts.

Process Low-Acid Foods in a Pressure Canner

Process vegetables and stewed tomatoes containing celery, onion, or green pepper in a pressure canner at 10 pounds pressure.⁴

Follow the manufacturer's directions for the canner you are using. Here are general pointers for using any pressure canner:

1. Pour 2 or 3 inches of water in bottom of canner and heat to boiling.
2. Set jars on rack in canner. If you have two layers of jars in the canner, use a rack between them and stagger the second layer.
3. Fasten the canner cover securely so that no steam can escape except through the vent.
4. Once steam pours steadily from vent, let it escape for 10 minutes to drive all air from the canner. During processing, the canner must be filled with steam, not air, since it is steam that reaches the

⁴ Many vegetables may be processed at 15 pounds pressure (250° F.) instead of 10 pounds pressure. The advantage at 15 pounds pressure is that processing times are shorter. The time-table on page 14 includes processing times at 15 pounds pressure.



desired temperature of 240° F. at 10 pounds pressure.

5. Close the vent or put on the weighted gauge (pressure control or pressure regulator).
6. If the canner has a dial gauge, bring pressure up quickly to 8 pounds, then adjust the heat to maintain 10 pounds pressure. **Start counting the processing time when gauge registers 10 pounds pressure.**

If the canner has a weighted gauge, start counting the processing time when it jiggles or rocks. Adjust heat so that gauge jiggles 2 or 3 times a minute or maintains a slow, steady, rocking motion.

For most products, processing times are given for pints and quarts. If you are using half pint jars, use processing times for pints. For one-and-one-half pint jars, use processing times for quarts.

7. When the processing time is up, turn off the burner. (If you are using a coal or wood stove, remove canner from heat.) **Let the pressure in the canner drop to zero by itself.** This may take 45 minutes in a 16-quart canner filled with jars and almost an hour in a 22-quart canner. If the vent is opened before the pressure drops to zero or if cooling is rushed by running cold water over the canner, liquid will be lost from the jars.
8. When the pressure has dropped to zero, open the vent or remove the weighted gauge. (With a weighted gauge canner, pressure is completely reduced if no steam escapes when the gauge is nudged

or tilted. If steam spurts out, pressure is not yet down.)

9. Remove canner cover, tilting it away from your face.
10. Remove jars from canner. If liquid boiled out of jars during processing, do not open them to add more. **Do not retighten screw bands.**
11. Place hot jars upright on a rack, a towel, or folded newspaper to cool. Leave space between them for air to circulate. Keep them out of drafts.

Check for Seals

Vacuum seals form as the jars cool. When jars are cool (12 to 24 hours after processing), check the seals. If the lid is depressed or concave and will not move when pressed, it is sealed.

When jars are thoroughly cool (24 hours after processing), carefully remove screw bands. If a band sticks, loosen it by covering it for a moment with a hot, damp cloth. Bands left on jars during storage may rust, making later removal difficult.

If You Find an Unsealed Jar

If, within 24 hours after processing, you find an unsealed jar, take one of the following steps:

- Refrigerate the food and use it within 2 to 3 days.
- Freeze the food. (Drain vegetables before freezing.)
- Reprocess the food. Remove lids, empty the contents of the jars into a pan, heat to boiling, pack into clean, hot jars, and put on new lids. Process again for the full time. The eating quality of twice-processed food may be poor.

If more than 24 hours have gone by since processing, discard the food. It may have already started to spoil.

The causes of sealing failure include:

- Failure to follow manufacturer's directions for preparing lids.
- A chip on the jar rim.
- Food particles on the jar rim. Al-

ways wipe rim clean before putting on lid.

- Leaving way too much headspace.
- Leaving too little headspace. If jars are filled too full, food may boil out during processing, leaving particles on the jar rim that prevent a seal from forming.
- During processing, allowing pressure in a pressure canner to fluctuate; after processing, opening the vent before pressure has dropped to zero or putting the canner under cold water to lower pressure quickly. In each of these cases, liquid will be lost from the jars and food particles may be deposited on the jar rim, causing sealing failure.
- Retightening screw bands after removing jars from canner. Do not retighten bands.
- Reusing lids. Lids should be used only once.
- Defective lids.

Label and Store Sealed Jars

Label sealed jars with contents and date. Store them in a cool, dry, dark place. Properly stored canned foods will retain their quality for at least a year.

Avoid storing canned foods near hot pipes, a range, a furnace, or in direct sunlight. Canned foods stored in a warm place may lose quality in a few weeks or months, depending on the temperature.

If canned foods are stored in a cold place, protect them from freezing by wrapping the jars in newspaper or covering them with a blanket. Canned foods that do freeze may be used as long as freezing does not break the seal. However, they may not be as

palatable as properly stored canned foods.

If canned foods are kept in a damp place, lids may rust.

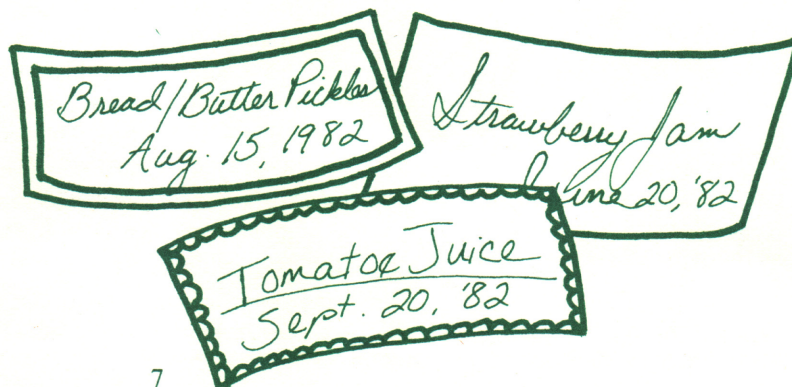
Check Canned Foods For Spoilage

Always be on the alert for signs of spoilage. Examine unopened jars for leakage, bulging lids, or loss of seal. Bulging or loss of seal indicates gas formation inside the jar. As you open the jar, look for spurting liquid. After opening, check for gassiness, cloudy liquid,⁵ disagreeable odor, or mold. **Do not taste food that shows any sign of spoilage. Dispose of the food so that neither humans nor animals will eat it.**

It is possible for improperly processed low-acid foods to contain botulism toxin without showing signs of spoilage. **Therefore, unless you are sure of your canning methods and pressure gauge, boil home-canned, low-acid foods before tasting. Boiling will destroy botulism toxin.** Heat vegetables and stewed tomatoes containing celery, onion, or green pepper to boiling; cover and boil 10 minutes, stirring occasionally. Boil spinach and corn 20 minutes.

Black deposits on the underside of a lid are **not** a sign of spoilage. The underside of canning lids is coated with enamel. If there are imperfections (for example, tiny scratches or pinholes) in the enamel, natural com-

⁵ Although cloudy liquid may be a sign of spoilage, it could instead be due to minerals in hard water or starch from overripe vegetables. If liquid is cloudy, check for other evidence of spoilage. If there are no other signs of spoilage, boil the food. Do not use any food that foams or has a disagreeable odor during heating.



pounds in food can react with the metal in the lid to form harmless brown or black deposits.

Avoid Unsafe Canning Methods

To ensure the safety of your home-canned foods, use reliable, up-to-date canning directions. Process acid foods in a water bath canner and low-acid foods in a pressure canner.

Do not use open-kettle canning except for jams and jellies. In open-kettle canning, food is cooked in an ordinary kettle, then packed boiling hot (212°F.) into hot, sterilized jars and sealed without processing. No matter how fast this is done, spoilage

organisms can get into the food as it is transferred from kettle to jar. Low-acid foods must reach above-boiling temperatures to kill botulinum spores.

