

PRESERVING FOODS

Factsheet | HGIC 3000 | Updated: Jan 28, 2020

Unless food is preserved in some manner, it begins to spoil soon after it is harvested or slaughtered. The main methods of food preservation that will keep food safe are canning, freezing and drying. Preserving food at home means having:

- An abundant supply of a variety of foods when the fresh products aren't readily available
- Specialties such as strawberry-fig preserves or green tomato relish that can't always be purchased
- The satisfaction of preserving foods yourself

However, preserving food at home may not save you money, depending on the costs of buying or raising the food, the needed equipment, energy and time.

Canning is the process in which foods are placed in jars or cans and heated to a temperature that destroys microorganisms and inactivates enzymes. This heating and later cooling forms a vacuum seal. The vacuum seal prevents other microorganisms from re-contaminating food within the jar or can. High-acid foods such as fruits and acidified tomatoes can either be processed or "canned" in a boiling water canner or a steam canner (both 212 °F), while low-acid vegetables and meats must be processed in a pressure canner at 240 °F (10 pounds pressure at sea level). For more information about canning foods in a boiling water bath, a steam canner, or a pressure canner, request **HGIC 3040, *Canning Foods at Home***.

Pickling: Pickling is another form of canning. Pickled products have an increased acidity that makes it difficult for most bacteria to grow. Pickled products are also heated in jars at boiling temperatures (212 °F) to destroy other microorganisms present and form a vacuum in the jar.

Jams & Jellies: Jams & jellies have a very high sugar content. The sugar binds with the liquid present making it difficult for microorganisms to grow. To prevent surface contamination after the product is made and possible yeast or mold growth jams and jellies are canned, frozen or refrigerated.

Freezing

Freezing reduces the temperature of the food so that microorganisms cannot grow, yet many still live. Enzyme activity is slowed down but not stopped during freezing.

- **Enzymes in Vegetables:** These must be inactivated by blanching to prevent loss of color, flavor and nutrients. The vegetable is exposed to boiling water or steam for a specified time and then quickly



Fresh Figs can be frozen, dried or canned to extend storage time.

Adair P. Hoover@2020 HGIC, Clemson University

cooled in ice water to prevent cooking. Blanching is essential for top quality frozen vegetables and helps to destroy microorganisms on the surface of vegetables.

- **Enzymes in Fruits:** These can cause browning and loss of vitamin C, and are controlled by the addition of ascorbic acid.

For more information, request [HGIC 3060, *Freezing Basics*](#), or [HGIC 3063, *Freezing Fruits and Vegetables*](#).

Drying

Drying removes most of the moisture from foods. Thus, microorganisms cannot grow and enzyme action is slowed down. Dried foods should be stored in airtight containers to prevent moisture from rehydrating the products and allowing microbial growth. For more information, request [HGIC 3080, *Drying Foods*](#).

Unsafe Canning Methods

Open-kettle Method: This outdated method of canning is now considered unsafe. In this method, foods were heated in a kettle, then poured into jars and a lid was placed on the jar. No processing was done. With this method there was often spoilage because bacteria, yeast and molds that contaminated the foods when the jars were filled were not killed by further processing. The growth of these microorganisms, in addition to spoiling the food, often caused any lids that did seal to later come unsealed. This method resulted in a very real danger of botulism.

Other Unsafe Methods: Canning food in the microwave oven, electric ovens, slow cookers or crock pots can be extremely dangerous, especially with low-acid foods, and is not recommended. So-called canning powders are useless as preservatives and do not replace the need for proper heat processing.

New Canning Methods

Steam Canning: This is a newer method of canning that was previously not considered safe. When canning using this method, the jars are heated by steam. However, steam canners are NOT recommended for low-acid foods. Low-acid foods canned in these canners are potentially deadly because of possible botulism contamination. Also, there is risk of under-processing the food, leading to spoilage.

Adjustments for Altitudes

As altitude increases, water boils at lower temperatures. Because the lower temperatures are less effective for killing bacteria, processing time must be increased for boiling water bath canning and steam canning at higher altitudes. For pressure canning, the pressure is increased.

The directions for canning foods are usually designed for an altitude of 0 to 1000 feet. If you are canning at an altitude over 1000 feet, check for altitude adjustments needed for canning each type of food. Ask your county extension agent to help you determine your altitude or check with your local airport.

On Guard Against Spoilage

Don't taste or use food that shows any kind of spoilage! Look closely at all jars before opening them. A bulging lid or leaking jar is a sign of spoilage. When you open the jar, look for other signs, such as spurting liquid and off-odors or mold.

