



FREEZING: FRUITS and VEGETABLES

Freezing is a quick, convenient, and popular way to preserve fruits and vegetables, and it preserves more nutrients in the food if properly done. Frozen foods are easy to serve on short notice. Freezing retards the growth of bacteria, molds, and yeasts. Once the food is thawed, microorganisms may continue to grow.

Natural enzymes in foods cause changes in flavor, color, texture, and nutritive value. Freezing slows this activity but does not stop it. To prevent further enzyme activity, vegetables need to be blanched in boiling water or steamed before freezing.

Some nutrient loss occurs when vegetables are blanched before freezing. By comparison, however, the nutrient losses from enzymatic activity are greater if vegetables are not blanched.

Enzymatic browning in light colored fruits can be prevented by using ascorbic acid mixtures. If fruits and vegetables are not properly packaged, air can cause changes that affect flavor.

Moisture from the food can evaporate, causing the food to become dry and tough. Off-flavors will develop. To prevent this "freezer burn," use moisture vapor-proof or resistant packaging, such as "can or freeze" glass jars, plastic freezing containers, heavy weight aluminum foil, plastic coated freezer paper, and plastic wraps.

The water in fruits and vegetables expands during freezing and breaks the cell walls. That's why thawed foods sometimes have a soft, mushy texture. To maintain as much of the crisp texture as possible, fruits and vegetables should be frozen at the lowest possible setting on the freezer. Freeze no more than can be solidly frozen in 24 hours. Store frozen foods at 0°F or lower.

Constant storage temperature helps in retention of quality. Fluctuating temperature will damage the texture of frozen fruits and vegetables as the ice melts and then refreezes in the cells. Nutrient loss is lower when stored at 0°F or below than at higher temps.

STEPS IN FREEZING VEGETABLES

1. **Choose young, tender vegetables at their peak of flavor and texture.** Freeze as soon after picking as possible. Refrigerate vegetables if they cannot be frozen soon.

2. **Work in small quantities.**
3. **Blanch in boiling water or steam.** Start counting blanching time as soon as the lid is on. See Table 1, Preparing Vegetables for Freezing, on page 3.

To blanch in boiling water—Blanch no more than 1 pound of vegetables per gallon of boiling water at a time. Immerse wire basket or mesh bag with vegetable in boiling water. Cover and keep on highest heat for the total blanching time.

To steam blanch—Place one layer of vegetables in a wire basket or cheesecloth bag suspended at least 3-inches above 1 to 2 inches of rapidly boiling water in steamer. Cover. Start counting steaming time as soon as the lid is on. Steam for suggested time in Table 1.

Generally, water blanching takes less time and fuel. However, the nutrient losses may be somewhat less for steam blanching.

Microwave oven blanching—Because microwave ovens do not have standardized power levels, it is impossible to publish a timetable that can be used with all ovens. Follow directions given by the oven manufacturer. The times in this leaflet are for conventional cooking.

Little research has been published on the effectiveness of blanching in the microwave oven. Some studies have shown microwave-blanched vegetables to be lower in vitamin C and color than steam- or water-blanched vegetables.

4. **Cool immediately in cold water (60°F or less) for the same time as for blanching.** Use about 1 pound of ice for each pound of vegetables. Drain thoroughly.
5. **Two basic packing methods for freezing vegetables: DRY PACK**—Pack tightly in freezer bags or rigid containers. Squeeze as much air as possible from bags before sealing. Leave 1/2- to 3/4-inch headspace for expansion in containers. **TRAY PACK**—Place well dried vegetables in single layer on trays or pans. Place in freezer until firm, remove and quickly fill labeled bags or containers. Close and freeze immediately.

6. **Label with product and date.** Freeze at once at 0°F or lower.
7. Vegetables may be placed in a single layer on a tray and frozen until nearly solid. Transfer to freezer bag or container. Seal and label.
8. **Store at 0°F or lower.** Use within 8 to 12 months for best quality and nutrient retention.

USING FROZEN VEGETABLES

Most frozen vegetables can be cooked without thawing. However, corn on the cob should be partially defrosted. Cook vegetables in a small amount of water, 1/2 cup or less. Cook until just tender—about half as long as if the vegetable were fresh.