Do not process foods in the oven. Jars may explode when the oven door is opened. No matter how high the oven temperature is set, the temperature of food inside the jars will not get above boiling. Low-acid foods must reach above-boiling temperatures for botulinum spores to be destroyed.

Do not process foods in a microwave oven. Again, jars may explode when the oven door is opened, and regardless of the power setting used, the internal temperature of the food will not rise above boiling. There may

also be "cold spots" in the food since microwave heating is uneven. Finally, metal (in the canning lids) should not be used in a microwave oven.

Do not use aspirin as a substitute for processing. Aspirin is not a preservative.

Do not experiment with new recipes or procedures.

For More Information

If you have further questions about home canning, call or write the Extension Home Economist in your county. You will find the Cooperative Extension Service listed in the telephone directory under county offices.

Directions for Canning Fruits and Tomatoes

APPLES

Wash, peel, core, and slice apples. To keep fruit from darkening during preparation, drop slices into cold water containing 2 tablespoons each salt and vinegar per gallon. Drain and rinse.

Boil fruit in thin syrup for 5 minutes. Pack hot fruit into clean, hot jars to ½ inch from top. Cover with boiling-hot syrup, leaving ½-inch headspace. Adjust lids. Process in a boiling water bath—pints for 15 minutes, quarts for 20 minutes.

APPLESAUCE

Wash, peel if desired, core, and cut apples into quarters. Simmer in a

small amount of water until tender. Press through a strainer or food mill. If desired, add sugar to taste.

Reheat applesauce to boiling. Pack boiling-hot applesauce into clean, hot jars to ½ inch from top. Adjust lids. Process in a boiling water bath—pints and quarts for 20 minutes.

BERRIES⁶

Wash berries.

Raw pack (recommended for soft berries that do not hold their shape well)—Pack raw berries into clean, hot jars to ½ inch from top. For a full pack, shake berries down while filling jars. Cover with boiling-hot syrup, leaving ½-inch headspace. Process in a boiling water bath—pints for 10 minutes, quarts for 15 minutes.

Hot pack (recommended for firm berries)—Add ½ cup sugar to each quart berries. Cover and heat to boiling, stirring frequently. Pack boiling-hot berries into clean, hot jars to ½ inch from top. Adjust lids. Process in a boiling water bath—pints for 10 minutes, quarts for 15 minutes.

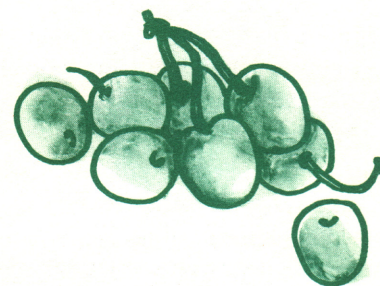
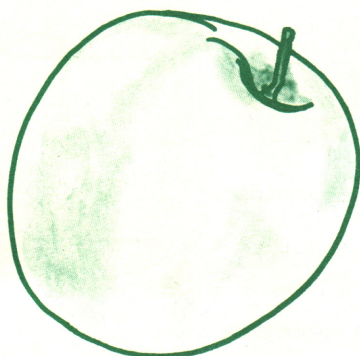
⁶ Strawberries are not recommended for canning. They are better frozen or made into jam.

CHERRIES, sweet or tart

Wash cherries. If desired, remove pits.

Raw pack—Pack raw cherries into clean, hot jars to ½ inch from top. For a full pack, shake cherries down while filling jars. Cover with boiling-hot syrup, leaving ½-inch headspace. Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

Hot pack—Add ½ cup sugar to each quart cherries. Add a little water to unpitted cherries to prevent sticking while heating. Cover and heat to boiling, stirring frequently. Pack boiling-hot cherries into clean, hot jars to ½ inch from top. Adjust lids. Process in a boiling water bath—pints for 10 minutes, quarts for 15 minutes.



GRAPE JUICE

Wash, stem, and crush fully ripe Concord grapes. Add 1 cup water to each gallon crushed grapes. Cover and heat to boiling. Reduce heat and simmer 10 minutes. Strain through two layers of damp cheesecloth.

Let juice stand overnight in refrigerator. Strain again through two layers of damp cheesecloth to remove tartrate crystals.

Reheat juice to boiling. Pour boiling-hot juice into clean, hot jars to $\frac{1}{2}$ inch from top. Adjust lids. Process in a boiling water bath—pints and quarts for 15 minutes.

PEACHES

Wash and peel peaches. Dipping peaches for about $\frac{1}{2}$ minute in boiling water, then quickly in cold water makes peeling easier. Cut peaches in halves and remove pits. Slice if desired. To prevent fruit from darkening during preparation, drop halves or slices into cold water containing 2 tablespoons each salt and vinegar per gallon. Drain and rinse.

Raw pack—Pack raw fruit into clean, hot jars to $\frac{1}{2}$ inch from top. Cover with boiling-hot syrup, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a boiling water bath—pints for 25 minutes, quarts for 30 minutes.

Hot pack (recommended method)—Heat syrup to boiling. Add fruit and heat through. Pack hot fruit into clean, hot jars to $\frac{1}{2}$ inch from top. Cover with boiling-hot syrup, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

PEARS

Tree-ripened pears may have a coarse, gritty texture when canned. If possible, pick pears when they are full size but still firm and green. Hold them for about 2 weeks in cold storage; refrigerator temperatures (35° to 40° F.) are best. Then allow them to ripen at room temperature before canning.



Wash, peel, halve, and core pears. Cut into quarters if desired. To keep fruit from darkening during preparation, drop halves or quarters into cold water containing 2 tablespoons each salt and vinegar per gallon. Drain and rinse.

Raw pack—Pack raw fruit into clean, hot jars to $\frac{1}{2}$ inch from top. Cover with boiling-hot syrup, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a boiling water bath—pints for 25 minutes, quarts for 30 minutes.

Hot pack (recommended method)—Heat syrup to boiling. Add fruit and heat through. Pack hot fruit into clean, hot jars to $\frac{1}{2}$ inch from top. Cover with boiling-hot syrup, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

PLUMS

Wash plums. To can whole, prick skins in several places with table fork to prevent splitting. Freestone varieties may be halved and pitted.

Raw pack—Pack raw fruit into clean, hot jars to $\frac{1}{2}$ inch from top.

Cover with boiling-hot syrup, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

Hot pack (recommended method)—Heat syrup to boiling. Add plums and heat through. Pack hot fruit into clean, hot jars to $\frac{1}{2}$ inch from top. Cover with boiling-hot syrup, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

RHUBARB

Wash rhubarb. Cut into $\frac{1}{2}$ -inch pieces. Add $\frac{1}{2}$ cup sugar to each quart rhubarb and let stand to draw out juice.

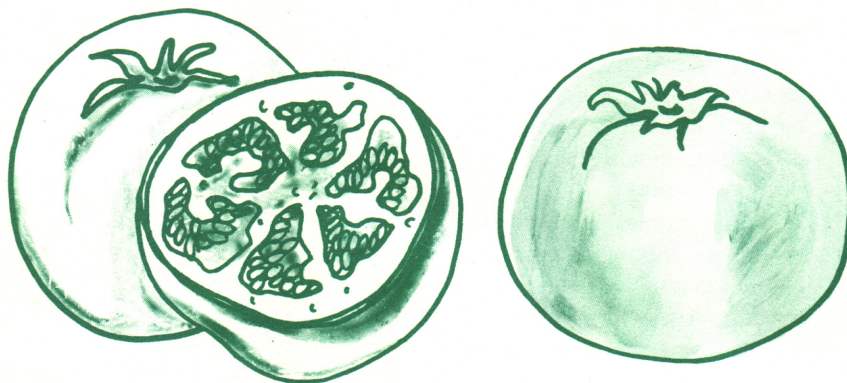
Heat rhubarb to boiling. Pack boiling-hot rhubarb into clean, hot jars to $\frac{1}{2}$ inch from top. Adjust lids. Process in a boiling water bath—pints and quarts for 10 minutes.

