

FREEZING FRUITS & VEGETABLES

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Freezing is a quick and convenient way to preserve fruits and vegetables at home. It is the method of food preservation that preserves the greatest quantity of nutrients. To maintain top nutritional quality in frozen fruits and vegetables, it is essential to:

- Select fresh, firm-ripe produce
- Blanch vegetables as directed
- Store the frozen product at 0 °F
- Use within suggested storage times.

Chemical Changes

Harvested fresh, fruits and vegetables continue to undergo chemical changes that can cause spoilage and deterioration of the product. This is why these products should be frozen as soon after harvest as possible and at their peak degree of ripeness. Enzymes in the fruits and vegetables must be inactivated to prevent the loss of nutrients and color and flavor changes that will occur.



Corn on the cob ready for the freezer.
Millie Davenport © 2018 HGIC, Clemson Extension

Enzymes in Vegetables: Enzymes are inactivated by the blanching process, which is the exposure of the vegetables to boiling water or steam for a brief period of time. The vegetable must then be cooled rapidly in ice water to prevent it from cooking. Contrary to statements in some publications on home freezing, in most cases blanching is absolutely essential for producing top-quality frozen vegetables. Blanching also helps to destroy microorganisms on the surface of the vegetable, brightens the color, helps retard loss of vitamins and helps make some vegetables, such as broccoli and spinach, more compact.

Enzymes in Fruits: The major problems associated with enzymes in fruits are the development of brown colors and loss of vitamin C. Because fruits are usually served raw, they are not blanched like vegetables. Instead, ascorbic acid (vitamin C) is used either in its pure form or in commercial mixtures, such as Fruit Fresh™, to control the activity of the enzymes.

Other methods to control browning include soaking the fruit in dilute vinegar solutions or coating the fruit with sugar and lemon juice. However, these other methods do not prevent browning as effectively as treatment with ascorbic acid.

Preventing Rancid Flavors: Rancid oxidative flavors may develop through contact of the frozen product with air. This problem can be prevented by using a wrapping material that does not permit air to pass into the product and by removing as much air as possible from the freezer bag or container before freezing.

Textural Changes

Cause of Textural Changes: Water makes up over 90 percent of the weight of most produce and is held within the fairly rigid cell walls that give support, structure and texture to the fruit or vegetable. Freezing fruits and vegetables actually consists of freezing the water contained in the plant cell. When the water freezes, it expands, and the ice crystals cause the cell walls to rupture. The texture of the thawed produce will be much softer than it was when raw.

For example, when a frozen tomato is thawed, it turns into a pile of mush and liquid. This explains why celery, lettuce and tomatoes are not usually frozen, and why it is recommended that raw frozen fruits be eaten before they have completely thawed. Textural changes due to freezing are not as apparent in products that are cooked before eating because cooking also softens cell walls. These changes are also less noticeable in high-starch vegetables, such as peas, corn and lima beans.

Prevention: When produce is frozen quickly, it forms a large number of small ice crystals. These small ice crystals produce less cell wall rupture than slow freezing, which produces only a few large ice crystals. This is why it is sometimes recommended that the temperature of a freezer be set at the coldest setting several hours before foods will be placed in the freezer. The maximum amount of unfrozen product that can be frozen at one time is 2 to 3 pounds to each cubic foot of freezer space per 24 hours.

Moisture Loss

Moisture loss, or ice crystals evaporating from the surface area of a product, produces freezer burn — a grainy, brownish spot where the tissues become dry and tough. This surface freeze-dried area is very likely to develop “off” flavors. Packaging in heavy-weight, moisture-proof wrap will prevent freezer burn.

Microbial Growth in the Freezer

The freezing process does not actually destroy the microorganisms that may be present on fruits and vegetables. While blanching destroys some microorganisms and there is a gradual decline in the number during freezer storage, sufficient populations are still present to multiply and cause spoilage of the product when it thaws. For this reason it is necessary to inspect carefully any frozen products that have accidentally thawed if the power goes off or the freezer door is left open.

Recommended Storage Times

Longer storage of fruits and vegetables than those recommended will not make the food unsafe for use but will decrease its quality.

Fruits: Most frozen fruits maintain high quality for eight to 12 months. Unsweetened fruits lose quality faster than fruits packed in sugar or sugar syrups.

Vegetables: Most vegetables will maintain high quality for 12 to 18 months at 0 °F or lower. However, it is a good idea to use your home-frozen vegetables before the next year’s crop is ready for freezing.

Selecting Freezer Containers

Use good-quality freezer containers that are both moisture- and vapor-proof so that moisture can be kept in the product and air kept away from it.

Moisture- & Vapor-Resistant Wraps: Heavy-weight aluminum foil, plastic-coated freezer paper and saran are effective at excluding oxygen. They should be strong, pliable and adhere to the shape of the food item. Seal these only with tape that is designed for the freezer because other household tapes lose adhesive quality in the extremely cold freezer temperatures. Wraps are not as convenient for fruits and vegetables as plastic bags or rigid freezer containers.