STEPS IN FREEZING FRUITS

1. **Do not use underripe or overripe fruit.** The flavor and texture will be undesirable.
2. **Wash and sort fruit according to size.** Work with a small amount at a time.
3. **Pare and remove pits, seeds, and blemishes.** Leave whole, slice, or puree according to Table 2, Preparing Fruits for Freezing, on page 4.
4. **Use an anti-darkening agent on fruits that turn brown.** Ascorbic acid preparations or mixtures of sugar and citric acid are the most effective. Use amounts recommended in Table 2 or in manufacturer's directions. Sodium bisulfites should not be used if individuals are sulfite sensitive.
5. **Use dry sugar, syrup, or unsweetened pack.**
6. The flavor, color, and texture of most fruits is retained best when some sweetening is used.

Dry Sugar—Sprinkle sugar over fruit (see specific fruit for amount). Gently stir until pieces are coated with sugar and the juice is drawn out. Pack in containers, allowing recommended headspace for syrup-packed fruit.

Syrup—A 30 to 40% syrup is used for most fruits (see Syrup Proportions Chart on page 4). Dissolve sugar in water. Heavier syrups may be needed for very sour fruits. Allow 1/2 to 2/3 cup syrup for each pint. Add fruit and cover with additional syrup, leaving 1/2-inch headspace for wide-top pints, 1 inch for wide-top quarts, 3/4-inch for narrow top pints and 1 1/2-inch for narrow top quarts.

Unsweetened—Fruit also may be packed in its own juice, other fruit juices, or water to which an anti-darkening agent is added (1 teaspoon ascorbic acid per quart of water). Use an anti-darkening agent if the fruit is light colored or if you choose to use a nonnutritive sweetener. Unsweetened fruits lose quality faster than those sweetened with sugar or syrup.

7. **Spread small, whole fruits like whole berries, in a single layer on a tray and frozen until nearly solid.** Transfer to freezer bag or containers.
8. **Store at 0°F or lower.** Use within 8 to 12 months for best quality.

NOTE: Pour 1/2 cup syrup into each container. Dissolve sugar in cold or hot water. If hot water is used, cool syrup before using. Syrup may be made the day before and kept covered in the refrigerator. Up to 1/4 of the sugar may be replaced, amount for amount, with corn syrup or honey.

USING FROZEN FRUITS

Thaw fruit at room temperature in its original package. If faster defrosting is required, submerge in lukewarm water or partially defrost in microwave oven. Serve with a few ice crystals still remaining. Completely thawed fruits will be limp or mushy.

WHEN THE FREEZER GOES OFF

1. **Keep the freezer closed.** A fully loaded freezer should keep food frozen for 1 or 2 days if the door isn't opened.
2. **Move the food to another location to maintain their frozen state.**
3. **Add dry ice if you can get it.** The more dry ice used, the longer the food will keep. Use 2½ pounds per cubic foot of freezer space to hold the temperature of a half-full cabinet below freezing for 2 or 3 days or fully loaded for 3 or 4 days. Use gloves when handling dry ice. Put heavy cardboard directly on the packages and then put the dry ice on top of the cardboard. Cover freezer with blankets, making sure that the motor and vent are not covered. Do not open the freezer.

You can safely refreeze fruits and vegetables that have partially thawed if they still contain ice crystals or if food has not warmed to above 40°F; use thermometer to check. The quality will not be as good, however.

Discard foods that have been warmer than 40°F for more than 2 hours. Discard any foods contaminated by raw meat juices. Dispose of soft or melted ice cream for quality's sake.

Vegetables contain bacteria that multiply rapidly and it may be impossible by their odor to tell if they have started to spoil. If they are still cold (40°F) and have not been thawed for more than 1 or 2 days, they may be cooked or refrozen. Quality will be lost. If the temperature is higher than 40°F, the vegetables may be unsafe.

FREEZER TEMPERATURES AND SHELF LIFE OF FOOD

Use a thermometer to check the temperature of your freezer. Place thermometer in a location easy to read as temperature fluctuates when door is open.