TOMATOES

Use only firm, ripe tomatoes for canning. Don't can overripe tomatoes, tomatoes with decayed areas (even if only a small part of the fruit is affected), or tomatoes picked from dead vines, as they may be low in acid.

Wash tomatoes thoroughly to remove all soil. To loosen skins, dip into boiling water for about $\frac{1}{2}$ minute, then dip quickly into cold water. Peel and core. Leave small tomatoes whole. Halve or quarter larger tomatoes.

Raw pack—Pack raw tomatoes into clean, hot jars to $\frac{1}{2}$ inch from top, pressing gently to fill spaces. Do



not add water. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts.

If you have decided to acidify the tomatoes (see section below on tomato acidity), add bottled lemon juice (1 tablespoon to pints, 2 tablespoons to quarts) or crystalline citric acid (¼ teaspoon to pints, ½ teaspoon to quarts) to top of jars.⁷

Adjust lids. Process in a boiling water bath—pints for 35 minutes, quarts for 45 minutes.

Hot pack (recommended method)—Heat tomatoes to boiling, stirring frequently. Do not add water. Pack boiling-hot tomatoes into clean, hot jars to ½ inch from top. If desired,

add ½ teaspoon salt to pints, 1 teaspoon to quarts.

If you have decided to acidify the tomatoes (see section above on tomato acidity), add bottled lemon juice (1 tablespoon to pints, 2 tablespoons to quarts) or crystalline citric acid (¼ teaspoon to pints, ½ teaspoon to quarts) to top of jars.⁷

Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

TOMATO JUICE

Use only firm, ripe tomatoes. Don't use overripe tomatoes, tomatoes with decayed areas, or tomatoes picked from dead vines.

Wash tomatoes thoroughly to re-

move all soil. Remove cores. Cut into halves or quarters. Heat rapidly to boiling while stirring and crushing. Do not add water. Press tomatoes through a strainer or food mill. If desired, add 1 teaspoon salt to each quart juice.

Reheat juice just to boiling. Pour boiling-hot juice into clean, hot jars to ½ inch from top. If you have decided to acidify the juice (see above section on tomato acidity), add bottled lemon juice (1 tablespoon to pints, 2 tablespoons to quarts) or crystalline citric acid (¼ teaspoon to pints, ½ teaspoon to quarts) to top of jars.⁷ Adjust lids. Process in a boiling water bath—pints for 20 minutes, quarts for 25 minutes.

Note: Tomatoes contain both enzymes and pectin, the "cementing material" that holds plant cells together. Once raw tomatoes are crushed, enzymes start breaking down the pectin. Enzymes remain active as the tomatoes are heated, and are not destroyed until the tomatoes reach near-boiling temperatures.

Tomato Acidity

During the last few years, concern has arisen over whether tomatoes are high enough in acid to be canned safely in a boiling water bath. Research has shown that most varieties of tomatoes—unless overripe, decayed, or harvested from dead vines—are sufficiently high in acid for water bath canning. Even cherry, patio, and light-colored (yellow, orange, or pink) tomatoes are suitable for water bath canning, though seed catalogs sometimes describe them as "low acid."

There is evidence that four varieties of red tomatoes—Ace, Ace 55VF, Cal Ace, and Garden State—tend to be undesirably low in acid. Although the risk is minimal, we suggest adding acid when canning any of these varieties. Use lemon juice or citric acid in the amounts given in the directions for canning tomatoes or tomato juice.

It is not necessary to add acid to other varieties of tomatoes before canning. However, lemon juice or citric acid may be used if desired as an extra measure of insurance.

⁷ Crystalline citric acid is available at drug stores. Do not use **fresh** lemon juice, vinegar, or a tomato canning tablet. The acidity of fresh lemon juice may vary and, tablespoon for tablespoon, vinegar is much less effective than bottled lemon juice in acidifying tomatoes; it may also give an off-flavor. Tomato canning tablets may contain less than the suggested amount of citric acid.

Processing Times (in Minutes) for Fruits and Tomatoes*

(For complete directions, see previous section.)

Fruit	Pack method	Pressure Canner at 5 pounds pressure†			
		Water bath canner			
		PINTS	QUARTS	PINTS‡	QUARTS
Minutes					
Apples	Hot	15	20	10	10
Applesauce	Hot	20	20	10	10
Berries	Raw or hot	10	15	—	—
Cherries	Raw	20	25	—	—
	Hot	10	15	10	10
Grape juice	Hot	15	15	—	—
Peaches	Raw	25	30	—	—
	Hot	20	25	10	10
Pears	Raw	25	30	—	—
	Hot	20	25	10	10
Plums	Raw	20	25	—	—
	Hot	20	25	10	10
Rhubarb	Hot	10	10	10	10
Tomatoes	Raw	35	45	—	—
	Hot	20	25	10	10
Tomato juice	Hot	20	25	10	10
Tomato sauce	Hot	30	40	—	—

* When processing time is not given, procedure is not recommended.

† Fruits or tomatoes processed at 5 pounds pressure must be packed hot into jars.

‡ If you are canning pint jars of fruits or tomatoes in a 4- or 6-quart pressure cooker (pressure saucepan), use the processing times shown; longer processing times are not necessary.

Separation of home-canned tomato juice is due to the breakdown of pectin. During the time it takes to heat a big pot of tomatoes to boiling on a home range, enzymes can break down much of the pectin in the tomatoes. A thin-bodied juice that separates easily is produced.

Commercially, tomatoes for juice are heated to boiling in a matter of seconds, not minutes, in a steam-jacketed kettle. Enzymes that break down pectin are destroyed before they have a chance to act. The resulting

tomato juice is uniform and thick-bodied.

It is difficult to duplicate the commercial procedure at home. The best that can be done is to heat tomatoes to boiling **as quickly as possible** while stirring and crushing.

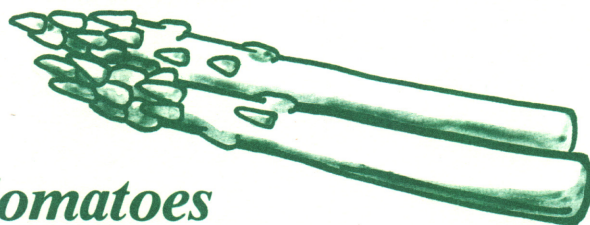
TOMATO SAUCE

Use only firm, ripe tomatoes. Don't use overripe tomatoes, tomatoes with decayed areas, or tomatoes picked from dead vines.

Wash tomatoes thoroughly to remove all soil. Remove cores. Cut into halves or quarters. Cook until softened, stirring frequently. Do not add water. Press tomatoes through a strainer or food mill.

Cook uncovered until volume is reduced by half and sauce is thick, about 1½ hours. Pour boiling-hot sauce into clean, hot jars to ¼ inch from top. Adjust lids. Process in a boiling water bath—pints for 30 minutes, quarts for 40 minutes.

Directions for Canning Vegetables and Stewed Tomatoes



Some vegetables—including broccoli, Brussels sprouts, cabbage, cauliflower, parsnips, rutabagas, and turnips—do not can well. For that reason, no directions are given for canning these vegetables.

