



Freezing is an easy and convenient way to preserve your summer harvest and requires less time than other food preservation methods, such as canning or dehydrating foods. Freezing offers many benefits and delivers fresh flavor, natural color, and a higher nutritional value than other preservation methods.

Selecting Produce for Freezing

Preserving food does not improve quality, so start by selecting good-quality produce.

- Quality varies among varieties, so choose a variety best suited for freezing.
- Fruit and vegetables should be free of disease, mold, or insect damage and not overripe.
- Freeze produce right after harvesting or shortly after purchasing.
- If unable to freeze within 6 to 12 hours of harvest, store in a cool, dry location to minimize deterioration.

Food Preservation Goals

Microorganisms causing food spoilage include molds, yeasts, and bacteria. These microorganisms can be found anywhere and can easily contaminate foods.

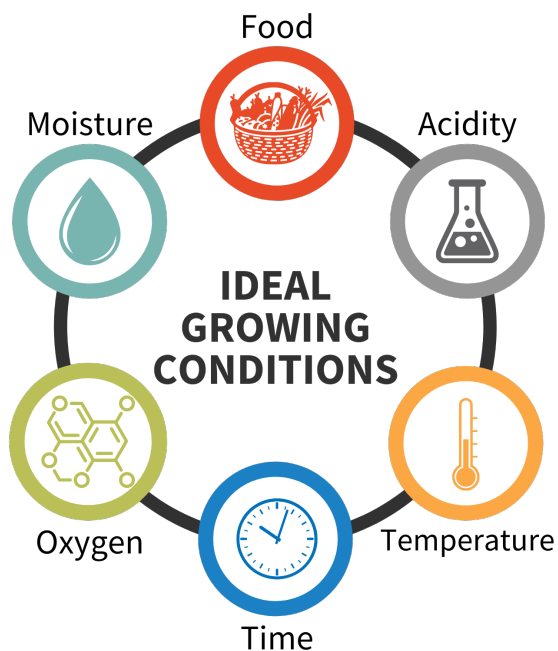
Under ideal conditions, bacteria can easily grow on food and multiply quickly, increasing the rate at which food spoils and can cause a foodborne illness.

Controlling the ideal growing conditions for these harmful microorganisms is the best way to prevent food spoilage and decrease the risk of foodborne illness.

It is important to remember that nothing will come out of the freezer in better condition than when it went in. Understanding these structural changes and why they occur is a key factor in successfully freezing your garden harvest.

Natural chemical changes occur during freezing, resulting in structural changes to fruits and vegetables that can impact the taste, texture, and overall quality.

Freezing stops the growth of harmful microorganisms, but once thawed, microorganisms become active and begin multiplying rapidly.



FACTORS CONTRIBUTING TO BACTERIAL GROWTH

How Does Freezing Work

Water makes up 70 to 90% of the weight of most fruits and vegetables. During the freezing process, water expands, and ice crystals are formed, causing cell walls to rupture.

- Water contained in food freezes and expands.
- Cell walls rupture, resulting in a softer texture.
- It is more noticeable in vegetables that contain a higher water content.
- This is less noticeable in starchy vegetables.

Although water freezes at 32 F, not all foods freeze at 32 F. This is because most food contains a combination of many substances, such as air, fiber, sugar, and water.

Types of Freezing

Freezing produce as quickly as possible will result in smaller ice crystal formation. Smaller ice crystals cause less damage to cell walls, resulting in a crispier texture and less liquid loss when thawed.

- **Rapid freezing:** occurs at a temperature of -13 F or less, produces smaller ice crystals, and results in a better-quality product.
- **Slow freezing:** occurs at a temperature of -11 F or above, produces larger ice crystals, and results in softer texture and more liquid loss when thawed.
- **Freeze-thaw cycle:** occurs when there are fluctuating temperatures; it allows the growth of ice crystals and further damage to cell walls.

Freezer Packaging

Quality freezer packaging is essential when freezing fruits and vegetables. Freezer bags and containers are specially designed for freezer use.

These materials have a different composition and/or thickness than regular plastic storage bags and containers, allowing them to provide the best moisture vapor barrier.

Choosing Containers

Freezer containers should keep moisture in and air out while protecting food from absorption of off-flavors or odors and freezer burn. Quality packaging should be durable, moisture-resistant, leak-proof, and easy to seal.

- **If using rigid packaging,** select containers specifically designed to withstand cold temperatures that will not become brittle and break or those with screw-on lids that will not pop off in the freezer and spill.
- **If using glass jars,** use caution, as glass breaks easily at freezing temperatures.

Container Headspace

Headspace, or unfilled space in a sealed container above the food and below the lid, allows food to expand while processing.

The amount of headspace required depends on the type of food being frozen. Liquids expand more than solids when frozen, so leave ample headspace when processing liquids.

Blanching

Blanching is the process of quickly exposing vegetables to boiling water or steam for a specified amount of time and then rapidly cooling. It is not required from a food safety standpoint; however, it will affect the quality of frozen vegetables.

- Destroys microorganisms on the surface of vegetables.
- Softens the vegetable, brightens color, and slows the loss of vitamins.
- Inactivates enzymes, leading to flavor, color, and texture loss in frozen produce.
- Freezing does not stop enzyme activity; only blanching inactivates vegetable enzymes.

How to Blanch Vegetables

- Use 1 gallon of boiling water per 1 pound of prepared vegetables.
- Place vegetables in a blanching basket and lower them into vigorously boiling water. Place a lid on the kettle.
- The water should return to a boil within 1 minute. If water does not return to a boil within 1 minute, too many vegetables are being used for the boiling water.
- Begin counting blanching time as soon as the water returns to a boil.
- Keep the heat on high during the indicated blanching time.