Table 1. Preparing Vegetables for Freezing

VEGETABLES	PREPARATION AND BLANCHING IN BOILING WATER
ASPARAGUS	Wash and sort small, medium, and large stalks. Leave whole or cut in 1- or 2-inch lengths. Blanch small stalks 2 minutes. Blanch medium stalks 3 minutes, large stalks (½- to ¾-inch diameter) 4 minutes. Chill in ice water for same time.
BEANS, green and yellow podded	Wash, snip off tips, and sort for size. Cut or break into suitable pieces or freeze small beans whole. Blanch 3 minutes. Chill in ice water 3 minutes.
BEANS, lima	Wash, shell, and sort. Blanch small beans 2 minutes; medium beans, 3 minutes; large beans 4 minutes. If desired, blanch in the pod and shell after cooling. Chill in ice water for same time.
BEANS, green soybeans	Harvest when beans have filled the pod and in the green stage; wash. Boil beans in the pods for 5 minutes. Cool promptly in ice water. Squeeze beans out of the pods.
BEETS	Remove all but 2 inches of top; wash. Cook until tender. Chill. Remove skins. Slice or dice large beets. Since beets are completely cooked, blanching is unnecessary.
BROCCOLI	Remove tough leaves and woody butt ends. Cut through stalks lengthwise, leaving heads 1 inch in diameter. Soak ½ hour in salt brine (½ cup salt to 1 quart water) to drive out small insects. Rinse and drain. Blanch 3 minutes in water or steam-blanch 5 minutes. Chill in ice water.
BRUSSELS SPROUTS	Wash and trim. Soak ½ hour in salt brine (see Broccoli). Rinse and drain. Blanch small heads 2 minutes; medium heads 4 minutes; large heads 5 minutes. Chill in ice water.
CABBAGE	Wash and discard coarse outer leaves. Cut into wedges or shred coarsely. Blanch wedges 3 minutes and shredded cabbage 1½ minutes. Chill in ice water.
CARROTS	Trim, wash, and scrape. Dice or slice ¼-inch thick. Blanch 2 minutes. Chill in ice water.
CAULIFLOWER	Trim and wash. Slit heads into individual pieces 1 inch in diameter. Soak ½ hour in salt brine (see Broccoli). Rinse and drain. Blanch 3 minutes. Chill in ice water.
CORN, sweet, cut whole kernel	Husk, remove silks, and trim ends. Use a large kettle. Blanch whole kernel corn to be cut from the cob 4½ minutes. Chill in ice water. Cut from cob after cooling.
CORN, cream style	Prepare as for whole kernel corn, except cut only the kernel tips; then scrape the cobs with the back of a knife to form juice and remove the heart of the kernel.
CORN, sweet on-the-cob	Husk, remove silks, and trim ends. Use a large kettle for blanching. Blanch small ears (1¼-inch diameter) 7 minutes; medium ears (1¼-1½-inch diameter) 9 minutes; large ears (over 1½-inch diameter) 11 minutes. Chill in ice water until cool. Corn that is not thoroughly cooled may become mushy. Cooling corn-on-the-cob will take longer than blanching time.
HERBS	Wash and drain, but do not blanch leaves. Wrap a few sprigs or leaves in foil or seal in plastic bags. Store in carton or glass jar in freezer.
KOHLRABI	Remove tops, wash, peel, and dice in ½-inch cubes. Blanch 1 minute. Chill in ice water.
MUSHROOMS	Wash and remove stem base. Freeze small mushrooms whole; cut large ones into 4 or more pieces. When blanching mushrooms, add 1 teaspoon citric acid, or 1 tablespoon lemon juice, or ½ teaspoon ascorbic acid per quart of water to prevent darkening. Blanch medium or small whole mushrooms 5 minutes; cut pieces 3 minutes. Chill in ice water.
OKRA	Wash. Cut off stems without opening seed cells. Blanch small pods 3 minutes; large pods 4 minutes. Chill in ice water.
PEAS, green, English, blackeyed	Wash. Shell small amount at a time. Blanch green and English for 1½ minutes. Blanch blackeyed peas 2 minutes. Chill in ice water.
PEAS, edible, podded, sugar, Chinese	Wash. Remove stems, blossom ends, and any string. Leave whole. Blanch 1 1/2 to 3 minutes. Chill in ice water.
PEPPERS, hot varieties	Do not handle or cut without plastic or rubber gloves. Select crisp green or bright red pods. Wash and drain.
PEPPERS sweet, green, red	Wash, cut out stem, and remove seeds. Halve. Blanch halved peppers 3 minutes. Chill in ice water. Chopped peppers can be frozen without blanching.