Spoiled canned foods should be discarded in a place where they will not be eaten by humans or pets. Spoiled meats, seafood and low-acid vegetables, should be detoxified to destroy any poisons that might be present before they are discarded.

To detoxify canned low-acid foods that have been spoiled, carefully remove the lid from the jar. Be extremely careful when following these directions not to spread or come in contact with suspect food or liquid. Place the open jar(s) of food and the lids in a saucepot. (No need to remove the food from the jar

— removing it could contaminate other items.) Add enough hot water to cover the jar(s). Boil for 30 minutes and then cool. Drain water and dispose of food and lids. The jars may be reused.

Improperly canned low-acid foods can contain botulinum toxin without smelling spoiled or visibly showing signs of spoilage. Low-acid foods are considered improperly canned and not safe if any of the following are true:

- The food was NOT processed in a pressure canner.
- The gauge of the canner was inaccurate.
- Up-to-date researched processing times and pressures were NOT used for the size of the jar, style of pack or kind of food being processed.
- Ingredients were added that were NOT in an approved recipe.
- Proportions of ingredients were CHANGED from the original approved recipe.
- The processing time and pressure were NOT correct for the altitude at which the food was canned.

Because improperly canned low-acid foods can contain botulinum toxin without showing signs of spoilage, they should also be detoxified and then discarded.

Surfaces that come in contact with spoiled or questionable food should be cleaned with a solution of 1 part chlorine bleach to 5 parts water. Wet the surface with this solution and let stand 5 minutes before rinsing.

Preserving Food for Special Diets

It is possible to preserve food at home for people who are watching their salt or sugar intakes. Simply use methods that don't require sugar or salt for their preservative properties.

If preserving food for someone trying to cut sugar consumption, the food may be dried, or fruits may be canned or frozen in water or juice instead of a sugar syrup. The sugar specified in canning and freezing is only needed for its effects on flavor and texture. There are also many pickle recipes that call for little or no sugar.

Sugar is the major means by which most jams, jellies and preserves are safely preserved. These products are not suitable for a person on a low-sugar diet. However, there are special low-methoxyl pectins and recipes designed to make jams and jellies with no added sugar. It is also possible to preserve food at home for people who are watching their salt intake. The salt used in canning, freezing or drying foods is used only for its flavor or color protection quality. Pickling, especially when fermentation is involved, usually requires salt for preservative effect. Read the recipe. If it calls for a large quantity of salt, then it cannot be eliminated or replaced with a salt substitute. However, if the recipe calls for a large amount of vinegar and only a teaspoon or two of salt for flavor (not soaking), then the salt can be left out.

Approximate Yields for Canned or Frozen Fruits & Vegetables

Raw Products	Measure & Weight	Approximate Quart Jars or Containers Needed	Approximate Pounds Needed for 1 Quart Jar or Container
Fruits:			
Apples	1 bushel (48 pounds)	16 to 20	2½ to 3
Apples (for sauce)	1 bushel (48 pounds)	15 to 18	2½ to 3½

Apricots	1 lug (24 pounds)	9 to 12	2 to 2½
Berries (except strawberries & cranberries)	24-quart crate (36 pounds)	12 to 18	1½ to 3 (1- to 2-quart boxes)
Cantaloupes	1 crate (60 pounds)		1 large melon
Cherries (with stems)	1 bushel (56 pounds)	22 to 32 (un-pitted)	2 to 2½
	1 lug (box) (15 pounds)	6 to 7 (un-pitted)	2 to 2½
Cranberries	1 bushel (100 pounds)	100	1
	1 box (25 pounds)	25	1
Figs	1 box (6 pounds)	2 to 3	2 to 2½
Grapes	1 bushel (48 pounds)	10 to 12	4
Grapes, Western	1 lug (28 pounds)	7 to 8	4
Grapes, Eastern	12 – quart basket (18 pounds)	3 to 4	4
	4 – quart basket (6 pounds)	1	4
Grapefruit Florida, Texas & California	1 bag or ½ box (40 pounds)	5 to 8	4 to 6 fruits
	1 box (65 pounds)	8 to 13	4 to 6 fruits
Nectarines	Flat (18 pounds)	6 to 9	2 to 3
Peaches	1 bushel (50 pounds)	19 to 25	2 to 2½
Pears	1 bushel (50 pounds)	20 to 25	2 to 2½
	1 box (46 pounds)	19 to 23	2 to 2½
	1 crate (22	8 to 11	2 to 2½