Enzyme Activity in Vegetables

Enzymes are large protein molecules in fruits and vegetables that promote chemical reactions, such as ripening, and can affect the quality of your product.

Enzyme activity helps to speed up the breakdown of foods, which leads to the deterioration of food quality. The activity of enzymes is specific for the actual enzyme type and depends on both pH and temperature.

Enzyme activity affects the quality of your product and leads to a loss of nutrients and changes in color, texture, and flavor.

Vegetable	*Time
Artichoke – Globe (Hearts)	7
Artichoke – Jerusalem	3-5
Asparagus: small stalk	2
Asparagus: medium stalk	3
Asparagus: large stalk	4
Beans (Snap, Green or Waxed)	3
Beans (Lima, Butter, or Pinto): small	2
Beans (Lima, Butter, or Pinto): medium	3
Beans (Lima, Butter, or Pinto): large	4
Broccoli: flowerets 1.5 inches across	3
Broccoli: steamed	5
Cauliflower: small	5
Cauliflower: d diced, sliced, or lengthwise	5
Carrots: small	5
Carrots: diced, sliced, or length	5
Celery	3
Collard Greens	3
Greens, All Other	2
Corn-on-the-cob: small ears	7
Corn-on-the-cob: medium ears	9
Corn-on-the-cob: large ears	11
**Whole kernel or cream style	4
Peas: edible pod	2-3
Peas: field (black-eyed)	2
Peas: green	1.5-2.5

*Blanching time in minutes.

**Ears blanched before cutting corn from the cob.

Fruit Freezing Methods

When freezing fruit, always know what the intended use for the fruit will be. Most fruit will have a better texture and flavor if packed in sugar or syrup, but sugar is unnecessary to preserve fruit safely.

If you intend to pack fruit in sugar or syrup, choose the type of packing method that best fits your intended use.

Sugar Pack

Fruits packed in granulated sugar or unsweetened are best for cooking purposes because they result in less liquid. Sugar pack is ideal for peaches, strawberries, figs, deseeded grapes, plums, and cherries. Small, whole fruit may be coated with sugar and frozen.

Sprinkle sugar over the fruit and gently mix until the juice is drawn out of the fruit and the sugar is dissolved. For soft, sliced fruits, layer slices with sugar and allow to stand for 15 minutes.





Syrup Pack

Fruits packed in syrup are generally best for uncooked desserts. A 40% syrup pack is recommended for most fruits; however, the proportion of sugar to water depends on the frozen fruit's sweetness.

Lighter syrups are recommended for mild-flavored fruits to prevent masking of natural fruit flavor. Heavier syrups are recommended for very sour fruits.

Type of Syrup	Percent of Syrup*	Cups of Sugar**	Cups of Water	Yield of Syrup in Cups
Very Light	10%	½	4	4-½
Light	20%	1	4	4-¾
Medium	30%	1-¾	4	5
Heavy	40%	2-¾	4	5-⅓
Very Heavy	50%	4	4	6

*Approximate percent. ** Up to ¼ of the sugar may be replaced by mild-flavored honey or corn syrup; however, this may affect the color and flavor of the fruit.

Enzyme Activity in Fruit

When freezing fruit, adding one of the chemical compounds below can help control enzyme activity, leading to browning and loss of Vitamin C.

Ascorbic Acid (Vitamin C)

Ascorbic acid prevents discoloration in most fruits and must be used in powder form. Purchase ascorbic acid where freezing supplies are sold.

Ascorbic Acid Mixtures

These special anti-darkening preparations consist of a mixture of ascorbic acid with sugar and citric acid.

Citric Acid and Lemon Juice

Although both citric acid and lemon juice can be used, these are not as effective as ascorbic acid and may mask the natural fruit flavor.

Making Syrup Pack

- Dissolve sugar in lukewarm water, mixing until the solution is clear.
- Chill the solution before covering the fruit.
- Cover the fruit with enough syrup, approximately $\frac{1}{2}$ to $\frac{2}{3}$ cup solution per pint.
- When using a rigid container, place crumpled parchment paper or other water-resistant wrapping material on top of the fruit solution.

Options for Freezing Unsweetened Fruit

Unsweetened Pack

Packing fruit for freezing in water or unsweetened juice may result in products having a softer texture and a duller color. Fruits will freeze harder and take longer to thaw. This method is ideal for fruits such as:

- Blueberries
- Cranberries
- Currants
- Gooseberries
- Raspberries
- Steamed apples

Dry Pack

This method is ideal for small, whole berries that will result in a good quality product without sugar.

- Pack fruit into a container, seal it, and freeze.
- To prevent clumping, place fruit in a single layer onto a shallow tray and freeze.
- Once frozen, remove from the tray, pack in freezer-safe packaging, and return to the freezer.

Pectin Syrup

This unsweetened pack method is ideal for fruits that retain their texture better than frozen in water or unsweetened juice. Fruits such as strawberries and peaches freeze well in pectin syrup.



Call Your Local Office

Contact your local Illinois Extension office with your food safety questions: go.illinois.edu/FindILExtension.

References and Resources

- [So Easy to Preserve](#), University of Georgia Extension
- [Freezing](#), National Home Center for Home Food Preservation
- [What is blanching, and how does it relate to enzyme activity when freezing food?](#), USDA
- [Understanding the Process of Freezing](#), Penn State Extension
- [Home Canning and Botulism](#), CDC.gov
- [General Canning Information](#), National Home Center for Home Food Preservation The Ball® Blue Book
- [What's Cooking with Mary Liz Wright](#), YouTube.com
- [Cottage Food](#), University of Illinois Extension
- [Food Preservation Resources](#), University of Illinois Extension

Modified May 2025



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