Table 1. Preparing Vegetables for Freezing

VEGETABLES	PREPARATION AND BLANCHING IN BOILING WATER
POTATOES	Wash; peel; remove deep eyes, bruises, and green surface coloring. Cut in ¼- to ½-inch cubes. Blanch 5 minutes. Cool. For hash browns—cook unpeeled until almost done; peel and grate; form in desired shapes; freeze. For french fries—peel and cut in thin strips; fry in deep fat until very light golden brown; drain and cool; complete browning before serving.
POTATOES, new	Choose those of uniform size; scrub vigorously to remove tender skin. For ¾-inch diameter potatoes, blanch 4 minutes. For 1-inch diameter, blanch 6 minutes. For 1½-inch diameter, blanch 7 minutes. For those larger than 1½-inch diameter, blanch 8 to 10 minutes. Chill potatoes in ice water 3 to 5 minutes; drain well. Use within a month for best quality.
PUMPKIN SQUASH, winter	Cut or break into fairly uniform pieces. Remove seeds. Bake at 350°F, or steam until tender. Cool, scoop pulp from rind, and mash or put through ricer. Spoon into moisture-proof containers. If freezing pie mix, omit cloves.
SPINACH/GREENS	Sort and remove tough stems. Blanch most leafy greens 2 minutes. Blanch collards and stem portions of Swiss chard 3 to 4 minutes. Blanch very tender spinach 1½ minutes. Chill in ice water.
SQUASH, summer, zucchini	Wash, peel, and cut in ½-inch slices. Blanch 3 minutes. Chill in ice water.
TOMATOES, cooked	Select firm, sound, ripe tomatoes. Wash, core, cut, and cook until soft.
TOMATO juice, puree	Select firm, sound, ripe tomatoes. Wash, core, and cut into pieces. Simmer about 5 minutes and put through food mill for juice. Cool. For purée, cook juice until concentrated to about half its volume.

Table 2. Preparing Fruit for Freezing

FRUITS	PREPARATION
APPLES	Wash in cold water, peel, core, and cut into pie slices. To prevent darkening, use one of these methods: <ul style="list-style-type: none"> • Dissolve ascorbic acid in a little cold water. For syrup packs, dissolve ½ teaspoon ascorbic acid in each quart of syrup. Use ¼ teaspoon dissolved in ¼ cup cold water for each quart of fruit, for sugar and unsweetened packs, for crushed fruits and purees. • Ascorbic acid mixed with sugar or with sugar and citric acid may be available. Follow manufacturer's directions. • Citric acid or lemon juice may be used, but is not as effective as ascorbic acid.
APRICOTS	Wash, halve, pit, peel, and slice, if desired. If not peeled, heat in boiling water for ½ minute to keep skins from toughening during freezing. Cool in cold water, drain. Pack apricots in 40% syrup, adding ¾ teaspoon ascorbic acid per quart of syrup. Or sprinkle with ascorbic acid solution and pack without sugar as described for apples.
AVOCADOS	Select avocados that are soft ripe. Peel, cut in half, and remove pit. Mash until puréed. Add 1/8 teaspoon ascorbic acid mixture per each quart purée. Package in recipe size amounts.
BLACKBERRIES, BLUEBERRIES, BOYSENBERRIES, DEWBERRIES, ELDERBERRIES, HUCKLEBERRIES, LOGANBERRIES, RASPBERRIES, YOUNGBERRIES,	Select firm, fully-ripe berries. Sort, wash, and drain. Wash in cold water. Pack in 30% syrup, dry unsweetened pack, dry sugar pack (¾ cup sugar per quart of berries), or tray pack. Or crush and pack using 1 cup sugar for 7-8 cups fruit. For pies, pack berries dry without sugar. Wash in cold water and sort. Pack in syrup (3 cups sugar to 1 quart water). Or crush and pack using 1 cup sugar for 7-8 cups fruit. For pies, pack berries dry without sugar.
SWEET CHERRIES	Select well-colored, tree-ripened cherries. Stem, sort, wash thoroughly. Drain and pit. For pies, pack in dry sugar using ¾ cup sugar per quart of fruit. Pack in 30-40% syrup to which 1/2 teaspoon of ascorbic acid per quart has been added.