	pounds)		
Pineapple (with top)	1 crate (70 pounds)	20 to 28	2½ (2 average)
Plums	1 crate (70 pounds)	28 to 35	2 to 2½
	1 bushel (56 pounds)	24 to 30	2 to 2½
Rhubarb	15 pounds	7 to 11	2
Strawberries	24-quart crate (36 pounds)	12 to 16	6 to 8 cups
	1 crate (60 pounds)	17 to 23	2½ to 3½
	1 lug (32 pounds)	9 to 12	2½ to 3½
Tomatoes (for juice)	1 bushel (53 pounds)	12 to 16	3 to 3½
	1 crate (60 pounds)	17 to 20	3 to 3½
	1 lug (32 pounds)	8 to 10	3 to 3½
Vegetables			
Asparagus	1 bushel (24 pounds)	8 to 12	2 to 3
	1 crate (30 pounds)	10 to 15	2 to 3
Beans, lima (in pods)	1 bushel (30 pounds)	5 to 8	4 to 5
Beans, green or wax	1 bushel (30 pounds)	15 to 20	1½ to 2
Beets (without tops)	1 bushel (52 pounds)	17 to 20	2½ to 3
Broccoli	1 crate (25 pounds)	10 to 12	2 to 3
Brussels Sprouts	4 quarts	1 to 1½	2
Cabbage	1 bag or 1 crate (50 pounds)	16 to 20	2½ to 3
Cabbage, Western	1 crate (80 pounds)	26 to 32	2½ to 3

Carrots (without tops)	1 bushel (50 pounds)	16 to 20	2½ to 3
Cauliflower	1½-bushel crate (37 pounds)	12 to 18	2 medium heads
Corn, Sweet (in husks)	1 bushel (35 pounds)	8 to 9 (as kernels)	4 to 5
Cucumbers	1 bushel (48 pounds)	24 to 30	1½ to 2
Eggplant	1 bushel (33 pounds)	15 to 18	2 average
Greens	1 bushel (18 pounds)	8 to 9	2 to 3
Okra	1 bushel (30 pounds)	19 to 21	1½
Peas, Field	1 bushel (25 pounds)	6 to 7	3½ to 4
Peas, Green (in pods)	1 bushel (30 pounds)	6 to 8	4 to 5
Peppers	1 bushel (25 pounds)	17 to 21	1⅓
Potatoes, Irish	1 bushel (60 pounds)	18 to 22	2½ to 3
Pumpkin			1½ to 3
Spinach	1 bushel (20 pounds)	4 to 9	2 to 6
Squash (Summer)	1 bushel (40 pounds)	16 to 20	2 to 3
Squash (Winter)			3
Sweet Potatoes (cured)	1 bushel (50 pounds)	16 to 25	2 to 3

Source:

1. Reynolds, Susan and Paulette Williams, *So Easy to Preserve*, Bulletin 989. Cooperative Extension Service, the University of Georgia. Fifth Edition revised by Elizabeth Andress and Judy Harrison. 2006.

If this document didn't answer your questions, please contact HGIC at hgic@clemson.edu or 1-888-656-9988.

Original Author(s)

Pamela Schmutz, Former Retired HGIC Food Safety Specialist, Clemson University

E.H. Hoyle, PhD, Retired Extension Food Safety Specialist, Clemson University

Adair Hoover, HGIC Food Safety Agent, Clemson Extension, Clemson University

Dr. Susan Barefoot, PhD, Retired Professor Emerita & Extension Program Team Leader, Food Safety & Nutrition, Clemson University

Revisions by:

Sydney McKay, UPIC Intern, Clemson University

This information is supplied with the understanding that no discrimination is intended and no endorsement of brand names or registered trademarks by the Clemson University Cooperative Extension Service is implied, nor is any discrimination intended by the exclusion of products or manufacturers not named. All recommendations are for South Carolina conditions and may not apply to other areas. Use pesticides only according to the directions on the label. All recommendations for pesticide use are for South Carolina only and were legal at the time of publication, but the status of registration and use patterns are subject to change by action of state and federal regulatory agencies. Follow all directions, precautions and restrictions that are listed.

Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, gender, religion, national origin, disability, political beliefs, sexual orientation, gender identity, marital or family status and is an equal opportunity employer.

Copyright © 2020 Clemson University
Clemson Cooperative Extension | 103 Barre Hall Clemson, SC 29634
864-986-4310 | HGIC@clemson.edu