ASPARAGUS

Wash asparagus. Snap off tough ends and trim off scales. Wash again. Leave asparagus whole or cut into 1-inch pieces.

Raw pack—Pack raw asparagus as tightly as possible without crushing into clean, hot jars to ½ inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving ½-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 25 minutes, quarts for 30 minutes.

Hot pack—Cover asparagus with boiling water. Boil 2 to 3 minutes. Pack hot asparagus loosely into clean, hot jars to ½ inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling-hot cooking liquid or, if the liquid contains grit, with boiling water. Leave ½-inch headspace. Adjust lids. Process in a pressure canner at 10

pounds pressure—pints for 25 minutes, quarts for 30 minutes.

Note: The yellow crystals sometimes seen in canned asparagus are deposits of rutin, a natural pigment in asparagus. If the asparagus was packed in water with a high iron content, the precipitated rutin may be grey rather than yellow. Either way, it is harmless.

BEANS or peas, dry

Use any variety of dry beans or peas. Wash and sort. Cover with water. Heat to boiling and boil 2 minutes. Remove from heat and let stand 1 hour. If necessary, add water to cover beans; simmer 30 minutes.

Pack hot beans into clean, hot jars to 1 inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leav-

ing 1-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 75 minutes, quarts for 90 minutes.

BEANS, fresh lima

Can only young, tender beans. Shell and wash.

Raw pack—Pack raw beans loosely into clean, hot jars. Do not press or shake down. Fill pint jars to 1 inch from top, quart jars to 1½ inches from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 40 minutes, quarts for 50 minutes.

Hot pack—Cover beans with boiling water. Heat to boiling. Pack hot



beans loosely into clean, hot jars to 1 inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 40 minutes, quarts for 50 minutes.

BEANS, snap (green or wax)

Wash beans. Trim off ends. Cut into 1-inch pieces.

Raw pack—Pack raw beans tightly into clean, hot jars to ½ inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving ½-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 20 minutes, quarts for 25 minutes.

Hot pack—Cover beans with boiling water. Boil 5 minutes. Pack hot beans loosely into clean, hot jars to ½ inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling-hot cooking liquid or boiling water, leaving ½-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 20 minutes, quarts for 25 minutes.

BEETS

Sort beets for size. Cut off beet tops, leaving an inch of stem. Leave roots attached. Scrub beets well. Cover with boiling water and boil



until skins slip off easily, 15 to 25 minutes depending on size. Peel and trim. Leave baby beets whole. Cut medium or large beets into ½-inch cubes or slices.

Pack hot beets loosely into clean, hot jars to ½ inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving ½-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 30 minutes, quarts for 35 minutes.

CARROTS

Wash and scrape carrots. Slice or dice.

Raw pack—Pack raw carrots tightly into clean, hot jars to 1 inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving ½-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—

pints for 25 minutes, quarts for 30 minutes.

Hot pack—Cover carrots with boiling water. Heat to boiling. Pack hot carrots loosely into clean, hot jars to ½ inch from top. If desired, add ½ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling-hot cooking liquid or boiling water, leaving ½-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 25 minutes, quarts for 30 minutes.

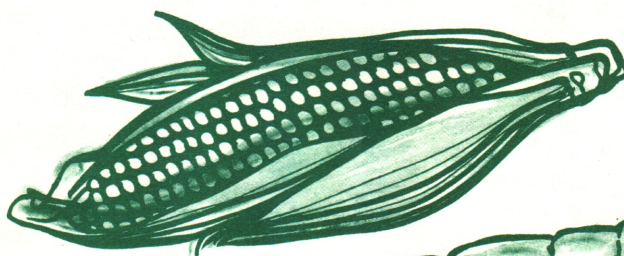
CORN, cream style

Can corn immediately after harvesting. Husk corn and remove silk. Wash. Cut corn from cob at about center of kernel and scrape cobs.

Raw pack—Use pint jars only. Pack raw corn loosely into clean, hot jars to 1½ inches from top. Do not press or shake down. If desired, add ½ teaspoon salt to each jar. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 95 minutes.

Hot pack—Use pint jars only. To each quart corn add 2 cups boiling water. Heat to boiling. Pack boiling-hot corn into clean, hot jars to 1 inch from top. If desired, add ½ teaspoon salt to each jar. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 85 minutes.

Note: Sweet corn sometimes darkens during processing due to caramel-



ization of sugar. The sweeter the corn, the more likely it is to darken. Although the dark color is unattractive, the corn is safe to eat.

CORN, whole kernel

Can corn immediately after harvesting. Husk corn and remove silk. Wash. Cut corn from cob at about two-thirds the depth of kernel. Do not scrape cobs.

Raw pack—Pack raw corn loosely into clean, hot jars to 1 inch from top. Do not press or shake down. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 55 minutes, quarts for 85 minutes.

Hot pack—To each quart corn add 2 cups boiling water. Heat to boiling. Pack boiling-hot corn and liquid into clean, hot jars to 1 inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 55 minutes, quarts for 85 minutes.

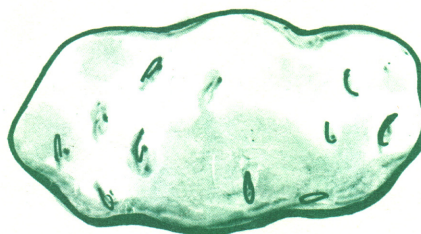
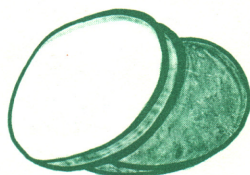
Note: Sweet corn sometimes darkens during processing due to caramelization of sugar. The sweeter the corn, the more likely it is to darken. Although the dark color is unattractive, the corn is safe to eat.

MIXED VEGETABLES

For best quality, combine vegetables that have similar processing times. Follow directions given in this bulletin for preparing each vegetable. **Use the processing time for the vegetable requiring the longest processing time.**

MUSHROOMS

Can only fresh mushrooms. Trim off stem ends and discolored parts. Soak mushrooms 10 minutes in cold water to remove soil. Wash thoroughly in fresh water. Leave small mushrooms whole. Cut larger mushrooms into halves or quarters. Steam 4 minutes or heat gently for 15 minutes without added liquid in a covered saucepan.



Use half pint or pint jars only. Pack hot mushrooms into clean, hot jars to $\frac{1}{2}$ inch from top. If desired, add $\frac{1}{4}$ teaspoon salt to half pints, $\frac{1}{2}$ teaspoon to pints. For better color, add $\frac{1}{16}$ teaspoon crystalline ascorbic acid to half pints, $\frac{1}{8}$ teaspoon to pints.⁸ Cover with boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—half pints and pints for 30 minutes.

PEAS, green

Can peas as soon as possible after harvesting. Shell and wash.

Raw pack—Pack raw peas loosely into clean, hot jars to 1 inch from top. Do not press or shake down. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving $1\frac{1}{2}$ -inches headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints and quarts for 40 minutes.

Hot pack—Cover peas with boiling water. Heat to boiling. Pack hot peas loosely into clean, hot jars to 1 inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving 1-inch headspace. Adjust lids. Process in a pressure canner at 10 pounds

⁸ Crystalline ascorbic acid (vitamin C) is sold at drug stores. A commercial anti-darkening preparation containing a mixture of ascorbic acid and citric acid can be used instead; follow package directions. Anti-darkening preparations are available at grocery stores.



pressure—pints and quarts for 40 minutes.

POTATOES, cubed

Wash, peel, and cut potatoes into $\frac{1}{2}$ -inch cubes. To prevent darkening during preparation, drop cubes into cold water containing 1 teaspoon salt per quart. Drain. Cook 2 minutes in boiling water; drain.