Plastic Film Bags: These seal with twist-and-tie tops. Collapsible cardboard freezer boxes are frequently used as an outer covering for plastic bags to protect them against tearing and for easy stacking in the

freezer. Plastic sandwich bags and bread wrappers are not suitable for freezing.

“Freeze-&-Cook” Bags: These bags withstand temperatures from below 0 °F to above the boiling point and are suitable for both freezing and cooking the product. They come in 1½ pint and quart sizes and also as large rolls of plastic so they can be made the size desired. A heat sealer is necessary for closing these bags. These products are more expensive but convenient since you can cook in them.

Freezer Temperature

To maintain top quality, frozen fruits and vegetables should be stored at 0 °F or lower. Higher temperatures increase the rate at which deterioration can take place and can shorten the shelf life of frozen foods. Do not attempt to save energy by raising the temperature of frozen food storage above 0 °F. A freezer thermometer can help determine the actual temperature of the freezer. If the freezer has number temperature settings, such as from one to nine, check the manual to see what settings are recommended for different uses.

Changing temperatures in the freezer can cause the migration of water vapors from the product to the surface of the container as may be seen in improperly handled commercially frozen foods.

Methods of Packing Fruits

There are three ways to pack fruits for freezing: sugar pack, syrup pack and unsweetened pack. Although some fruits may be packed without sweeteners, the flavor of many fruits is retained better with the use of sugar. Gooseberries, currants, cranberries, blueberries and rhubarb give as good quality packs with or without sugar.

Unsweetened Pack: Simply spread a single layer of prepared fruit on shallow trays and freeze. To prevent freezer burn, package the fruit as soon as it is frozen and return to the freezer. Sugar substitutes may be used in any of the unsweetened packs. Both saccharin and aspartame work well in frozen products, or they can be added to the fruit just before serving.

Sugar Pack: To freeze fruits using a sugar pack, sprinkle the required amount of sugar over the fruit. Gently stir until the pieces are coated with sugar and juice.

Syrup Pack: To make sugar syrup, dissolve the needed amount of sugar in water, mixing until the solution is clear. Chill syrup before using. Use just enough cold syrup to cover the fruit.

Preventing Discoloration in Fruits

Some fruits, such as peaches, apples, pears and apricots, darken quickly when exposed to air and during freezing. They may also lose flavor when thawed. There are several ways to prevent darkening of fruit and flavor loss.

Ascorbic Acid (Vitamin C): Ascorbic acid or vitamin C is effective in preventing discoloration in most fruits. Not only does it preserve natural color and flavor of fruits, but it adds nutritive value as well. Ascorbic acid in powdered form is available at some drugstores or where freezing supplies are sold. Ascorbic acid tablets may be more readily available and less expensive, but are more difficult to dissolve. They do need to be finely crushed before use. Fillers in the tablets may make the syrup cloudy, but they are not harmful. One-half teaspoon powdered ascorbic acid equals 1500 mg. Ascorbic acid may be added by the following methods when freezing fruits.

Syrup or Liquid Packs: Add powdered or crushed ascorbic acid to cold syrup shortly before using. Stir it gently so you do not stir in air. Keep syrup refrigerated until use.

Sugar or Dry Packs: Dissolve the ascorbic acid in two to three tablespoons of cold water and sprinkle dissolved ascorbic acid over fruit just before adding sugar.

Crushed Fruits, Fruit Pulses & Fruit Juices: Add ascorbic acid to prepared fruit and stir well.

Ascorbic Acid Mixture: Ascorbic acid mixtures are special anti-darkening preparations, usually made of ascorbic acid mixed with sugar or with sugar and citric acid. The important active ingredient in these mixtures is ascorbic acid. Follow the manufacturer's directions for use.

Citric Acid & Lemon Juice: Citric acid or lemon juice are sometimes used in place of ascorbic acid but are not as effective as ascorbic acid. When used in large quantities, they often mask natural fruit flavors.

Steps in Freezing Fruits

1. Select best-quality fruits; wash and sort fruits carefully, discarding parts that are of poor quality. Do not soak.
2. Prepare fruits as you will use them. Do not use iron or copper equipment that can react with the acid in fruit.
3. Use ascorbic acid as an anti-browning treatment.
4. Use dry sugar or sugar syrup as recommended. If you are preparing a sugarless pack of fruits that brown, be sure to treat with ascorbic acid or other anti-browning agents.
5. Pack into good-quality plastic bags, freezer containers or freezer jars. Allow ½-inch headspace for expansion. Keep fruits that tend to darken, such as peaches, under the syrup by placing crumpled wax paper between lid and fruit.

To Use Home-Frozen Fruits

Thaw fruit at room temperature in its original package to preserve quality and nutritive value. If faster defrosting is required, place package in front of an electric fan or submerge (if watertight) in cool lukewarm water. Serve as soon as defrosted, preferably while a few ice crystals remain.