Table 2. Preparing Fruit for Freezing

FRUITS	PREPARATION
PIE CHERRIES, red sour	Select well-colored, tree-ripen cherries. Stem, sort, wash thoroughly. Drain and pit. For pies, use 1 1/2 to 2 cups sugar with 4 cups pitted cherries for 9-inch pie. To improve color, add 1/4 teaspoon ascorbic acid. Or pack in sugar syrup (4 cups sugar to 4 3/4 cups water).
CRANBERRIES, CURRANTS	Wash in cold water, sort, and pack without sugar.
GOOSEBERRIES	Wash in cold water and sort. Pack without sugar or syrup, or mix berries and sugar as called for in pie recipe, using 3/4 cups sugar for 4 cups berries.
GRAPE JUICE	Choose fully ripe, firm, sweet grapes. Sort, stem, and wash. For juice as a beverage: Crush and heat until juice flows from pulp. Strain through cloth bag and sweeten if desired. Common proportion is about 1/4 cup sugar per quart juice. For juice for jelly: Add just enough water to keep grapes from sticking in kettle. Cover and boil on high heat, reduce heat and simmer 5-10 minutes. Let juice stand in refrigerator overnight to remove tartrate crystals. Strain through 2-inch thickness of damp cheesecloth.
MELONS	Select firm-fleshed, well-colored ripe melons. Wash rinds well. Cut open, scoop out seeds. Slice or cut in chunks. Pack in 30% syrup or pack dry using no sugar. Pulp also may be crushed (except watermelon). Add 1 teaspoon sugar per quart and freeze in recipe-size containers.
PEACHES, NECTARINES	Cut in halves, quarters, or slices into anti-darkening solution (3 tablespoons lemon juice per quart of water). Pack in 30-40% syrup, adding 1/2 teaspoon ascorbic acid per quart of syrup, or sprinkle each quart of fruit with solution of 1/4 teaspoon ascorbic acid dissolved in 1/4 cup cold water. Add up to 2/3 cup sugar, mix well, and pack in containers. Also can be packed in cold water containing 1 teaspoon ascorbic acid and 1 quart of water.
PEARS	Select firm, full-flavored well-ripened pears. Wash, peel, and core. Slice. Heat in a 40% boiling syrup depending on size of pieces. Drain and cool. Add 3/4 teaspoon ascorbic acid to 1 quart syrup. Pack in cold 30-40% syrup.
PINEAPPLE	Select firm, ripe fruit with full flavor and aroma. Pare and core, removing eyes. Dice, slice, crush or cut into wedges, removing center core. Pack fruit tightly into container without sugar. Leave headspace. Seal and freeze.
PLUMS	Select firm ripe fruit soft enough to yield to slight pressure. Sort, leave whole or halve, and pit. For dry sugar, use 1/2-3/4 cup sugar per quart fruit. For syrup pack, cover fruit with a 40% syrup. For best quality, add 1/2 teaspoon ascorbic acid per quart of cold syrup or pack whole fruit in containers with out sugar or syrup.
RHUBARB	Select tender, firm, well-colored stalks. Remove leaves and woody ends, wash in cold water, and cut in 1-2 inch lengths. Heat in boiling water for 1 minute and cool promptly in cold water to retain color and flavor. For dry pack, pack the rhubarb either raw or preheated into containers without sugar. Leave headspace. Seal and freeze. For syrup pack, pack either raw or preheated rhubarb tightly into containers, cover with a 40% syrup. Leave headspace.
STRAWBERRIES	Select fully ripe, firm berries with a deep red color. Wash in cold water, sort, and stem. Pack whole, sliced (preferred), or crushed berries with 3/4 cup sugar for 1 quart of fruit. Or pack whole berries in 50% syrup.

Syrup Proportions Chart

TYPE SYRUP	SUGAR	WATER	YIELD	CALORIES/ 2/3 CUP
30%	2 1/4 cups	5 1/4 cups	6 1/2 cups	162
40%	3 cups	5 cups	6 cups	235
50%	4 1/4 cups	4 1/4 cups	6 1/2 cups	306

FOR MORE FOOD PRESERVATION INFORMATION

- Call AnswerLine (800) 262-3804 (voice) or (800) 735-2942 (telecommunications device for deaf)
- Download ISU Extension and Outreach fact sheets from store.extension.iastate.edu
- Access the U.S. Department of Agriculture's Complete Guide to Home Canning at nchfp.uga.edu

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