Pack hot cubes loosely into clean, hot jars to $\frac{1}{2}$ inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 35 minutes, quarts for 40 minutes.

POTATOES, whole

Use potatoes 1 to 2 inches in diameter. Wash and peel potatoes. To prevent darkening during preparation, drop peeled potatoes into cold water containing 1 teaspoon salt per quart. Drain. Cook 10 minutes in boiling water; drain.

Pack hot potatoes into clean, hot jars to $\frac{1}{2}$ inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 30 minutes, quarts for 40 minutes.

PUMPKIN, cubed

Wash pumpkin, remove seeds, and peel. Cut into 1-inch cubes. Cover with boiling water. Heat to boiling.

Pack hot cubes into clean, hot jars to $\frac{1}{2}$ inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling-hot cooking liquid or boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 55 minutes, quarts for 90 minutes.

Note: Only cubed pumpkin or winter squash is recommended for home canning. If desired, mash just before serving or using in recipes. Do not can mashed pumpkin or winter squash, as the product may be too thick to ensure adequate heat penetration during processing.

SPINACH and other greens

Can only young, tender, freshly harvested spinach or greens. Discard damaged leaves. Wash spinach or greens thoroughly in several changes of water, lifting out of water each time. Remove tough stems and mid-ribs. Place about $2\frac{1}{2}$ pounds spinach or greens in a cheesecloth bag and steam about 10 minutes or until well wilted.

Pack hot spinach loosely into clean, hot jars to $\frac{1}{2}$ inch from top. Do not press down. If desired, add $\frac{1}{4}$ teaspoon salt to pints, $\frac{1}{2}$ teaspoon to quarts. Cover with boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 70 minutes, quarts for 90 minutes.

SQUASH, summer

Select young, tender squash of any variety (zucchini, yellow crookneck, etc.). Wash but do not peel. Trim off ends. Cut squash into $\frac{1}{2}$ -inch slices; halve or quarter slices to make pieces of uniform size.

Raw pack—Pack raw squash tightly into clean, hot jars to 1 inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 25 minutes, quarts for 30 minutes.



Hot pack—Cover squash with boiling water. Heat to boiling. Pack hot squash loosely into clean, hot jars to $\frac{1}{2}$ inch from top. If desired, add $\frac{1}{2}$ teaspoon salt to pints, 1 teaspoon to quarts. Cover with boiling-hot cooking liquid or boiling water, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process in a pressure canner at 10 pounds pressure—pints for 30 minutes, quarts for 40 minutes.

Note: Hot-packed squash requires longer processing times than raw-packed squash because it packs more solidly into jars.

SQUASH, winter

Follow method for pumpkin, cubed.

TOMATOES, stewed

Yield: 7 pints

- 4 quarts peeled, cored, chopped tomatoes (about 24 large)
- $\frac{1}{2}$ cup chopped celery
- $\frac{1}{2}$ cup chopped onion
- $\frac{1}{2}$ cup chopped green pepper
- 1 tablespoon sugar, if desired
- 2 teaspoons salt, if desired

Use only firm, ripe tomatoes. Wash thoroughly to remove all soil. To

Processing Times (in Minutes) for Vegetables and Stewed Tomatoes*

(For complete directions, see previous section.)

Vegetable	Pack method	Pressure Canner at:			
		10 pounds pressure		15 pounds pressure	
		PINTS†	QUARTS	PINTS‡	QUARTS
		Minutes			
Asparagus	Raw or hot	25	30	15	15
Beans or peas, dry	Hot	75	90	—	—
Beans, fresh lima	Raw or hot	40	50	30	30
Beans, snap	Raw or hot	20	25	15	15
Beets	Hot	30	35	15	15
Carrots	Raw or hot	25	30	15	15
Corn, cream style	Raw	95	—	—	—
	Hot	85	—	—	—
Corn, whole kernel	Raw or hot	55	85	50	50
Mushrooms	Hot	30	—	20	—
Peas, green	Raw or hot	40	40	30	30
Potatoes, cubed	Hot	35	40	—	—
Potatoes, whole	Hot	30	40	20	20
Pumpkin, cubed	Hot	55	90	20	20
Spinach and other greens	Hot	70	90	35	35
Squash, summer	Raw	25	30	20	20
	Hot	30	40	20	20
Squash, winter— see pumpkin					
Tomatoes, stewed	Hot	15	20	—	—

*When processing time is not given, procedure is not recommended.

† If you are processing pints in a 4- or 6-quart pressure cooker (pressure saucepan) at 10 pounds pressure, add 20 minutes to the processing times shown.

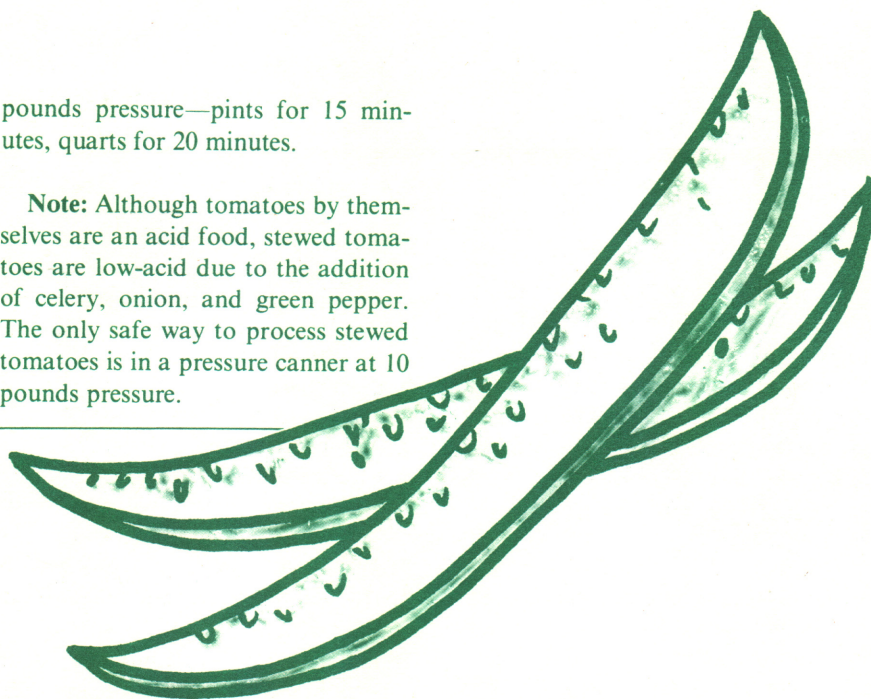
‡ If you are processing pints in a 4- or 6-quart pressure cooker (pressure saucepan) at 15 pounds pressure, add 10 minutes to the processing times shown.

loosen skins, dip into boiling water for about ½ minute, then dip quickly into cold water. Peel, core, and chop tomatoes.

Combine all ingredients. Heat to boiling and cook 10 minutes, stirring occasionally to prevent sticking. Pack boiling-hot tomato mixture into clean, hot jars to ½ inch from top. Adjust lids. Process in a pressure canner at 10

pounds pressure—pints for 15 minutes, quarts for 20 minutes.

Note: Although tomatoes by themselves are an acid food, stewed tomatoes are low-acid due to the addition of celery, onion, and green pepper. The only safe way to process stewed tomatoes is in a pressure canner at 10 pounds pressure.



Directions for Pickling

Like fruits and tomatoes, pickled products are acid foods. There are two types of pickled products, fresh-pack and fermented. **Fresh-pack pickled products** are made with vinegar which contains acetic acid. Examples are quick dill pickles, bread and butter pickles, and pickled beets. **Fermented pickled products** contain lactic acid produced by bacterial fermentation. Brined dill pickles and sauerkraut are examples. They take more time and effort to prepare than fresh-pack products.