Methods of Packing Vegetables

There are two basic methods for packing vegetables for freezing, the tray pack and the dry pack.

Dry Pack: This is the term used to describe the packing of blanched and drained vegetables into containers or freezer bags. Pack the vegetables tightly to cut down on the amount of air in the container. If the vegetables are packed in freezer bags, press air out of the unfilled part of the bag. When packing broccoli, alternate the heads and stems. Allow ½ inch headspace (except for loose packing vegetables such as asparagus and broccoli that do not require headspace). Seal.

Tray Pack: This is the method of freezing individual pieces of blanched and drained vegetables on a tray or shallow pan, then packing the frozen pieces into a freezer bag or container. This method produces a product similar to commercially frozen plastic bags of individual vegetable pieces and is particularly good for peas, corn and beans. Pack the frozen pieces into a bag or container as soon as they are frozen. Long exposure will result in loss of moisture. Do not leave headspace. Seal.

Steps for Freezing Vegetables

1. Assemble the necessary equipment.
 - Large pot (minimum capacity 2 gallons)
 - A colander, wire basket, or net bag for blanching
 - Large pans for cooling
 - Ice cubes or ice blocks for cooling

- Cutting board, knives, hot pads
- Plastic freezer bags or other containers
- A timer or a clock with a second hand

2. Choose vegetables for freezing that are at their peak of flavor and texture. If possible, harvest the vegetables in the cool of the morning and process immediately or refrigerate the vegetables until processed to preserve quality and nutrients.

3. Carefully follow the blanching instructions. Time the blanching from when the vegetable is immersed in the vigorously boiling water. Do not add so much vegetable that the water stops boiling. Underblanching stimulates the activity of enzymes and is worse than no blanching. Overblanching causes loss of flavor, color, vitamins and minerals.

Note: Very hard water can cause the toughening of vegetables such as green beans. If you have problems with tough green beans, check into the levels of hardness in your water supply.

Methods of Blanching Vegetables

Boiling Water Blanching:

- Use 1 gallon water for each pound of vegetables except for leafy greens, which need 2 gallons per pound.
- Bring water to rolling boil.
- Immerse wire basket, blanching basket or mesh bag containing vegetables.
- Cover pot and boil at top heat the required length of time. You may use the same blanching water two or three times. Keep it at the required level. Change the water if it becomes cloudy.
- Cool vegetables immediately in pans of ice water for the same time used for blanching. Keep water ice cold for chilling.
- Drain the vegetables thoroughly. Extra water will form too many ice crystals.
- Pack, using dry or tray pack methods. Freeze.

Water Blanching Times:

1½ minutes: Cabbage (shredded)

2 minutes: Asparagus (small stalks), blackeye peas, carrots (diced or sliced), greens (except collards)

3 minutes: Beans (snap, green or wax), broccoli and cauliflower flowerets (1½ inches across), celery, collards, sweet peppers (halves), rutabagas and turnips (cubed), summer squash (½-inch slices)

4 minutes: Whole kernel or cream corn (blanch on cob, cool and cut off cob), eggplant (1/3-inch slices)

5 minutes: Carrots (whole, small)

The following times depend on size:

1½–2½ minutes: Green peas

2–4 minutes: Asparagus, beans: lima, butter, pinto

3–4 minutes: Okra

3–5 minutes: Brussels sprouts, Irish potatoes (new)

3–7 minutes: Onions (until center is heated)

7–11 minutes: Corn-on-the-cob

Steam Blanching: Blanching in steam is recommended only for a few vegetables. For broccoli, pumpkin, sweet potatoes and winter squash, both steaming and boiling work well.

- Use a pot with a tight lid and a basket that holds the food at least 3 inches above the bottom of the pot.
- Put 1–2 inches of water in the pot and bring the water to boil.
- Put the vegetables in the basket in a single layer so that steam reaches all parts quickly.
- Cover the pot and keep heat high.
- Start counting steaming time as soon as the lid is on.

Steam blanch broccoli flowerets (1 ½ inches across) for 5 minutes. Steam the other recommended vegetables until soft before freezing.

Microwave Oven-Blanching: Directions for microwave-blanching of vegetables are not based on any published research. Recent research indicates some of these times are not sufficient to adequately blanch some vegetables. Inadequate blanching does not cause a food safety problem, but quality may suffer. Water is a more reliable method of blanching.

To Use Home-Frozen Vegetables

All vegetables may be cooked from the frozen state except corn-on-the-cob, which should be partially defrosted. Cook frozen vegetables in a small amount of salted water (about ½ cup or less). Cook only until tender — about half as long as if the vegetables were fresh. You can use a pressure saucepan or microwave oven for cooking frozen vegetables. Follow manufacturer’s directions for cooking time. A pack should be thawed enough to break it up before pressure cooking. If cooking vegetables in a freezer pouch in the microwave oven, be sure to split the package open first.

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

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