Use Pickling Cucumbers

For cucumber pickles, use a variety of cucumbers grown especially for pickling rather than immature slicing cucumbers. Start pickling the cucumbers as soon as possible after harvesting. Wash them thoroughly, using a vegetable brush. Remove all blossoms; they may be a source of the enzymes that soften cucumbers during brining or fermentation. Don't use waxed cucumbers for pickling.

Use either cider vinegar or white distilled vinegar containing 4 to 6 percent acetic acid. Cider vinegar has a milder flavor but may discolor light-colored pickled products. Don't use homemade vinegar, as the acidity is unknown.

Use pure salt which is sold as pickling, canning, or Kosher salt. Kosher salt is coarse. Pickling or canning salt

may be either granulated (like ordinary table salt) or flake. Flake salt is labeled as such. If "flake" is not on the label, you can assume that the pickling or canning salt is granulated. For 1 cup of pure granulated salt, substitute 1⅔ cups of pure flake salt or 2 cups of Kosher salt. Uniodized table salt can be used instead of pure granulated salt, but the anti-caking ingredients may cloud the pickling liquid. Iodized salt may darken pickles.

Water used for pickling should be moderately soft. If it is very hard, boil it and allow the minerals to settle. Then strain it through several layers of cloth. Chemically softened water may be too soft for pickling. Unless there are some minerals (especially calcium and magnesium) in the water, pickles may be soft. It might be best to use a blend of one part hard water to two parts softened water.

Use whole spices. Powdered spices may darken the pickles or cloud the pickling liquid. One tablespoon of dill seed may be substituted for 3 heads of fresh or dried dill. However, fresh dill—picked just as the flowers are beginning to open—is more flavorful than either dried dill or dill seed.

Use Proper Utensils

For brining or fermenting pickles, use a crock or stone jar, an unchipped enameled pan, a large glass bowl or jar, or a food-grade plastic container.

Plastic containers that are intended for use with foods like mixing bowls, food keepers, or cake savers are food grade. Large food-grade plastic containers are available at winemaking supply stores. Don't use plastic pails or trash cans for brining pickles. Undesirable compounds could migrate from these containers into the brine.

For heating pickling liquids, use unchipped enamelware, stainless steel, or aluminum utensils. Don't use iron, copper, brass, or galvanized (zinc-coated) utensils. These metals may cause color changes in the pickles or they may dissolve in undesirably high levels in the pickling liquid.

Don't Pack Tightly

Pack pickles loosely into jars, leaving plenty of room for the boiling-hot pickling liquid. This is especially important for whole cucumber pickles. If they are wedged so tightly into jars that hot pickling liquid cannot get between them, they may spoil.

Process pickled products in a water bath canner. Most up-to-date guides to pickling recommend using a boiling water bath. However, to help keep pickles crisp, a **simmering water bath** (about 200° F.) may be used instead. Wait until the water in the canner is simmering (as indicated by bubbles rising and collapsing just below the surface) to start counting the processing time. Keep the water at a simmer

for the entire processing time. Processing kills spoilage organisms and ensures a good seal on the jar.

Store sealed jars of pickles in a cool, dry, dark place.

Before using pickles, check for spoilage. Signs of spoilage include leakage, bulging lids, loss of seal, gasiness, cloudy liquid,⁹ mold, disagreeable odor, or unusual mushiness or slipperiness. Discard pickles without tasting that show any sign of spoilage.

QUICK DILL PICKLES

Yield: 7 quarts

- 17 to 18 lbs. pickling cucumbers,
3 to 5 inches long
- 1½ cups pure granulated salt (or 2½ cups
pure flake salt or 3 cups Kosher salt)
- 2 gallons water
- 6 cups vinegar
- 9 cups water
- ¾ cup pure granulated salt (or 1¼ cups
pure flake salt or 1½ cups Kosher
salt)
- ¼ cup sugar, if desired
- 2 tablespoons whole mixed pickling
spices
- 2 teaspoons whole mustard seed
per quart jar
- 3 heads fresh or dried dill per quart jar
- 1 to 2 cloves garlic per quart jar,
if desired

Wash cucumbers. Make brine by dissolving 1½ cups salt in 2 gallons cold water. Cover cucumbers with brine and let stand overnight. Drain.

Combine vinegar, 9 cups water, ¾ cup salt, and sugar. Tie mixed pickling spices in a clean, thin, white cloth and add to vinegar mixture. Heat to boiling.

Pack cucumbers loosely into clean, hot quart jars to ½ inch from top. **Avoid too tight a pack.** Add mustard seed, dill, and garlic to each jar. Cover with boiling-hot pickling liquid, leaving ½-inch headspace. Adjust lids. Process 20 minutes in a simmering water bath.

⁹ Although cloudy liquid may be a sign of spoilage, it could instead be due to minerals from hard water or anti-caking ingredients from ordinary table salt. In the case of brined dill pickles, yeast development during fermentation causes cloudiness. If liquid is cloudy, carefully examine the pickles for other signs of spoilage before using them.

BREAD AND BUTTER PICKLES

Yield: 7 pints

- 4 quarts pickling cucumbers, sliced
(about 6 lbs.)
- 4 to 6 medium onions, sliced
- ⅓ cup pure granulated salt (or ½ cup pure
flake salt or ⅔ cup Kosher salt)
- 2 quarts ice, crushed or cubes (about
2 trays)
- 3 cups vinegar
- 4 to 4½ cups sugar
- 1½ teaspoons turmeric
- 1½ teaspoons celery seed
- 2 tablespoons mustard seed

Wash cucumbers. Cut into ⅛-inch to ¼-inch slices; discard ends. Slice onions thinly.

In a large bowl, combine cucumber and onion slices. Add salt and mix thoroughly. Cover with ice and let stand 3 hours. Drain.

Combine vinegar, sugar, and spices. Heat to boiling. Add drained cucumber and onion slices and heat 5 minutes.

Pack hot pickles loosely into clean, hot pint jars and cover with boiling-hot pickling liquid to ½ inch from top. Adjust lids. Process 5 minutes in a simmering water bath.

SWEET GHERKINS

Yield: 6 to 7 pints

- 5 quarts pickling cucumbers, 1½ to
3 inches long (about 7 lbs.)
- ½ cup pure granulated salt (or ¾ cup pure
flake salt or 1 cup Kosher salt)
- 6 cups vinegar
- 8 cups sugar
- ¾ teaspoon turmeric
- 2 teaspoons celery seed
- 2 teaspoons whole mixed pickling spices
- 8 1-inch pieces cinnamon stick
- ½ teaspoon fennel, if desired
- 2 teaspoons vanilla, if desired

First day

Wash cucumbers. Place in a large container. Add salt and cover with boiling water. Let stand overnight (about 12 hours).

Second day

Morning. Drain. Prick cucumbers in several places with table fork. Make pickling liquid of 3 cups of the vine-



gar, 3 cups of the sugar, and spices. Heat to boiling and pour over cucumbers. (Cucumbers will be partially covered at this point.) Let stand.

Afternoon. Drain pickling liquid into pan. Add 2 cups of the vinegar and 2 cups of the sugar to it. Heat to boiling and pour over pickles. Let stand.

Third day

Morning. Drain pickling liquid into pan. Add the remaining 1 cup of vinegar and 2 cups of the sugar to it. Heat to boiling and pour over pickles. Let stand.

Afternoon. Drain pickling liquid into pan. Add the remaining 1 cup of sugar and the vanilla to it. Heat to boiling.

Pack pickles loosely into clean, hot pint jars and cover with boiling-hot pickling liquid to ½ inch from top. Adjust lids. Process 5 minutes in a simmering water bath.

PICKLED BEETS

Yield: 6 pints

- 3 quarts beets, sliced (about 7 lbs.
without tops)
- 3½ cups vinegar
- 1½ cups water
- 2 cups sugar
- 1½ teaspoons salt
- 1 tablespoon whole allspice
- 2 cinnamon sticks

Cut off beet tops, leaving an inch of stem. Also leave roots attached. Scrub beets well. Cover with boiling water and cook until tender. Peel and slice.

Combine vinegar, water, sugar, and salt. Tie allspice and cinnamon in a

clean, thin, white cloth and add to vinegar mixture. Heat to boiling; reduce heat and simmer 15 minutes. Remove spice bag.

Pack hot sliced beets into clean, hot pint jars and cover with boiling-hot pickling liquid to $\frac{1}{2}$ inch from top. Adjust lids. Process 30 minutes in a simmering water bath.

PICKLED CAULIFLOWER

Yield: 5 pints

- 3 quarts cauliflower florets (about 3 medium heads)
- 2 cups onion, sliced
- 1 cup sweet red pepper, cut into strips
- $\frac{1}{4}$ cup pure granulated salt (or $\frac{1}{3}$ cup pure flake salt or $\frac{1}{2}$ cup Kosher salt)
- 2 quarts ice cubes (about 2 trays)
- 4 cups white vinegar
- 2 cups sugar
- 1 tablespoon mustard seed
- 1 tablespoon celery seed
- 1 teaspoon turmeric
- 1 hot red pepper

Wash cauliflower. Break into florets. Combine cauliflower, sliced onion, red pepper strips, and salt. Cover with ice and let stand 3 to 4 hours. Drain.

Combine vinegar, sugar, and spices. Heat to boiling. Add vegetables and boil 10 minutes or until vegetables are crisp-tender. Remove hot red pepper.

Pack hot vegetables into clean, hot pint jars and cover with boiling-hot pickling liquid to $\frac{1}{2}$ inch from top. Cut hot red pepper into 5 pieces and add 1 piece to each jar. Adjust lids. Process 5 minutes in a simmering water bath.



DILLED GREEN BEANS

Yield: 7 to 8 pints

- 4 lbs. green beans (about 4 quarts)
- $\frac{1}{4}$ teaspoon crushed hot red pepper per pint jar
- $\frac{1}{2}$ teaspoon mustard seed per pint jar
- $\frac{1}{2}$ teaspoon dill seed per pint jar
- 1 clove garlic per pint jar
- 5 cups vinegar
- 5 cups water
- $\frac{1}{2}$ cup pure granulated salt (or $\frac{3}{4}$ cup pure flake salt or 1 cup Kosher salt)

Wash beans. Trim off ends. Pack whole beans lengthwise into clean, hot pint jars to $\frac{1}{2}$ inch from top. If necessary, cut beans to fit jars. Add red pepper, mustard seed, dill seed, and garlic to each jar.

Combine vinegar, water, and salt. Heat to boiling. Pour boiling-hot pickling liquid over beans, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process 5 minutes in a simmering water bath.

PICKLED PEPPERS

Yield: 8 pints

- 4 quarts long or cherry peppers (green, yellow, or red)
- $1\frac{1}{2}$ cups pure granulated salt (or $2\frac{1}{2}$ cups pure flake salt or 3 cups Kosher salt)
- 4 quarts water
- 10 cups vinegar
- 2 cups water
- $\frac{1}{4}$ cup sugar, if desired
- 2 cloves garlic

If peppers are hot, wear rubber gloves to avoid burning hands. Wash peppers. Cut 2 small slits in each pepper. Dissolve salt in 4 quarts cold water. Pour over peppers and let stand 12 to 18 hours in a cool place. Drain. Rinse and drain well.

Combine vinegar, 2 cups water, sugar, and garlic. Heat to boiling. Reduce heat and simmer 15 minutes. Remove garlic.

Pack peppers into clean, hot pint jars to $\frac{1}{4}$ inch from top. Cover with boiling-hot pickling liquid, leaving $\frac{1}{4}$ -inch headspace. Adjust lids. Process 10 minutes in a simmering water bath.

PICKLED ZUCCHINI

Yield: 6 to 7 pints

- 4 quarts zucchini, sliced (about 6 lbs.)
- 4 medium onions, sliced
- $\frac{1}{3}$ cup pure granulated salt (or $\frac{1}{2}$ cup pure flake salt or $\frac{2}{3}$ cup Kosher salt)
- 2 quarts ice, crushed or cubes (about 2 trays)
- 4 cups vinegar
- $2\frac{1}{2}$ cups sugar
- 4 teaspoons mustard seed
- 2 teaspoons celery seed
- 2 teaspoons turmeric

Use small (about 6-inch) zucchini. Wash but do not peel. Cut into $\frac{1}{4}$ -inch slices. Slice onions thinly.

In a large bowl, combine zucchini and onion slices. Add salt and mix well. Cover with ice and let stand 3 hours. Drain.

Heat vinegar, sugar, and spices to boiling. Add drained zucchini and onion slices and heat 5 minutes.

Pack hot pickles loosely into clean, hot pint jars and cover with boiling-hot pickling liquid to $\frac{1}{4}$ inch from top. Adjust lids. Process 5 minutes in a simmering water bath.

BRINED DILL PICKLES

Yield: 9 to 10 quarts

- 20 lbs. pickling cucumbers, 3 to 6 inches long (about $\frac{1}{2}$ bushel)
- $\frac{3}{4}$ cup whole mixed pickling spices
- 2 to 3 bunches dill, fresh or dried
- $1\frac{3}{4}$ cups pure granulated salt (or 3 cups pure flake salt or $3\frac{1}{2}$ cups Kosher salt)
- $2\frac{1}{2}$ gallons water
- $2\frac{1}{2}$ cups vinegar

Wash cucumbers. Place half the pickling spices and a layer of dill in the bottom of a 5-gallon crock or other suitable container. Fill crock with cucumbers to 3 or 4 inches from top. Add remaining spices and place a layer of dill on top of the cucumbers.

Make brine by dissolving salt in cold water and vinegar. Pour over the cucumbers. Cover cucumbers with a heavy china or glass plate that fits

inside the crock. Use a weight to hold the plate down and keep the cucumbers under the brine. A glass jar filled with water makes a good weight. Cover crock loosely with a clean cloth.

Keep cucumbers at room temperature. Remove any scum which forms on the surface of the brine daily. Scum may start forming in 3 to 5 days. Make sure that cucumbers are covered by brine. If necessary, make additional brine, using proportions specified in the recipe. Do not stir cucumbers.

After 3 weeks, fermentation should be complete. The pickles will have an olive-green color and desirable flavor. The brine will be cloudy as a result of yeast development during the fermentation period.

Strain brine through several layers of cheesecloth. Heat to boiling.

Pack pickles loosely along with some of the dill into clean, hot quart jars to $\frac{1}{2}$ inch from top. **Avoid too tight a pack.** If desired, add 1 or 2 cloves of garlic to each jar. Cover with boiling-hot brine, leaving $\frac{1}{2}$ -inch headspace. Adjust lids. Process 15 minutes in a simmering water bath.

SAUERKRAUT

Yield: 16 to 18 quarts



About 50 lbs. cabbage

1 lb. 2 oz. pure salt (about $1\frac{1}{4}$ cups pure granulated salt or about 3 cups pure flake salt or about $3\frac{1}{2}$ cups Kosher salt)

Remove outer leaves from firm, mature heads of cabbage. Wash and drain. Cut heads into quarters and remove cores. Using a shredder or sharp knife, cut cabbage into fine shreds about the thickness of a dime.

In a large container, thoroughly mix 3 tablespoons pure granulated salt (or 5 tablespoons pure flake salt or 6 tablespoons Kosher salt) with 5 pounds shredded cabbage. Use household scales to weigh the cabbage. Let the salted cabbage stand a few minutes to wilt slightly. This allows packing without excessive breaking or bruising of the shreds.

Pack the salted cabbage firmly and evenly into a large crock or other suitable container. Using a wooden spoon or your hands, press down until the juice comes to the surface. Repeat the shredding, salting, and packing until

the crock is filled to 3 or 4 inches from the top.

Place a plastic bag filled with water on top of the cabbage. The water-filled bag seals the surface from exposure to air and prevents the growth of yeasts or molds. It also serves as a weight. Use a heavy plastic bag that is intended for use with foods. For extra protection, put the bag filled with water inside another food-grade plastic bag. Adjust the amount of water in the bag to give just enough pressure to keep the fermenting cabbage covered with juice. Formation of gas bubbles indicates fermentation is taking place. A room temperature of 68° to 72° F. is best for fermenting cabbage. Fermentation should be complete in 3 to 4 weeks. At somewhat cooler temperatures, fermentation may take 5 to 6 weeks. Above 80° to 85° F., abnormal fermentations may occur.

When fermentation is complete, heat sauerkraut and juice to simmering, stirring frequently. Do not boil. Pack hot sauerkraut into clean, hot jars and cover with hot juice to $\frac{1}{2}$ inch from top. Adjust lids. Process in a simmering water bath—pints for 15 minutes, quarts for 20 minutes.

Guidelines for Making Jams and Jellies

To make jams and jellies, follow the recipes that come with powdered or liquid pectin. Measure ingredients carefully. Fruit, sugar, pectin, and acid (usually supplied entirely by the fruit) must be present in the right amounts for jam or jelly to gel.

Don't assume that the market quantity of fruit needed (for example, 1

quart of berries) will yield the exact amount of prepared fruit that the recipe uses (for example, 2 cups of crushed berries). Measure the prepared fruit.

Sugar Is Preservative

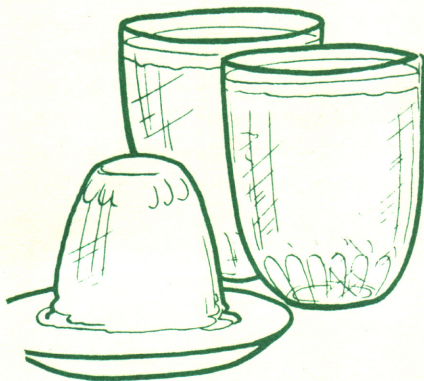
Use either beet or cane sugar. Do not reduce the amount of sugar that the recipe calls for. Sugar does more than give a sweet flavor to jams and jellies. At the high concentrations used, it acts as a preservative and helps in gel formation. If you use less, you'll end up with a runny or syrupy product.

Although powdered or liquid pectin can be used with equal success, they are not interchangeable. Powdered pectin is mixed with the un-

heated fruit; liquid pectin is added to the cooked fruit and sugar mixture. Store pectin in a cool, dry place so that it keeps its gel strength. It should not be held over from one year to the next.

For cooking jam or jelly, use a large (about 8-quart), heavy kettle with a broad, flat bottom. Make only one batch at a time so that the jam or jelly can be heated rapidly to boiling. The boiling time is the same with either powdered or liquid pectin—1 minute at a full rolling boil that cannot be stirred down. Accurate timing is important.

Before you start making the jam or jelly, get jars ready. Wash and rinse them. **Sterilize them in boiling water.** Stand the empty jars upright on a



rack in a water bath canner. Fill the canner and jars with hot water so that the water comes over the tops of the jars. Heat to boiling and boil 10 minutes. Leave jars in the water until you are ready to fill them.

Seal Jars with Lids

For best results, **seal jars with two-piece lids**. Prepare lids according to the manufacturer's instructions. Ladle boiling-hot jam or jelly into hot, sterilized jars to **$\frac{1}{8}$ inch from top**. (If more than $\frac{1}{8}$ -inch headspace is allowed, lids may not seal.) Wipe jar rims clean, put on lids, and tighten screw bands. Work quickly when filling and closing jars. Lids will seal as jars cool.

If desired, immediately after filling jars and adjusting lids, process the jam or jelly for 5 minutes in a boiling water bath. Although processing is not essential for jams and jellies, it does ensure a good seal on the jar.

Only jellies have a smooth enough surface to permit sealing with paraffin. Melt paraffin in a double boiler. Pour boiling-hot jelly into hot, sterilized jars to $\frac{1}{2}$ inch from top. Cover with a $\frac{1}{8}$ -inch layer of hot paraffin. A single thin layer that can expand or contract readily as temperatures fluctuate gives a better seal than one thick layer or two thin layers. Prick any air bubbles that appear, as they may form holes in the paraffin as it hardens.

Let jam or jelly stand undisturbed

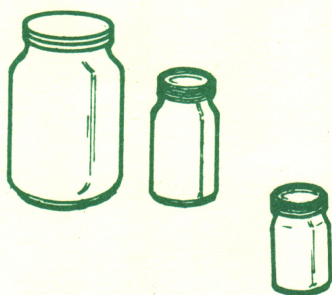
References for Further Information

- Agricultural Research Administration. 1953. *Pressure Canners: Use and Care*. Home and Garden Bulletin No. 30, U.S. Dept. of Agriculture.
- Agricultural Research Service. 1976. *Home Canning of Fruits and Vegetables*. Home and Garden Bulletin No. 8, U.S. Dept. of Agriculture.
- Agricultural Research Service. 1977. *How to Make Jellies, Jams, and Preserves at Home*. Home and Garden Bulletin No. 56, U.S. Dept. of Agriculture.
- Agricultural Research Service. 1978. *Making Pickles and Relishes at Home*. Home and Garden Bulletin No. 92, U.S. Dept. of Agriculture.
- Ball Blue Book*, Edition 30. 1977. Ball Corporation, Muncie, IN.
- Drew, F. and K. S. Rhee. 1980. Energy use, cost, and product quality in preserving vegetables at home by canning, freezing, and dehydration. *Journal of Food Science*, Vol. 45, pp. 1561-1565.
- Extension Bulletin E-977, *Household Equivalents of Fruit and Vegetable Retail Packs*. 1976. Michigan State University.
- Hamilton, L. W. and G. D. Kuhn. *Home Canning*. Extension Circular 569, Pennsylvania State University.
- Hamilton, L. W., G. D. Kuhn, and K. A. Rugh. 1976. *Home Canning: The Last Word*. Countryside Press, Philadelphia, PA.
- Wolf, I. D. and E. A. Zottola. 1978. *Home Canning—Fruits, Vegetables, and Meats*. Extension Bulletin 413, University of Minnesota.

overnight to avoid breaking gel. Cover paraffin-sealed products with metal or paper lids. Store sealed jars in a cool, dry, dark place. Opened or unsealed containers should be refrigerated to keep mold from growing.

Mold rarely grows on jams or jellies sealed with canning lids. However, it often grows on paraffin-sealed products where the paraffin has pulled

away from the glass. It is now known that a few of the molds that grow on foods produce toxins that can seep into the underlying food. For safety's sake, don't just scrape a small patch of mold off jam or jelly; spoon off the top half inch or more and use the remaining product. If there is more than a small spot of mold, discard the entire product.



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